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Research on the Courtyard Mosque Soundscape- A Case Study in the Huajue Alley Mosque

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Research on the Courtyard Mosque Soundscape --- A Case Study in the Huajue Alley Mosque

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Abstract. The mosque is one of the representative Islamic buildings. The unique sound of imam calling and Muslim chanting endows the mosque with the unique spirit of place. Soundscape examining the symbiotic relationship between humans and the environment from the perspective of multidisciplinary integration, realize the evaluation of the adaptability, matching and harmony among sound, architecture and environment from the perspective of human experience. In order to realize the characteristic integration of the modern life and the traditional human settlement space in the new era, to protect and inherit the unique role and charm of the sound elements in the environment, this article starts from the perspective of the soundscape, taking the acoustic environment in the national-protecting Mosque in Huajue Alley as the representative of the research object, combining objective measurement and subjective evaluation methods, a meticulous study has been carried out on the current acoustic environment of the Mosque in Huajue Alley and its main influencing factors. The results of the study highlight the importance of sound elements to the courtyard mosque architecture itself and to the daily life of Muslim communities. It also provides meaningful exploration and practice for enriching the construction of the soundscape theory system.

1. Introduction

Chinese culture has always attached importance to the role of sound. To appreciate, or enlighten, or cultivate, etc., various purposes are achieved through the creation of the acoustic environment. For mosques, a good acoustic environment plays a very important role in the creation of religious mood, the guidance of Muslims' daily life, and the orderly progress of religious activities. In contemporary society where the scale of the city is expanding and the interference of environmental noise is increasing, the research on the acoustic environment of mosques has important practical significance and far-reaching cultural value[1].

At present, there have been a considerable number of acoustic environment studies involving different types of buildings (such as public buildings, religious buildings, etc.) at home and abroad[2][3][4][5]. The latest research and literature have shown that the sound in the city and the built environment has an important impact on the quality of human life. Most researches on mosque architecture focus on its historical background and the building itself, and there are few studies involving the acoustic environment of mosques. Soundscape refers to the sound environment that is perceived, experienced or understood by a person or a group of people under a certain background. It is a landscape perceived by the auditory system. Different from the objective existence of the acoustic environment, the acoustic landscape has a strong subjective color. Sound is the basic element that constitutes the



acoustic environment, while the acoustic environment is the sum of various sounds in the environment. Soundscape is a subjectively considered acoustic environment formed after people reconstruct the objectively existing acoustic environment in their consciousness[6][7].

This work takes the Huajue Alley Mosque in Xi'an City as the research object, records, sorts out, classifies and analyzes the acoustic environment in the mosque, designs a special questionnaire to carry out soundscape surveys, and excavates the elements of the mosque's acoustic environment and its changing laws. It is hoped that this will guide the public to establish a correct and positive awareness of sound environmental protection, and lay the foundation for the soundscape of mosques and Muslim communities in the future.

2. Investigation on the present situation of acoustic environment of Huajue Alley Mosque

2.1. The overview of Huajue Alley Mosque

The Huajue Alley Mosque in Xi'an was originally named Qingxiu Temple. It was built in the early Ming Dynasty[8]. It is the largest and most fully protected traditional Chinese courtyard-style mosque in existence in China. The mosque is composed of a series of courtyards, showing a strong axis and guiding nature, with a total of four courtyards. At the time of worship, Muslims enter through the front-door of the first courtyard and the side-door of the second courtyard, and cross the long axis to the main hall for worship. The first courtyard is the entrance courtyard, and the traditional wooden archway is used as the composition center of the first courtyard. Its front-door is not open, but only opens on the north side of the courtyard. Within the second entrance is the second courtyard, and there is a three-bay room in the middle of the courtyard. In the center of the third courtyard, there is a two-story Xingxin Building as the commanding height of the whole mosque. There are bathrooms in the north and south compartments, imam lecture rooms, etc., which are the main places for daily activities of Muslims. The fourth courtyard is main courtyard of the whole mosque, the eastern half of the courtyard is a courtyard layout centered on the Phoenix Pavilion, and the western half of the courtyard has the main worship hall of the mosque and a wide front square. Some festivals, weddings and funerals are usually held in this square, as we can see in Figure 1.

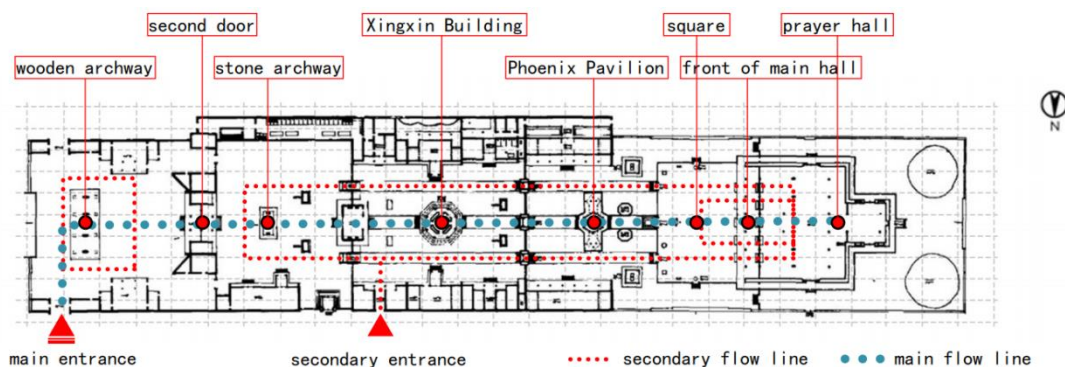


Figure 1. layout of sound walking and measuring points of Huajue Alley Mosque (redrawn by the author)

2.2. The sound environment of the Huajue Alley Mosque

Muslims perform five times of worship a day. The call of imams from the minaret in the mosque is the most important signal to guide Muslims to worship. Therefore, Muslims live around the mosque and develop connections around the small residential areas formed around the mosque, ultimately forming a large-scale Muslim settlement. The imam's voice spreads around the mosque every time of worship, and it can still be "as if there is a sound" in the distance. This is a unique cultural landscape in the Muslim community, which not only shows the solemnity of the worship ceremony, but also stimulates the curiosity of tourists who want to find out.

The imam recites sutras in the lecture room. The voice of reciting sutras in Shaanxi dialect version is serious and vigorous, reflecting the rigorous teachings of Islam and distinct regional characteristics. In Huajue Alley Mosque, loudspeakers are installed under the eaves of the side hall on both sides of the axis of the third and fourth courtyards. The reverberation time is moderate, the sound is clear and bright, and the "long-term sound and high-quality sound" of chanting is realized, and the strong religious atmosphere is enhanced. It can be seen that the sound environment in the mosque is marked by the sound of the imam calling before the service and the Muslim chanting. Both the sound of calling and the sound of chanting are linguistic sounds, which are easily masked by the sound of environment and affect the quality of religious ceremony.

In addition, the changes in the soundscape in the mosque are closely related to the number of tourists. The low season for tourism is from December to February of each year, and the peak season for tourism is from March to November. During the peak season, there is an endless stream of tourists visiting the mosque. Guides' explanations, introductions, and tourists' questions, conversations and cheers have been added to the courtyard. Huajue Alley Mosque is the largest mosque in Xi'an Muslim community, and the changes in its soundscape are highly related to Muslim festivals. For example, every October 1st is an important holiday in Islam---Eid al-Fitr. During the festival, Muslims gathered in the Huajue Alley Mosque from the early morning to hold a grand worship ceremony, and then held the ceremony in the mosque to start the lively festival celebrations, adding livelier atmosphere to the mosque than in the past. These sound elements constitute the background sound in the soundscape of the mosque.

3. Soundscape survey of Huajue Alley Mosque

Soundwalks is a practical research method designed by R. Murray Schafer in the late 1960s. It encourages participants to listen carefully to environmental sounds and make sensory judgments to identify soundscapes and soundscape elements in different locations.

This soundwalks were attended by 34 students from Northwestern Polytechnical University, whose majors included architecture, environmental acoustics and non-related majors. Among them, 24 were males and 10 were females, all with normal hearing, aged 18~25. Each experiment is carried out under sunny weather, good air quality, wind speed below 5m/s, temperature 24~31oC, 3 days as a cycle, a total of 2 cycles. Tests were conducted in 3 time periods in the morning (9:00-11:00), noon (12:00-15:00) and evening (17:00-19:00). During the sound walk, the subjects are asked to list the types of sounds they hear and their corresponding perceptions and preferences. The perception of loudness of each type of sound is divided into 5 standards (-2 very quiet, -1 quiet, 0 normal, 1 noisy, 2 very noisy), and evaluate the hearing and overall comfort of each test point. During the sound walk, the live environment was recorded for further sound analysis[9].

3.1. Foreground sound periodicity

The soundscape of the mosque has a remarkable periodicity. Every day, the soundscape in the mosque changes with the Muslims' five daily prayers (morning, asr, hasr, huh, and Isha), and it repeats itself again and again.

Each mosque has a slightly different time of worship five times a day. Take the Huajue Alley Mosque in Xi'an as an example, the starting times of the five prayers a day are: 5:25 in the morning, 11:05 in the morning, 14:55 in the evening, 19:25 in the evening and 20:15 in the evening. Outside of the five-worship period, there are almost no other obviously regular sounds in the mosque. Before the ceremony, with the help of amplifying equipment, the Imams summon Muslims with their unique language; afterwards, a large number of Muslims pour into the mosque in a short time and gather in the main hall to worship: chanting scriptures in their mouths, knelling and standing up constantly. A large number of sounds related to the activity reached harmony consciously and unconsciously, forming a solemn religious atmosphere. During the ceremony, visitors will consciously control the volume of conversations to maintain a quiet, peaceful, sacred and solemn atmosphere in the courtyard.

3.2. Background sound suitability

Although there have been developments and changes in the layout of the Arab and Chinese mosques, they have always maintained the basic layout of the courtyard style. On this basis, the traditional courtyard-style mosques in China connect the courtyards one by one, and the walls of the courtyard are high. And thorough, it not only ensures that the rich natural sound can stay in the mosque, but also blocks the external sound. Since mosques are mostly distributed in Muslim residential areas and surrounded by the noisy living environment around, this courtyard-style layout shows strong adaptability characteristics in the site layout.

The survey found that although the mosques in the Muslim residential area of drum tower in Xi'an are different in size, they all use quadrangle courtyards as the basic structural units of their layout. The Muslim residences are arranged in clusters around the mosques. Figure 2 shows the distribution of mosques and residential areas in the district where Xi'an Muslims live in clusters. The Huajue Alley Mosque is close to the important tourist attraction of Xi'an-Huimin Street. Due to the large number of tourists, it is very noisy and very quiet all year round. Inside the Huajue Alley Mosque, the central axis belongs to the dynamic zone; on both sides of the axis are arranged reception halls, lounges, etc., which belong to the quiet zone; the two zones are separated by green plants, combining dynamic and static. It can be seen from Figure 1 that the worship hall on the westernmost side is at a certain distance from the street and the three courtyards to the east. This design layout ensures that Muslims will not be disturbed by external sounds when praying; at the same time, due to the east side of the worship hall, with a wide square, the high-level sound produced during worship will gradually attenuate and dissipate in such a large-scale space, without affecting the quiet zone. In addition, the green plants in the mosque also play an active role in sound absorption[10].



Figure 2. distribution of mosques in the Muslim community of Xi'an Drum Tower

3.3. Uniqueness of logo sound

Unlike other religious ceremonies, Muslims do not ring bells or trumpets during worship, let alone play music. Instead, they send special persons (imam) to call regularly. The vocal sound pressure level is very low, and it is difficult to travel far away in a short place. In view of this, the early designers specially built a towering minaret, allowing the muezzin to pray on the top of the tower, and make a sound at a height to avoid the reflection and absorption of obstacles, so that the sound of the call can be transmitted farther and let Muslims living farther away hear. After the 1930s, many mosques began to use loudspeaker equipment to solve the problem of insufficient decibels of admiration sound. For the Huajue Alley Mosque, due to its large volume, the sound has suffered a certain loss due to the long vertical space. It can only be transmitted to the Muslim residents living in the neighborhood, and the call is mixed in the streets outside the mosque and many tourists on Huimin Street, not serving as a call and guide for Muslim residents living far away from the mosque.

With the development of science and technology and the progress of the times, contemporary Muslims do not need to rely solely on the call of imams to worship in the mosque. The five times a day calling

sounds, this unique sound symbol, has long become the cultural symbol of the mosque and the spiritual dependence of Muslims.

4. Sound environment monitoring of Huajue Alley Mosque

4.1. Selection of measuring points

According to the soundwalks-route in the aforementioned soundscape survey, 6 sound measurement points (in Figure 1) were selected in the Huajue Alley Mosque according to different regional functions and spatial layouts. The location characteristics of each measurement point are as follows.

The first test point is located at the wooden archway in the first courtyard of the Huajue Alley Mosque. The courtyard is formed by the main entrance and the second door. It is the first place where tourists gather and stay in the mosque. On the north side is the main entrance, and on the west side is the second door leading to the second courtyard. The sound of people flowing at the entrance, the sound of traffic outside the mosque gate, and the sound of browsing and staying conversation make the test point 1 have a unique acoustic environment, which is convenient for comparison and analysis with other test points.

The second test point is the stone archway in the center of the second courtyard. The courtyard has a wide open space and a large area of hard pavement provides visitors with activity space. Seating under the tree can satisfy activities and leisure functions. It is also a transitional space from the entrance to the center of the mosque, with relatively rich types of activities.

Test point three is located in the Xingxin Building in the middle of the third courtyard, which is the first core area of the entire mosque. The Xingxin Building is the tallest building in the mosque. There are lecture halls on the north and south sides of the courtyard. It is one of the key areas for Muslim activities and is most directly affected by the call.

Test point 4 is located in the Phoenix Pavilion of the fourth courtyard. There are important places for mosques on the north and south sides. There is no obvious separation between the fourth and the fifth courtyard. The Phoenix Pavilion is in front of the worship hall for tourists, the last gathering place.

Test point 5 is located at the center of the square in front of the worship hall. This square is a place where Muslims gather, wait, and talk during daily worship, large gatherings and other activities. It is the most lively place in the entire mosque. When the main hall cannot accommodate all the Muslims participating in worship, some Muslims will gather in the square to worship.

Test point six is located near the loudspeaker at the southern end of the front porch of the main hall. The voices of imams calling out and chanting during prayers will all spread from here.

4.2. Measuring time

Since the Huajue Alley Mosque is located in the scenic area of Xi'an Huimin Street, compared with other mosques, there are many types of sound sources in the mosque, and the sound level is strong. The earliest service time of the mosque is 5:25 in the morning and the latest service time is 20:15. However, non-Muslims are not allowed to enter before 8:00 and after 19:30.

The measurement is carried out on normal days (avoid holidays and large-scale worship days). The measurement period is from 9:00 to 20:30. The start time interval of each two sets of measurements is 0.5 hours, and one data is manually read every 5 seconds. Record 10 data, and take the arithmetic average of the sound pressure level after removing the highest value and the lowest value of the 10 measurement data as the sound level at that moment. The measurement period is 3 days. In order to ensure the comparability of the data, the measurement period of each day is guaranteed to be within the above range.

4.3. Acoustic environment measurement

According to the "GB/T 3222-94 acoustic environmental noise measurement method" in the demand for environmental noise measurement methods, combined with acoustic walking routes, the Huajue Alley Mosque is divided into 6m×10m equidistant grid. According to the route of tourists and Muslim into the mosque to visit or stay or worship, select six representative measurement points, including wood memorial arch (the first clustering location into the mosque), second door (second

courtyard center, near lecture hall), Xingxin Building (commanding heights, sounds coming from the point), Phoenix Pavilion (the fourth courtyard center, near the water room, the square leading to the main hall) and the square (the broadest place in the mosque and the place with the highest density of people gathering during worship). If there are obstacles, appropriate adjustments will be made. The measured height is about 1.2m from the ground and at least 3.5m from any reflective object (except the ground). The ambient noise in the mosque was measured in the weather without rain, snow, thunder and lightning, and the wind speed was less than 5m/s. HS5633 sound level meter is adopted as the measuring instrument. The instrument is calibrated before measurement with an error of less than 0.3dB (A).The time weight is F (fast).

Data measurement results (Table 1) show that at the time of worship every day, the environmental sound level in the mosque courtyard has been significantly increased, which is the result of the combined effect of the increase in the flow of people and the Muslim worship. The increase in sound level at the entrance of the hall and the square in front of the hall is the most significant.

Table 1. Record table of equivalent continuous A-sound-level of representative measuring points in Huajue Alley Mosque

Time	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30
Front of main hall	51.7	64.3	60.6	75.3	73.8	62.5	63.0	59.4	67.3	61.4	58.9	53.7
The square	67.4	60.5	64.3	66.5	77.8	59.8	62.1	56.3	58.2	59.4	62.3	59.9
Xinxin Building	58.4	63.6	59.5	69.9	66.3	49.2	52.8	62.2	57.6	66.2	59.2	59.1
Phoenix Pavilion	60.6	54.9	56.1	68.6	64.1	60.1	64.2	60.0	55.6	59.6	63.7	55.2
second door	50.1	58.2	63.3	64.1	57.7	52.9	58.5	55.8	57.7	60.3	59.0	54.3
wooden archway	54.2	59.0	62.9	66.8	57.8	52.9	58.5	55.2	58.2	60.4	59.5	55.2
Time	15:00	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00	20:30
Front of main hall	74.8	56.1	50.8	62.2	69.8	64.5	54.6	63.4	60.7	71.0	67.7	72.2
The square	75.1	52.3	58.8	64.5	74.4	68.5	60.2	65.9	63.6	74.7	62.1	69.6
Xinxin Building	68.5	48.5	51.7	53.2	66.8	55.6	58.1	58.3	62.6	68.4	61.8	67.7
Phoenix Pavilion	66.4	58.7	60.1	58.5	63.4	59.9	55.5	60.1	58.5	67.8	57.4	64.2
second door	64.4	58.1	62.3	50.5	57.2	56.6	58.3	57.9	56.7	63.3	54.8	64.7
wooden archway	65.2	59.0	63.2	54.6	59.5	58.2	59.7	60.4	55.8	65.8	55.8	63.5

The Huajue Alley Mosque is a national cultural relics protection unit and is visited by tourists during its opening hours. Relatively speaking, there are few tourists from 9:00-11:00 in the morning and 15:00-16:00 in the afternoon. The dominant sound sources in these two periods are the sound of wind, birds, and leaves. When there is no bird singing, the sound pressure level is generally 44~50 dB; when the bird is singing, it is generally 52~57 dB. Therefore, when the Huajue Alley Mosque is quiet and there are almost no tourists, the sound pressure level is generally 47~50 dB. When the number of tourists is relatively small, the sound pressure level will be around 55 dB, taking into account factors

such as their voices and footsteps; while there are more tourists, the sound level in the Huajue Alley Mosque will reach 60~65 dB.

The front of the worship hall, the Phoenix Pavilion, and the north and south sides of the Xingxin Building are equipped with amplifying equipment. Therefore, during the worship time, the dominant sound source is the speaker's announcement of the sound of the worship in the hall. When the speaker is playing, the sound level near the main hall can reach 70~80 dB; while in the Xingxin Building and its eastern part, the sound level is 55~65 dB (Figure 3).

In general, the sound field intensity in the Mosque of Huajue Alley shows a decreasing trend from west to east. Based on field research, the author believes that the main reasons are: there are more plants on the west side of the mosque (around the main hall) than on the east side, and the sound is louder under the action of the wind; the square in front of the main hall is open and the bird's sound is obvious; the main hall is in front of it. The plazas are crowded places where human voices have a great influence; the sound reinforcement equipment on the west side is denser than on the east side.

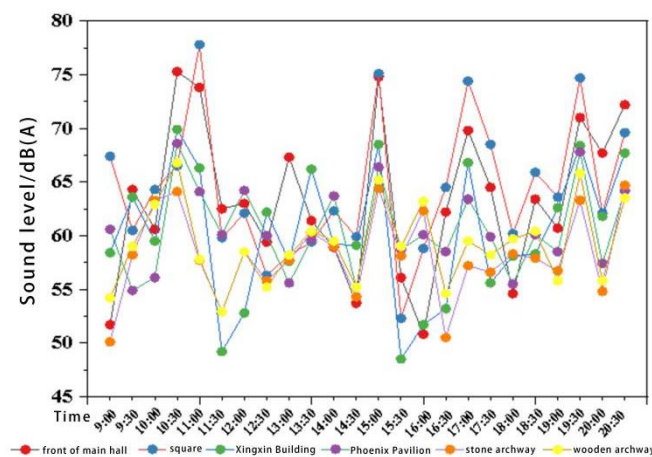


Figure 3. statistical chart of sound level of Huajue Alley Mosque

5. Subjective evaluation of acoustic environment of Huajue Alley Mosque

For different groups of people, design questionnaires and conduct social surveys to explore the soundscape of mosques.

During the acoustic environment measurement of the Huajue Alley Mosque in 2019, about 50 questionnaires were issued at the same time, and the SPSS software was used to count the results of the questionnaire, and the options were analyzed and adjusted, mainly to correct the invalid or lack of reliability and validity. Option to further improve it as a formal questionnaire. The formal questionnaire contains five questions: the first is the introduction, the social characteristics of the respondent, and the objective information of the physical environment; the second is the respondent's attitude towards Islam; the third is the surveyed question. The fourth part is the overall evaluation of the acoustic environment in the mosque and the evaluation of the sound preference for various sounds; the fifth part is the subjective suggestion of the mosque's acoustic environment, for the purpose of discovering and making up for the shortcomings of the previous part of the questionnaire.

In order to obtain complete survey information and make it easier for the interviewees to answer, the religious attitude questions, acoustic environment assessment and acoustic preference assessment questions are all designed as a single-choice grading scale form, which is divided into 3 to 5 levels depending on the situation.

For example, in the survey of voice preference, 1 means to like, 2 means to like relatively, 3 means to have no feeling, 4 means to not like a little bit, and 5 means to not like it in the questionnaire. The questionnaire also asks respondents to evaluate the quietness, comfort and coordination of the mosque's acoustic environment. The options are 1-quiet/comfort/coordination, 2-relatively quiet/comfortable/coordinated, 3-not quiet and not noisy/not feeling/not feeling, 4-relatively noisy/uncomfortable/not coordinated, 5-noisy/uncomfortable/not coordinated.

The adjusted survey was conducted in the summer and autumn of 2019. A total of 160 questionnaires were distributed and 152 valid questionnaires were returned. Among them, 97 were tourists and 55 were Muslims. Use SPSS to analyze survey data. All survey data passed the validity and reliability test.

5.1. Acoustic environment assessment survey

Regarding whether the acoustic environment is important in various physical environments in the Huajue Alley Mosque, more than 60% of the respondents chose the important option, indicating that it is necessary to conduct research on the acoustic environment of the mosque. Considering the fact that the mosque is quieter except for the hours of worship, the questionnaire specifically designed quietness, comfort, and sound coordination as the survey options for the soundscape of the Huajue Alley Mosque.

The questionnaire survey uses semantic segmentation. 1 point is quiet (comfortable, coordinated), 2 is relatively quiet (relatively comfortable, relatively coordinated), 3 is not quiet or noisy (no sensation, no sensation), 4 is relatively noisy (relatively uncomfortable, relatively chaotic), 5 is noisy (uncomfortable, chaotic).

Questionnaire statistics show that 80.9% of the respondents think that the sound environment of the Huajue Alley Mosque is quiet or relatively quiet. 86.2% think comfortable and relatively comfortable. 73.7% believed that the sounds heard in the mosque were in harmony with the overall religious atmosphere or more coordinated (Figure 4). Respondents' average evaluation of the current mosque's quietness is 2.03 (standard deviation 0.798), the average evaluation of acoustic comfort is 1.71 (standard deviation 1.028), and the average evaluation of acoustic environment coordination is 1.95 (standard deviation 1.237). The correlation coefficients (GAMMA) and significance values between the three evaluations are shown in Table 2, and they are all directly and significantly correlated. It shows that from an overall point of view, most of the respondents believe that the acoustic environment of the mosque is quiet and comfortable, and the sound in the mosque is in harmony with the religious atmosphere of the mosque.

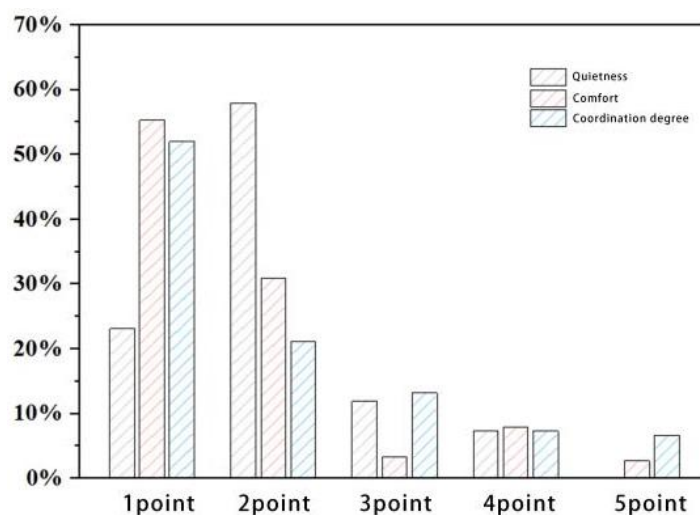


Figure 4. overall acoustic environment evaluation of Huajue Alley Mosque

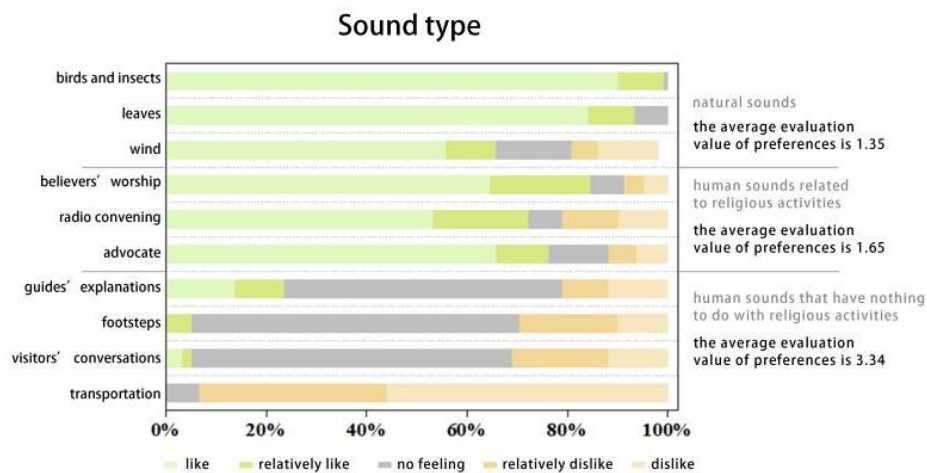


Figure 5. preferences evaluation of various sound in Huajue Alley Mosque

In response to the questionnaire about the best location for the acoustic environment in the Huajue Alley Mosque, 40% of the respondents believed that the place with the best acoustic environment was in the hall of worship, and 26% thought it was in the Xingxin Building. Analysis believes that both places are equipped with amplifying equipment, which can diffuse the call of imams and the chanting of prayers, highlighting a stronger religious atmosphere; the square in front of the worship hall is adjacent to the core area of religious activities, and the open space is more conducive to sound spreading, it is easier to cause a strong sense of resonance and ritual.

Table 2. Correlation between various subjective evaluation of acoustic environment in Huajue Alley Mosque

Category	Correlation coefficients/Significance values		
	Quietness	Comfort	Coordination degree
Quietness	1	0.556/0.330 (*)	0.364/0.547 (*)
Comfort	—	1	0.955/0.011 (*)
Coordination degree	—	—	1

*. At 0.05 level (two tailed), the correlation was significant.

5.2. Acoustic environment preference evaluation

Based on field research, this article divides the sounds in the Huajue Alley Mosque into 3 types: natural sounds (birds and insects, leaves, wind), human sounds related to religious activities (believers' worship, radio convening, and advocate sounds) and human voices that have nothing to do with religious activities (guides' explanations, footsteps, visitors' conversations, and transportation), to evaluate the preferences of different types of sounds in the mosque.

In the questionnaire, the voice preference is subdivided into 5 levels: like; relatively like; no feeling; relatively dislike and dislike. The corresponding evaluation values are 1 to 5, the lower the evaluation value, the more you like it, the higher the evaluation value, the less you like it. The results of the questionnaire show: the average evaluation value of human voice related to religious activities is 1.65 (standard deviation is 1.0); the average evaluation value of natural sounds is 1.35 (standard deviation is 1.0); the average evaluation value of human voices not related to religious activities is 3.34 (standard deviation is 1.5). Among the three types, people prefer the sound of birds and insects in natural sounds, secondly, they prefer the worship of believers in human voices related to religious activities, and the least favorite is in human voices that have nothing to do with religious activities and the sound of vehicles (Figure 5, Figure 6). The evaluation mean and standard deviation of each voice are shown in Figure 6 The most favorite human voices of the respondents in the mosque are calling

sounds (average evaluation value is 1.48) and worshippers (average evaluation value is 1.50), and the least favorite is traffic tool sound (mean value is 4.13). In contrast, among the human voices related to religious activities, believers like calling sounds the most (mean evaluation value is 1.24), tourists like the sound of worship most (mean evaluation value is 1.31), and everyone has basically the same preference for the rest of the sounds (Figure 7).

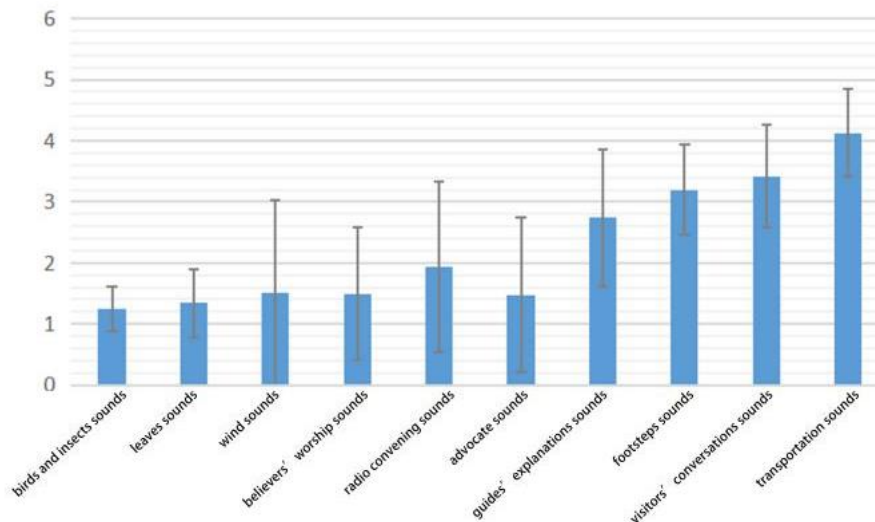


Figure 6. evaluation mean value and standard deviation of voice preference

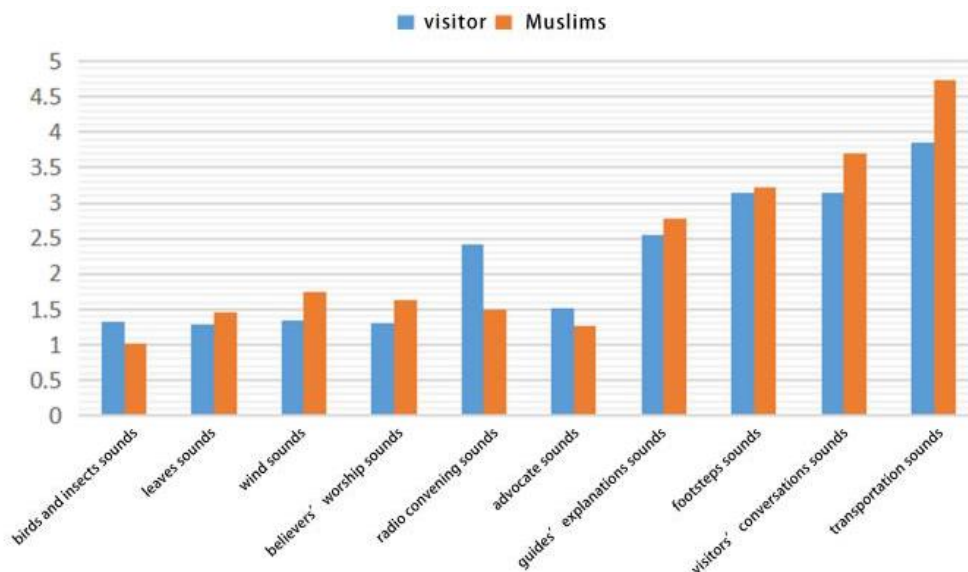


Figure 7. mean value of voice preference of tourists and Muslims

6. Conclusion

Sound is one of the important methods used by the Huajue Alley Mosque to create a religious atmosphere. Although Islam is not like Buddhism and Christianity, which have exclusive religious music, and does not promote the use of music, singing and other highly appreciative artistic methods to purify the soul, but sound still plays an important role in Islam. The soundscape of the mosque plays a vital role in the daily life of Muslims. It is an important cultural landscape in Muslim settlements and is also the spiritual support of Muslims.

Aiming at the acoustic environment design and daily management of the Huajue Alley Mosque, through research, we believe that the theory and research ideas of soundscape is a good way to integrate sound, architecture and human feelings. From this novel perspective, we should optimize the external space of the mosque (try to protect the external sound environment of the mosque and try to shield the noise of tourists around the mosque) and the layout of the internal courtyard (should protect and amplify the common favorite sounds of different groups of people, such as natural sounds and the sounds of worship and proclamation, and use the plant landscape to absorb the common dislike sounds of different groups of people, such as traffic noise; try to control the volume of tourists talking and the volume of the tour guide's explainer. The amplifying equipment on both sides of the side hall should ensure the sound quality and loudness, which is more conducive to highlighting and rendering religion atmosphere); in addition, the psychological and spiritual feelings of Muslims and tourists should be taken into consideration, and the soundscape of mosques, a unique cultural landscape and religious feature, should be reasonably protected with the help of modern acoustic technology.

7. References

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