RELIMINARY NOTES

0. This material deals with acquiring the basic framework of speech and with aids in consonant articulation. Some persons may be able to immediately apply the methods described, others may need additional assistance, the most important of these is proper relaxation, or neutralization of the oral and laryngeal regions. This can be done by ways such as keeping the head (and upper body) supported by the arms on a table, or by certain methods of breathing. In addition, learning proper articulation can also be assisted by keeping the mouth and eyes open or closed, as well as by positioning the jaw hinge. These details are not covered at this point.

1. The absolute musculo-mechanical basis of speech is the framework on which the more complex actions of articulation and phonation frames are built. In the case of the deaf the normal speech frame is not in place, so its acquisition can aid them in producing correct speech.

2. The three major functions of the respiratory-feeding tract, breathing, feeding and vocalization possess their own frameworks. Entering each frame is involuntarily initiated. This is obvious in breathing and mastication-swallowing, as well in normal speaking. Breathing is triggered by fall in blood oxygen level, mastication is triggered by some object in mouth. Hearing voices and words is the input that triggers speech. The deaf lack this input, and so do not automatically generate the speech frame.

3. The deaf already possess use of the respiratory and feeding frames since both have appeared at birth. Familiarity with these two can enable them to acquire the correct speech frame. If they succeed, approximating normal speech will come automatically when instructed in the details of articulation and phonation.

THE BASIC SPEECH FRAMEWORK

Introductory points

1. The tongue and the other oral organs are quite sensitive and open to perception by everyone. One can feel one's way around especially well if looking at anatomic diagrams. By perceptive observation the material presented here can be readily verified.
2. There are technical details that make such observations easier, but are not elaborated on at this time. These include such variables as to whether the mouth or

the eyes are kept open or closed, or the tilt of the head, which changes the position and shape of tongue, or whether breathing is oral or nasal.
3. Analysis of a complex system is only possible when its variables are isolated. The complexity of speech production is greatly simplified when articulation is isolated from phonation. (Although this is not emphasized in the present material, isolation of the two functions is the basis of the work leading to the data offered in this material. Such isolation of functions, I believe can also be helpful in training students in articulation.)

Vertical setting of the tongue - articulation

The **tongue** consists of a muscle mass, comprised of (a) the superior longitudinal (**SL**), (b) the inferior longitudinal (**IL**) and (c) the composite of the transverse plus vertical muscles. The last group is designated as the combined longitudinal (CL) in the "The Human Tongue Atlas" of the Visible Human Project, but here it is more appropriate to call it the *middle layer*, (**ML**). **Fig. 1**. (Figures refer to diagrams in the Basic.pdf file).

The tongue mass cannot move in the oral chamber, it can only change the tongue shape, curve it **upward** vs. **downward**, or alter its **length** and **width**. Moving the tongue within the oral chamber is accomplished by the extrinsic lingual muscles.

The role of the SL and IL enters at this point. In curving the tongue they are the chief agents, or **prime movers** in executing the curvature. The verticals in the ML are their synergists. In upward curvature the verticals pull upwards with the SL and in downward curvature they pull downwards with the IL. The upward curvature is the innate fundamental setting for breathing, whereas downward sets up feeding.
When the upward pull and downward pull are **equal** in strength, then the tongue is vertically divided into two parts, lying one above the other, and which **balance** one another in an **antagonist pairing** in a state of **equilibrium**. **Fig. 2**.

There are two **important** points arising from this.
First, if the forces creating up and down curving halves exert **equa**l forces, and are **simultaneously** held on to, then the two regions can be merged into a composite unit filling the entire tongue. The merged unit generates the basic **lingual articulation frame**. Settling in this frame enables normal, efficient articulation. **Figs. 3 and 4**.

The **second** point is that once established in the working speech mode, the upper half of the tongue is the fundamental shaping agent of **consonant** articulation, while he lower one serves for **vowels**. **Fig. 5**.

Axial setting if tongue and larynx - phonation

The function of phonation belongs to a **second antagonist pair**, consisting of the tongue and larynx. The two organs exert axial pull or compression between one another.
In each case, the tensions applied to the larynx cause specific glottal strictures, i.e., phonation. In normal speech it is articulation that generates the correct amount of phonation to match a particular phoneme or syllable. The correct matching occurs when the lingual and laryngeal forces are balanced in a temporary state of equilibrium.

The tract shape of full speech

In ongoing speech the vocal tract takes on an approximate **cone** shape, and alternately a **spindle** shape with a wide middle section. The term "spindle" is arbitrary, because the tract shape involved is really a merger of two cones joined at their bases, forming there a "belly". The shape can be also described as a toy top, lying on its side. However, for the time being, it is simplest to call it a "spindle". **Fig. 6**.

The cone shape occurs with vowels, and the spindle shape for consonants. The reason for this behavior can be explained. For vowels the oral chamber is enlarged to produce the vocalic space, and it is narrowed at the larynx, which needs tract constriction to produce phonation. **Fig. 6**.
For consonants the tract narrowing occurs at the lingual tract as well as at the larynx. However, in compensation for these two strictures, to ensure the required air volume flow, the tract needs to widen at some point between the two constrictions. This part can be called the "belly" of the spindle.
Thus, by varying the tract diameter at various points the total tract volume is relatively constant: this is a matter of regulation. In any of the three biological functions of the tract the volume of respiration needs to remain constant as required by circumstances.

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