Structure for standardization in acoustics

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Abstract

This text discusses standardisation in acoustics as an instrument oriented toward human needs. Although often linked to industrial standardisation and commercial exchange, it is justified by society's need for control. Because individuals act through society, these tasks are delegated to it and rely on measurements. To perform them, a metrological and instrumentation framework is established, which requires definitions of physical quantities. This chain is synthesised in a diagram relating subjective quantities, physical quantities, means of action, measurements, and means of control. Based on this scheme, the system blocks are described. In "Subjective Quantities", topics include the expression of quantities, sensation curves, intelligibility, hearing parameters, levels compatible with health and comfort, and criteria for adjusting room reverberation times, noting that many topics are better suited to guidance and recommendations than to standards. In "Physical Quantities", emphasis is placed on the expression of quantities, reference quantities, and terminology. Next, the "Means of Action" and the "Measurements" block are presented, defining what to measure, how to measure, and for what purpose, with examples in environment, materials/components, source emission, and audiometry. Finally, the "Means of Control" encompass standards, laws, and ordinances, including legislation and quality control. The creation of an Acoustics Committee and a technical Structuring Group is proposed to organise and guide the process. *Note: this text is a modern, commemorative adaptation, written to mark the 40th anniversary of the first two articles published in the journal Acústica e Vibrações (Acoustics and Vibrations Journal) No. 1 in June 1985.*

Keywords: technical standardisation, acoustics, metrology, measurements, control.

PACS: 43.15.+s, 43.58.-e, 43.10.Qs.

Estrutura para normalização em acústica

Resumo

Este texto discute a normalização em acústica como instrumento orientado ao ser humano. Frequentemente vinculada à padronização industrial e ao intercâmbio comercial, ela se justifica pela necessidade social de controle. Como o indivíduo atua por meio da Sociedade, delegam-se a ela essas tarefas, dependentes de medições. Para realizá-las, organiza-se um esquema metrológico e de instrumentação, que requer definições das grandezas físicas. Esse encadeamento é sintetizado em diagrama que relaciona grandezas subjetivas, grandezas físicas, meios de atuação, medições e meios de controle. Com base nesse esquema, descrevem-se os blocos do sistema. Em "Grandezas Subjetivas" incluem-se expressão de grandezas, curvas de sensação sonora, inteligibilidade, parâmetros de audição, níveis compatíveis com saúde e conforto e critérios para ajuste dos tempos de reverberação, observando-se que muitos tópicos se adequam melhor a guias e recomendações do que a normas. Em "Grandezas Físicas" destacam-se a expressão das grandezas, as grandezas de referência e a terminologia. Em seguida, apresentam-se os "Meios de Atuação" e o bloco das "Medições", que define o que medir, como medir e com que finalidade, com exemplos em ambiente, materiais/componentes, emissão de fontes e audiometria. Por fim, os "Meios de Controle" abrangem normas, leis e portarias, incluindo legislação e controle de qualidade. Propõe-se a constituição de um Comitê de Acústica e de um Grupo de Estruturação técnico, para organizar e orientar o processo. *Observação: este texto constitui uma adaptação moderna e comemorativa, elaborada por ocasião dos 40 anos dos dois primeiros artigos publicados na revista Acústica e Vibrações nº1 em junho de 1985.*

Palavras-chave: normalização, acústica, metrologia, medições, controle.

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1. INTRODUCTION

Although often oriented toward the standardisation of industrial processes and toward facilitating commercial exchange, standardisation exists above all for the benefit of human beings, which becomes particularly evident in Acoustics[1].

This human being, however, acts through Society, to which he delegates the tasks of organisation and control. Control requires measurements. And, in order to perform measurements, a metrological and instrumentation framework must be established, which, in turn, requires definitions of the physical quantities involved. This can be seen clearly in the diagram shown in Figure 1.

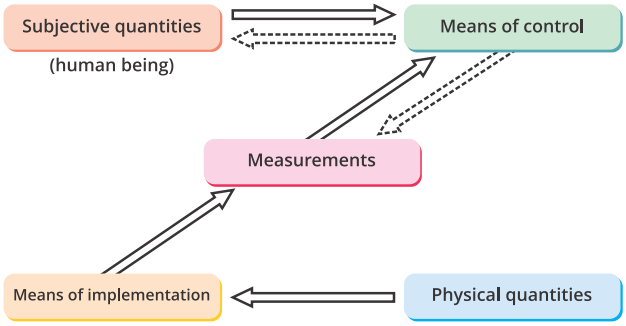

Figure 1: Conceptual framework for standardisation in acoustics, relating subjective quantities, physical quantities, means of implementation, measurements and means of control.

2. BLOCKS OF THE STANDARDISATION SYSTEM

Based on the conceptual framework presented above, the blocks that make up the acoustics standardisation system are described below, from the quantities involved to the practical means of measurement and control.

2.1 Subjective Quantities

In the block related to "Subjective Quantities", the topics would include, among others:

- Expression of subjective quantities;
- Equal-loudness (auditory sensation) magnitude curves;
- Intelligibility;
- Hearing parameters;
- Sound levels compatible with health, safety and comfort requirements;
- Criteria for adjusting room reverberation times;
- etc.

Many of these topics are not, strictly speaking, matters for standards. It would be more appropriate to address them in a "Guidance Document" or simply in a "Collection of Recommendations" drawn from published research.

2.2 Physical Quantities

At the other end of the diagram, in the block of "Physical Quantities", some topics would be, for example:

- Expression of physical quantities;
- Reference quantities and preferred quantities; and
- Terminology: definitions, nomenclature and symbology.

2.3 Means of Implementation

Once the Physical Quantities have been defined, one naturally moves to the block of "Means of Implementation", which deals, among other things, with:

- Metrology: metrological verification (microphone and audiometer calibration, etc.), laboratory accreditation, and coordination of the national calibration network.
- Statistical processes: precision and confidence limits, sampling, and precision, engineering and knowledge methods.
- Qualification of measurement sites: anechoic chambers, reverberation rooms and open-field conditions.
- Instrumentation: specification of transduction, recording and analysis equipment.

[1] This text is a modern and commemorative adaptation, prepared on the occasion of the 40th anniversary of the first two articles published in *Acústica e Vibrações* no. 1 (June 1985) [1].

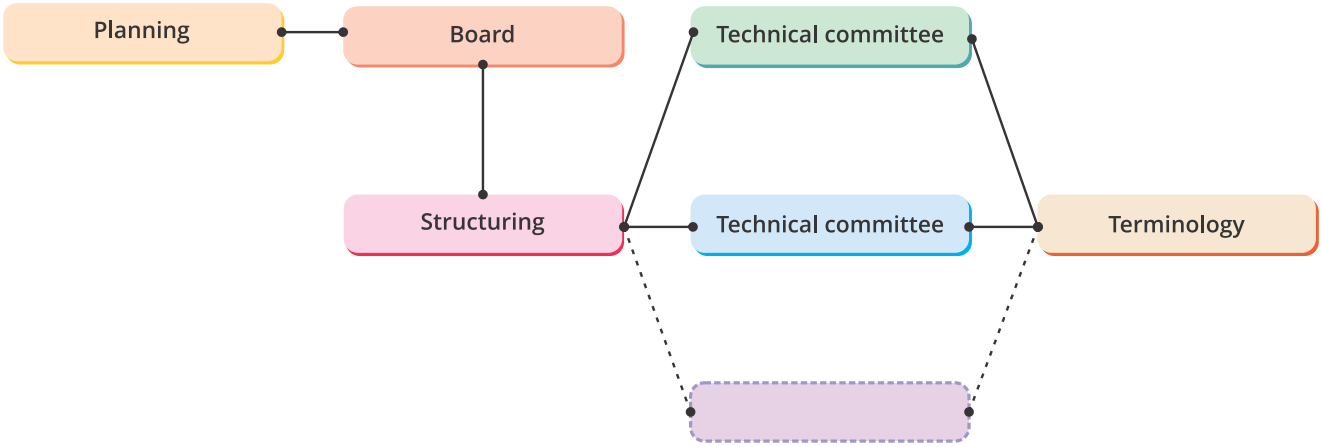

Figure 2: Outline of an organisational structure for an acoustics committee, with planning/management axes, structuring, technical committees and terminology.

2.4 Measurements

Midway through the process, returning to human needs, we find the "Measurements" block. This is where the core of standardisation in Acoustics lies, because it is here that the practical and effective means are established to enable the control required by society, based on theoretical knowledge and metrological resources. The main topics in this block concern what to measure, how to measure, and the purpose of the measurement. Examples include:

- Environment: measurements in Architectural Acoustics, Urban Noise and Industrial Noise;
- Materials/Components: sound insulation, sound absorption;
- Source emission: sound power, noise from mobile sources (road vehicles, rail cars and locomotives, aircraft, and ships); and
- Audiometry.

2.5 Means of Control

Finally, there is the block of "Means of Control", which, coincidentally, is the purpose of the entire standardisation system. This block encompasses not only standards, but also laws, ordinances, codes and the broader administration of society. Examples of topics include:

- Legislation: community noise/zoning, transportation, occupational hygiene and safety.
- Quality control: consumer protection, producer–buyer contracts, inspection and enforcement.

3. PROPOSED ORGANISATIONAL STRUCTURE

To implement the scheme of activities outlined above, the establishment of an Acoustics Committee is proposed, structured as shown in Figure 2.

4. STRUCTURING GROUP

The proposal for a Structuring Group should be highlighted, with the following functions:

- Detail the structure of acoustics standardisation in Brazil;
- Provide guidance to technical committees on what should be included in a given standard and what could be transferred to another standard;
- Forward to the appropriate technical committees the needs identified by other committees;
- Seek to address such needs in the absence of the competent technical committees; and
- Recommend consultation of provisional documents.

The importance of the "Structuring Group" is decisive. Its field of action is technical, and in this it differs from the "Planning Group", which is intended to advise the Committee's Board on policy and standardisation matters.

5. FINAL CONSIDERATIONS

Even if the Committee cannot be implemented in the short term, vocations for these functions should be identified from now on and, if possible, cultivated, so that when the time comes, acoustics standardisation in Brazil may mature within a well-formed context.

NOTE (*JUNE 1985*)

* *Peter Joseph Barry is a physicist and head of the IPT Acoustics Laboratory.*

REFERENCES

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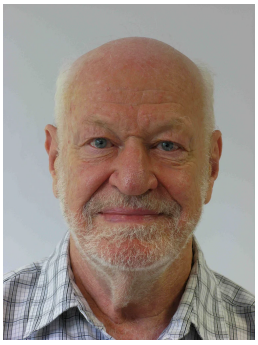
TRIBUTE TO PETER JOSEPH BARRY



Peter Joseph Barry is a New Zealand physicist specialising in acoustics, recognised for his long and influential work in Brazil, particularly at the Institute for Technological Research (IPT), in São Paulo, SP, Brazil. He graduated in Physics from Victoria University of Wellington, New Zealand, obtaining a *B.Sc.* degree in 1964 and a *B.Sc. (Hons)* degree in 1965. He later consolidated complementary training in management and quality by obtaining the *Certified Quality Engineer (CQE)* certification from the American Society for Quality in 1991).

In 1973, Barry settled in Brazil and joined the IPT Acoustics Laboratory, contributing decisively to the consolidation of national capabilities in applied acoustics. Over the decades, he developed research and testing across core fronts of the field, with notable contributions to building acoustics, electroacoustics and environmental acoustics, reaching the senior level of Researcher III at IPT. His technical and scientific output includes studies on the acoustic performance of building systems and experimental procedures, including investigations of materials and solutions for sound absorption and sound insulation.

In the field of environmental noise, his work supported the technical basis for diagnoses and mitigation proposals in large urban centres, through participation in studies and projects related to noise monitoring and management, including interventions and assessments in the context of the Metropolitan Region of São Paulo. In parallel, his expertise intersected with normative development and the dissemination of acoustic performance criteria in Brazil, in step with sectoral evolution and with the growing social demand for acoustic comfort in buildings.

Barry is among the pioneers who helped structure the Brazilian acoustics community. He participated in the founding of the Brazilian Acoustical Society (Sobrac) in 1984. Later, he helped bring the technical–scientific field closer to the demands of the productive sector, joining the movement that culminated in the creation of the Brazilian Association for Acoustic Quality (ProAcústica), where he serves as an advisor and is recognised as an honorary member. Internationally, he closely followed the trajectory and maturation of Brazilian acoustics on the global stage, including attendance at historic editions of the *Inter-Noise* congress and the perception of milestones of international recognition associated with the development of the field in the country. More recently, in 2023, he became an honorary member of Sobrac, an honour granted to pioneers in the field of acoustics.

Even after a career of remarkable breadth, Peter Joseph Barry remains an intellectual and technical reference, contributing to the literature and to contemporary professional debate, including more recent publications related to measurements and the acoustic performance of buildings. His trajectory synthesises metrological rigour, commitment to acoustic quality and dedication to training and to the institutional strengthening of the sector. For these reasons, his work constitutes a lasting legacy to acoustics in Brazil and inspires new generations of researchers and professionals.

– Biographical text by William D'Andrea Fonseca.