

Dimension Analysis of Wideband-transmitted Speech

Marcel Wältermann, Alexander Raake, Sebastian Möller

In this contribution it is analyzed which perceptual dimensions are existent for speech that is transmitted over wideband telephone connections. In order to reveal the relevant dimensions, two auditory experiments with subsequent multidimensional analyses were carried out with a diverse set of mixed narrowband and wideband conditions. For the considered set of speech samples, a perceptual space with a dimensionality of at least four can be obtained. The perceived continuity and noisiness are reflected by two dimensions, respectively. Two further dimensions capture distortions in the frequency domain. One of those reflects the perceived distance of speech, originating from bandpass filtering or the use of hands-free equipment. The other frequency-related dimension mainly reflects distortions in the frequency range beyond traditional narrowband speech. Therefore, the observed effects seem to be unique for wideband speech transmission. Furthermore, the fact that the perceptual space contain more dimensions than in the narrowband-only case indicate that potentially more kinds of distortions may appear in wideband speech transmission.

By mapping the dimensions onto overall listening quality scores in a linear way, statements regarding the importance of single dimensions could be made for the given context. It turned out that "continuity" is the main contributor for overall listening quality.

The knowledge of perceptual dimensions and their contribution to overall quality allow to diagnose and estimate overall listening-quality of wideband speech. For the next generation of instrumental assessment methods, it was recently decided by ITU-T/SG12 that so-called degradation indicators may be integrated to provide diagnostic information about the overall quality estimates. It will be presented how perceptual dimensions can contribute to the definition of such degradation indicators. Perceptually motivated dimensions can provide useful information about the kind of degradations each indicator has to be capable to estimate. An example is given how a frequency-related dimension estimator performs for wideband speech.