

Analysis of Sound Quality of the “Theatro Da Paz” from the User’s Subjective Perception

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ABSTRACT

Studies begun in 2016 will correlate analytical results with the subjective responses of the user and musicians of the Symphonic Orchestra of Theatro da Paz, Belém/Brazil. This article presents the results of the subjective perception of the users of the hall regarding physical and sound aspects, from a virtual questionnaire. 70% of people have no musical or acoustic training. 93% consider good or very good audibility; 80% clearly distinguished the instruments and 91% the soloist; 84% listened to the orchestra well or very well; for 51%, the sounds are acute and 44% are the bass; the center front sector is where the sound is best perceived and worse in the upper balcony sector to 44%; 70% consider the room little or nothing reverberant; 77% good or regular intimacy; 69% find the room alive or very alive; clear or very clear to 75%; from 69% to 89% hear the sound soft, strong, pleasant and engaging; 53% hear outside noise; 29% hear more traffic noise; 91% hear internal noise, mainly people (55%); the door creaking is heard by 69%. 80% consider the architecture of the room very good and 20% good, it is what attracts more attention to 84%, appearing among the main perceived aspects of the room.

Keywords: Room, Concert Hall, Theatre.

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1. INTRODUCTION

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The Theatro da Paz (TP) is considered one of the most imposing neoclassical opera houses in Brazil. Built between 1869 and 1874. Opened in 1878 is an heritage from the period of rubber economy's expansion in the Amazon [1]. At 141 years old, it is always praised in its beauty as in its acoustics.

According to [2], the TP, theoretically thought to be resistant to time passing, was not prepared for the accelerated growth of the city and its surroundings. Therefore, it is questioned if the noise generated by the traffic of vehicles interferes in the acoustic quality of the room.

[3, 4] report in previous studies that the acoustic quality of a music room in a historical environment such as the Roman, Italian and Neoclassical theaters for example, is directly related to the physical and emotional well-being of theater users and that aesthetics architectural design of the room may overlap with acoustic quality because it represents an emotional conditioner of pleasantness.

The authors emphasize that the acoustic quality of a room depends on several elements and when dealing with rooms destined to music, besides the analysis of form, volume, surfaces and location of the source, it is added to this complex study of the physical-acoustic phenomena, the physiological effects of human perception, the visual appreciation of space. So being a musician or a spectator, the experience in a concert hall is variable according to the individual sensitivity of each one.

According to [5], the approach of inclusion of spectators in the analysis of acoustics is unusual, the author justifies by the fact that in Italy it is commonly considered valid in the evaluation of a theater's acoustics only the opinion of musicians, and more precisely, of conductors.

For all the above, this article was elaborated with the objective of evaluating the subjective sound perception of the listeners of Theatro da Paz. The consultation was done through the platform of the application of online questionnaire, aimed at the users of the theater. The questionnaire was adapted from works developed by international authors [3, 4, 6, 7, 8, 9]. From the statistical analyzes, the perception parameters were evaluated for the general aspects of the theater; acoustic perception; sound characteristics; musical sensation; and global acoustic aspects;

2. RESULTS PRESENTATION

At the end were considered 80 questionnaires applied to analysis in this work, the number of interviews is representative for the intended purpose. The form has been divided into 4 sections: section A presents the public profile. Section B presents the general aspects of the room, not necessarily acoustic, but is related with the environmental comfort and the sensation of well-being that can influence directly in the evaluation of the music's perception by the listener.

Section C exposes the acoustic perception, this is subdivided into 4 categories: the arrangement of the sounds in the orchestra (global distinction of orchestra, instruments, soloist, intensity); the considerations about the room (predominance of high pitches, bass, better and worse position for the audience and non-acoustic aspects of the room); the sound characteristic of the room (reverberation, intimacy, vivacity, brightness, clarity and turbidity); the sensation transmitted as a spectator (softness, strength, pleasantness and involvement). Section D corresponds to the overall acoustic perception (perception and type of internal and external noise, door squeaking, comments and observations).

Section A characterized the interviewees, out of a total of 80 respondents, 60% were female and 40% male. 70% of respondents are between 18 and 29 years of age, 15% between 30 and 45 years. In the last 12 months, about 49% of the interviewees visited Theatro da Paz

only once, more than 81% considered programming as the main motivation to visit it. About 74% of the interviewees do not have musical training.

In section B, in relation to the architecture of the concert hall, 85% of users consider it very good and 15% say it is good. The public's behavior regarding silence was recorded as very good by 16.2% of listeners; good by 49%; regular by 32.5%; only 1.25% rated it as bad and very poor.

As for the preferred place in the theater, the public preference is in the audience and balcony (32.5%); 18.75% like frisas; 11.25% of 1st order boxes; and 2.5% feels good in the paradise and gallery. These percentages suffer a small change when the questioning happens to be about the place where it was in the last show, so that 42.5% affirmed to have occupied the audience; 21,25% in frisas; 16.25% the balconies; 7.5% for 1st order boxes; 5% the gallery and 3.75% the 2nd order boxes. About the visibility of these seats, 37.5% said they were very good; 43.75% claimed to be good; 11, 25% said to be regular; and 6.35% considered it bad. Regarding the audibility of the area where they were in the last show, 46.25% consider it very good; 47.5% good; and 6.25% regular. The temperature of the room was recorded good for 51.25% of the interviewees.

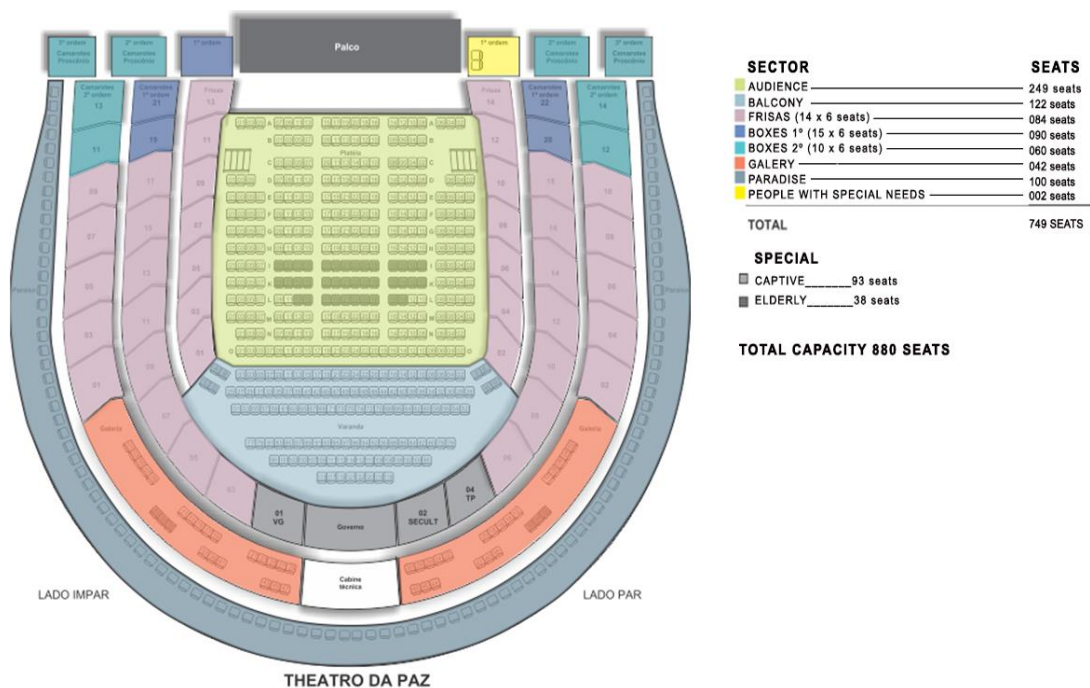


Figure 1. Seating arrangements at Theatro da Paz

The information of section C allowed to identify the sound perception of the room. 52.5% consider that they are able to distinguish clearly the sounds of the different instruments; 30% distinguish them well, 13.75% reasonably differ and only 3.75% said they have difficulty distinguishing the sounds. 38.75% stated that the sound intensity of the instruments was very good; 47.5% consider it good, 11.25% regular and 2.50% said to be bad.

When there is presence of the soloist, 50% of the users responded being able to differentiate it very well and 41.25% distinguishes it well. 51.25% report that they perceive the orchestra very well, while 33.75% perceive it well.

Concerning the perception of high frequencies, 51.25% said that there is a predominance of treble sounds and 40% that they are not always able to perceive it. Regarding the low frequencies, 47.5% say that there is predominance of the bass sounds and 38.75% that are not always perceived.

45% of the interviewees consider that the audience sector is where the sound is better perceived; 30% the balcony, and 10% the paradise sector. Paradise is where the sound is not well perceived to 47.5%; in the gallery, to 17.50%; and in the audience, to 8.75%. 82.5% say that architecture is the most eye-catching aspect of the showroom.

As for the characteristics of the sound in the room, 8.75% considers it very reverberant; 37.5% of users consider it reverberant; 36.25% of respondents consider regular; 10% little reverberant, while 5% feel nothing reverberant; and 2.5% could not comment.

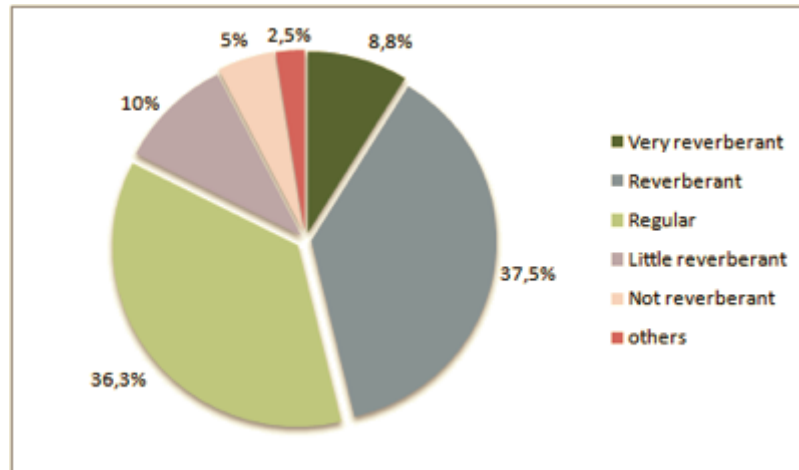


Figure 2. Room reverb perception

Regarding the sense of intimacy of the space, 8.75% consider it very intimate; 26.25% of respondents answered that the environment is intimate; 43.75% consider the room to be regular; 11.25% consider it not intimate, 7.5%, not intimate, and 2.5% of those interviewed could not comment.

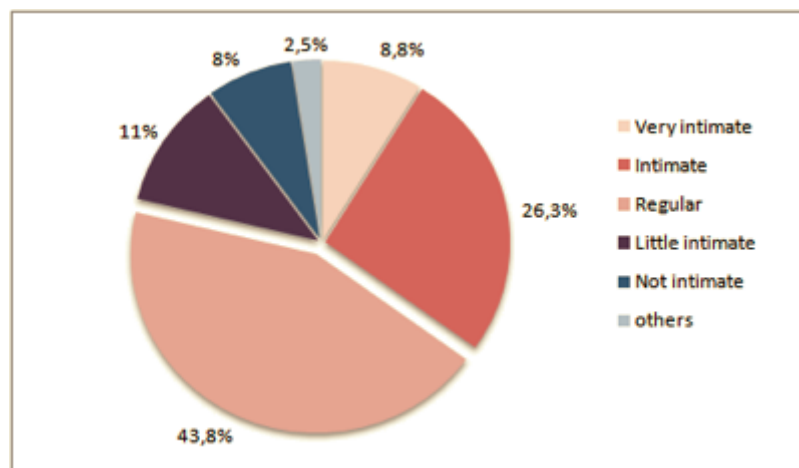


Figure 3. Degree of perceived intimacy

As for vivacity, 30% say that the room is very vivid; 42.5% consider it vivid, rich, bright; 25% regular; and 2.5% say they are little vivid.

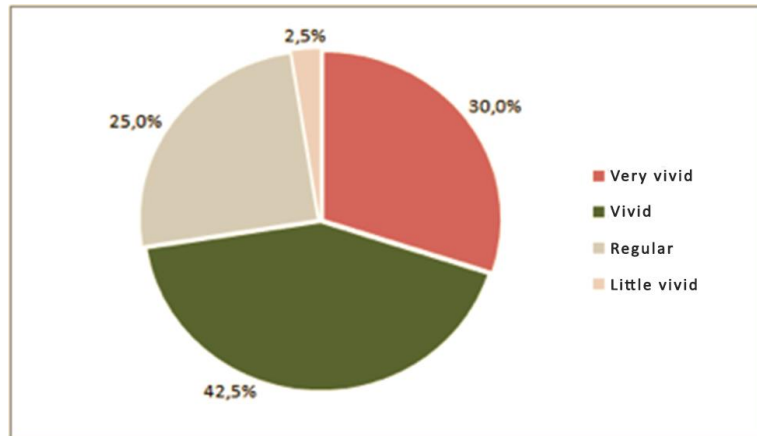


Figure 4. Sensation of the room vivacity to the listener

Regarding the clarity of the room, 31.25% said to be very clear; 47.5% considered it clear 17.5% stated that the environment had regular clarity; and 3.75% say it is unclear.

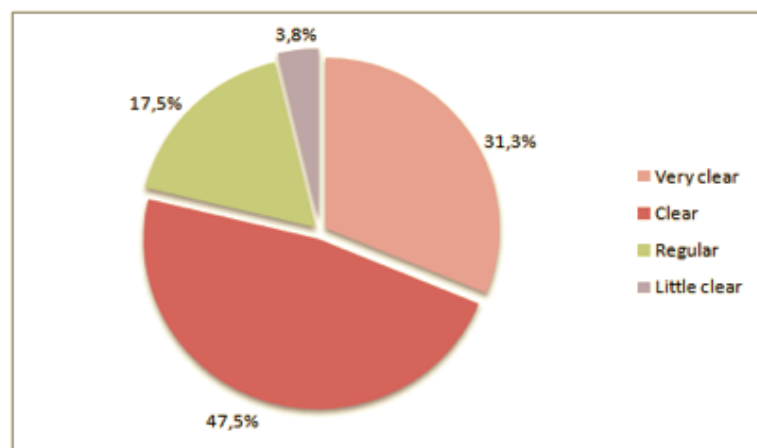


Figure 5. Perception of clarity

About the individualized sounds of musical performance, those who consider it very turbid are 2.5%; 10% say they are turbid; 36.25% say the room is average; 38.75% consider it to be slightly turbid, 12.5% consider it not turbid.

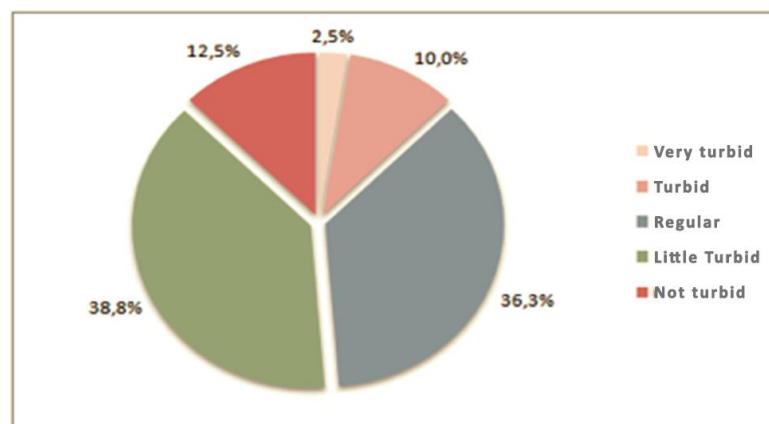


Figure 6. As for the turbidity impression

When asked if the room transmits a soft music sensation, 75% answered yes and 8.75% said no; 16.25% were undecided on the subject. About the sonority of the room 71.25%

considered it strong; 8.75% said they were weak; 20% demonstrated indecision. Regarding the pleasantness, 90% said to be pleasant and 1.25% not pleasant; 8.75% demonstrated indecision. When asked if they felt involved in the sound, 75% said yes; 21.25% said they were regularly involved and 3.75% did not feel involved.

The information about the overall acoustic perception (section D) allowed to verify that 46.25% do not hear the noise outside the room; 32.5% reported hearing them at times; and 21.25% reported hearing outside noise. Regarding the type of external noise heard, the traffic of vehicles (35%) and people (21.25%) were highlighted.

As for internal noise, 51.25% reported hearing them; 36.25% reported hearing only in some moments; and 13.75% do not hear any internal noise. Regarding the type of internal noise, people (65%) and people's footsteps are the most heard (22.5%). When questioned if the noise of the access door bothered them, 37.5% answered yes and 35% said that sometimes.

3. ANALYSIS AND DISCUSSION

The data shows that the audience is predominantly young, under 30 years old, with no musical background, attracted mainly by theater programming, attends one show at least once a year and there is little gender difference.

Section B shows unanimously the importance of room architecture for listeners. As for the impression of the degree of silence, it is said to be acceptable for approximately half the respondents. With regard to the preferred sector of the public, it becomes evident they are the audience sector and balcony. Although the audience stands out as preferred, when asked which sector the user occupied on their last visit, about 81% consider the visibility very good and good, demonstrating that most of the audience sectors have adequate visual field of the stage.

The audibility was evaluated as very good and good by 94% of the interviewees, with the exception of paradise sector, although the majority of the public consulted did not possess musical formation, demonstrating the subjectivity of the sound perception.

Concerning the sound perception of the room (section C), the great majority perceives well the orchestra, distinguishes with ease and intensity the different instruments and clearly identifies the soloist, corroborating with the affirmation of the quality of the sound perception of the room by the consulted ones.

As previously described, less than half of the respondents say that they are not always able to distinguish between bass and treble sounds, with the result that there is no predominance of bass nor treble. [10] cites a testimony of Leopold Stokowsky, who points out as a severe acoustic deficiency the difficulty of hearing instruments of a more serious texture, understood as lack of sonorous heat of the room.

The characterization of the room sound perceived by the listener, points out that most of the interviewees consider the room with good and average reverberation. 72.5% consider the overall sound of the room to be a bright and vivid sound (presence of medium and high frequencies), which may produce a certain imbalance in relation to the results of distinguishing the bass and treble sounds by the listeners, however, this data may show a sound heat deficit, mentioned above.

Concerning the clarity of the sound in the room, about 80% evaluate it as clear, this affirmation is verified when correlated with the perception of the reverberation in the room, that is, if the room presents a good reverberation the sound will be perceived with greater clarity [11].

This assessment is also proven when asked about the perception of turbidity. The room when the sound is turbid is perceived in a confused and indefinite way, these aspects were not observed by the interviewees, since most pointed the room as little or not turbid.

The feeling of intimacy of space, which corresponds to the impression of proximity to the sound coming from the stage, as if the show was being performed in a small room [12] is perceived as good and regular large part of the interviewees.

Finally we tried to analyze the sound perception of the room in a global way, which must be related to the previous parameters. The results showed that, even with a certain amount of undecided answers, the section indicates balanced values, which ratify its results. It is indicated that the predominant majority of the listeners considers the room pleasant, with good sound involvement and smoothness in the musical transmission.

External noise, particularly traffic noise, is heard by $\frac{1}{3}$ of the interviewees, however the biggest complaint is about the internal noise of the people themselves during the show. The theater's greatest gift to society, regardless of the spectacle, is the human connection. [13] points out how the type of audience that attends the musical performances, as well as the behaviors adapted to the event, that nowadays are quite opposite. The rigidity and social formality in concert halls in the mid-twentieth century has ceased to be so restricted, although rituals of applause, silence, coughing, lifting and even the entrance and exit order of the musicians still persist.

4. CONCLUSIONS

The survey provided a good response or this first essay about the subjective perception of sound in Theatro da Paz. It was possible to identify the general public and their overall feeling with concert halls.

The highlight of the architecture of the room demonstrate a strong emotional of general public with space. Negative behaviors were motivating to public performance. It is hoped that the themes for the technical rules, from the measurements of the acoustic waves, with particularities of the theater (room/ musicians/acoustics) and open new lines of research in the context of the concert halls in historical buildings and their relation with the local public.

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