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## Acoustic conditions in the atrium of Slovak philharmonic

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### Abstract

Musical performances, conferences, receptions or other events when many people gather can take place in different types of rooms and large shopping centres, atria or city courtyards are not an exception. Continental weather however, doesn't allow for keeping these semi-open spaces uncovered, in case of the whole year operation. Volume, shape and material choice of interior surfaces in atria are typically hard and thus sound reflective, which has very strong influence on acoustic comfort inside. This article analyses acoustic conditions in the atrium of Slovak philharmonic from room acoustic point of view and compares 5 different alternatives of a position of sound absorption in terms of its efficiency and adaptation of an atrium space for music performances, conferences or receptions.

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### 1. Introduction

When people speak about acoustic conditions in rooms, they typically refer to a so-called "good or bad acoustics". But what does a term "good acoustics" actually mean? The answer of an acoustician should be: "The acoustic quality of a room depends on its function, and therefore we cannot speak about a "good or bad acoustics" of a room in general, without knowing what type of activity is performed inside [1].

Most of us have probably already experienced a musical performance in a concert hall, where symphonic orchestra sounded excellent, but once a string quartet started to play a disappointment came, due to lack of volume

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and envelopment by sound and even more problematic situation might have occurred once moderator of a concert started to speak from the stage without suitable microphone – loudspeaker system

It is well known, that understanding of speech needs shorter reverberation time in comparison with music and in case of large room with a volume above ca 1000m<sup>3</sup>, it is almost impossible to reach all people in the audience without sound amplification system. But this is valid also vice versa, e.g. classrooms, auditoria or spoken theatres would be too “dry” for classical music presentation [2]. Different types of music also need different amount of sound absorption applied on interior surfaces, resulting in different reverberation times. While pipe organ sounds better in places with long reverberation, classical music needs a bit shorter sound reverberation [3]. Opera houses are somewhere in between, since opera music should sound well and in the same time certain amount of speech intelligibility of the singer must be kept [4].

Finally, in order to achieve a high quality of music perception in a hall, not only proper sound absorption, but also sound diffusion is extremely important [5].

Places such as restaurants or other gathering places need as much absorption as possible and in case that low sound levels are required also the amount of people per m<sup>2</sup> must be limited [6]. However, decreasing the number of people in a public room such as atrium is in most cases very difficult to control.

If we look back in the history, returning to the period in which electroacoustic equipment haven't exist yet, we will see that antique open air theatres, used mainly for political gatherings and theatre plays, had typically very steep slope of the audience area, so that the distance between the speaking person and the audience would be as short as possible, allowing for sufficient sound intensity at receiver positions. If we look at the paintings of Napoleon, showing him speaking to large crowds of people, we cannot unnoticed, that he was sitting on a horse. This has allowed him to sit higher (for visual an acoustic reason), and also to move in the crowd of people in order to reach a broader public by being well understood. The development of electroacoustic amplification systems (microphone – loudspeaker) has brought completely different situation when giving a speech to large amounts of people in the same time. This, although very positive development in electroacoustic, gave also a powerful tool to dictators to manipulate large crowds easily.



Fig. 1. Interior of the atrium of Slovak philharmonic in Bratislava with and without absorptive material placed over the stage

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