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Abe Pepinsky
University of Minnesota

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THE LARYNGEAL VENTRICLE CONSIDERED AS AN ACOUSTIC FILTER

ABE PEPINSKY

University of Minnesota

The Ventricle is a pocket-shaped slit in the sides of the larynx which extends laterally between the true and false vocal folds. It is deepset in the middle, and there projects vertically upward from its anterior half a blind sac (the appendix). The physiological function of the ventricle is supposedly only that of lubricating the vocal folds. The presence of fibrous tissue in the ventricular fold seems to indicate the possibility of muscular control of the volume of the ventricle and the area of the orifice communicating with the larynx.

There has evidently been no attention paid to the ventricular influence on vocal tone quality, but there is some evidence for an innervation from the pharyngeal plexus which is useful in fixing the larynx in position for "ventricular band voice" in pathological conditions of the true vocal folds. There is moreover the possibility of considerable contraction in the pharynx, thereby narrowing the larynx with a consequent approximation of the ventricular bands. This knowledge is used in phonation which begins with a glottal stop for strongly accented initial vowels. A good deal of work has been done in cases of "double voice" which produces two different fundamental frequencies. This was further found to depend upon voluntary approximation of the ventricular bands.

The above considerations thus definitely indicate the possibility of controlling the inclosed volume of the ventricle and the area of its orifice for the conductivity of vibrational energy. Here, then, are all factors essential to the consideration of the ventricle as a resonator. It must be remembered, however, that the damping effect of the mucous membrane-lining of the walls of the ventricle greatly broadens the frequency range of this implied resonance.

Reports of research in the fields of phonetics and vocal tone quality have given theoretical consideration to the coupled resonator system consisting of the oral, pharyngeal and nasal cavities and have even mentioned the possible influence of the sinus, but the effects of the ventricle seem to have been neglected. Stimulus to such thinking is furnished by the acoustic filters of G. W. Stewart, especially by the type known as "low frequency pass" filters. In such a system, by analogy, the pharynx could be assumed to take care of the inertance factor, and the ventricle would constitute the branch section after the fashion of a Helmholtz resonator offering inertance and capacitance in series. This system offers transmission of a broad band of low frequencies from zero to what would be a rather sharp cut-off, but which under the damping conditions of absorbent tissue, would taper off at a higher frequency level.

With the evidence of comparatively low intensity for the lowest frequency components of the extremely complex note produced by the vocal bands, and with evidence of the relatively great strength of the higher partials, it is readily understandable that the laryngeal system should thus be able to conserve the energy in a desirable frequency region in order that this may be transmitted to the coupled resonator system, beginning with the pharynx, for requisite tone quality. It is highly probable that this is an important factor in the empirical approach used in vocal technique, but results are gained in the latter through efforts to "fix" the respiratory tract.

The foregoing outline merely attempts to explain the direction being taken in some new studies of vocal quality. It is, of course, difficult to obtain a sufficient number of laryngeal specimens to make for a meaningful statistical measure of the actual relationships involved. Furthermore, even with fresh specimens elastically unspoiled by pickling solutions, it is difficult to obtain a true picture of the volume of the ventricle. This is being attempted, however, and the results seem to justify the hypotheses presented in this paper.

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A. O. C. NIER

University of Minnesota

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RICHARD J. ANDERSON

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CARL J. ULRICH

Edison High School