PRINTS OF USEFUL KNOWLEDGE,
No. 21. (TRANSLATION).

FACIAL SPEECH-READING

HERMANN GUTZMANN, M. D.
SPECIALIST ON THE ORGANS OF SPEECH,
BERLIN.

Medizinisch-pädagogische Monatsschrift für die gesammte Sprachheilkunde mit Einschluss der Hygiene der Lautsprache. Nos. 3 and 4, Zweiter Jahrgang, 1892.

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VOLTA BUREAU,
FOR THE INCREASE AND DIFFUSION OF KNOWLEDGE RELATING TO THE DEAF,
WASHINGTON CITY, U. S. A.

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It is well known that deaf-mutes in Germany acquire speech, and at the same time the ability to read from the lips of a speaker what is spoken to them. All who have had anything to do with deaf-mutes, however, know that this latter ability, in many instances, is insufficiently cultivated, and at all events cannot even remotely be compared to the achievements attained by hard-of-hearing pupils, or such as have become deaf later in years, whenever these have enjoyed the advantages of methodically conducted instruction in speech-reading. The cause of this is that deaf-mutes attain *their* ability to read speech by themselves, largely from the positions of the organs within the mouth, when producing, during the progress of articulation teaching, individual sounds. Vowels, of course, readily manifest their characteristics externally; the consonants, however, of the second and third articulating divisions (dentals and palatals) deaf-mutes generally distinguish only by the position of the tongue; and consequently it is necessary, in order to be understood, that the speaker addressing them should open his mouth wide. A special course of instruction in speech-reading does not generally prevail in institutions for the deaf, although, for all the future intercourse of a deaf person with hearing persons, such instruction is of even greater importance than instruction in articulation, for the deaf have far more to learn from hearing persons than they have to teach them. Furthermore, the deaf, in reading the speech of others, are guided solely by the sensa-

tion of their own speech. They do not learn to read speech independently of this, merely from its visible facial manifestation. Finally, it is a serious disadvantage that the deaf, during the whole period of their attendance at school, are restricted in speech-reading solely to practice with their teacher, who adapts his teaching entirely to the standard of the articulation instruction. They should be encouraged to practice speech-reading with one another, and I hold this to be the best of measures to suppress chatting by means of gestures.

What has just been mentioned is an evident defect in the prevailing instruction of the deaf. When, therefore, any one hard-of-hearing, or who has become deaf late in life, applies to a teacher of the deaf to be taught the art of so-called "lip-reading," that is, reading of the mouth, and the teacher undertakes to instruct him in speech-reading in a manner similar to that he has been accustomed to employ with his pupils, the attainment will be very meagre. Speaking with faces close to one another and mouths widely opened is not conversation at all; it is simply mutual torment, apart from the fact that in public places such a thing is hardly possible without attracting attention. The reason that the congenitally deaf, even such as have enjoyed good instruction in speech-reading, frequently do not attain desirable results, is that, in comparison with the hard-of-hearing and those becoming deaf later in life, their command of language is far more limited. Perfect command of language is of the greatest importance in order to attain absolute facility in speech-reading; hence, highly intelligent persons will more readily attain this art than those less intelligent.

In text-books treating of the physiology of speech, the *external features* peculiar to speech sounds have thus far been dwelt upon and described comparatively little. Only those tones or sounds whose external effects have necessarily to be noted in treating of their vocal charac-

teristics, such as vowels and labials, have, in this connection, been referred to, and even then not at all fully. The externally visible movements of the muscles of the cheeks, the manifold positions and movements of the lower jaw, have been neglected, because these were looked upon simply as secondary results of the primary movements, no special value being accorded to them in producing the characteristic features of the sounds. Although this view is, for some purposes, allowable, nevertheless these characteristic features are of so constant a nature that but little practice is required in order distinctly to distinguish individual speech-tones, not only in a front view (face to face), but also in profile; and even when the speaker's mouth is covered, a close observer is able to recognize nearly all sounds simply by noting the positions and muscular actions of the cheeks and of the lower jaw, and some other distinctive features pertaining to vocal utterance. I would term these externally visible indicators of speech-tones *external speech physiology.*

The practical value of this external physiology of speech-tones is self-evident. The achievements of speech-reading instruction conducted upon these scientific principles are at times simply marvellous; especially so in the case of persons who have become deaf after infancy and have already acquired considerable command of language, —a circumstance by no means to be underrated. But even the congenitally deaf, and those who have become deaf in infancy, can attain an ideal facility in speech-reading. If this is denied, it only proves that those who deny it have had no experience in this special line of instruction. I was truly delighted in Hill's "Anleitung zum Unterricht taubstummer Kinder," etc., Essen, 1839 (p. 31), to read his confirmation of my own practical experience and that of others. Hill (Schmalz, p. 216 b), says: "Several of my pupils had achieved such skill that they could read the replies given to the teacher by their fellow-pupils,

even when the latter raised their hands to prevent the mouth from being seen, and so compelled the others to read their speech simply from the action and movements of the facial muscles remaining visible."

Owing to the exceptional importance of the subject and the peculiar character of the periodical I am writing this for, giving, as it does, special consideration to the cure of speech impediments, it will be necessary to enter more into detail in regard to the *external physiology of speech-tones*. After having considered the same, I will, before concluding, add something in the way of methodical speech-reading instruction.

I shall commence with the vowels, describing the special external characteristics of the sounds. In the first place, the facial reading of vowels presents the least difficulties; and, secondly, by attaining greater facility in the facial reading of vowels, one also attains greater facility in the facial reading of words. The vowel movements are large, because, in speech, they have longer duration than the movements of consonants. In practice it will therefore frequently be found that the vowel sounds of words will be read quite correctly, whereas for the consonants actually pronounced others will be substituted. Furthermore, let us just here lay stress upon the fact *that the number of syllables uniformly corresponds to the number of vowels*, counting, of course, the diphthongs *au*, *ei*, *eu* as single sounds. These observations of a general character will be defined more clearly further on, and I only make mention of them here in order to emphasize the importance which must be accorded to an accurate observation of the visible vowel manifestations.

The Vowel U (English OO).

It being necessary in order to pronounce U that the vocal-tube (*Ansatzrohr*) should be elongated as much as

possible, we perceive that the lips, or, better described, the flexible parts of the mouth which constitute the *atrium oris*, form themselves into a nozzle, supported by the projecting lower jaw. On the other hand, the larynx, quitting its passive position, is depressed, thus extending the distance between the lower-jaw angle and the thyroid cartilage to its extreme limit.

In front we see the tubularly extended *atrium*, with its circular orifice, which, in clear vowel formations, is bordered by the rounded edges of the lips. The action of the lower jaw, however, is not rendered visible thereby, as its movement, in comparison with that of the soft flexible parts, is too insignificant. On the contrary, the chin, as the bonier part, seems withdrawn. That this, however, is only apparently so, can readily be seen by taking a side view of the face. We observe the aforesaid slight forward movement of both the chin and lower-jaw angle as the change is made from the passive position to that exacted in pronouncing U. We furthermore see that the said change of form of the *atrium* causes also the soft portion of the cheeks to be likewise drawn forward. This movement of the skin (observable even more readily in bearded faces) is of such a peculiar character, more especially when in connection with it the changed position of the lower-jaw angle is noticed, that the U can be recognized even when the mouth is covered. This recognition is furthermore promoted by the increased distance between the thyroid cartilage and the lower-jaw angle.

The Vowel I (English, long E).

While in pronouncing U the vocal tube was elongated to its extreme length, with I (English E) it is shortened as much as possible. The *atrium* disappears almost entirely; the horizontal extension of the mouth aperture, together with the drawing of the corners of the mouth

obliquely upward and backward, by the action of the zygomatic muscles, causes the lips to be pressed closely against the teeth. The larynx moves upward from its position of rest. Thus, its distance from the lower jaw, already indicated, is diminished. Inasmuch as there occurs here a contraction of the middle part of the vocal tube, the lower jaw must elevate itself in order to serve as support for the raised tongue, and at the same time must make a rearward movement from its passive position, and so assist in shortening the vocal tube. According to the sequence which governs force, this results in a movement of the bone obliquely upward and backward.

In front, therefore, we see the mouth broadened and upwardly concave, the upper and lower rows of teeth in close proximity to each other; the lower teeth, however, receding somewhat from their passive position. In people who have the thyroid cartilage (Adam's apple) strongly developed, we can plainly see it elevated.

A side-face view shows us, therefore, clearly a shortening of the distance between the lower jaw and the thyroid cartilage. The elevation of the lower jaw is observable only in its frontal part, the chin; whereas the angle in relation to the horizontal plane continues firm in its passive position, but in relation to the frontal plane shows clearly a posterior movement. The extremely narrow and pointed corners of the mouth are drawn upwards. Should we cover the mouth, we should even then be able to distinguish I (English E) by the strained direction of the cheek's surface which participates in the general facial movement. The cheek-bone constitutes the point of direction, and hence the action of the zygomatic muscles is clearly exhibited.

The Vowel A (as in mama).

"A is produced by all parts of the mouth-space being in their natural position," says Thausing. Consequently,

in pronouncing this vowel, no characteristic feature presents itself other than the opening of the mouth without any action whatever on the part of the external facial muscles. We only observe the cheeks narrowing somewhat, owing to the lowering of the lower jaw.

This movement is alike unmistakable, viewed either from the front or side, and is executed without any perceptible deviation of the larynx from its passive position; only when using exceptional voice power it raises itself slightly above the level of its static position. The only thing notable is that, owing to the depression of the lower jaw and elevation of the larynx, the distance is lessened between the lower jaw and the thyroid cartilage. The *atrium*, which had completely vanished in pronouncing I (English E), and was elongated to its extreme length in U, naturally here preserves its passive position; that is to say, the edge of the lips, in consequence of the tension of the muscles and their external concave form, takes position a considerable distance away from the line of the teeth. Of course, this position is largely governed by the age of the speaker, and the fleshy or fatty character of these parts.

On the whole, we can note, as characteristic of A uttered in an ordinary speech-tone, a depression of the lower jaw.

The Vowels O and E (E, as A in fate).

When we endeavor audibly to make the transition from the A to the U position, we arrive at a point where we distinctly hear an O. This experiment of itself gives us the external characteristics of O.

The *atrium* is elongated, but not to the extent required for U. The lower jaw is projected, but less than in U. The distance between the thyroid cartilage and the lower jaw is less than it is in U, and greater than it is in A, and the tension noticeable upon the cheek surface is also less

distinct than it is in U. While all of this is visible from a side view, we notice in front more especially the action of the crossed fibres of the buccinator muscle. In A, no contraction whatever of the lips is noticeable; but when the transition from the A to the O position is made, besides the contracting of the *orbicularis oris*, a contraction of the above-named fibres takes place, which results in the two corners of the mouth being drawn towards each other. They do not, however, approach each other as much as they do in U, and the lip-line or mouth-slit remains transversely oval.

If now we attempt with audible voice to make the transition from the A into the I (English E) position, we shall about midway (somewhat nearer to the I, however) attain the characteristic E (English A) position.

As the position for O stands between A and U, so that of E (English A) stands between A and I (English E); consequently the external manifestations correspond to these positions.

A front view shows that the quite uncontracted opening of the mouth for A is here broadened by muscular action in a strictly horizontal direction. As the lower jaw takes an upward movement, the two rows of teeth approach each other more closely than is the case in pronouncing A. A side view discloses to us an approach of the lips towards the teeth, consequently diminishing the *atrium*, an elevation of the lower jaw, and upon the cheeks (even when the mouth is covered) a drawing of the skin backward, the direction being about in a line with the lower edge of the ear-lobe. Hence, while in pronouncing I (English E), we have to deal with a movement resulting from the co-operation of the zygomatic muscles, here a simple movement presents itself. The position of the lower jaw, of the corners of the mouth, and the direction in which the facial surface is drawn, distinguish E (English A) from I (English E).

The Umlauts A^e, O^e, U^e.

Just as O and E (English A) are midway steps between A on the one hand, and U and I (English E) on the other, so are the umlauts midway steps between any two of the vowels heretofore considered; hence their external manifestations accord strictly with these intermediate positions. For any additional desired information upon this subject, I take occasion to refer here to the well-known vowel table of Brücke.

A

A^e A^o

E^a A^{oe} O^a

E E^o O^e O

I I^u U^i U

We see in this table that there are divers A^e, O^e, and U^e sounds, and even for the ordinary O we have two additional modified sounds tending towards A. The latter, as is known, we hear in such words as *Ort* and *Ordnung*, and frequently in Low German. Accordingly, then, as either O or A constitutes the predominating sound of the mid-vowels, respectively, the external manifestations will correspondingly show themselves. If the vowel tends more towards O, we shall, in front, see an approach towards each other of the corners of the mouth, the lower jaw projected; neither of them, however, as marked as would be the case in the pure O. Should the vowel tend more towards A, it will be found that the lower jaw, and also the form of the *atrium*, or mouth-vestibule, tend towards the passive state which we have become familiar with in the A position. Identically so it is with A^e, O^e, and U^e, the two first forming, as it were, midway stations between A and O and E (English A), respectively, and U between U and I (English E).

After the single vowels have been fully described, the

external distinctive characteristics of the mid-vowels are self-evident. Alike both in front and in profile, and even with the mouth covered, all of the characteristic features of the vowel sound are clearly recognizable in the form of the oral vestibule (*atrium*), in the position of the lower jaw, and by the movements of the cheek surface, rendering it unnecessary here to recapitulate the positions of the several vowels.

Only O^e and U^e deserve special mention, because they are the result of two directly diverse movements. Whereas, in O the vestibule of the mouth was elongated, in O^e and U^e it is, on the whole, curtailed by drawing the lips against the teeth, which can best be seen if we make the transition from the A position to that of O^e and U^e in as unconstrained a manner as possible. In doing so, however, the corners of the mouth, in consequence of the operation of the *orbicularis*, have approached each other in a manner to impart to the vestibule of the mouth (*atrium*) a most peculiar form. That the entire vocal tube (*Ansatzrohr*) has naturally suffered a curtailment, one can best see if we successively whisper A^e, O^e, U^e. One then hears the successive rising of the resonant tone of the mouth cavity which takes place.

The Diphthongs AU, EI, EU.

Diphthongs present exteriorly no defined position, but movements. These movements, of course, start from defined fixed positions and end in defined positions.

In pronouncing AU (English, like OU in *out*) the initial position, as is indicated in writing, is A, which has already been described; its final position is U.

We therefore observe, in a front view, that the mouth-vestibule, or *atrium*, changes from its passive position into the tubular form of U, the corners of the mouth approach each other, and the wide transversely oval form

of the mouth assumes that of the nearly round U position. A side view shows us, externally, a corresponding downward and then forward movement of the cheek surface simultaneous with an elevating and forward gliding of the lower jaw.

With the diphthongs AI and EI (English I) the A position is initial, and the I (English E) position final. We therefore again recognize, in the side view, the A, and then the I (English E) movement of the lower jaw and of the *atrium*, as also that of the cheek surface already described. In front we observe, owing to a withdrawing and upward moving of the corners of the mouth effected by the co-operation of the *zygomatic* muscles, that the transversely oval mouth aperture A is transformed into an upwardly concave slit, while the rows of teeth approach each other, etc. To attempt a more detailed description of movements would only be reiterating facts already sufficiently stated.

In pronouncing EU (approximately English OI) the initial and final positions differ greatly, according to dialects. In general, we can distinguish three different EU sounds, whose characteristics may be noted as follows: 1st, AU^e (erroneously written A^eU). 2d, O^aU^e. 3d, OI.

In AU^e, therefore, the initial position is that of A, and the final that of U^e; in pronouncing O^aU^e the positions are expressed by O^a and U^e; in pronouncing OI by O and I (English E).

Although AU, EI, and EU are the principal diphthongs, there are, nevertheless, also others. Brücke distinguishes the following, whose initial and final positions are sufficiently characterized by the mode of their writing: AI, A^eI, E^aI, AU^i, A^eU^i, OI, UI. The EU, which I would designate by O U^e and A U^e, respectively, is unknown to Brücke, although it frequently occurs in Northern Germany.

This concludes the description of the external charac-

teristic features of vowels.* At least I am not aware of having omitted anything that would be essential in a statement of their external characteristics. Possibly I may be even accused of having entered too much into detail; it may be asserted that the movements described are, in part, too insignificant to be observed.

To prove that such is not the case I need only mention that after two hours of instruction in the sight-reading of vowels, based upon the assistance rendered by just these little characteristic features, the success attainable is so great that all vowels and diphthongs can be promptly read upon the face even when the mouth is covered. In further support of what has been said, I invite attention to the closing paragraph of this article. The features here indicated remain distinctly recognizable even when speaking rapidly, and this is evidently a highly important matter in further practice.

Should any one assert that all of the vowels can be pronounced without in the least changing the position of the mouth, I will, of course, admit this (see Thausing's "*Vikariat der Vokale*"), but I call attention to the fact that this mode of forming the various vowels is unnatural. One can, it is true, speak thus, but it is not done ordinarily in speaking.

Moreover, other movements exist which are peculiarly characteristic of certain vowels—such as the changes effected in the region of the temples. These movements, however, only attract attention in emphatic tone-production; in ordinary speech, and such is now under consideration, they are of too insignificant a character to be of any appreciable service. Furthermore, in current conversation, observation can be intently directed only to a limited area of the face, and hence, of course, attention is more directly given to that portion which affords the readiest means of speech-reading.

* Compare the interesting chapter in Merkel's "*Spracliphysiologie*," page 103 *et seq.*

In connection with the above description of the facial characteristics which present themselves in the pronunciation of vowels, I now briefly summarize those demanding special attention.

In considering singly the characteristics of vowels, I directed attention more especially to three points: 1, the changes in the form of the mouth; 2, the position of the lower jaw; and 3, the movement of the cheek surface.

While pronouncing I (English E), the lips are so firmly pressed against the upper row of teeth that one cannot properly speak of a vestibule or *atrium* as existing; also, in pronouncing E (English A), the lips lie near the teeth, but yet not so closely pressed. With A, on the other hand, considering the peculiar form which the tender parts of the mouth assume when at rest, we have, in reality, an *atrium* or vestibule. It can be best compared to a hollow cone, whose point has been cut away rather low down. The line of the lower row of teeth forms the basis. In pronouncing O this cone is elongated, and the height of the *atrium* enlarges itself considerably. In pronouncing U, the cone attains its greatest height; in fact, when pronounced forcibly, the curved lips already commence the formation of a new but inverted cone.

In pronouncing I (English E) the lower jaw leaves its state of inaction in such a manner that it stands shoved upward and backward, causing the lower row of teeth to take position far more to the rear of the upper row than usually is the case; and in pronouncing E (English A), it moves forward and notably downward. The latter position it retains in pronouncing A. In O, however, it again moves upward and forward; finally, in U, it again moves so far forward that with a slight additional movement one feels that the edges of the two rows of teeth closely fit upon each other. As the lower row of teeth in a state of inactivity is 2 to 3 millimeters back of the upper row, the lower jaw has traversed a total distance of 2 to 3

millimeters from the position of its passive or quiescent state. The larynx, which stood highest in pronouncing I (English E), drops gradually in succession as E (English A), A, O, and U are respectively given, and consequently at U has reached its lowest place. Accordingly, the distance between the thyroid cartilage and the angle of the lower jaw is least when pronouncing I (English E), and increases successively up to the U position, where it is greatest.

The movements of the cheek surface are closely connected with those of the lower jaw. In pronouncing I (English E) a diagonally upward and backward drawing, or tension, is observed; in E (English A) the tension is backward; in A downward; in O forward; and, finally, in U decidedly forward. Here we observe the successive changes which follow in order, viz: I (English E), E (English A), A, O, U.

In proceeding now to give the external characteristic features presented by *consonants*, the stopped or shut sounds more especially, I must again revert to the differences existing between *media* and *tenuis*, already mentioned. Of importance to us are (1) the difference in the consistence of the parts which make the stoppage or closure and the forms and modes of contact thus assumed by the mouth organs (Thausing), and (2) the nature of the release of contact, because both of these differences plainly manifest themselves in visible positions and movements.

In regard to the differences first named, the statement I have already made holds good in general: In the *mediæ* larger surfaces part from one another than in the *tenues*. That these diverse forms of contact are recognizable through external indications is evidenced by the fact that the lower jaw, in order more readily to secure for the parts in question greater surfaces of contact, must assume a more elevated position for the *mediæ* than is requisite for the *tenues*.

That the differences in releasing the closure are really visible can certainly not be questioned.

B and P.

Inasmuch as the lips when pronouncing B are of a tender consistence, their muscles must not appear especially tense. In fact we see, in the B closure, that the lips are almost in the passive position they assume for A (as in mama). The edges of the lips do not press against the teeth; in front we see the wide red surface of the lips; and from the side, the conical shape of the *atrium*. In pronouncing P, on the other hand, the lips are pressed somewhat together, and their edges as a rule are incurved, so that they are drawn against the teeth, and by means of this point of support the pressure is promoted (Merkel). Through this contraction of the muscles the P receives a hard consistence. In contrast to B, we thus see from the front the red portion of the lips narrowed in P; while, from the side, we observe the lips so drawn against the teeth that the conical form of the *atrium* entirely disappears. Although this shows that the point of contact in B is very different from that of P, the fact is nevertheless further emphasized by the circumstance that, in pronouncing P, the lower jaw maintains very nearly its passive position, while in B it is raised somewhat in order to favor the enlargement of the surface of contact. In contrast to B, we thus in P see, in front, the chin elevated; on the side, the lower jaw takes a higher position; finally, the third notable characteristic is the mode of explosion. While in B we see, in front, a forward* rolling and then a parting and raising of the lips, we observe in P that the closure is explosively opened. As a consequence of this different mode of explosion, we observe, also, that the lower jaw makes

*In pronouncing B, the main direction of the movement is forward, while in P it is downward.

far less of a downward movement in B than it does in P. A side view gives us this movement more plainly; and what emphasizes this difference between B and P still more is the fact that, previous to the explosive opening of the lip closure for P, a slight inflation of the cheeks takes place. I am of the opinion that this feature, in connection with the side-view characteristics already described, amply suffices to distinguish B from P, even when the mouth is covered. A practical test will give proof of this apparently bold assertion.

D and T.

While, at the point of closure in the first articulation division, the *media* is clearly distinguishable from the *tenuis*, this is changed more and more the farther back the closure takes place. Practice will here have to contribute the most towards its acquirement. Nevertheless, from the point of view here indicated there will be ample criteria for the eye to enable one to base the practice upon physiological grounds, and avoid the necessity of leaving expertness in speech-reading to blind chance. I would further remark that my statement refers to Brücke's so-called palatal or alveolar D and T, as it is this which is almost exclusively spoken here in Northern Germany, while the people of Central Germany almost universally form the so-called dorsals (Merkel). The manifestations, however, are readily transferred from one to the other.

The difference in consistence shows itself in this way: the tongue seen from in front, between the two rows of teeth, is less visible in D than in T. In uttering the latter, the tongue must take on a harder consistence, in consequence of which its under surface is more exposed than in the corresponding *media*. This of course is not visible from a side view; but, on the other hand, the effect of the greater surface of contact shows itself quite clearly by the elevated position of the lower jaw.

While in T—in which the tongue, board-like, is extended from back and low towards front and high, and only touches with its edge the articulating position—the lower jaw remains in its position of inaction, or, in a more decided utterance, is moved downward, in D it must elevate itself. For here the place of articulation is touched with a flattening of the point of the tongue, and in order to facilitate this contact it is necessary that the lower jaw elevate itself from its quiescent position. Of course we see this changed position of the lower jaw also in front, but not as clearly as from the side.

Furthermore, the difference in the explosion is mainly rendered observable by the movement of the lower jaw, which in D is hardly discernible, but in T appears quite excessive. While this, from a side view, is only apparent by the movement of the lower jaw, it is, in front, presented to us by the distance from each other of the two rows of teeth. In addition, however, we also observe clearly that the explosion, in uttering T, causes the tongue to be thrown downward, while in uttering D its motion is backward. This causes us also to observe from the side that, in consequence of the muscle movement, the angle between the lower jaw and the front throat-surface is blunted and more rounded in D, whereas in T the angle remains the same, and we only observe upon the side of the throat just previous to the explosion a slight fluctuation of the skin, like that manifested in P upon the cheek surface.

We are to consider, furthermore, whether D and T are also distinguishable when the mouth is covered. Here, too, after the careful and repeated observations I have made, I must assert that they are. I need only refer to the diverse positions and movements of the lower jaw, as also to the angle of the throat and lower jaw, to prove this assertion. Nevertheless, as I have already observed, it is rather difficult to attain perfect speech-reading in the T genus. Practice must here serve as a substitute for the readier visibility of externally distinguishing features.

G and K.

While in the T genus the point of the tongue lies back of the upper row of teeth, in the K genus it lies back of the lower row. This being understood, the G distinguishes itself from the K, in the first place, by the consistence of the articulating organ—in this instance the tongue. Thus, while in K, owing to its rigidity, one sees the entire ridge of the tongue exposed, in G one sees only a small portion of it. The area of contact is much larger in G than in K, where there is only a faint line of contact. In front this difference is made visible in the manner just described in speaking of the consistence of the articulating parts. In addition, we see the lower jaw more elevated in G than in K. In the former the jaw supports the securing of a larger area of contact, while in K, owing to the rigidity of the tongue, the jaw is rather thrust downward. In general, therefore, in front we see the two rows of teeth wider apart in K than in G; and on the side we observe the lower jaw higher in G than in K, being somewhat depressetl in the latter. The angle of the lower jaw and throat is drawn upward in both sounds, but more so in G than in K.

Finally, the difference in the process of releasing the closure asserts and manifests itself externally. In G we see in front a depression of the ridge of the tongue, and in K, a lowering and thrusting forward of it. This is why the movement of the lower jaw is greater in K; it is noticeable in front by the movement of the two rows of teeth and the chin; it is noticeable from the side upon the lower rim of the lower jaw, and especially upon the angle of the lower jaw and throat. In K a fluctuating movement of the skin (Merkel) is clearly visible upon the lateral surface of the neck, previous and subsequent to the explosion, while nothing of the kind is observable in G. The movement of the angle of the lower jaw and throat is greater in K than in G.

Fricative or Spirant Sounds.

As in the stopped sounds we have distinguished hard and soft consonants, we can also make a like distinction in the fricative sounds; since, for the purpose of facial speech-reading, the ordinary distinction between voiceless and vocal fricative sounds is immaterial. The hardness of the fricative organs is equally visible with that of the stopped sounds; for instance, we can easily convince ourselves, by means of the eye, how in F and P the lips assume a far more firm consistence than in W (English V) and B, where they are "more or less soft and pliable," says Thausing. Apart from the consistence, consideration must also be given to the size of the limiting surfaces; these, for instance, are considerably larger in F than in W. Finally, the transition from F to A is totally different in appearance from that of W to A; the first named, owing to the stronger pressure of air, produces a more passive impression, while the latter shows an active muscle movement. Taking all into consideration, we have in the fricatives the same points of view by which we distinguish between the voiceless and vocalized, just as we distinguished the *tenues* from the *mediæ*.

F and W (English V).

With F we see the upper lip elevated and made tense, so that its lower edge is brought up to a level with the crown line of the upper row of teeth. The two rows of teeth separate somewhat, owing to a backward and downward movement of the lower jaw. This is done in order to enable the lower lip to be curled inward, and over the lower row of teeth. Thus it is that the lower lip comes to lie quite loosely against the upper row of teeth. In W (English V), however, the two rows of teeth only come to be separated from one another about the same distance

they are in E (English A); the lower jaw therefore takes a more elevated position than in F, and so facilitates the formation of a larger surface for the walls of the aperture. The lips are not quite as tense as in F; they take a position similar to that in A (as in mama), only the lower lip approaches the lower row of teeth somewhat, but is not drawn inwardly so much as in F. Thus "the length of the mouth aperture is diminished, and the corners of the mouth are brought towards each other," says Merkel. In F, on the other hand, the mouth aperture retains its ordinary length.

In front, therefore, we see, when F is uttered, the red exposure of the lips lessened, the chin lower and the corners of the mouth in their usual position; whereas in W (English V) the red exposure of the lower lip is rather broadened, the chin is elevated, and the corners of the mouth are somewhat contracted. A side view reveals the fact that in F the *atrium* nearly disappears, while in W it is preserved and the lips retain their ordinary shovel-like form. While in F the downward and backward movement of the lower jaw is mainly noticeable, in W the jaw is raised in addition to moving backward as has been already explained. In the transition to a vowel, we see in W a forward trend, which in F is still more decided. Of course the backward movements of the lower jaw are observable alike from a side view and when the mouth is covered, although at first it is somewhat difficult to distinguish a voiced fricative from a vowel.

SS and S.*

Merkel says: "The easiest and most common way to form S is as follows: The two jaws are so brought together that the two rows of the teeth are near each

* The German SS has no exact equivalent sound in English, but will be readily recognized upon closely observing the remarks here made.

other, or, if they had previously been separated, they are brought towards each other in such a manner that the uncovered crowns or edges of both lines of teeth lie in one and the same horizontal line, and the edges of the lower incisors take a position in the rear of the upper ones, although, more especially if the S sound is less prominent, the edges of the upper incisors stand off a little from the lower."

In front, we see in SS the two rows of teeth quite close to each other, but in S they stand slightly apart from each other in such manner that the lower teeth take position in the rear of the upper ones. We also invariably see that, when the lower jaw shifts from its passive position into that of S, the chin projects. Most frequently it will also be observed that, in assuming the S position, a broadening out of the mouth aperture takes place. This, of course, is plainly visible from the side, where we observe a backward movement of the corners of the mouth, and, at the same time, a forward movement of the lower jaw—a movement which, in the vocalized S, is coupled with a yet more decided upward movement of the lower jaw than is the case in voiceless SS.

These characteristic features are sufficiently discernible even when the mouth is covered. Altogether, the S of itself is easily read, although the difference between the vocalized and voiceless S is not near as pronounced as that between F and W. For purposes of speech-reading, however, it matters not whether the vocalized S is distinguished from the unvocalized or not.

*CH and J.**

It is very difficult to distinguish these two sounds from one another or from others. The place of articulation is located nearly where the vocal tube is contracted in form-

* The German CH has no exact equivalent in English; J is the English consonant Y.

ing the vowel I (English E). It is true that in uttering CH "the tongue is also drawn upwards and backwards toward the soft palate" (Merkel). This also compels the lower jaw (which, we have already seen, retreats upwards) to elevate itself even more. It is from this position of the lower jaw that we must learn to read these two consonants. These two positions of the lower jaw can, naturally, be best observed from a side view. It will also be seen that the *atrium* is so extremely diminished as almost to disappear, which constitutes another similarity to the I (English E) position, and is caused by the backward movement of the lower jaw; however, the corners of the mouth are not drawn up as high as in the I position. In the utterance of I, the two rows of teeth, viewed from the front, are further apart than in CH or J. Hence, in the utterance of the word "*ich*," we see the two rows of teeth further apart in I than in CH. Neither is the mouth aperture as broad in CH as it is in I, which difference, of course, is observed only in a specially distinct utterance. I do not consider it very essential for the purpose of speech-reading to be able to distinguish CH from J.

SCH (English SH).

This is another easily read consonant, alike in front or from the side, and also with covered mouth. Its articulate characteristics are clearly seen. The question which concerns us is whether the point where the tongue (hyoid) bone is located (the angle between the lower jaw and the neck) is altered by the raising and projecting forward of the lower jaw (Merkel). This alteration makes a characteristic not to be undervalued, more especially when, with the mouth covered, one compares from the side the difference in the movements peculiar to SCH and U. But these movements can hardly, even remotely, be considered as much a part of the characteristic features of SCH as is the peculiar change effected in

the *atrium*. These changes, or, better, positions, furthermore, deviate but slightly from the quiescent position; the lips, on the other hand, are opened and curled outwards, thus being drawn away from the incisors and their alveoli. At the same time "the two corners of the mouth are elevated somewhat, and the whole mouth aperture generally assumes a slightly higher position than is the case in a state of quiescence;" furthermore, this lifting and curling of the lips cause the corners of the mouth to approach each other. In this manner the outer border of the red part of the lips assumes an approximately square or right-angled form, having blunted corners; the inner border, at the same time, forms a triangular orifice, whose apex lies in the middle of the red portion of the lower lip.

While we can observe all this with the greatest ease from the front, there are also presented from the side, in the change of form assumed by the *atrium*, distinctive features which we instantly recognize. Although we may have become familiar with divers vowels in uttering which the *atrium* is projected forward, yet in all of these the shape assumed by the *atrium* approximates that of a section of a cone, while in SCH the shape is more that of a hollow cylinder. And furthermore, upon closer observation, we recognize that the lower jaw, as has already been said, is projected forward, and that the angle between the lower jaw and the front surface of the throat is more obtuse. This, taken in connection with the peculiar forward stretching of the cheek surface (a difficult thing to describe, but readily recognized), presents ample characteristics for the recognition of SCH, even when the mouth is covered, and for its distinction from the vowels above mentioned.

L.

Entirely isolated from all other sounds of speech stands the sound of L. It belongs properly neither to the stopped

nor to the fricative sounds, nor to any other class of speech tones. Should it be thought that its external characteristics would therefore be the more readily apparent, a glance into the physiology of speech would suffice to prove this idea apparently erroneous. But it is only apparently so. The external characteristics of no sound have been so surprisingly neglected as those of L. Not only in front, but from the side, and even with covered mouth, it can be read with certainty.

In front we observe that the teeth stand apart somewhat more than in the quiescent position of the lower jaw. We furthermore see that since this deviation from the quiescent position is really considerable, the tongue, cone-like, (partaking of the parrot tongue-form) is pressed against the back of the upper row of teeth. Owing to its very hard consistence in L, the tongue thus depresses with its root the bottom of the mouth, and we see a bulging out of that portion of the arch of the chin which is formed by the soft parts between the two lower jaw-bones.

At the same time, we observe that, both in consequence of the depression of the lower jaw and the projection of the sides of the mouth, the cheeks appear flattened.

In the side view, we recognize L chiefly by the vaulted or arched bottom of the mouth, the simultaneous backward pressure of the lower jaw, and the increased obtuseness of the above indicated angle. All of these manifestations are also discernible when the mouth is covered.

The Nasal Tones.

The nasal tones are distinguished from all others by the fact that their emission occurs through the nose instead of the mouth. In general, their articulating place (*locus articulationis*) is identical with that of the stopped sounds; nevertheless there are some additional peculiarities to be observed.

M has the same articulating place as that of the P genus; it differs, however, from the latter in this, that the lips, or rather their red surfaces, are incurved. M therefore, in front, is distinguishable from P by the fact that it displays a narrower lip-border; and, from the side, by the distinctly observable narrowing of the space between the lips and teeth.

N, in its external manifestation, takes an intermediate position between L and T, when the sound is viewed from the front. The rows of teeth assume about a medium distance from each other; therefore, when viewed from the side, the lower jaw also assumes an intermediate position. On the whole, the position approaches nearer that of T, only that the two rows of teeth, as seen in front, appear farther apart; that the lower jaw, seen from the side, lies lower downward; and furthermore, that, when the transition to the vowel is made, an entirely different kind of a movement is to be noted.

NG, finally, in its position is externally hardly recognizable, principally owing to a lack of all external characteristics, despite the opening of the mouth, which corresponds nearly to the quiescent position of A, D, and H. The formation of the NG sound makes this self-evident, as it is effected solely by the relaxing of the soft palate.

Some Important Groups of Sounds.

In reviewing the order of the sounds thus far named, we constantly find three main places of articulation. The first involves the lips; the second the teeth, the third the palate.

The group F, M, P, B (Labials).

While in F, viewed from the front, the *atrium*, especially its lower portion, is considerably shortened, the sound of M shows an evenly compressed lip-border. The width of

the red portion of the lips is only slightly narrower at the corners of the mouth than at the middle. On the whole, the red portion of the lips appears considerably narrower. In P it is also narrowed; but midway of the mouth its breadth considerably exceeds that at the corners of the mouth, although the real place of pressure certainly lies more towards the middle. In B, finally, the red portion of the lips appears to its full extent.

Viewed from the side, we observe in F, on the part of the lower jaw, a considerable movement to the rear, while in M it plainly moves decidedly forward. But even here the borders of the lips are curled inward. This disappears in P; nevertheless, the lips continue to be forcibly pressed against the teeth. In B, finally, the lips move sufficiently forward to assume their natural quiescent position.

The Group L, N, T, D, S (Dentals).

This group, in a front view, shows us the distinctive features of the tongue constantly lowering itself, and the rows of teeth gradually approaching each other in such a manner that in L the aperture between the teeth is greatest; in S it is least, and the tongue is lowest. A side view shows this change most effectually by the altered position of the lower jaw. While in L it is depressed, it gradually elevates and projects itself, until in S the crowns of the teeth stand directly opposite to one another.

The Group CH, J (English Y), G, K (Palatals).

This group does not display so regularly graded a succession of external manifestations; and it can be arranged in this order only when the position of the lower jaw is observed from the side. In CH its position is highest; in K lowest.

If, however, we take a front view of the group, we shall

soon find that they must be arranged as follows: J, CH, G, K; for in J the corners of the mouth are farthest apart; in K, on the other hand, the aperture widens, and the corners of the mouth are closest to each other.

R.

It is with great difficulty that we can read this sound. It is recognized most readily at the close of a syllable. In this case it is generally pronounced like the vowel A. The syllable *er* sounds *ea;* the syllable *der*, *dea;* *mir*, *mia*, etc. When a word commences with R, no definite feature of recognition can be given. On the whole, only the following is to be noted and especially practised. If R is uttered as a tongue R, it may be confounded with D, T, N, and especially with L. If, however, R is uttered as a palatal R, it will, of course, easily be confounded with the sounds of the third articulation division, particularly with G and J. These hints must suffice to impress the fact that R must be practised in contrast with the consonants above named.

This closes the description of the external characteristics of individual speech sounds. It remains as a matter of supplemental proof to add some remarks.

Should it be thought desirable to test further what has been said, it would assuredly be an error to commence doing so with one's self. Due objectivity in judging of external characteristics of speech sounds, by the observation of one's own person, is rarely preserved; of this I have satisfied myself innumerable times.

An excellent means of determining and fixing the objective characteristics of individual sounds is given us by instantaneous photography. It was utilized in 1885 for this purpose, and its importance and the results attained were explicitly stated in an article by Félix Hément,

entitled: "Les progrès récents dans l'enseignement des Sourd-muets," in the periodical *La Nature* for 1885, p. 168. I have myself given this subject special attention during the past year or more, and in time we shall certainly achieve interesting results in this line. With ordinary instantaneous photography, however, it is extremely difficult to photograph a sound singly apart from its sound combination in word or sentence; it requires much practise and great skill to close the shutter at the right moment. A more convenient way would be to use the "series" apparatus, which enables one to take a series of instantaneous photographs. Such apparatus, however, is very expensive and beyond the means of single individuals. The apparatus would have to be of such a character that at least twenty negatives could be taken within a second. Notwithstanding this, I considered the subject of such importance that I, myself, consumed a considerable portion of my time in endeavoring to solve it. Meanwhile an article was making the rounds of the press, inspired by an article in the *Figaro*. I extract the following from the *Photographhische Mittheilungen* of March 1, 1892, p. 362:

In the *Figaro* of February 2, 1892, under the heading "*Au jour le jour*," there is a noteworthy article, by Guy Tomel, which prompts me to offer the following observations:

The fact that every motion consists of a series of movements, or phenomena, which succeed one another so rapidly that, to our vision, they appear as a single motion, may be assumed as already known. Our eye is only capable of fixing, as it were, the pictures of passing objects, whether singly or collectively, when at a visible distance they are directly in front.

Instantaneous photography, at present, has arrived at such a high state of perfection that skilfully constructed apparatus enables us to fix, in the fraction of a second, the individual phases of an apparently single movement. The resulting prints are then pasted successively equi-distant upon a strip of paper, the ends of which are so joined as to form a continuous circle. This picture-circle is then placed in a rapid-vision apparatus, the upper part of which is likewise circular (but wider than the picture cylinder, and provided with slits), and placed on a revolving

disc. When revolving, one observes, through one of the slits, the exact succession of the apparent motions of the photographed object.

According to the writer in the *Figaro*, Messrs. Demeny and Marey, of the *Collège de France*, have availed themselves of this process to photograph the lip movements of a person speaking; and, as just indicated, have united these pictures in a rapid-vision instrument such as above described, for the purpose of enabling deaf-mutes, by imitating the apparent lip movements thus presented to their view, to communicate with any and all persons, without resorting to the cumbersome language of signs, foreign to the majority of people—certainly one of the greatest of services that photographic art could render to suffering mankind! Our unfortunate fellow-men are thus enabled, virtually, to practise every movement, and by means of intelligent direction to attain the highest grade of distinct enunciation; and it is self-evident that thus an immense amount of time and pains will be saved, as even the most patient and devoted of teachers would find it impossible constantly (even voicelessly) to undergo such exacting speech exercises with their pupils, to say nothing of precision.

To Messrs. Demeny and Marey is due the credit of having given the first impetus in this direction towards the amelioration of human suffering. It would be a great satisfaction, however, to the writer of this, should these observations of his contribute to animating the proper parties to institute diligent tests as to whether or not these achievements of instantaneous photography can be rendered serviceable to the pupils of deaf-mute institutions.

Every instructor of the deaf will at once realize that the demands here made upon the achievements of instantaneous photography are excessive. Let us assume that in moderately rapid speech twelve sounds are uttered in a second;* this would hardly enable any one to speak and consequently photograph more than two words per second. In doing so, however, it is absolutely necessary that the instantaneous process seize the most characteristic positions of the sounds. It is well known that instantaneous pictures can be taken with a flash-light in

* This assumption is rather low. I have made numerous counts upon myself and others and found that when speaking moderately fast 1,200 to 1,500 sounds per minute are produced, which would be 20 to 25 sounds per second. It is, however, only with the best of series apparatus that 20 to 25 pictures can be taken per second, which would be necessary if we desired to divide ordinary speech into its elementary sounds.

$\frac{1}{1000}$th of a second. For speech-action flashes of $\frac{1}{500}$th to $\frac{1}{300}$th of a second would suffice. Let us now assume that we wish to photograph the word "übermorgen." The word represents ten characteristic positions of the organs. Let us assume that the stop is correctly lifted at the beginning of the ü; we will then, considering the comparative duration of the utterance of ü (provided the regular release of the stop is made), secure possibly two pictures, whereas, in view of the rapid transient process in utterance, it may occur that just at the cut off, or stop movement, no picture is obtained. I will, however, assume that a flash-light negative was obtained at the very moment when the most characteristic feature of the sound presented itself. We nevertheless shall not obtain the valuable transitions from sound to sound. As I have already mentioned, we would need to have an apparatus which would give us at least twenty pictures in a second. Such an apparatus, however, to accomplish its purpose, would be extremely expensive.

Assuming, however, that we had such an instrument and could take twenty pictures of a word having ten distinct sounds, it would, after all, be only one word! Would it then be really anything of an exercise for a deaf-mute to continually whirl around a single word in a so-called Stroboscope? Would he thus learn to read speech? Certainly not. He would have to take a series of word-pictures for every word—a kind of Stroboscopic Dictionary; only then could it be said that the desired achievements of the apparatus were attained. In my opinion, instantaneous or flash-like pictures of single sounds would far better attain the object; and I have utilized such instantaneous pictures for the purpose indicated.

If then we would really utilize the Stroboscope or Zoëtrope for this purpose, a large number of pictures of individual sounds might be procured and kept on hand to enable one to construct certain sound-pictures for given

purposes; for instance, if it were desirable to present the word "Schokolade," the pictures might be thus arranged:

(Sch) (o) (o) (k) (o) (o) (l) (a) (a) (d) (e).

For the three vowels, we should need to insert two of the same vowel pictures, as the vowels consume greater time in utterance than the consonants.

Some experiments I have been diligently making in this direction for more than a year are not yet concluded. Possibly I may present at a future time some of the sound-pictures I have secured by instantaneous photography.*

If we would, with the naked eye, observe in minutest detail the external characteristics of speech-sounds, there is in my opinion but one way; and that is, while listening, carefully to observe persons who are speaking to us unconstrainedly and who do not know that we are observing them. We must, however, in observing the external characteristics of any particular sound, concentrate our attention, at the time, solely upon that individual one. In listening, it will very often occur that, shortly previous to its advent, we shall know what sound is to be uttered, and can therefore quickly concentrate attention upon it. Of course, the observing of any one person and one single observation will not suffice to fix in our mind the external characteristic of a sound. We need frequently to identify the sound as seen in one person, and then to verify it by observations upon other persons. In doing this, an accurate knowledge of speech-physiology is necessary. In this manner, the above data were obtained three years ago, and their correctness has since been verified. The really striking success which has thus often attended my father's efforts and my own has convinced me of their

*Dr. Gutzman's Stroboscope, known also as the Zoëtrope, consists of an apparatus constructed upon the principle of the Kinetoscope, in which the movements of the mouth when uttering any letter or combination of letters are shown by Kinetographic pictures.

correctness. Incidentally let me cite in evidence the fact that a gentleman who became deaf after the twelfth year of his age attained such skill as to enable him, while in the parquet of a theatre, to follow, word by word, the conversation of two ladies in an adjacent box. And a young lady, who had almost entirely lost her hearing power, by this process attained so great a proficiency in speech-reading that the examining aurist (Professor Dr. Trautmann) could not at first be made to believe that the lady had absolutely not heard a word of all he had spoken to her. I am also glad to be able to have had an opportunity to demonstrate, at the first medical clinic of Privy Counsellor Professor Dr. Leyden, in the Auditorium at Berlin, the possibility of a deaf-mute's thus faultlessly reading sounds and words solely from the general facial indications, even when the mouth was covered.

It will, no doubt, prove of great practical value if, as a supplement to what I have said of the external physiology of speech-sounds, I now briefly give an illustration of the method of teaching speech-reading.

A. Individual Sounds.

In presenting a method for speech-reading instruction, we must constantly assume, as a basis, what I have brought to a conclusion in the preceding part—the acquisition of perfect familiarity with the external characteristics of individual sounds. Why it is of the greatest importance first to practise upon and familiarize one's self with the vowels I have already stated, but will here recapitulate.

In the first place, the vowels are very easily read; I assume that this has been made evident to every one. The vowel movements are distinct and protracted; they give each word its character alike to the eye and to the ear. Every full-sounding word involves a considerable number of vowel movements. Every person who articulates dis-

tinctly will give special emphasis to the enunciation of vowels, and thus will impress auditors more pleasantly, and will be more readily understood by the speech-reader. Why it is that vowels are of the greatest importance in all languages I cannot here consider, but will refer to Thausing, Techmer, Sievers, Steinthal, and others. Some additional matters in this connection will be presented further on; though they will only be such as relate to our special purpose of speech-reading, they may, nevertheless, contribute somewhat toward solving many an interesting question in phonetics.

It is, of course, understood that only the most practical and simplest forms should be presented to those whom we would instruct. Nevertheless, I regard it as highly advantageous to have the learner not only familiarize himself with them visually, but also commit them to memory. The manner in which I would have this understood I will here exemplify by a few exercises.

Example of an Exercise in Individual Sounds.

A (as in mama).

Front and Lateral — Lower jaw depressed. Mouth at rest.

U (English OO).

Lateral — Lower jaw projecting forward. Mouth projecting forward proboscis-like. Cheek surface drawn forward.

Front — Mouth aperture very small. Lips puffed out. Mouth-corners strongly drawn toward each other.

O.

Lateral
- Lower jaw downward and forward.
- Mouth forward (less than in U).
- Cheek surface drawn forward (less than in U).

Front
- Mouth aperture oval.
- Mouth-corners nearer each other than in A.

I (English E).

Lateral
- Lower jaw diagonally upward and backward.
- Mouth drawn backward.
- Mouth-corners diagonally upward and backward.
- Cheek surface drawn diagonally upward and backward. (Objective point, the cheek bone.)

Front
- The two rows of teeth approaching each other.
- Mouth-corners wide apart (somewhat upward).
- Mouth aperture no longer oval, but in the form of a slit.

E (English A).

Lateral
- Lower jaw upward.
- Lips drawn somewhat backward.
- Skin shows tension backward. (Objective point, ear-lobes.)

Front
- The two rows of teeth nearer each other than in A, wider than in I.
- Mouth-corners wider apart than in A.
- Mouth aperture slit-like.

Questions.

Tell me what you see in the A utterance.
" " " U "
" " " O "
" " " E "
" " " I "

Here follows the explanation of the vowel triangle in the simplest form :

A

A^e

O O^e E

U U^e I

Questions.

What lies between A and E?
What lies between O and E?
What lies between U and I?

Double vowels always have two positions, the one at starting and the other at the close.

Observe accordingly and practice:

	Start.	Close.
Au:	A	U
Ei:	A	I
Eu:	O^a	I

Two movements here invariably take place as follows:

	I.	II.		
Au	downward	front		
Ai	down	diagonally	upward	back.
Eu	front	"	"	"

Speech-reading exercises.

Individual vowels: A, E, I, U, O, A^e, O^e, U^e, EU, AU, EI.

Two vowels following one another: A O, I U, A^e EU, AI O^e, AU U^e, etc.

Three vowels following one another: A E U, AU E EI, O A^e EU, etc.

Table showing the difference between hard and soft consonants:

1. Consistence	hard	soft
2. Area of contact	small	great
3. Motion	passive	active

Hard stopped or shut sounds are: P, T, K.

Soft stopped or shut sounds are: B, D, G.

In stopped sounds there are invariably two distinguishable movements:

1. The *formation* of the closure.
2. The *releasing* of the closure.

P.

Formation of the closure.

Lateral { Lips drawn backward against the teeth.
Lower jaw at rest.

Front { Lip-red narrowed.
Chin at rest.

Releasing of the closure.

Lateral { Lower jaw downward.
Cheeks slightly puffed.

Front { Lips separated directly upward and downward.
Chin directly downward.

B.

Formation.

Lateral { Lips resting upon one another.
Lower jaw somewhat upward.

Front { Lip-red not narrowed.
Chin somewhat elevated.

Releasing.

Lateral { Lower jaw at rest.
Cheeks show slight movement forward.

Front { Lips move forward, rolling apart.
Chin remains at rest.

Exercise. Compare severally the points of difference between P and B.

Speech-reading exercise.

PA, BA, PO, PAU, BAU, PEI, BEI, BI, BAᵉ, PEU, etc.

Papa, Puppe, Baubau, Pappe, Baba, etc.

I trust this will suffice to show how I conduct, and would have others conduct, methodical exercises on the external characteristics of individual sounds. All of these statements, lessons, questions, and exercises are, of course, dictated to the pupils, and entered in their note-books.

B. Syllable Pictures.

In identically the same manner as individual sounds have just been practised, I would have exercises to practise certain syllables, which frequently and regularly occur in language. I mean those syllables which in grammar are usually designated as prefixes and suffixes. The former, for instance, are b, ge, ent, an, um, etc.; the latter, thum, heit, keit, ung, nen, en, er, etc. All of these syllables, of which there are a great number, and which naturally in the course of instruction should all receive attention, possess characteristics peculiar to each. It seems hardly necessary to speak further of their importance in the matter of speech-reading; suffice it to say that, without methodically practising them, perfect skill in the art of speech-reading cannot be attained. The labor they exact of both instructor and scholar, in cases where the latter attains even moderate skill in reading individual sounds, is comparatively little, while the compensation is great. They must, of course be practised until, like the stenographer's symbols, they are under ready command, more especially those syllables which in ordinary speech are usually uttered most rapidly and indistinctly.

C. The Visibility of the Accent.

Just as the emphasizing of a word manifests itself to the hearer by stronger sound-waves, so it does to the speech-reader by a stronger movement and more distinct picture of the vowel involved.

This observation must also lead to methodical exercise in speech-reading, and that, too, in divers ways, as, for instance, in giving the speech-reader meaningless words to read, in which he must be required to designate the accented syllable according to the vowel or to its position. When once progress has been made with word and sentence pictures, this faculty can be further cultivated by having the emphasized words in an uttered sentence designated.

D. Word Pictures.

By means of these preliminary exercises in reading syllabic pictures and accented syllables, the pupil will have arrived at a stage when, with but little additional practice, he will, to the delight of others and of himself, soon also be able to read words indistinctly uttered. One rule must here again be called to attention, which is of the greatest importance for the rapid acquisition of skill in speech-reading, and that is: *The number of vowels equals the number of syllables.*

Of course, great additional latitude in combinations is given to persons who have great command of language; nevertheless, it is directed, as it were, into a given channel, and thus less frequently leads to misunderstanding.

E. Conclusion.

Finally, we proceed to the acquisition of certain sentence pictures, and, of course, such will be selected as are most important in the practical affairs of life. Much

more might be added or, at least, enlarged upon, but I have purposely kept the latter part of this paper strictly aphoristic. Any person of experience will graduate the progress to suit himself, and adapt the same to each individual case ; but the method pursued, according to my view, must be based upon the principles herein briefly and suggestively given. I will not close this labor without giving expression to an opinion, based upon practical experience, in regard to the erroneous view held by some aurists, who maintain that hard-of-hearing persons have their remaining hearing power impaired by acquiring speech-reading ability. This view is held upon the hypothesis that hard-of-hearing people, when they can readily read speech, give their hearing power less exercise, and hence, owing to inactivity, there ensues atrophy of the remaining power of hearing that they possess. Despite extensive practice and experience, I have been unable to verify this ; in fact, just the contrary proves to be the case : owing to the speech-reading facility acquired, the remainder of the hearing power has been more fully utilized and improved.

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