

THE VOICE AND THE AUDIO FREQUENCIES

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Which is the importance of the several audio frequencies to the voice? In the voice, pure vowels are characterized having a periodic format; pure consonants don't, having a transition format, that is, they are transient signal that don't repeat.

This is easily verified. Let's consider a pure vowel, for example, the 'e' of the Portuguese language (sounding in English like the 'e' in the word 'palmetto'). One can emit that sound indefinitely (only limited by the person breath capacity), showing its periodicity. Try to emit continuously the sound of a pure consonant like the 't', for instance. It is not possible (see note). Suggestion: try to say the word 'maker' without its vowels: the result is the sound 'brk', reasonably understandable. Now say it without the consonants: it will sound as 'ae'; it is not possible to be understood as it may be confounded with many other words like 'lake', 'made', 'pace', etc, that generate the same sound when we take their vowels.

The periodicity (or not) of a sound can be easily confirmed with an oscilloscope. Theoretically, by the Fourier transforms, we know that, for building transient wave shapes, high frequencies are necessary, that is, the more explosive the sounds are (more abrupt transitions), the higher are the necessary frequencies to build it exactly. The audible periodic wave shapes are less abrupt and, therefore, not as exigent concerning the high frequencies need as the transient ones.

So, we see that pure vowels (periodic) may be constructed with relatively low frequencies, but pure consonants (transient) may not. As it is experimentally verified that the pure consonants are responsible for the sound intelligibility (see the suggestion above), just the latter will be impaired by the decrease of the high frequency response. Without the vowels, the voice power decreases, that is, the so-called 'talking power' diminishes.

As a well-known example, we have the fact that to understand a foreign language (which we are not very fluent in) through a telephone contact is much more difficult than in person. Why? Just because the telephone system is not a high-fidelity one, that means, there is a great high frequency limitation, decreasing the consonant response.

Another example is that older people have more problems to understand what we say just because the decrease of high frequency response of their ears. In the HF transmitters, especially those used by hamradio

operators, it is common the existence of the so called 'voice processors' (indeed compressors that actuate on the audio directly or on the modulated RF envelope, in this case generating less distortion). The purpose of those processors is to increase the talking power of the signal, performing new balance between low and high frequencies, letting more average power of the modulated signal that becomes easier to be copied under interference and/or noise. If the processing level is too much great, the resulting distortion decreases the intelligibility, despite the more signal penetration.

Note: here we call pure vowels just those that can be emitted indefinitely as all the vowels of the Portuguese language; the English language vowel 'i' (as in the word 'mine') has a sound that is formed, indeed, by two pure vowels, more or less the 'a' (as in 'father') followed by an 'i' (as in 'it') and, therefore, is not a pure vowel (indefinitely emittable); the pure vowels are periodic. The pure consonants are those having only transient sounds like the 't', 'd', 'j', 'g', 'p', in English; for example, the 'sh', 's', 'v', 'f', 'l', 'm', 'n', 'r', 'z', the initial 'h', in English, can be continuously emitted and, therefore, are not pure consonants. They are periodic, but have low energy at the lower frequencies and the human audition must have a good high frequency response to understand them well.