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LARGE PUBLIC DATABASE OF ROOM ACOUSTIC RESPONSES

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ABSTRACT

Room acoustic results are usually published only in the form of graphs or tables after processing and evaluation. This makes it impossible to compare and reevaluate findings of different authors or methods correctly and by that, it makes hard to draw real conclusions either. Measuring room acoustics by taking room impulse responses is evident for decades, but this type raw data is rarely shared to allow reevaluation, presumably due to contractual reasons. While there are some important or notable collections available to the public, a large collection of room impulse responses from diverse authors, projects, rooms, measurement systems or methods etc. is still missing. The author with support from other colleagues in Hungary started to collect raw measurement data in a structured anonymous manner for reevaluation. The paper presents the methods, formats of this collection with preliminary results of the reevaluation.

Keywords: *room acoustics, measurement results, meta-analysis, public database.*

1. INTRODUCTION

Evaluation of measurement results is essential for understanding room acoustic processes. This is especially important because there is still an active debate today about what is generally accepted, generally admired or disliked in terms of room acoustic quality. There was a hope to find an overall acoustic quality indicator that clearly indicates trends according to each assessment criterion.

To the author's knowledge, no such parameter exists yet and presumably there will not be any. However, design practice requires threshold values, that differentiates acceptable and unacceptable qualities.

When looking at different standards, requirements of even the most basic room acoustic parameter, reverberation time seem diverse.

It is unfortunate, too, that thorough surveys are rarely conducted on acoustically sensitive spaces in renowned public institutions, or that results of those surveys are not published unless advertising demands some loud statement. Yet it is exactly in such situations that one can say that the professional public interest requires monitoring and drawing lessons.

The above problems are not helped by the fact that professional publications present selected end results, so the already available measurement results cannot be examined and compared from different perspectives or principles.

The handful existing public measurement data databases are very important, but are not extensive enough or do focus on specific aspects only.

2. WHY A PUBLIC DATABASE IS NEEDED

The solution is to make already available measurement results available to the professional community. Other colleagues have their own collection of measurement data from the past >20 years and agreed to contribute.

In order to avoid any conflict of interest, it is essential to convert data in a unified manner, that does not allow direct identification but still carries as much information as possible. This should not be a problem from a professional perspective, because the goal is not to review the institution associated with the measurement result, but only the information carried in the measurement data.

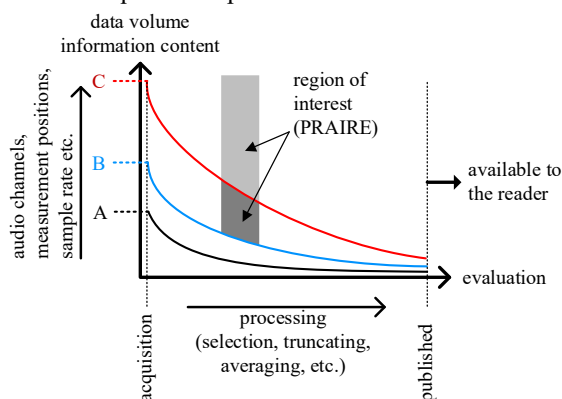*Corresponding author*: *furjes.andor@aqrate.hu*

Publicity means that anyone can contribute to the database and at the same time gain access to previous data. Details of a controlled environment is not yet decided.

3. PRAIRE – THE IDEA

The name "PRAIRE" is an acronym of "Public Room Acoustic Impulse Response Exhibition" and the aim that it should be wide open...

3.1 Data Format: Looking for the Compromise

A hypothetical function of amount of data vs. level of evaluation is shown in Figure 1. Evaluation in general is about extracting the most relevant information therefore it is a kind of compression. But because evaluated data itself always carries a predetermined perspective, a meaningful re-evaluation requires less-processed data.

Figure 1. A hypothetical function of information content from raw data collected during measurements to published evaluations from different measurement methods.

4. RAW DATA IN THE DATABASE

In room acoustics, impulse responses contain all information of the linear transfer function.

In its simplest form, an omnidirectional sound source and an omnidirectional microphone represents one source and receiver pair by one room impulse response (RIR, see [1]).

In a more sophisticated form, responses from a multichannel spherical loudspeaker array and a multichannel spherical microphone array can represent spatial components of the RIR of one single pair of source and receiver within the room.

PRAIRE database currently relies on collections of existing measurements up to 4 channels for each source-receiver pair.

Channels are denoted by letters: W (mono), WXYZ (Ambisonic), LR (binaural). Files are in .flac format.

Besides deconvolution and cycle averaging, responses in the collection are not processed if not stated otherwise. The goal is to test evaluation algorithms with the collection as well.

4.1 Technical Prerequisites of the Collection

At least 3 impulse responses at different source/receiver positions must be collected in rooms, where only one sound source is operated at the same time. Sound sources must not be highly directional, but responses from conventional two-way sources are accepted. Responses from distributed systems, line-arrays etc. are excluded.

Recordings must be clean enough to meaningfully evaluate RIR up to at least 8 kHz and down to at least 100 Hz with >35 dB dynamic range in mid-range (please note, that some measurements in the collection are >20 years old).

4.2 Metadata Required

Measurement sets of rooms are called "cases". Each case has an Excel file containing metadata: type of room, main dimensions, channel configurations, file names, description of conditions, position and aiming of source and receiver for each channel.

4.3 Current Status

Currently >100 cases are in the collection and 67 cases of them are processed to the uniform format with metadata, uploaded to the host: 7 churches (including cathedrals), 22 classrooms, 7 concert halls (with different configurations), 11 event halls, 2 gymnasiums, 4 offices, 10 theatres, etc. Altogether 1479 responses (747 WXYZ, 500 LR, 232 W).

5. SUMMARY

To explore relationships between measurable and perceptual attributes and relationships inherent in room responses, as much information as possible is required. Existing collections of measurements are prepared for reevaluation to get to more grounded conclusions.

6. ACKNOWLEDGEMENT

The collection is made possible by contributions from various colleagues. Hosting of the collection is currently provided by TU Budapest.

7. REFERENCES

[1] ISO 3382-1 "Acoustics – Measurement of room acoustics parameters – Part1: Performance spaces"