Literatur Sprechatmung

Hixon, T. (1987) “Respiratory Function in Speech and Song”. (Sign. VII Hix 1,1)
v.a.

Kap. 1 “Respiratory Function in Speech”
Kap. 3 “Kinematics of the chest wall during speech production: Volume displacements of the rib cage, abdomen and lung”
Kap. 4 “Dynamics of the chest wall during speech production: Function of the thorax, rib cage, diaphragm and abdomen”
Kap. 6 “Speech breathing kinematics and mechanism inferences therefrom”

Hixon, T. & Weismer, G. (1995). “Perspectives on the Edinburgh study of speech breathing”. J. Speech & Hearing Res., 38, 42-60.

Hixon, T. & Hoit, J. (2005). “Evaluation and management of speech breathing disorders”. (Sign. VII Hix 2,1)

Weismer, G. (1985). “Speech breathing: Contemporary views and findings”, in R. Daniloff (ed.), Speech Science. Recent Advances. (Sign. VII Dan 4,1)

Ladefoged, P. (1967). “Stress and Respiratory Activity” = Three Areas of Experimental Phonetics, Chap. 1. (Sign. II Lad 1,3)

Grosjean, F. & Collins, M. (1979). Breathing, pausing and reading. *Phonetica*, 36, 98-114.

Pulmonary Subdivisions

The pulmonary system is capable of holding various amounts of air. This air can be measured with a number of different simple devices, some of which trace out a permanent record of air volume changes called a *spirogram*. Figure 1–13 shows an example of such a tracing and illustrates in principle the various *lung volumes* and *capacities* (Pappenheimer et al., 1950).

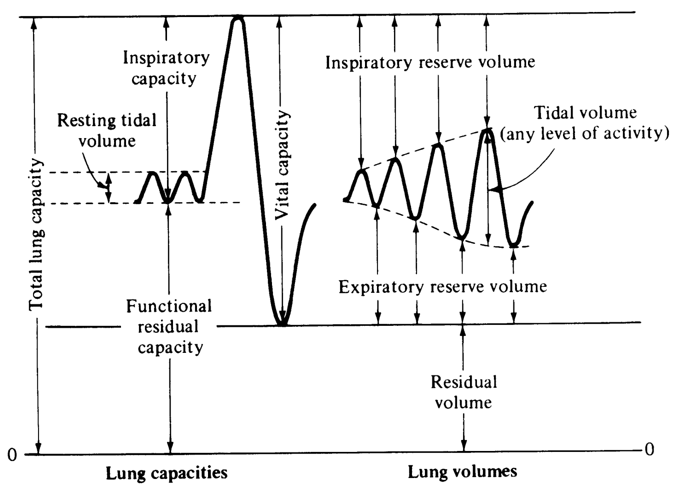


FIGURE 1–13. Spirogram illustration of lung volumes and lung capacities. (After Pappenheimer, J., et al.: Standardization of definitions and symbols in respiratory physiology. *Federation Proceedings, 9*, 602–605, 1950. Used by permission.)

Illustration of the classic view of speech breathing.
(cf. Ladefoged, 1967)

Compare with Fig. 3-12 below from Perkins & Kent. This is superficially very similar. The crucial difference is that it shows ***overlap*** of inspiratory and expiratory activity.

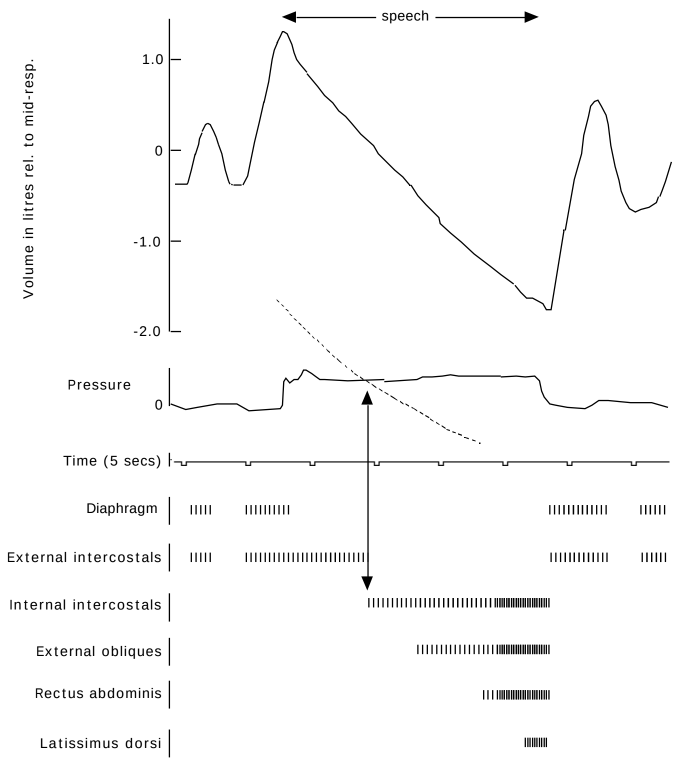


Figure 1. Upper part of the figure, the volume of air in the lungs and the esophageal (sub-glottal pressure) during respiration and counting from 1 – 32 at a conversational loudness. Lower part of the figure, a diagrammatic representation of the muscular activity that was observed to accompany speech during such pressure and volume changes. The dashed line indicates the relaxation pressure associated with the corresponding volume of air in the lungs.

Problems with the classic view of speech breathing

It does not account adequately for “speech breathing as an efficient process” (Weismer, p.49).
The main problem is that the classic view probably underestimates the amount of abdominal activity in normal utterances.

Why would abdominal activity be advantageous?
It stabilizes the respiratory system for production of stress.
During speech it keeps the diaphragm in a domed position, ready for fast, efficient inspiration.

How can we ‘see’ this abdominal activity?
Hixon uses a technique of displaying the configuration of rib-cage and abdomen relative to the so-called ‘relaxation characteristic’.
Speech generally takes place to the left of the relaxation line. This means that the abdomen is smaller and the rib cage larger than during relaxation at the prevailing lung volume (Hixon, Chap.6, p.245).
It can also be observed in the phenomenon of “***prephonatory chest-wall posturing***” (see detailed version of example utterance). Shortly before the start of the utterance the abdomen contracts strongly while the thorax continues to expand slightly (at around t=10.5s in the figure).

Illustration of relaxation characteristic. Adapted from Hixon, 1987.

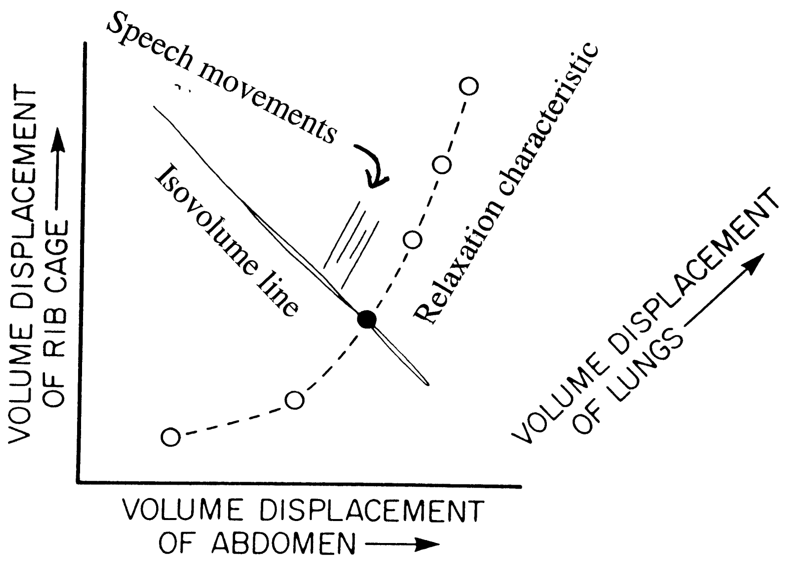
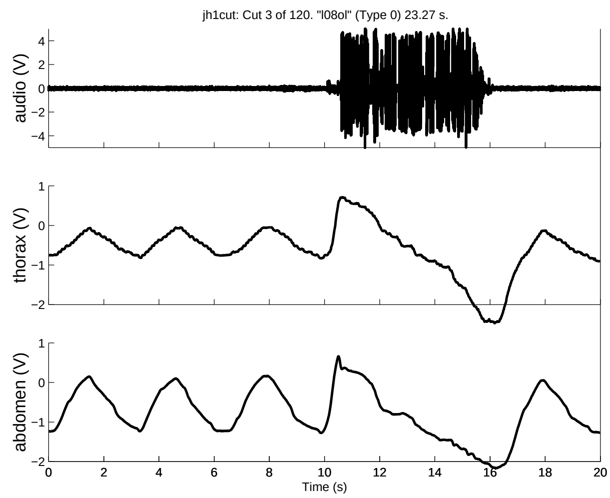


FIGURE 6–8. Data from an upright normal subject.

Illustration of thoracic and abdominal movement for quiet breathing followed by a long utterance (approx. 30 syllables).



Detail of same utterance showing '***prephonatory chest-wall posturing***'

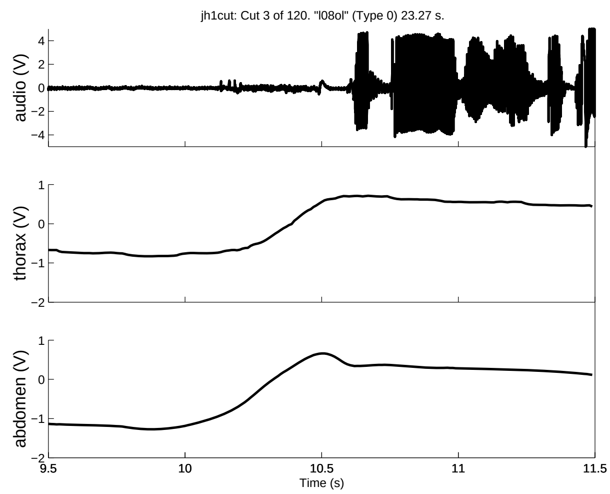
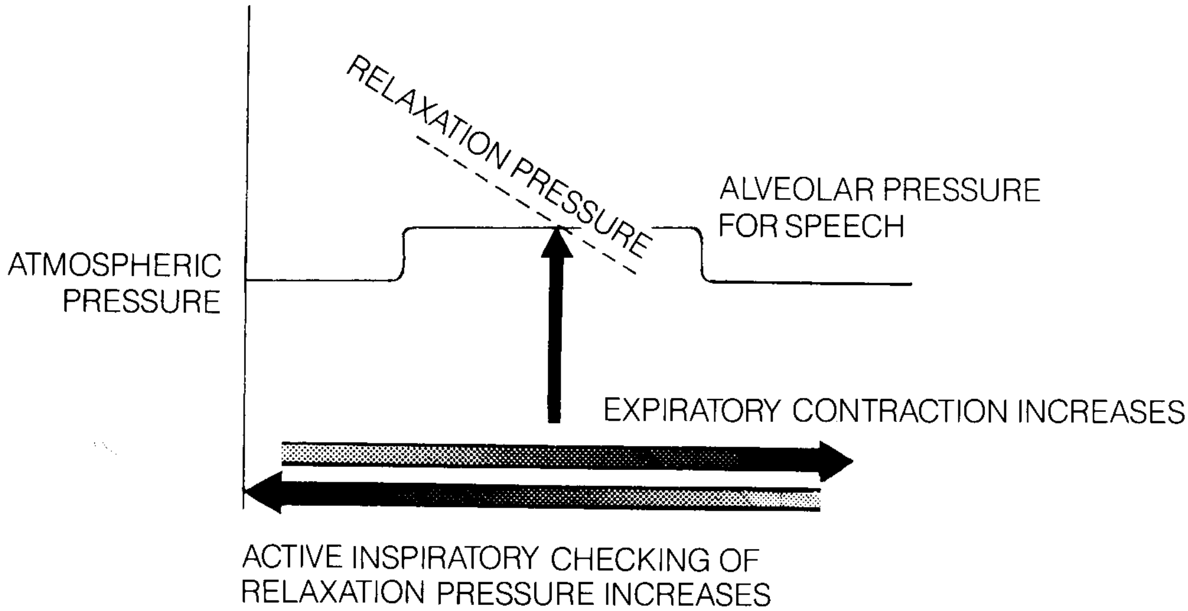


FIGURE 3-12
RESPIRATORY DYNAMICS FOR SPEECH



Maintaining Alveolar Pressure for Speech

We are now ready to confront one of the many paradoxes about speech. Obviously, we inhale with inspiratory and exhale with expiratory muscles. Speech, of course, occurs on exhalation, so common sense tells us that we will use exhalatory muscles to speak. The paradox is that at the beginning of speech both inspiratory and expiratory muscles are often used. Conversely, expiratory muscles are also used to some extent during inhalation.

If you have not already detected the answer to this puzzlement, it is not far to find. Your experiment demonstrated part of it. When you began to speak, relaxation pressure was too high for the alveolar pressure needed for the loudness of your phrase. To offset excessive relaxation pressure, active inhalatory muscular contraction continued to lift the rib cage until relaxation pressure was reduced to about the necessary alveolar pressure level (Fig. 3-12). This reduction in relaxation pressure occurred as air was expended during speech. As air flow continued, lung volume and elastic recoil decreased, as did the need to counteract relaxation pressure with inspiratory muscles. Thus, the muscular force needed to check relaxation pressure varied from instant to instant during speech. If you had inhaled less than 60 percent of vital capacity, relaxation pressure would not have exceeded the required alveolar pressure for speech, so active checking of passive exhalatory force would not have been required. This points up the general principle of speech breathing: For any given alveolar pressure needed for speech, a different balance of active and passive muscular forces will be required to maintain that pressure at each lung-volume level.

This explains why active force is required to offset passive relaxation pressure at the beginning of an utterance. But why should inhalatory and exhalatory muscles be used simultaneously during speech inhalation as well as exhalation? You can see for yourself how this arrangement works by stiffening your abdominal muscles as if you were going to shout, but, instead, keep them tense and speak softly. What you will have done is to escalate the size of the inspiratory force required to offset relaxation pressure by opposing it with active exhalatory muscular force. The effect is to give you more precise control over the alveolar pressure you need for speech. Professional speakers and singers, who pay considerable attention to breathing, are especially likely to use a respiratory pattern such as this.

Another variation which most of us use in a long, loud statement, is to continue speaking after relaxation pressure falls below the desired alveolar pressure level. To do this requires progressive recruitment of more and more expiratory muscles until your air supply is exhausted as you squeeze out the last gasp. At this point, when you relax your active exhalation, the chest wall and lungs will rebound to the relaxed position of about 35 to 40 percent of vital capacity (VC), thereby demonstrating that negative relaxation pressure builds rapidly as exhalation drops below 35 percent VC just as positive passive force builds rapidly as inhalation exceeds 60 percent VC.

(Perkins & Kent, p. 57)