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Comparison of Soundscape Evaluation in Forest-Type and Urban-Type Han Chinese Buddhist Temples

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Abstract: Soundscapes are one of the main means of creating a religious atmosphere in Han Chinese Buddhist temples, which are the most important religious sites in China. This paper selected several representative forest-type and urban-type Han Chinese Buddhist temples and employed a questionnaire and sound level measurement methods to conduct a comparative analysis of four aspects of acoustic environment evaluation, i.e., quietness, comfort, harmony, and sound preference, to identify and compare the characteristics of respondents' soundscape evaluation in these two types of temples. The results showed that compared with urban-type temples, respondents found the acoustic environment in forest-type temples to be quieter, more comfortable and more harmonious with the religious atmosphere. The sound level, measured with the questionnaire and respondents' social characteristics, such as age, occupation, level of education, purpose and frequency of visiting the temples, and attitude towards Buddhist thought, influenced their soundscape evaluation of urban-type and forest-type temples to different degrees. Among the various kinds of sounds in the temple, natural sounds, such as the sounds of flowing water, birds and insects, and rustling leaves, were preferred in forest-type temples, while Buddhism-related human-made sounds, including chanting and background music, were preferred in urban-type temples.

Keywords: forest-type temple; urban-type temple; Han Chinese Buddhism; soundscape evaluation; influencing factors

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1. Introduction

The term "soundscape" is defined as "the acoustic environment as perceived or experienced and/or understood by a person or people, in context" [1]. The notion of a soundscape was first proposed by Schafer and has continued to develop [2]. The soundscape of a place is considered to be a person's perceptual construct of the acoustic environment of that place [3,4]. In recent years, soundscapes have been one of the focuses of academic research. Many international journals have addressed the topic of soundscapes, and many interdisciplinary soundscape research organizations have been formed. The researchers come from the disciplines of acoustics, aesthetics, sociology, ecology, psychology, architecture, religious culture, environmental health, and urban studies. The research scope of soundscape places is constantly expanding, including parks [5], residential areas [6], historical buildings [7], historic towns [8], and religious architecture [9]. The research methods used include questionnaires [10], grounded theory approaches [11], soundwalk methods [12], laboratory experiments including binaural recordings [13], audio-visual interactions [14], predictive soundscape models, artificial neural networks [15], and structural equation modeling [16]. Unlike traditional acoustics, which focuses on the study of objective sound field characteristics, the soundscape approach enables the consideration of acoustic environments in positive terms, with soundscapes evaluated either positively or negatively [17]; therefore, the subjective evaluation of soundscapes is an important part of soundscape research.

Currently, many studies aim to evaluate soundscapes in forest parks or urban green spaces. Regarding the evaluation of the acoustic environment, some surveys have indicated

that social/demographic/behavioral factors and visit motivations all showed significant relationships with individual sound perception in parks or green spaces [18–20]. Acoustic-related factors and park environment factors also influence the acoustic comfort evaluations of urban parks [21]. People's opinions of the meaning of tranquility may also influence the overall perceived quality of the soundscape during a park visit [22], and sounds caused by various human activities in parks play an important role in influencing the eventfulness of soundscape perceptions. LAeq is a useful indicator for the evaluation of environmental quietness [23]. Regarding the evaluation of sound preference in parks, some previous studies have shown that almost everyone likes sounds such as "songbirds" and "sparrows" in parks [24]. The presence of birds twittering, insects chirping, flowing water, light music, and ancient temple bells makes tourists feel more immersed [25], and running water and birdsong are the most commonly heard and most preferred sounds in national parks [16]. Recent literature also suggests that different types of birdsong exhibit different sound comforts in different seasons [26], and soundscapes with a rich array of perceived bird sounds and minimal perceived traffic noise offer the greatest perceived restorative value in parks [27]. There are many factors that affect sound preference. Age is one of the most influential dimensions in the perception of and preference for individual sounds in urban recreational forest parks [28]. In addition, perceptual responses to human sounds, birdsong, and water sounds differ significantly across cultural backgrounds [29].

There are also many studies on the soundscape evaluation of various urban spaces. Regarding the evaluation of the acoustic environment, results have shown that the perceived quality of the urban soundscape is very much an individually subjective experience [30]. For example, there are significant differences among different age groups in terms of acoustic comfort [4], and differences in the purpose of going to urban open spaces and education levels might lead to differences in the evaluation of acoustic comfort [31]. Interviewees' age, occupation, duration and purpose have a significant effect on their acoustic satisfaction in urban historical areas [32]. Visit frequency affects visitors' expectations of the general soundscape, and visitors' perceptions of loudness and satisfaction are associated with maximum sound levels [33]. Another study showed that acoustic comfort has a significant correlation with LAeq in public squares [34]. Regarding the evaluation of sound preference in urban space, relevant studies have revealed that "traffic" sounds and "birdsong" are critical factors that influence participants' initial perception of urban soundscape quality [35]. Birdsong plays an important and positive role in urban soundscape perception [36], and bird sounds are the most preferred among the natural sounds in urban streets [37]. Water sounds have been determined to be the best sounds to use for enhancing the urban soundscape [38], while traffic sounds are the dominant indicator that negatively affects pleasantness in urban residential areas [14]. The results of a questionnaire on the soundscape of a city square showed that the most unpleasant sounds were motorcycles, cars, and handcarts, while the most pleasant sound was water [39]. Some analyses of the influencing factors of sound preference have shown that demographic factors affect the evaluation of sound preference in urban open spaces; for example, with increasing age, people are generally more positive towards sounds related to nature, culture, or human activities [40]. Age and education level are two factors that universally influence sound preference, while gender and occupation generally do not significantly influence sound preference evaluation [41]. In brief, although natural sounds are perceived more favourably than urban sounds, an urban soundscape cannot be equated to noise, and its positive aspects should be more broadly acknowledged [42].

In recent years, scholars have analysed the relationship between the acoustic environments of religious spaces and human feelings from the perspective of soundscapes. Regarding the soundscape evaluation of temples, in contrast to an ordinary urban open space or simple natural landscape, natural sounds, cultural sounds, and historic sounds are widely appreciated in people's subjective feelings about Chinese Buddhist temples [43]. One author of this paper analysed the correlation between Chinese people's evaluations of Buddhist temple soundscapes and mental health [9] and studied sound preferences in Han

Buddhist temples [44]. In a Chinese Taoist temple, the soundscape evaluation was affected by the measured sound pressure level and the respondents' belief, type of activity, social factors, and spatial position [45]. Regarding the soundscape of churches, a previous study showed that 67% of observed visitors spent less than a minute in a chapel, yet 49% of the visitor comment cards mentioned the chapel or the chapel soundscape as their favourite part of the visit [46]. One study on the degree of acoustic comfort inside several churches in Sheffield suggested that there was no clear correlation between acoustic comfort and measured reverberation time [47]. Another study used a survey questionnaire to compare the soundscape around a Catholic church with the soundscape around a Buddhist temple in South Korea and proposed that sounds related to religious activities in the temple precincts are relatively more significant than those of cathedral precincts [48]. Regarding the soundscape of mosques, a study showed that the acoustic comfort conditions were perceived to be satisfactory in all case studies in historical and new mosques [49], and there was a correlation between the acoustic design of the mosque and the worshippers' comfort [50]. Another study proposed that the majority of respondents were in favour of a broadcast of music or prayer in both indoor and outdoor areas of a historical mosque [51].

In summary, the sites of most existing soundscape evaluations have mainly been common urban or forest areas. These studies noted the importance of studying the relationship between the acoustic environment and people's feelings from the perspective of the soundscape. Some studies have also analysed the acoustic environment of Christian churches or mosques from the perspective of traditional acoustic methods or soundscapes. However, there is currently relatively little research on the subjective evaluation of the soundscapes of Han Buddhist temples, and no research has focused on the respective characteristics of the soundscape evaluations of forest-type and urban-type temples, which are the two most important and most numerous types of religious architecture in China (approximately 47% of Han Chinese Buddhist temples are located in forests, 44% are urban-type temples, and the remaining 9% are rural-type temples [52]). A good acoustic environment both inside and outside the temples is the main means of facilitating a religious atmosphere. Especially for forest-type temples located in famous mountains and featuring beautiful scenery, all kinds of pleasant natural sounds dominate the acoustic environment of the temples, which can make a deep impression on people. In contrast, urban-type temples are located near city centres and are associated with more vehicles and pedestrians; accordingly, the sound environment of these temples is relatively noisy. There are obvious differences between the two types of temples. These differences undoubtedly affect people's perception of the acoustic environment of these two types of Buddhist temples. Therefore, we plan to analyse the respective characteristics of the soundscape evaluation of forest-type and urban-type temples and compare the differences among and factors influencing the soundscape evaluation of these two types of temples. Three specific research questions are addressed in this study.

(1) What are the characteristics of respondents' evaluations of the acoustic environment of forest-type and urban-type temples? Urban-type temples have a certain function for public activities, while forest-type temples have the functions of leisure and relaxation, similar to parks. Are the characteristics of their soundscape evaluations different from ordinary public spaces?
(2) To what extent do the objective measured sound level and the subjective sociological characteristics of the respondents affect the evaluation of the acoustic environment of the two types of temples?
(3) Are there differences in the evaluation of sound preference between the respondents in the two types of temples? What are the influencing factors for these differences?

A large number of questionnaires were distributed in four typical Han Buddhist temples (including two forest types and two urban types), and sound pressure levels were synchronously measured. Subsequently, in accordance with statistics concerning the results of the questionnaire, differences in respondents' evaluations of the sound environment between these two types of temples were analysed and compared, as was the influence

of objective factors (sound pressure level) and subjective factors, that is, respondents' sociological characteristics (including age, belief, occupation, purpose and frequency of visiting the temples, and level of education) on this difference. This study attempted to identify differences in the respondents' sound preferences between urban-type and forest-type temples. The research results are conducive to the better design of the soundscapes of the two types of temples and to the creation of a healthy and favourable religious acoustic environment for users.

2. Materials and Methods

2.1. Characteristics of Research Sites

In this study, four typical forest-type and urban-type Han Chinese Buddhist temples were selected for comparative analysis of the soundscape evaluation. Figure 1 shows the location and surrounding environment of each temple. With regard to the temples, the four research objects selected were all large-scale temples with a long history and many worshippers. Xiantong Temple and Longquan Temple were selected as representative forest-type temples. Xiantong Temple (hereinafter referred to as "FT1") is the largest and most historic Han Chinese Buddhist temple on Wutai Mountain. Longquan Temple ("FT2") is the largest Buddhist temple on Qianshan Mountain, Liaoning Province. Xiangguo Temple and Ci'en Temple were selected as representative urban-type temples. Xiangguo Temple ("UT1") is located in the centre of the city of Kaifeng. This temple is one of the ten most famous Han Chinese Buddhist temples. Ci'en Temple ("UT2") is one of the key temples of Chinese Buddhism in China and the largest existing Buddhist temple in the city of Shenyang. With respect to their geographical locations, "FT1" and "UT1" are located in central China, while "FT2" and "UT2" are located in northern China. The locations of the four temples represent different regions. Meanwhile, there are many similarities in culture, language and belief between the people in central China and people in northern China, and these would avoid the problem that the difference in social characteristics (especially the different attitudes towards Buddhist thought of the respondents in different regions) of the respondents in the temples could affect the results of the questionnaire. All four temples support monks' practice of Buddhism and are open to the public. They have an important position and extensive influence in the Chinese Buddhist circle; therefore, the acoustic environment of these temples is typical.

Figure 1. Location and surrounding environment of the four temples.

2.2. Questionnaire Survey Method

2.2.1. Design and Distribution of Questionnaire

(1) Before the formal investigation, this study first distributed 70 pilot questionnaires at Puji Temple in Putuo Mountain. Adjustments were made to the questionnaire items after the statistical results were obtained and analysed. Items that were invalid or lacked reliability and validity were revised, and the final version of the questionnaire was produced.

The formal questionnaire consisted of five parts. Previous studies have shown that the evaluation of soundscapes in various spaces is affected to varying degrees by objective acoustic environmental factors and human sociological characteristics. Therefore, the first part collected basic demographic information from the respondents, including gender, age, level of education, and occupation. In the questionnaire, people were divided into five groups according to age: younger than 18 years old (high school students and below), 18 to 30 (youth), 30 to 45 (middle-aged), 45 to 60 (middle-aged and elderly), and older than 60 (retiree). The aim was to analyse the differences between the soundscape evaluations of people of different age groups. However, the statistical results of this study showed that the soundscape evaluation results of respondents younger than 18 years old and those 18 to 30 years old were similar, and the results of respondents aged 45 to 60 years old and those older than 60 years old were similar. Therefore, in the current questionnaire analysis, the respondents were divided into three categories: younger than 30 years old, 30 to 45 years old and older than 45 years old. For the division of education level, the respondents were divided into four categories: primary school, middle school, university, and postgraduate.

The second part included items related to Buddhist beliefs, including attitudes towards Buddhist thought, the respondents' annual frequency of attending religious activities or visiting Buddhist temples and the respondents' purpose for visiting Buddhist temples. The questionnaire divided the respondents in accordance with their attitudes towards Buddhist thought into the categories of firm believers, partial believers (those who believe to a limited extent), and nonbelievers. The respondents' purpose was divided into four categories: visiting/tourism, worshiping the Buddha, exercising, and other purposes. In addition, in the pilot questionnaire, the respondents were asked to fill in the number of visits to the temple every year. The results showed that 70% of the respondents did not go to the temple more than 4 times a year. Therefore, the average number of annual visits to the temple was divided into less than once, 1 to 2 times, 3 to 4 times and more than 4 times in the formal questionnaire.

The third part was used to evaluate the respondents' attitudes towards the acoustic environment in Buddhist temples, including comfort, quietness, and harmony. Acoustic comfort has always been an important aspect of soundscape research [4,21], and the same is true for quietness [17,19,40]. Previous studies have suggested that religious precincts should be quiet and tranquil to allow people to engage in religious self-reflection [43,48,51,53]. This study chose the degree of acoustic harmony as an index in the soundscape evaluation of Buddhist temples, with reference to previous studies [18,54]. As Buddhist temples are the most important religious places in China, whether or not the acoustic environment is harmonious with the religious atmosphere is of great significance for facilitating a religious atmosphere.

The fourth part was used to evaluate the respondents' preferences for the typical sounds associated with Han Chinese Buddhist temples. Considering that the soundscape includes the entire acoustic environment resulting from natural and human-made sound sources [2,55], sound preference is an important aspect of soundscape research [56]. Previous study on the soundscape of religious places showed that the main components of sound elements were grouped into natural, social, and religious sounds [48]. In our pilot questionnaire survey and field observation, the natural sounds inside and outside the temple mainly included the sounds of flowing water, birds, insects, rustling leaves, and wind. Human-made sounds were divided into Buddhism-related sounds (including bells, chanting, various implements, drums, prayers, and background Buddhist music) and sounds unrelated to Buddhism (including footsteps, the voices of tour guides, tourist

conversations, traffic sounds, and construction site noises). Buddhism-related human-made sounds often had the characteristics of the temples, while Buddhism-unrelated human-made sounds could occur in other places and did not have the unique place characteristics of Buddhist temples. The fifth part collected subjective suggestions concerning the acoustic environment of the temple.

Considering that there were few questions within the questionnaire, we did not use reverse-coded items. All items related to soundscape evaluation in the questionnaire were rated on a Likert five-level scale because the Likert scale is easy to design, its requirements for descriptive words are limited to no logical errors, it can be used to measure multidimensional complex concepts or attitudes [57], and it was suitable for the diverse population structure in this study. Level 1 in the questionnaire represented "quiet/comfortable/harmonious", and Level 5 represented "noisy/uncomfortable/inharmonious". Regarding the respondents' sound preferences, Level 1 indicated "liked the sound" and Level 5 indicated "disliked the sound". For specific questions and items, please see the questionnaire in the Appendix A.

(2) A total of 720 questionnaires were distributed at 4 temples, and 685 valid questionnaires were recovered: 177 from "FT1", 170 from "FT2", 160 from "UT1", and 178 from "UT2". The number of questionnaires distributed in a single temple was based on previous studies reporting that a range of 100 to 150 questionnaires could be considered representative in the context of an urban environment soundscape survey [2].

The questionnaires were distributed in the spring and summer, usually between 8:30 am and 17:30 pm, when the temple was open to the public. The questionnaires were distributed in the field at four temples by the researcher's team members (approximately 4 to 5 members for each temple). The specific locations at which the questionnaires were distributed were the courtyards of the four temples. The outdoor courtyard was chosen as the place for questionnaire distribution because quiet was generally required inside the hall in the temple and the indoor space of the hall allowed tourists to stay only for a short time, which made it difficult to complete the questionnaire. The target subjects of the questionnaire survey were randomly selected tourists and worshippers encountered in the temples. Because the four temples where the questionnaires were distributed were all tourist places with a large number of people, the genders and ages of the respondents should be balanced as much as possible to ensure the randomness and universality of the questionnaire survey. All questionnaires used anonymous methods (no record of the respondents' information, such as name and phone number). First, we asked whether the respondent was willing to participate in the survey. During the process of completing the questionnaire, the research team members provided consultations nearby. If the respondents provided answers quickly without carefully reading the items, the questionnaire was immediately marked as invalid after being returned.

In this study, the sound level measurements and the survey questionnaire were conducted at the same time; as the respondents answered the questionnaire, the on-site acoustic environment was simultaneously measured to ensure good correspondence between the psychological feelings expressed in the subjective survey and the objective measurement. During the measurement, the microphone of the sound level metre was positioned approximately 1 m away from any reflective surfaces and 1.5 m above the ground to reduce the effect of acoustic reflection [58]. The sound level corresponding to each questionnaire was measured more than 10 times. The interval between each measurement was five seconds, and the mean value was calculated. The instantaneous sound pressure level instead of LAeq was used in this research as the curiosity of other visitors may disturb and influence the measurement results.

2.2.2. Statistical Results of the Questionnaire

The correlation calculation conducted for this study mainly focused on the correlation coefficient between the acoustic environment evaluation and the sociological factors of the respondents in the two types of temples or the synchronous measured sound level. All

results of the questionnaire survey were imported into SPSS software (version 26). Among these factors, the subjective acoustic quietness, acoustic comfort, acoustic harmony and sound preference, as dependent variables, were ordinal variables, while the independent variables, such as age, frequency of visiting, and attitude towards Buddhist thought were ordinal variables. Similarly, purpose and occupation were nominal variables, while gender and the types of temples were dichotomous nominal variables, and the measured sound level was a continuous variable. Due to the different types of dependent variables in question, the correlation calculation methods also differed between independent variables and dependent variables (as shown in Table 1).

Table 1. The calculation method for independent and dependent variables.

Independent	Dependent Variables	SPSS Calculation Approach	Index	Variable Type
The measured sound level value synchronous with questionnaire	Acoustic comfort (harmony, quietness) evaluation	Bivariate correlation	Pearson	Continuous variable/ Ordinal variable
Gender, the types of temples	Acoustic comfort (harmony, quietness) evaluation, sound preference evaluation	Independent-samples *t*-test	Mean difference	Dichotomous (nominal) variable/ordinal variable
Purpose, occupation, different temples	Acoustic comfort (harmony, quietness) evaluation, sound preference evaluation	Crosstabs	Phi and Cramer's V	Nominal variable/ Ordinal variable
Age, frequency of visiting a temple, attitude towards Buddhist thought, education level	Acoustic comfort (harmony, quietness) evaluation, sound preference evaluation	Crosstabs	Gamma	Ordinal variable/ Ordinal variable
Acoustic comfort (harmony) evaluation	Acoustic quietness (harmony) evaluation	Crosstabs	Gamma	Ordinal variable/ Ordinal variable
Different demographic factors	Sound preference evaluation	Compare means	One-Way ANOVA	Nominal variable (or Ordinal variable)/ Ordinal variable

Reliability and validity analyses of questionnaires are a necessary step before data analysis. The SPSS software's reliability analysis was used to perform a confidence test on the reliability. The calculation results showed that the Cronbach's α coefficient of the whole soundscape evaluation scale was 0.748, the coefficient of the acoustic environment evaluation was 0.727, and the coefficient of the sound preference was 0.708. All were within the acceptable range, indicating acceptable reliability of the data [59]. Then, factor analysis was used to verify the construct validity of the questionnaire. KMO = 0.778 for the acoustic environment evaluation. Accordingly, two factors were extracted with characteristic roots greater than 1, their cumulative contribution to all variables was 52.1%, and Bartlett's test of sphericity indicated $p < 0.001$. On the other hand, KMO = 0.778 for the sound preference evaluation. Four factors were extracted with characteristic roots greater than 1, their cumulative contribution to all variables was 51.6%, and Bartlett's test of sphericity indicated $p < 0.001$. These data showed that the results of the soundscape evaluation questionnaire met the requirement for construct validity [59,60].

In this paper, an independent-samples *t*-test was used to analyse whether the acoustic environment evaluation of respondents with the same characteristics between the two types of temples had significant differences. All assumptions for eligibility to perform the *t*-test were checked and passed before use, i.e., the samples were quantitative data, the two populations were normally distributed, and the two samples were random independent samples [60]. In this study, analysis of variance (ANOVA) was used to determine whether the mean value of two or more population samples with normal distribution was significantly different. Before performing ANOVA, the author checked that these datasets met the ANOVA assumptions, including that each population sample followed a normal distribution and the homogeneity of variance of each population and that each sample was independent and randomly selected [60].

Table 2 presents the distribution of the characteristics of 685 respondents in two types of temples, including gender, age, level of education, attitude towards Buddhist thought, and frequency and purpose of visiting temples. These distributions were the classification conditions when analysing the various evaluations of soundscapes in the temples. Next, the influence of subjective and objective factors on the soundscape evaluation in the two types of temples (including acoustic quietness, comfort, harmony and sound preference) was analysed, and the differences in these effects between the two types of temples were compared.

Table 2. Percentage of respondents' characteristics by the temple type in the questionnaire.

Respondents' Characteristics		Temple Type	
		Forest-Type Temple	Urban-Type Temple
Gender	male	48.70%	46.40%
	female	51.30%	53.60%
Age	under 30	50.90%	47.60%
	30–45	30.50%	32.50%
	above 45	18.60%	19.90%
Frequency of visiting temple	less than one time	62.80%	47.00%
	1 to 2 times	10.70%	9.80%
	3 to 4 times	7.80%	7.70%
	more than 4 times	18.70%	35.50%
Education level	primary school or less	7.90%	8.30%
	middle school	27.40%	42.00%
	college or university	56.20%	41.30%
	postgraduate	8.50%	8.40%
Purpose	visiting tourism	61.70%	44.70%
	worshiping the Buddha	22.70%	35.80%
	exercising	7.80%	7.70%
	others	7.80%	11.80%
Attitude towards Buddhist thought	firmly believe	30.00%	41.10%
	partially believe	59.00%	48.80%
	do not believe	11.00%	10.10%

It should be noted that our soundscape research referred to ISO 12193 (ISO Standard) [1,61,62], but considering the difference between the soundscape in Buddhist temples and that in other public spaces (the soundscape in religious buildings focuses more on the influence and inspiration of believers), the parameters and indices selected in the course of investigation and analysis were not completely consistent with those recommended in ISO 12193 (for example, the types of sound sources, performed effective quality, the assessment of surrounding sound environment, etc.).

3. Results and Discussion

3.1. Factors Influencing the Acoustic Environment Assessment

According to the statistical results of the questionnaire, the value of respondents' evaluation of the whole acoustic quietness in four temples was 2.13, that of acoustic comfort was 1.96 and that of the harmony between the acoustic environment and the religious atmosphere was 2.28. The evaluation value of the acoustic environment in the two types of temples is shown in Figure 2. The mean values of quietness, comfort, and harmony for forest-type temples (2.07, 1.87, and 2.17, respectively) were lower than those for urban-type temples (2.18, 2.06, and 2.39, respectively). The lower the value, the more quiet, comfortable, and harmonious the respondents considered the acoustic environment. The respondents' feelings about the overall acoustic environment were better for forest-type temples than for urban-type temples. The results of the correlation analysis showed that the values of

the three acoustic environment evaluations were significantly correlated with each other, regardless of whether they were whole or divided into two types of temples. The correlation coefficient is shown in Table 3. The degree of correlation in forest temples was generally higher than that in urban temples. The results of the independent-samples *t*-test showed that there were significant differences in the evaluation of acoustic comfort or acoustic harmony between the two types of temples, but there was no significant difference in the evaluation of acoustic quietness. This study subsequently analysed the subjective and objective factors that affect the evaluation of the acoustic environment in the two types of temples.

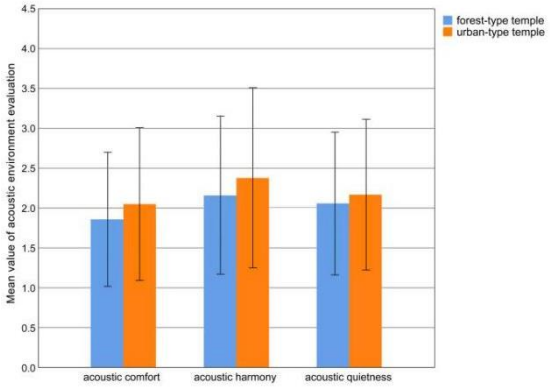

Figure 2. The evaluation value and standard deviation of the acoustic environment in forest-type and urban-type temples.

Table 3. Correlation between the subjective evaluation of the acoustic environment in the temple.

Category	Overall Correlation Coefficient (Forest-Type Temple/Urban-Type Temple)		
	Acoustic Comfort	**Acoustic Harmony**	**Acoustic Quietness**
Acoustic comfort	1	0.67 ** (0.78 **/0.56 **)	0.75 ** (0.78 **/0.71 **)
Acoustic harmony		1	0.59 ** (0.67 **/0.52 **)
Acoustic quietness			1

Note: ** in the table indicates significance level that is $p < 0.01$.

3.1.1. Objective Factor

The mean value of the measured sound level synchronous with the questionnaire in the temple was 56.9 dBA (standard deviation of 7.3, below the same). The correlation between the measured sound level and the acoustic environment evaluation of the temple is shown in Table 4. The measured sound level was significantly correlated with acoustic comfort and quietness, with correlation coefficients of R = 0.118** and R = 0.195**, respectively, and had no correlation with acoustic harmony.

The mean value of the measured sound level synchronous with the questionnaire in urban-type temples was 58.0 dBA (8.2), and the maximum and minimum values were 76.8 and 45.0 dBA, respectively. The mean value of the measured sound level in forest-type temples was 55.9 dBA (6.3), and the maximum and minimum values were 72.6 and 36.4 dBA, respectively, which were all lower than those in urban-type temples, indicating that the sound field of forest-type temples was generally quieter than that of urban-type temples. In urban-type temples, the correlation coefficients between the measured sound level and the acoustic environment evaluation were 0.156** for acoustic comfort, 0.269** for quietness, and 0.006 ($p = 0.921$) for harmony. However, there was no significant correlation between the measured sound level and the three kinds of acoustic environment evaluations in the forest-type temples. The objective factor of the measured sound level synchronous with the questionnaire only affected acoustic comfort and quietness evaluations in urban-type temples.

Table 4. Correlation between objective or subjective factors and temple acoustic environment evaluation.

Influence Factor	Correlation Coefficients/Significance Level		
	Acoustic Comfort	Acoustic Harmony	Acoustic Quietness
Gender	0.055/0.310	0.040/0.550	−0.030/0.442
Age	−0.138/0.013 (*)	−0.152/0.003 (**)	−0.268/0.000 (**)
Attitude towards Buddhist thought	0.336/0.000 (**)	0.340/0.000 (**)	0.252/0.000 (**)
Purpose	−0.148/0.005 (**)	−0.174/0.001 (**)	−0.154/0.003 (**)
Occupation	0.190/0.002 (**)	0.182/0.009 (**)	0.223/0.000 (**)
Average number of visits to the temple every year	−0.178/0.004 (**)	−0.134/0.026 (*)	−0.133/0.042 (*)
Education level	0.156/0.007 (**)	0.172/0.002 (**)	0.156/0.004 (**)
The measured sound level synchronous with the questionnaire	0.118/0.002 (**)	0.195/0.000 (**)	0.130/0.440

Note: * and ** in the table indicate significance level, * indicates $p < 0.05$, ** indicates $p < 0.01$.

3.1.2. Subjective Factor

The level of significance of the correlations between the respondents' sociological factors and the evaluation of the acoustic environment in the temples is shown in Table 4. The respondents' age, occupation, level of education, purpose and frequency of visiting temples and attitude towards Buddhist thought were significantly correlated with their evaluations of the acoustic environment (note: There was no correlation between gender and the three kinds of acoustic environment evaluations. This was consistent with previous studies that found no significant difference between males and females in acoustic environment evaluation [4,31], so no further analysis was conducted on this issue. Therefore, this study includes these sociological factors as independent variables to analyse the differences in evaluations of the acoustic environment (as dependent variables) between forest-type and urban-type temples.

(1) Age

Figure 3a presents the mean values of acoustic comfort evaluation by respondents of different ages between the two types of temples (this item is given in Question 4 of the questionnaire in the Appendix A). With increased age, respondents tended to indicate more comfort in their evaluations of the acoustic environment of forest-type temples, while no such trend was observed with regard to evaluations of the acoustic environment in urban-type temples. The correlation coefficient between age and the acoustic comfort evaluation was calculated as −0.279** in forest-type temples and −0.018 ($p = 0.822$) in urban-type temples, indicating that age was correlated with the evaluation of acoustic comfort only in forest-type temples. The result of the independent-samples *t*-test showed that with regard to people younger than 30 years old or 30 to 45 years old, there were no significant differences in the acoustic comfort evaluation between the two types of temples. Among people older than 45 years old, the mean value of the acoustic comfort evaluation in forest-type temples was lower than that in urban-type temples by 0.47, and there was a significant difference between the two types of temples. This result suggested that for people older than 45 years, the type of temple affects their acoustic comfort.

The mean value of people's evaluations of acoustic harmony for the two types of temples across different ages is shown in Figure 3b (this item is given in Question 5 of the questionnaire in the Appendix A). These results are similar to those associated with acoustic comfort evaluations. With increasing age, respondents tended to indicate more harmony in their evaluation of the acoustic environment of forest-type temples, while no such trend was found for urban-type temples. The correlation coefficient between age and acoustic harmony evaluation was calculated as −0.227** for forest-type temples and −0.091 ($p = 0.187$) for urban-type temples, indicating that age was correlated with the evaluation

of acoustic harmony only in forest-type temples. For people younger than 30 or those aged 30 to 45 years, no significant differences in acoustic harmony were found between the two types of temples. Among people older than 45 years, the mean value of acoustic harmony evaluation in forest-type temples was lower than that in urban-type temples by 0.45, and there was a significant difference in the evaluation of acoustic harmony between the two types of temples, which is similar to the findings concerning acoustic comfort evaluation.

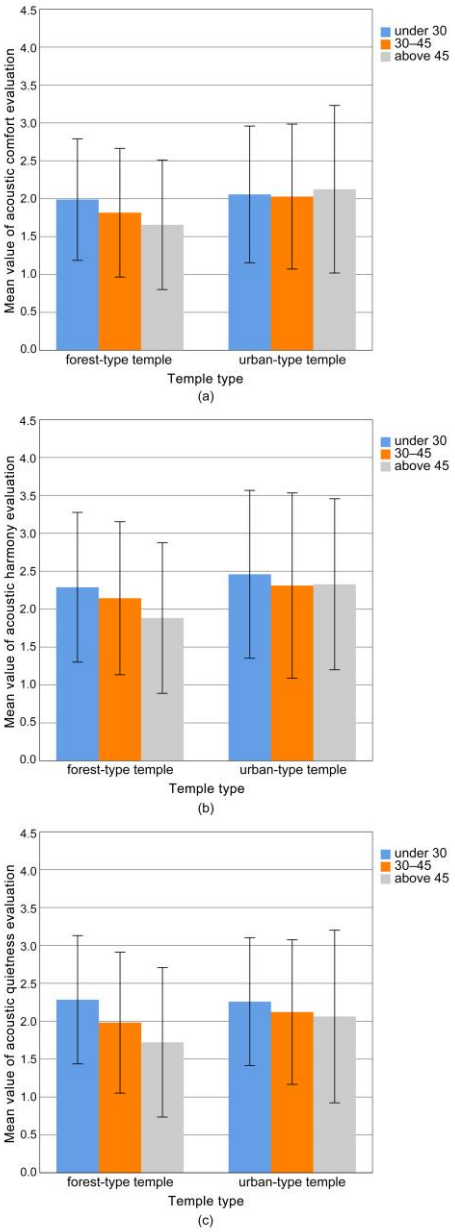

Figure 3. The evaluation value and standard deviation of acoustic environment by different respondents' age: (**a**) comfort; (**b**) harmony; (**c**) quietness.

Regarding the evaluation of quietness in the two types of temples (this item is given in Question 3 of the questionnaire in the Appendix A), Figure 3c shows that with increasing age, the respondents' evaluation of quietness in the two types of temples tended towards indications of quietness. The correlation coefficient between age and the evaluation of quietness was −0.351** in forest-type temples and −0.184* in urban-type temples. The results indicate that there were no significant differences in the evaluation of acoustic quietness

reported by respondents of the same age group between the two types of temples. This finding differs from the results concerning evaluations of acoustic comfort and harmony.

(2) Belief Factor

Figure 4a presents the relations between the respondents' attitudes towards Buddhist thought and the mean values of acoustic comfort evaluation for the two types of temples. (This item is given in Question 4 of the questionnaire in the Appendix A.) The same trends were found for both types of temples; that is, the more people believe in Buddhist thought, the more comfort they report in their evaluation of the acoustic environment. The correlation coefficient was 0.346** for forest-type temples and 0.360** for urban-type temples. The mean evaluation value of acoustic comfort by respondents who partially believed in Buddhist thought was 0.23 lower for forest-type temples than for urban-type temples (a lower value indicated that the respondents felt the acoustic environment to be more comfortable). The result of the independent-samples *t*-test indicated that between the two types of temples, only respondents who partially believed in Buddhist thought exhibited significant differences in their evaluation of acoustic comfort. For the other two groups of people, although the mean evaluation value of acoustic comfort by respondents in the forest-type temple was lower than that in the urban-type temple (0.21, firm believers; 0.34, nonbelievers), there were no significant differences in acoustic comfort evaluation between the two types of temples.

The relations between respondents' attitudes towards Buddhist thought and the mean values of acoustic harmony evaluation between the two types of temples are shown in Figure 4b. (This item is given in Question 5 of the questionnaire in the Appendix A). The trend is similar to that associated with the evaluations of acoustic comfort; that is, the more people believed in Buddhist thought, the more their evaluations tended to indicate harmony between the acoustic environment and the temple atmosphere. The correlation coefficient was 0.375** for forest-type temples and 0.336** for urban-type temples. Respondents who firmly believed or partially believed in Buddhist thought had a lower mean evaluation value of acoustic harmony for forest-type temples than for urban-type temples by 0.30 and 0.22, respectively. The result of the independent-samples *t*-test indicated the presence of significant differences in the evaluation values of acoustic harmony reported by people who firmly believed or partially believed in Buddhist thought between the two types of temples. Respondents deemed that the acoustic environment and temple atmosphere were more harmonious in forest-type temples. For those who did not believe in Buddhist thought, there was no significant difference in their evaluation of acoustic harmony between the two types of temples.

For the quietness evaluation, as shown in Figure 4c, the more the respondents believed in Buddhist thought, the more their evaluations of the temple acoustic environment tended towards quiet (this item is given in Question 3 of the questionnaire in the Appendix A). The correlation coefficient was 0.236** for forest-type temples and 0.291** for urban-type temples. These results indicated that between the two types of temples, only respondents who partially believed in Buddhist thought exhibited significant differences in terms of their evaluation of quietness, and those who partially believed in Buddhist thought in forest-type temples felt quieter (their mean evaluation value of acoustic quietness was 0.21 lower than that of urban-type temples). This is similar to the findings concerning the evaluation of acoustic comfort.

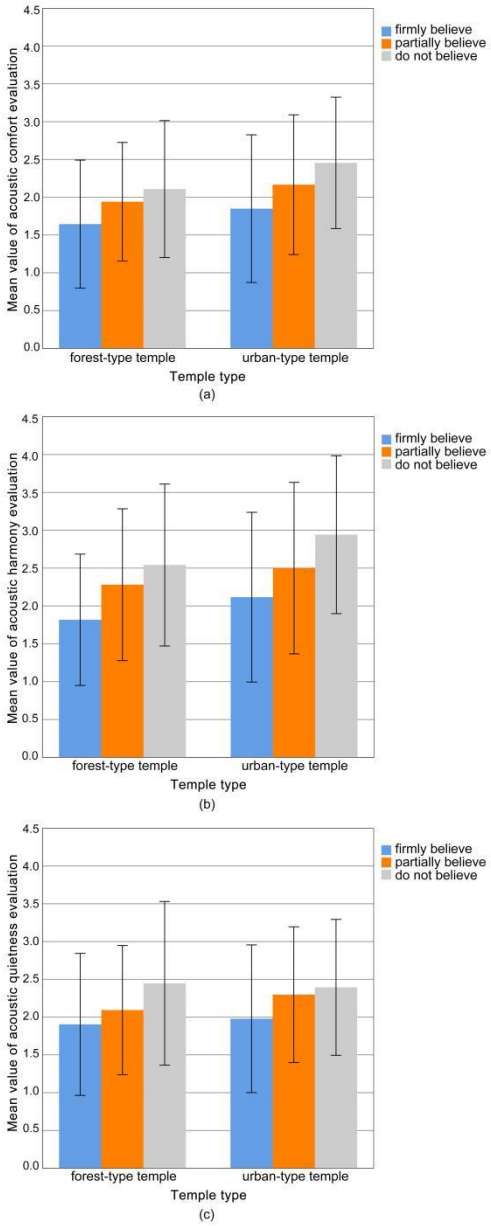

Figure 4. The evaluation value and standard deviation of acoustic environment by different respondents' attitude towards Buddhist thought: (**a**) comfort; (**b**) harmony; (**c**) quietness.

(3) Purpose

Figure 5a presents the relations between the respondents' purpose and the mean value of acoustic comfort evaluation between the two types of temples (this item is given in Question 4 of the questionnaire in the Appendix A). Respondents who worshipped the Buddha in both types of temples believed that the acoustic environment of the temple was most comfortable. The correlation coefficient between the purpose of visiting the temple and acoustic comfort evaluation was −0.200* for forest-type temples and −0.154* for urban-type temples.

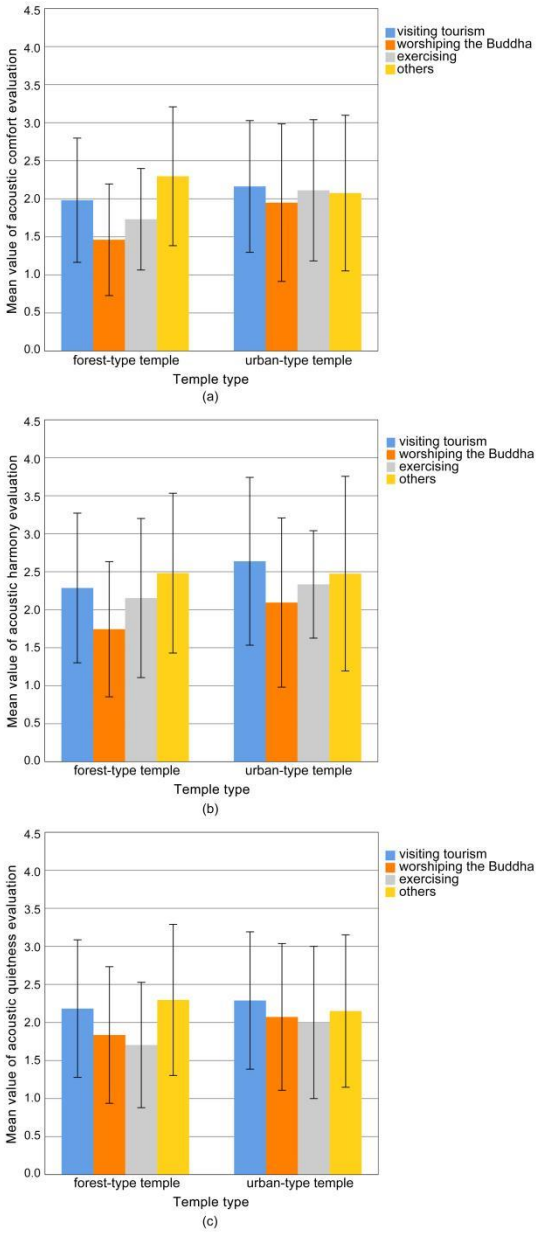

Figure 5. The evaluation value and standard deviation of acoustic environment by different respondents' purpose: (**a**) comfort; (**b**) harmony; (**c**) quietness.

The mean evaluation values of acoustic comfort by respondents who visited forest-type temples for tourism purposes or to worship the Buddha were lower than those for the same purpose in urban-type temples by 0.18 and 0.49, respectively. The result of the independent-samples *t*-test indicated that there were significant differences in the acoustic comfort evaluations between the two types of temples for tourists or worshipers; that is, respondents in forest-type temples for these two purposes felt that the acoustic environment was more comfortable. With respect to people exercising or other purposes, there were no significant differences in the evaluation of acoustic comfort between the two types of temples.

The relations between the respondents' purpose for visiting the temples and the mean value of acoustic harmony evaluation between the two types of temples are shown in Figure 5b. The correlation coefficient between the purpose of visiting the temples and the acoustic harmony evaluation was −0.170* for forest-type temples and −0.219** for urban-type temples. The mean values of acoustic harmony evaluation by respondents

who visited forest-type temples for tourism purposes or to worship the Buddha were both lower than those for the same purpose in urban-type temples by 0.35 and 0.35, and the result of the *t*-test indicated that there were significant differences in the acoustic harmony evaluation values reported by people for tourism purposes or to worship the Buddha between the two types of temples. There were no significant differences in the evaluation of acoustic harmony between the two types of temples by people exercising or other purposes, similar to the findings concerning the evaluation of acoustic comfort.

Figure 5c shows that in the two types of temples, respondents who visited the temples to exercise reported that the acoustic environment of the temple was the quietest, followed by respondents who visited so to worship the Buddha. The correlation coefficient between their purpose in visiting the temple and the quietness evaluation value was −0.184* for forest-type temples and −0.154* for urban-type temples. The result of the *t*-test indicated that there were no significant differences between the two types of temples in the quietness evaluation of respondents who visited the temples for the same purpose. This finding is different from the results of the evaluation of acoustic comfort and harmony.

(4) Frequency

We analysed the effect of frequency-related factors on the acoustic environment evaluation, as shown in Figure 6a. With an increase in the average number of annual visits to the temple, respondents tended to express more comfort in their evaluations of the acoustic environment. In general, this trend was especially evident in forest-type temples. The correlation coefficient between the average number of annual visits to the temple and the evaluation of acoustic comfort was −0.267** for forest-type temples and −0.150* for urban-type temples. The result of the *t*-test indicated that there were no significant differences in the evaluation of acoustic comfort between the two types of temples among people who visited the temples with the same frequency each year.

Figure 6b shows that respondents who visited the two types of temples 3 to 4 times per year evaluated the acoustic environment and religious atmosphere of the temples as the most inharmonious, while those who visited the temples more than 4 times a year thought that the temples' acoustic environment was the most harmonious. The correlation coefficient between frequency and acoustic harmony evaluation was −0.160* for forest-type temples and −0.168* for urban-type temples. The result of the *t*-test indicated that there were no significant differences in the evaluation of acoustic harmony between the two types of temples among people who visited the temples with the same frequency each year, which is similar to the findings concerning the evaluation of acoustic comfort.

Figure 6c presents the relationship between respondents' average number of visits to the temple per year and the mean value of the acoustic quietness evaluation between the two types of temples. The correlation coefficient was −0.231** for forest-type temples and −0.025 (p = 0.769) for urban-type temples, indicating that the average number of visits to the temple per year was correlated with the acoustic quietness evaluation only for forest-type temples. With an increase in the average number of visits to temples per year, respondents tended to report quiet in their evaluations of the acoustic environment of forest-type temples, while no such trend was observed in the context of urban-type temples. The results showed that among people who visited forest-type temples more than 4 times per year, the mean evaluation value of acoustic quietness was lower than that reported by those who visited urban-type temples by 0.31. The result of the *t*-test indicated that respondents who visited temples more than 4 times per year (and who are therefore more likely to be followers of Buddhism) exhibited significant differences in terms of their evaluation of acoustic quietness between the two types of temples. Respondents in forest-type temples felt that the environment was quieter. People who visited the temple with other frequencies exhibited no significant differences in quietness evaluations between the two types of temples. These findings are different from the findings concerning the evaluation of acoustic comfort and acoustic harmony.

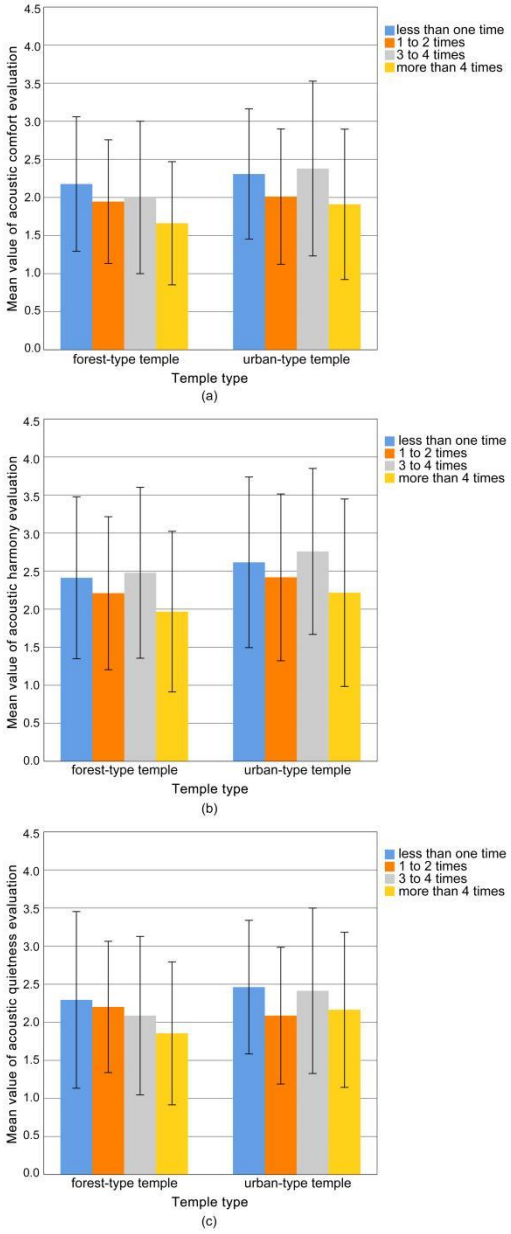

Figure 6. The evaluation value and standard deviation of acoustic environment by different respondents' average number of annual visits to the temple: (**a**) comfort; (**b**) harmony; (**c**) quietness.

(5) Education and Occupation

Figure 7a presents the relations between the respondents' levels of education and the mean values of acoustic comfort evaluation regarding the two types of temples. The correlation coefficient between the level of education and the acoustic comfort evaluation was 0.341** for forest-type temples and 0.053 (p = 0.506) for urban-type temples, indicating that the level of education was correlated with acoustic comfort evaluation only in the context of forest-type temples. The mean evaluation values of acoustic comfort reported by people with primary school or middle school education were 1.00 and 0.42 lower for forest-type temples than for urban-type temples, respectively, and the results indicated that there were significant differences in the evaluation values of acoustic comfort reported by people with primary school education or middle school education between the two types of temples. For people with the same educational background, there was no significant difference between the two types of temples.

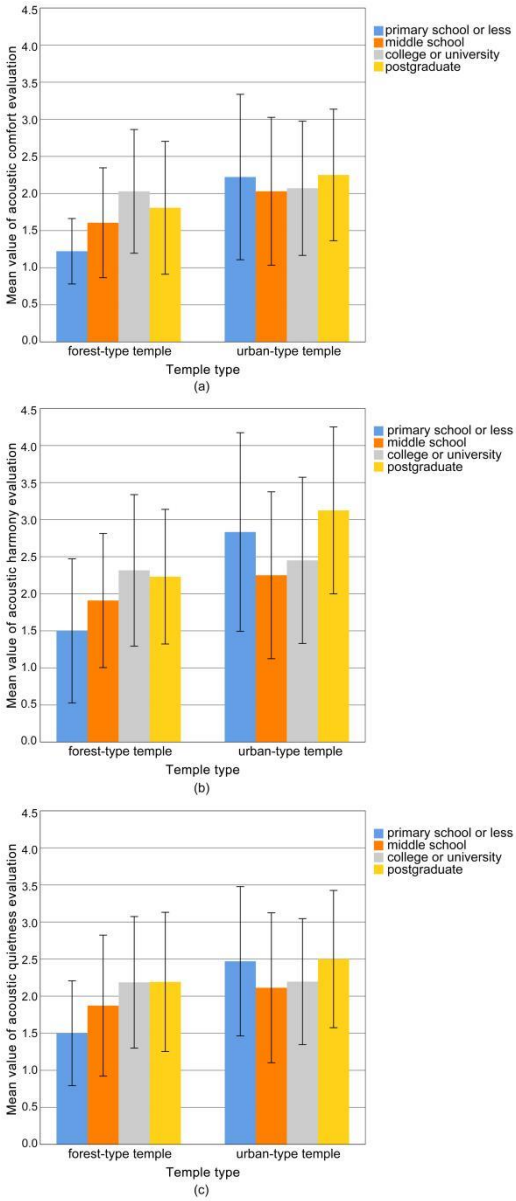

Figure 7. The evaluation value and standard deviation of the acoustic environment by different respondents' educational level: (**a**) comfort; (**b**) harmony; (**c**) quietness.

Figure 7b presents the relations between the respondents' levels of education and the mean value of acoustic harmony evaluation regarding the two types of temples. The correlation coefficient between these factors was 0.313** for forest-type temples and 0.105 (p = 0.174) for urban-type temples, indicating that the level of education was correlated with the acoustic harmony evaluation only in the context of forest-type temples. The mean evaluation values of acoustic harmony reported by people with primary school, middle school, and postgraduate education were lower for forest-type temples than for urban-type temples by 1.33, 0.34, and 0.90, respectively. The results of the t-test indicated that these three kinds of people with the same level of education exhibited significant differences in their evaluation of acoustic harmony between the two types of temples.

Figure 7c presents the relations between the respondents' level of education and the mean value of acoustic quietness evaluation regarding the two types of temples. The correlation coefficient was 0.267** for forest-type temples and 0.072 (p = 0.356) for urban-type temples, indicating that level of education was correlated with the quietness evaluation only in the context of forest-type temples, which is similar to the evaluation of acoustic

comfort and acoustic harmony. The mean evaluation value of acoustic quietness reported by people with a primary school education was lower for forest-type temples than for urban-type temples by 0.97, and the result of the *t*-test indicated that only people with a primary school education exhibited significant differences in their evaluation of acoustic quietness between the two types of temples.

In addition, we analysed the influence of the respondents' occupations on their evaluation of the acoustic environment with regard to the two types of temples. To ensure the accuracy of the results, occupation types that referred to fewer than 15 people were removed from the survey numbers (the total number of remaining questionnaires was 660), and the results are shown in Figure 8a. The correlation coefficient between occupation and the acoustic comfort evaluation was 0.149** for forest-type temples and 0.132** for urban-type temples. A comparison of various occupations shows that the mean evaluation values of acoustic comfort reported by housewives and teachers were lower for forest-type temples than for urban-type temples by 1.02 and 0.55, respectively. The result of the *t*-test indicated that between the two types of temples, significant differences emerged in the evaluation values of acoustic comfort only in the case of housewives or teachers, while there were no significant differences for people who worked in other occupations.

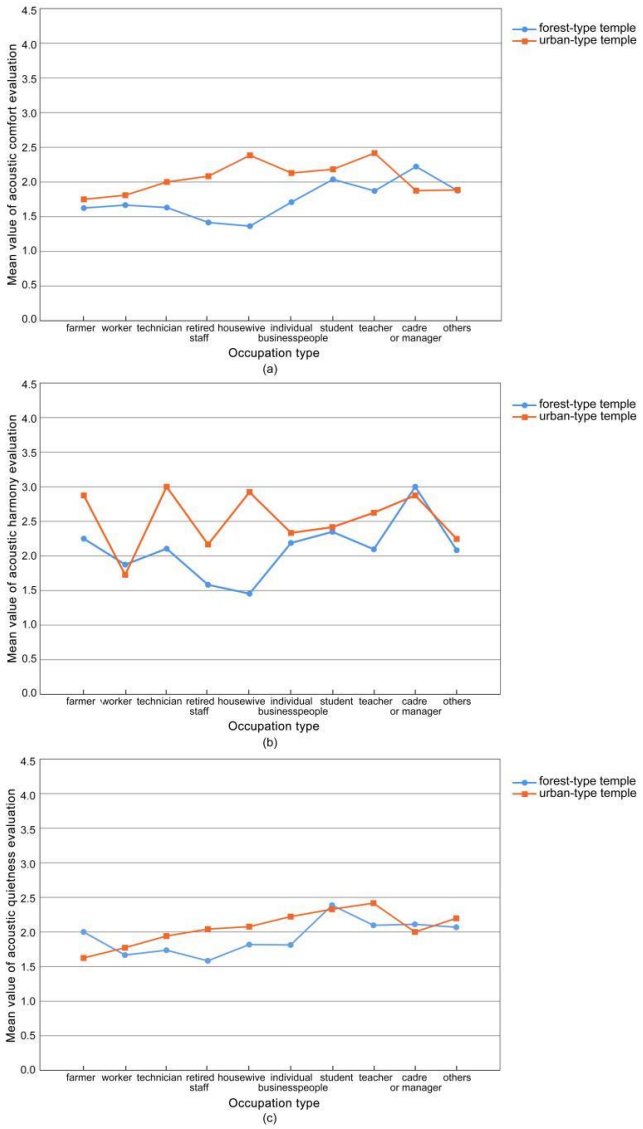

Figure 8. The evaluation value of the acoustic environment by different respondents' occupations: (**a**) comfort; (**b**) harmony; (**c**) quietness.

Figure 8b presents the relations between the respondents' occupations and the mean value of the acoustic harmony evaluation in the two types of temples. The correlation coefficient was 0.192** for forest-type temples and 0.143** for urban-type temples. A comparison of various occupations showed that the mean evaluation values of acoustic harmony reported by housewives and technicians were lower for forest-type temples than for urban-type temples by 1.47 and 0.89, respectively. The result of the *t*-test indicated significant differences in the evaluation of acoustic harmony between the two types of temples only in the case of housewives and technicians. There were no significant differences for people of other occupations.

Figure 8c presents the correlation between respondents' occupations and the mean value of the acoustic quietness evaluation between the two types of temples (this item is given in Question 3 of the questionnaire in the Appendix A). The correlation coefficient was 0.257** for forest-type temples and 0.218** for urban-type temples. The results of the *t*-test showed that there were no significant differences in the evaluation of acoustic quietness by people of the same occupation between the two types of temples.

3.2. Factors Influencing Sound Preference Evaluation

Various kinds of sounds occur in Han Chinese Buddhist temples, and respondents' preference evaluations of these different sounds might be affected by temple factors. The evaluation results concerning various sound preferences between the two types of temples are shown in Figure 9. With respect to the preference evaluation of natural sounds, Buddhism-related human-made sounds and Buddhism-unrelated human-made sounds, the *p* values of the independent-samples *t*-test between forest-type temples and urban-type temples were 0.000, 0.028 and 0.254, respectively. This indicated that there were significant differences in the evaluation of sound preference for natural sounds or Buddhism-related human-made sounds between the two types of temples, while there was no significant difference in the evaluation of Buddhism-unrelated human-made sounds. In general, the respondents in forest-type temples preferred natural sounds (1.40 for forest-type temples, 1.63 for urban-type temples), and respondents in urban-type temples preferred Buddhism-related human-made sounds (2.15 for forest-type temples, 2.00 for urban-type temples). For Buddhism-unrelated human-made sounds, the mean values of sound preference evaluation between the two temple types were similar (3.50 for forest-type temples, 3.55 for urban-type temples), indicating that people did not like Buddhism-unrelated human-made sounds in any environment and that this sound preference was unaffected by the factor of temple type.

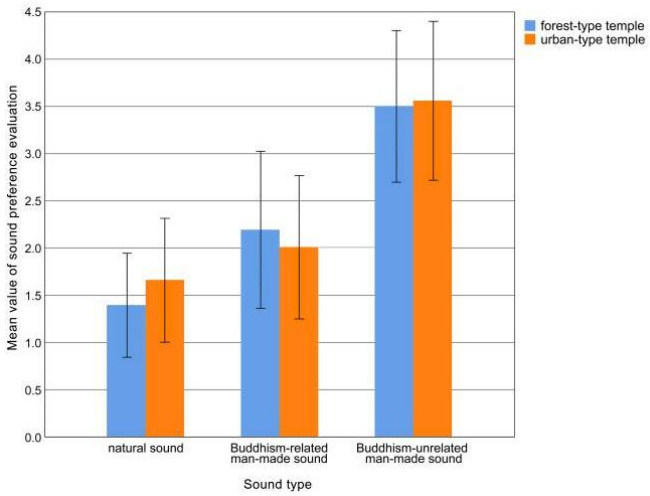

Figure 9. The evaluation value and standard deviation of preference for different sounds in the temple.

The preference for various sounds in the two types of temples was analysed. As shown in Figure 10, the mean values of the preference for the sounds of flowing water, birds and insects, and rustling leaves reported by respondents were lower for forest-type temples than for urban-type temples by 0.25, 0.21 and 0.27, respectively, while the mean values of the preferences for the sound of chanting and background music reported by respondents were lower for urban-type temples than for forest-type temples by 0.15 and 0.22, respectively. The results of the *t*-test indicated that there were significant differences in the evaluation values of respondents' preferences for these five kinds of sounds between the two types of temples. These results again showed that the environment of Buddhist temples had an impact on the evaluation of people's sound preferences. In forest-type temples, people preferred flowing water, birds and insects, and rustling leaves (all natural sounds), while in urban-type temples, people preferred chanting and background music, such as Buddhist odes (Buddhism-related human-made sounds).

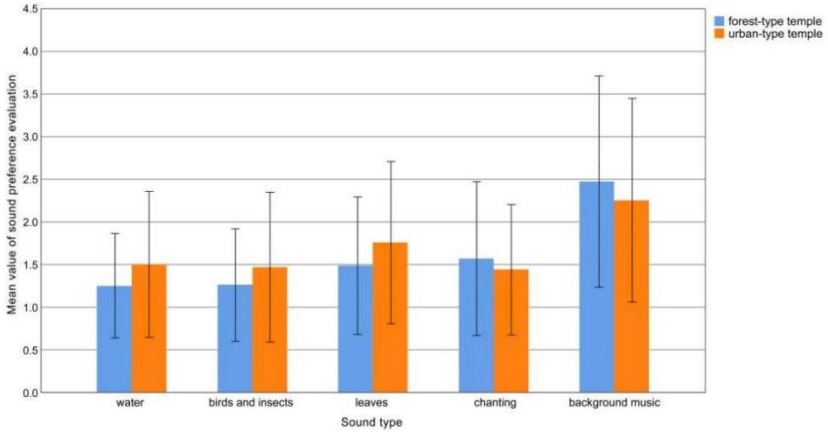

Figure 10. The evaluation value and standard deviation of sound preference for the five sounds with significant differences between the two types of temples.

Whether the preferences for the five sounds in the two types of temples were influenced by human sociological factors was analysed. In forest-type temples, the results showed that sound preferences for birds and insects and rustling leaves were affected by different educational levels (the correlation coefficients were −0.235* and −0.255**, respectively). The higher a person's education, the more he or she liked the sounds of birds and insects and rustling leaves. The preference for chanting in forest-type temples was affected by different ages, belief factors and purposes (−0.284**, 0.563**, 0.309**); the older people were, or the more they believed in Buddhist thought, the more they liked chanting. The preference for background music in forest-type temples was affected by belief factors (0.169*); the more people believed in Buddhist thought, the more they liked background music.

In urban-type temples, the preference for flowing water was affected by different purposes (the correlation coefficient was 0.327**). The preference for rustling leaves was affected by different ages (correlation coefficient was 0.159*); the older people were, the less they liked the sound of leaves. The preference for chanting was affected by different purposes, belief factors, and the frequency of visiting the temple (correlation coefficients were 0.321**, 0.489** and −0.311**, respectively); the more people believed in Buddhist thought or visited temples, the more they liked chanting. The preference for background music was affected by belief factors (correlation coefficient was 0.195**); the more people believed in Buddhist thought, the more they liked background music.

The above results show that in both urban-type and forest-type temples, the preference evaluation of Buddhism-related human-made sounds is obviously affected by belief factors, while the factors that affect the preference for natural sounds do not reflect a consistent rule (the preference for natural sounds in forest-type temples may be affected by different educational backgrounds, while in urban-type temples, it may be affected by different

purposes and ages). In addition, the ANOVA results showed that among people with different belief factors, there were significant differences in their preference for background music or chanting, while there were no significant differences in their preference for other sounds. These results were consistent in urban and forest temples.

3.3. Discussion

3.3.1. Comparison among Various Influencing Factors on Acoustic Environment Evaluation

(1) As shown in Figure 11, in forest-type temples, the three factors that had the most significant effect on the evaluation of acoustic comfort and harmony were attitudes towards Buddhist thought > education > age. The factors that had the most significant effect on the evaluation of acoustic quietness were education level > age > occupation. In urban-type temples, the three factors that had the most significant effect on the evaluation of acoustic comfort were attitudes towards Buddhist thought > frequency of visits to the temple per year > measured sound levels synchronous with the questionnaire; the factors for acoustic harmony were attitudes towards Buddhist thought > purpose > frequency of visits to the temple per year, and the factors for acoustic quietness were attitudes towards Buddhist thought > sound levels by synchronous measurement with the questionnaire > occupation. The above analysis shows that the most significant influencing factor of the evaluation of the acoustic environment was attitudes towards Buddhist thought in both forest-type and urban-type temples. In forest-type temples, the factors of education level and age were also important, while in urban-type temples, the frequency of visits to the temple per year and measured sound levels were also important.

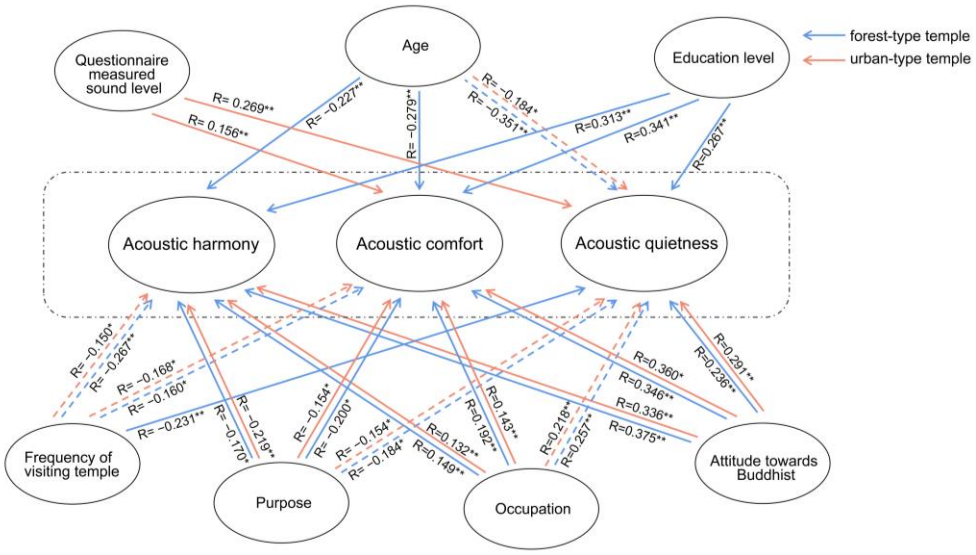

Figure 11. Schematic diagram of the influencing factors of three kinds of acoustic environment evaluations. Note: The double solid line indicates that certain people with the same characteristics have significant differences between the two types of temples, while the double dotted line indicates that people with the same characteristics have no significant differences between the two types of temples. In the figure, * and ** indicate significance level, * indicates $p < 0.05$, ** indicates $p < 0.01$.

Our research showed that in both types of temples, the influences of these factors usually differed between the three acoustic environment evaluations. This indicates that in research on special soundscapes such as religious buildings, it is not necessary to completely follow the standard assessment process of the surrounding sound environment recommended by ISO 12913, and different evaluation indices according to different architectural soundscape characteristics should be selected. These targeted soundscape evaluation indicators can enrich future editions of ISO 12913 (which should be under constant revision) by offering valuable approaches.

(2) In this study, the differences in the influencing factors on the evaluation of the acoustic environment between the two types of temples were analysed. The most significant factors were education level and attitudes towards Buddhist thought. For these two factors, there were significant differences in the three acoustic environment evaluations between the two types of temples. The measured sound levels were synchronous with the questionnaire, and there were significant differences in the evaluation of acoustic comfort and quietness between the two types of temples. Regarding the factors of purpose, occupation and age, there were significant differences in the evaluation of acoustic comfort and harmony between the two types of temples. The factor with the least difference was the frequency of visits to the temple per year; there was a significant difference only in the evaluation of acoustic quietness between the two types of temples.

3.3.2. Comparison with Previous Studies

Previous studies have not examined the difference in soundscapes between urban-type and forest-type religious sites. Considering that urban-type temples have the function of public activities while forest-type temples have the functions of leisure and relaxation, similar to parks, we compare the findings of this study with those of soundscapes in similar and single-place types. For example, the soundscape of forest-type temples was compared with the soundscape of parks, and the soundscape of urban-type temples was compared with the soundscape of urban public spaces.

(1) In terms of the relationship between the objective sound level and the acoustic environment evaluation, previous studies showed that when a pleasant sound such as music or water dominated the soundscape, the relationship between the acoustic comfort evaluation and the sound level was considerably weaker than that of other sound sources such as traffic and demolition sounds [4], and the overall noise annoyance had a significant relation with sound levels in an old town [6]. Our findings are consistent with these studies that showed that in urban-type temples (where the surrounding environment may be dominated by traffic sounds), there are significant correlations between sound levels and acoustic environment evaluations such as comfort and quietness, while in forest-type temples (where natural sounds usually dominate the soundscape), there is no correlation between sound levels and various kinds of acoustic environment evaluations.

(2) Among the subjective influencing factors of soundscape evaluation, in terms of age, Tarlao et al. found that older people rated the urban soundscape as less pleasant and less monotonous than younger people because they were more sensitive to noise [10], and the value of the acoustic satisfaction evaluation of retired or aged people was lower than that of other interviewees in urban historical areas [32]. Another study found the opposite: teenagers tended to be the most unsatisfied group, and older people were the most satisfied group in terms of acoustic comfort in urban open public spaces [4]. However, the research on urban temples in this paper showed that there was no relationship between age and the evaluation of acoustic comfort or harmony. This could indicate that the relationship between age and acoustic environment evaluation is complex in urban spaces and that there are no uniform results. In the condition of green spaces, a study conducted by Hedblom et al. showed that elderly individuals reported greater calmness when hearing bird songs and rustling leaves than younger and middle-aged individuals did [63]. This was similar to the results of the acoustic environment evaluation of forest-type temples in our paper; that is, with increasing age, the respondents in forest-type temples tended to evaluate the acoustic environment as more comfortable, quiet, and harmonious, indicating that older people have a higher tolerance to the acoustic environment than younger people in green space.

In terms of the relationship between soundscape evaluation and factors related to religious belief, Xie et al. showed that compared with laypeople, Taoist priests' acoustic comfort in a forest-type temple was more influenced by Taoist religious principles, emphasizing harmony between human beings and nature [45]. Similarly, our study indicated that people who completely believed in Buddhist thought felt that the acoustic environ-

ment in forest-type temples was quieter, more comfortable, and more harmonious with the religious atmosphere in the temples. As a result of studying urban-type Buddhist temples in Chengdu, Yi proposed that respondents who lacked religious response felt quiet or relatively quiet and comfortable or relatively comfortable and that the religious atmosphere was harmonious or relatively harmonious [64]. In contrast, we found that in urban-type temples, people who did not believe in Buddhist thought responded that the acoustic environment of temples was noisier or more uncomfortable and that the religious atmosphere was more disharmonious than people who firmly believed or partially believed in Buddhist thought. This difference may be because the two urban-type temples in our study were located in northern and central China, while the four temples investigated by Yi were located in southwestern China. Factors such as the personality of people in different regions (for example, different expectations for the acoustic environment of temples) might affect the soundscape evaluation of temples. Therefore, the influence of religious belief on the soundscape evaluation of Buddhist temples requires further analysis.

Regarding the relationship between the purpose of visiting temples and soundscape evaluation, Tse et al. found that with regard to the perception of park soundscapes, the motivation for visiting a park did not affect individuals' acoustic comfort evaluation [21]. However, some studies on the soundscapes of parks have suggested that different visit motivations could result in different soundscape experiences [18], and visit motivations have the most significant relationships with the perceived occurrences of individual sounds [20]. The last two studies were consistent with the findings of our research that people's purposes could affect their perceptions and evaluations of soundscapes in forest-type temples because the correlation coefficient between the evaluation of acoustic comfort and the purpose was −0.200* for forest-type temples. Respondents who came to worship the Buddha believed that the acoustic environment of the temple was more comfortable.

Regarding the frequency factor, previous studies have shown that people who came to the park more frequently showed more preference for natural sounds, especially wind blowing, tree rustling, raining, and water sounds [18], and visit frequency and length of stay were most frequently associated with the perception of individual sounds [20]. However, the research results of this paper did not show that the frequency of visits to the temple had an effect on sound preference. This may be because people who go to parks often may go for exercise, while people who go to temples often are more likely to be Buddhists. In terms of education level, a previous study revealed that educational background showed no significant relationship with the degree of harmony of any sound in the park [18]. However, another study on parks' soundscapes showed that higher education indicated lower tolerance towards sounds [28]. The results of our study supported the latter view; in forest-type temples, the higher the education level, the worse the evaluation of acoustic comfort, harmony and quietness (correlation coefficients of 0.341**, 0.313**, and 0.267**). Interestingly, there was no significant relationship between education level and the three kinds of acoustic environment evaluations in urban-type temples. We speculate that the possible reason is that people with higher education perceive the acoustic environment in urban-type temples to be affected by noisy surroundings and therefore have lower expectations of the acoustic environment.

In terms of occupation factors, several previous studies have shown that whether in green space or urban open space, occupation has no significant relationship with sound preference [20,40,41]. The findings of our research were similar to these studies; in both urban-type and forest-type temples, occupation had only a slight influence on sound preference.

(3) With regard to the sound preference for urban open space, a previous study showed that the sound of bells and the songs of birds were identified by passers-by as two of the most annoying sound sources in an old town [6]. However, the results of other studies differed: church bells were one of most preferred sounds in urban open public spaces [40], and one social survey of urban religious spaces that examined a cathedral and a Buddhist temple in Seoul suggested that bell sounds and sounds from religious ceremonies in the cathedral and temple were considered more important than other sounds, and human

sounds from religious activities, such as Buddhist chants, were perceived as pleasant by visitors [48]. Similar to the latter two studies, our research also found that Buddhism-related human-made sounds were preferred in urban-type temples.

For forest parks or green spaces, many studies on soundscapes have found similar results. In Jingci Temple (one Chinese forest-type temple in a famous West Lake scenic area), natural sounds were most widely praised [43]. In parks, the majority of visitors had a high preference for natural sounds [33], and birds, insects, and water sounds were the most preferred [16,20,28]. Natural sounds were used positively to reduce unpleasant feelings [19], and respondents' tolerance of natural sounds was high relative to that of traffic noise in nature parks [65]. Furthermore, natural sounds were associated with a much higher degree of favourability in natural and ecological areas than in modern commercial areas [66]. These results are consistent with our study; natural sounds were preferred in forest-type temples more than in urban-type temples.

4. Conclusions

The current study conducted comparative research to investigate subjective soundscape evaluations between typical forest-type and urban-type Han Chinese Buddhist temples. Based on an analysis of 685 valid soundscape questionnaires, it was concluded that there were differences in people's evaluation of the acoustic environment (including quietness, comfort and harmony) and sound preference between forest-type and urban-type temples. Objective factors, such as the measured sound levels synchronous with the questionnaire, and subjective factors, such as the respondents' sociological factors (including age, belief, the purpose of visiting the temple, the frequency of visits to the temple per year, education level, and occupation), had significant relationships with the evaluation of the acoustic environment of the temples, but these factors played different roles in the evaluation of the two types of temples, and some factors may not have contributed to the evaluation of the acoustic environment in certain types of temples. The respondents in the two types of temples had different sound preferences: respondents in forest-type temples preferred natural sounds, while respondents in urban-type temples preferred Buddhism-related human-made sounds. Overall, given the results of our quantitative questionnaire analysis, this study identifies the specific differences in the soundscape evaluation of the two types of temples so that the soundscapes of different types of temples can be designed to meet the needs of different people. These findings could be instructive in soundscape planning and designing processes in forest-type or urban-type temples. In the research process, the definition and data collection methods in ISO 12913 on soundscapes were referenced, and this paper also took into account the actual situation of soundscapes in religious buildings and referred to the research of other scholars [45,48]. These attempts might play a certain role in the development and subsequent revision of ISO 12913. In future work, more diversified and thorough research with the help of VR, eye-tracking technology, and physiological response monitoring should be adopted with the aim of identifying measures to effectively improve the acoustic environment of different types of temples and create a soundscape that is beneficial to people's mental health.

5. Research Limitations

To some extent, the aforementioned results elucidate the subjective soundscape evaluations of respondents with regard to forest-type and urban-type temples. The limitation of this study is that the survey was distributed in only four temples located in northern and central China, and more questionnaires and measurements focusing on more representative temples with a larger geographical area may be necessary. In addition, this study used univariate analysis in the correlation analysis without considering the interaction between the independent variables, that is, whether there was an influence of mediating variables or moderating variables. Only questionnaires and measured sound levels were used in the research without audio-visual interaction or observation of human physiological indicators.

Despite these limitations, the results of this study might provide effective and concrete guidelines for better acoustic environments in two types of Buddhist temple.

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Appendix A

Questionnaire on the acoustic environment of Buddhist temples

Hello. This is a survey of the sound environment in Buddhist temples. This questionnaire is anonymous, and the results are only for this study, which will help to improve the quality of the sound environment in temples. Please fill out the questionnaire based on your feelings about the sound you heard inside and outside the temple. All questions are single-choice except where noted. Thank you for your support!

Time _____ Location (temple) _____ Weather _____ Temperature _____

Measured A sound level_____

Gender _____ (please mark √ under the selected items)
A. Male B. Female

Age _____
A. Younger than 18 years old B. 18 to 30 years old C. 30 to 45 years old
D. 45 to 60 years old E. Older than 60 years old

Educational level _____
A. Primary school B. Middle school C. College or university D. Postgraduate

Occupation: Farmer, worker, soldier, service personnel, technician, teacher, cadre, student, self-employed individual, managers, retired, unemployed, housewives, others (. . .)

The average times that you would visit temple visits per year are____
A. Less than one time B. 1–2 times C. 3–4 times D. more than 4 times

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1 You are here for_____ (mark √ under the selected items)
A. Visiting tourism B. Worshiping the Buddha C. Exercising D. others _____
2 What is your attitude towards Buddhist thought?
A. Firmly believe B. Partially believe C. Do not believe
3 What is your evaluation of the sound environment in your current location?
Quiet Somewhat quiet Neither quiet nor noisy Somewhat noisy Noisy
□ □ □ □ □
1 point 2 points 3 points 4 points 5 points
4 How do you feel about the sound environment among your current environment?
Comfortable Somewhat comfortable No feeling Somewhat uncomfortable Uncomfortable
□ □ □ □ □
1 points 2 points 3 points 4 points 5 points

5 Do you think the voices heard inside and outside the temple are in harmony with the overall religious atmosphere of the temple?

Harmonious Somewhat harmonious No feeling Somewhat inharmonious Inharmonious
□ □ □ □ □

1 points 2 points 3 points 4 points 5 points

6 In the temple, if you hear the following sounds, which ones do you like and which ones do you dislike? (please draw √)

Sound heard	like 1 points	somewhat like 2 points	no feeling 3 points	somewhat dislike 4 points	dislike 5 points
a. Bell					
b. Tourist conversation					
c. Construction site noise					
d. Flowing water					
e. Tour-guide voice					
f. Wind					
g. Background music					
h. Traffic sound					
j. Drum					
k. Fountain					
l. Birds and insects					
m. Footsteps					
n. Rustling leaves					
o. Instrument					
p. Tourists' prayers					
q. Monks chanting					

7 What advice do you have for sound environmrent improvement in Buddhist temples? _____

_____

_____

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