Variations in the anatomic constraints on sound patterns

Didier Demolin

Université Libre de Bruxelles

All humans have a vocal tract built on the same general plan. This leads to the conclusion that to a very large extent, human beings have the same sound producing potential. One can then consider the human vocal tract as a universal constraining the sound patterns of human languages. This is what permits us to describe and classify vocal sounds by means of a limited set of parameters. This leads us to consider that all human beings potentially use the same set of gestures or articulators to produce the acoustic output processed by listeners. The set of articulators and gestures is the same for all human beings but their variations in time and in the space of the vocal tract produce a variable set of features perceived and processed by the listeners of any language. This leads to consider that for any sound pattern to exist, both speakers and listeners must be able to categorize the relevant acoustic outputs in the sound system of their native language. They also have to be able to process this information to produce an adequate motor coordination of gestures to produce the correct acoustic output of sounds in a given language.

Brosnahan (1962) and Catford (1977) noted that small differences in vocal tract anatomy might lead to differences in the sound systems of languages. The differences may be small and individual and may also be related to specific groups of populations. These anthropophonic observations were related to variations in the presence of the risorus muscle (responsible for lip spreading) between Australians, Melanesians, Africans, Europeans and Chinese and Malays. The same observation was made for the tongue length and for differences in larynx musculature.

Data to sustain such observations are quantitatively weak but it is nevertheless important to try to understand whether or not small anatomic differences may lead to the shape of particular sound patterns in a particular form. Even if it is not possible to assign specific sounds (but maybe for the clicks in Khoisan languages) or sound patterns clearly only to a language family, the presence of the most common features present in some languages families are worth examining in this light. At least two perspectives are available to explain the variations in sound patterns. The first is that these specific features may be the consequence of the random sound pattern's evolution of a language towards a state in which it settles and keeps its dynamics (very much like the valleys described in self-organized systems). The second is to consider that a small anatomic variation accounts for the specificity of the sound pattern. In this perspective, it has been observed that the lip-rounding feature is not very frequent in many South American languages. In addition, when realized, it seems to be made without an obvious lip protrusion. Observations made with high-speed video camera and surface EMG on the lips of speakers of South American Indians languages seem to confirm this point. This suggests that there might a specific muscular configuration accounting for this phenomenon. The conclusion is that even if rounded vowels like o do occur they are very often realized without lip protrusion.