



DESIGN REQUIREMENTS FOR A CONTEMPORARY LIBRARY: HOW TO ACHIEVE ACOUSTIC WELL-BEING CONDITIONS

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ABSTRACT

The reading room in traditional libraries is conceived as a quiet place for individual study. Looking at worldwide old libraries, it's clear as the main big reading rooms have a high ceiling, which is often vaulted, and are mainly characterised by sound-reflecting materials. Their architecture itself was designed to inspire silence and self-restraint.

In contemporary libraries, in addition to areas dedicated to individual activities (reading, studying and writing rooms) areas for more collaborative activities – such as reading workshops and various age group activities – and social relations areas (coffee bar and meeting areas) are often present. New sounds and noise sources have necessarily come to light with the proliferation of various new activities, and they must be managed in a proactive way by designers by improving the overall experience of spaces depending on users' needs.

The paper opens up a debate upon the lack of specific acoustic parameters to be used during the designing phase, as the common acoustic quality objective parameters seems to be not useful anymore. In a space designed to host several activities acoustically contradictory to one another, new approaches focused on people perception and behaviour, as the indoor soundscape, have to be found and used.

Keywords: *libraries, well-being conditions, acoustic design solutions.*

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1. INTRODUCTION

In traditional libraries, the reading room is conceived as a quiet place for individual study. Looking at old libraries around the world, it is clear as the main big reading rooms have a high ceiling, which is often vaulted, and are primarily built with sound-reflecting materials.

The architecture itself was designed to inspire silence and self-restraint [1]. It is interesting to notice that stillness is achieved in these spaces by truly relying on very high reverberation times and on the exaltation of sounds (easily audible anywhere in the room), as in such an environment, users are more likely to maintain a silent behaviour [2].

Furthermore, libraries housed a relatively limited number of functions in the past (e.g., book storage, reading, study) that did not entail the presence of any particular sound source.

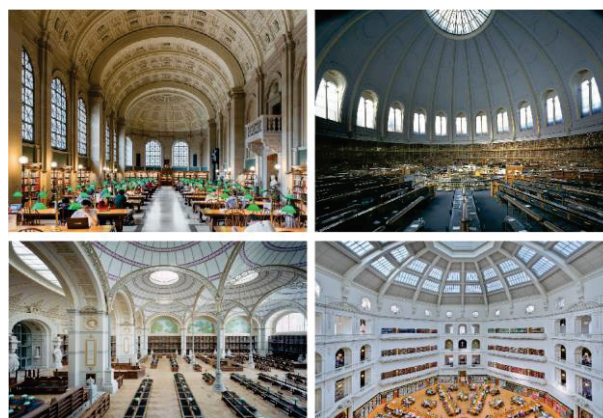


Figure 1. Clockwise from top left corner examples of historical libraries are represented: the Boston Public Library, Boston, USA; the British Museum's reading room, London, UK; the National Library of France, Paris,

France; the State Library of Victoria, Melbourne, Australia.

In contemporary libraries though, in addition to areas dedicated to individual activities (reading, studying, writing rooms), spaces for more collaborative activities (such as reading workshops and various age group activities) and spaces for sociality (cafeteria, meeting areas, etc.) are often incorporated. The proliferation of new activities in libraries has inevitably led to the rise of different types of sounds and sound sources, both of them need to be proactively managed by designers, by improving the overall experience of spaces also including the necessities of users.



Figure 2. Examples of multiple functions in a contemporary library.

2. ACOUSTIC DESIGN FOR LIBRARIES

The acoustic design of a room is usually oriented toward the satisfaction of acoustic quality objective parameters (sound pressure level, reverberation time, etc.) for which in literature there are optimal values to tend towards to, depending on the use of the space. These values mainly concern rooms intended for listening to speech or to

music, where the control of the acoustic response of the environment is the utmost requirement.

As far as libraries are concerned, acoustic quality objective parameters may not be sufficient to describe the suitability of these spaces because on the one hand they may be too restrictive and on the other hand they may not consider the experience of users, both in terms of expectations and behaviour.

3. THE ACOUSTIC CONDITIONS OF CONTEMPORARY LIBRARIES

Several studies have been conducted in order to examine the acoustic conditions of contemporary libraries. Analysis of the results of some of these studies provides interesting information that is summarized here below.

The role of libraries has changed a lot over the past three decades, a phenomenon that has led to a significant increase in background noise, especially during peak hours. The important socializing role assumed by libraries means that it is difficult to find quiet spaces conducive to concentration. The main cause of distraction is the presence of several people, which are active, and it includes third party conversations, noise related to movement, phones ringing, etc. In particular, it is very difficult to find the right balance between background noise and intelligibility because by increasing the background noise the intelligibility, as well as the comfort conditions, is decreasing. Only a rigorous design of distribution layouts can lead to the mapping of spaces with different noise levels and to the differentiation of the noisy ones (that need to be isolated) from those where concentration is required (that need to be protected) [3].

The factorial analysis among results of acoustic parameters measurements conducted in specific spaces of contemporary libraries and the observation of students' activities in those same spaces have revealed three categories of students' activities (that are concentration, relaxation and socialisation, and computer use), and three types of spaces (quiet study rooms, computer rooms, and relaxation/coffee areas). Categories of activities and room types are correlated with the acoustic measurements, indicating the need of distinct acoustic conditions for each one [4].

In most of the analysed contemporary libraries case studies, even though some noise management strategies have been employed to improve acoustic conditions, indoor noise levels are concerning. Sounds generated by walking on hardwood floors, by people talking, by the

functioning of building equipment and by traffic noise are the main sources of the observed noise [5]. Sounds due to people behaviour are the main noise pollution in libraries and for this reason, designing spaces considering activities taking place in the library and user behaviour is a worthy approach to reduce noise pollution [6].

4. NEW ACOUSTIC DESIGN APPROACHES FOR LIBRARIES

An innovative approach to the acoustic design of libraries may be to take into account the indoor soundscape. It is an approach focused on the human-perceived acoustic environment within a given context, which considers user behaviours and perceptions as key points to experiencing the library space and which explores acoustic comfort through objective characteristics and human perceptions.

The suitability of the library soundscape should allow reading and study activities that are not disturbed by surrounding noise. In order to do that, a possibility is to organize spaces according to a hierarchy, providing for a sequence of areas with decreasing noise, from the noisiest to the quietest: starting with the main circulation space, flanked by interaction and communication spaces, adaptive spaces, and, finally, spaces for reading and thinking (more protected and spaced out from the noisy areas).

Another innovative approach to library acoustic design may be to use virtual reality to assess the impact of room acoustics on cognitive performance and well-being. This is an approach that focuses on acoustic simulation, on auralization and on the reproduction of three-dimensionally spatialized audio to provide a listening skill with elaborate spatial characteristics that can be assimilated as closely as possible to listening in the real-world context. The adequacy of the library acoustic design should enable auralization and audio reproduction of spaces, aimed for the efficient evaluation of acoustic interventions and for the determination of the degree of noise disturbance and of the ability to perform a cognitive task within a specific context.

5. REFERENCES

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