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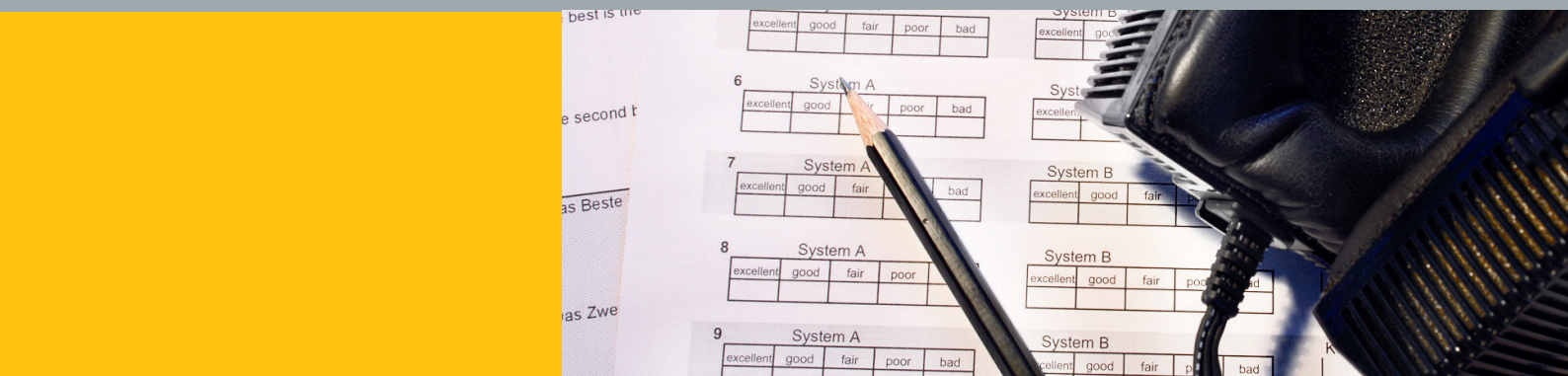## IDMT

Fraunhofer Institute for Digital Media Technology IDMT

Sound Evaluation by Means of Listening Tests and Perceptual Models

For more than 10 years, Fraunhofer IDMT has successfully worked on perceptual evaluation of sound. This includes the assessment of multimedia devices, multimedia algorithms, and sound emitting objects.

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Methods used for Sound Evaluation

Sound characteristics of multimedia devices and algorithms are traditionally evaluated by means of single-number parameters, especially the »Mean Opinion Score (MOS)«. Such parameters are adequate to evaluate the influence on sound quality caused by sound transmission systems. However, in situations where the listener does not have an absolute reference point (»best possible sound«), the MOS is of little use.

This limitation of the MOS has motivated Fraunhofer IDMT to conduct extensive research on how sound can be evaluated by using other attributes. Among these are parameters for describing how sound is perceived in rooms, such as »size of a sound source«, »immersion of the listener«, or »natural sound reproduction«. Other attributes describe sound characteristics, comprising both »classical« psychoacoustic parameters like »roughness«, »fluctuation«, »sharpness«, or »loudness«, and parameters referring to the emotions of the listener, like »arousal«, »valence«, or »dominance«.

The use of such attributes is not limited to multimedia devices and algorithms, but they can also be applied to evaluate sound produced by practically any object.

Development of Evaluation Procedures

In order to obtain reliable results from test subjects, precise definitions and descriptions of the attributes to be analyzed in the listening test are necessary. Another important factor is choosing the most appropriate testing method. Fraunhofer IDMT is among the leading institutions on a global level concerning the development of new evaluation methods. For example, Fraunhofer IDMT substantially contributed to the further development of evaluation methods such as »Free Choice Profiling (FCP)« and »Self-Assessment Manikin (SAM)«.

Accurate Acoustic Measurements and Listening Tests

To conduct listening tests, Fraunhofer IDMT is equipped with the latest and most innovative technology and acoustically optimized measuring facilities. This includes an anechoic chamber certified as class 1 but with an extended frequency range of up to 20 kHz, several listening rooms and test booths complying with Recommendations ITU-R BS.1116 and ITU-T P.800. A loudspeaker wall is used for the auralization of sound fields with high spatial sound resolution. Auralization is possible both for measured and for simulated data of devices and acoustical environments.

The combination of measurements in the anechoic chamber with auralization via the loudspeaker wall is particularly interesting if test subjects are to be freed from any visual influences during the test, for example, if a large number of different devices needs to be evaluated, or in the case of devices which are available as a simulation only.

Perceptual Modeling

Fraunhofer IDMT has outstanding scientific expertise concerning the development of application specific psychoacoustic models for simulating MOS based listening tests. Such models offer a resource efficient alternative to listening tests, as they allow cost-efficient computer based predictions of listening test results.