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The Influence of Different Evaluation Media on the Aesthetic Evaluation of Urban Parks

Qiang Wang[1, 3, †], Mingyuan Zhao[2, †], Lanyong Zhao[2, *]

[1]College of Horticultural Science and Engineering, Shandong Agricultural University, Taian, China
[2]College of Forestry, Shandong Agricultural University, Taian, China
[3]School of Architecture and Landscape Design, Shandong University of Art & Design, Jinan, China

Email address:
sdzly369@163.com (Lanyong Zhao)
[*]Corresponding author
† Qiang Wang and Mingyuan Zhao are co-first authors.

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Abstract: In the aesthetic evaluation of landscape under laboratory conditions, photographs or slides are the main type of evaluation media, and the research done by relying on this evaluation media has produced many meaningful aesthetic evaluation theories, but with the progress and development of technology, many new evaluation media have been used and studied, such as panoramic photography and virtual reality, which have improved and developed the traditional aesthetic evaluation theories. This paper takes Jinan city park in China as the landscape aesthetic evaluation object, and obtains different types of landscape evaluation media by shooting, which are four ways: Audio-only, Image-only, Video-only, Audio-video, and uses these four media ways to evaluate the park landscape and analyze the data to explore the influence of different media ways on the landscape evaluation results, in order to get the evaluation results closer to the real environment under the psychological state. The following conclusions were obtained: (1) Different evaluation media methods will have an impact on the aesthetic evaluation of urban park landscape, and the degree of impact depends on the sound and dynamic elements in the environment. (2) Sound landscapes have a superimposed effect on the aesthetic evaluation of urban park landscapes, with good natural sound and artificial noise enhancing and reducing visual evaluation scores respectively. (3) There are significant gender differences in the aesthetic evaluation of landscapes containing sound, which in turn affects the aesthetic evaluation of landscapes.

Keywords: Evaluation Media, Landscape Aesthetic Evaluation, Urban Parks

1. Introduction

Landscape aesthetic evaluation rose in the 1960s and 1970s, and in the following decades, research focused mainly on the evaluation of large-scale natural landscapes and their impacts, and gradually developed a relatively systematic theory [1]. The four major school of aesthetic evaluation: psychophysical paradigm, expert paradigm, cognitive paradigm and empirical paradigm. Based on the theory that more than 80% of human perception of the environment is visual and other related studies, most people believe that there is no significant difference between the validity of evaluation with the help of slides (photographs) and the evaluation of real landscape environments [2-5]. However, unlike large scale landscapes, for small and medium scale landscapes in urban parks, there must be significant differences between slides (photos) and the real landscape environment, as the traditional slide (photo) evaluation is only a static evaluation, but the urban park environment contains a variety of factors such as sound, dynamic landscape, physical sensation (wind, humidity) and smell, These factors all have a significant impact on visitors' visual perception and aesthetic psychology, which in turn affects the aesthetic evaluation of the landscape [6-8], and in some cases may lead to large differences in landscape evaluation results. For example, Rachel Kaplan & Stephen Kaplan investigated the pattern of human preference for information about the natural world through questionnaires, and found that dynamic landscapes such as clouds in the sky, branches and leaves in the wind, and streams are effective in relieving human stress [9]. Therefore, this study takes a Jinan city park scene as the research object, and compares the landscape aesthetic evaluation scores of the same landscape scene in four different modes (Audio-only, Image-only, Video-only, Audio-video) and gender differences, to investigate the different landscape information access The purpose of this study is to investigate the impact of different modes of landscape information acquisition on the aesthetic evaluation of landscapes and the interaction between these four modes in the process of aesthetic evaluation of landscapes, in order to improve and enhance the process and methods of aesthetic evaluation of landscapes.

2. Methodology

2.1. Landscape Evaluation Material Acquisition and Evaluation Process

Shooting equipment: Sony ILCE-6000(α6000) camera.

Playback device: Seewo S86EB multimedia tablet.

Sample scenes: In this study, scenes were selected and filmed in Jinan City Park, China. Each scene was filmed with a uniform human point-of-view height and fixed focal length, and photographs and audio-visuals were taken separately, each video was 10 seconds long, and after screening, a total of 54 scenes were obtained as material for the subjects of landscape aesthetic evaluation.

Evaluators: 25 male and 29 female junior undergraduate students in landscape architecture.

Experimental process: The 54 scenes were played on the playback equipment in the laboratory in four modes: Audio-only, Image-only, Video-only, and Audio-video, each scene was played for ten seconds, and 10 seconds were available for scoring evaluation after the playback.

Evaluation method: The quantitative evaluation of 54 scenes was conducted using the Likert scale method, and the evaluation was divided into five levels: very poor, poor, average, good, and very good, with scores of 1, 2, 3, 4, and 5, respectively.

2.2. Statistical Methodology

SPSS 21.0 software was used to analyze the data, and the measurement data conforming to normal distribution were described by mean±standard deviation (Mean±SD), independent samples t-test for comparison between two groups, ANOVA for comparison between multiple groups, and SNK method for statistically significant two-by-two comparisons; the measurement data with non-normal distribution were described by median and quartile spacing [M(Q1,Q3)], and intergroup Mann-Whitney U rank-sum test was used for comparison, and Kruskal-Wallis rank-sum test was used for comparison among multiple groups. Correlation analysis was performed on the mean values of the four groups of landscape evaluation composite scores, followed by factor analysis to explore the relationship between the landscape evaluation composite scores and the mean values of each group's scores, and all tests were performed using a two-sided test with the test level a=0.05.

3. Results and Analysis

3.1. Correlation Analysis

The Pearson correlation analysis shows that Audio-only mean scores are positively correlated with Image-only mean scores at a correlation coefficient size of 0.378, with Video-only mean scores at a correlation coefficient size of 0.349, and with Audio-video mean scores at a correlation coefficient size of 0.782; The Image-only mean scores is positively correlated with the Video-only mean scores at a correlation coefficient size of 0.764, with the Audio-video mean scores at a correlation coefficient size of 0.677; The Video-only mean scores is positively correlated with the Audio-video mean scores at a correlation coefficient size of 0.819, which was statistically significant.

Table 1. *Correlation analysis of the mean landscape evaluation scores.*

		Audio-only	Image-only	Video-only	Audio-video
Audio-only	Pearson Correlation Coefficient	1			
	P (2-tailed)				
	N	54			
Image-only	Pearson Correlation Coefficient	0.378**	1		
	P (2-tailed)	0.005			
	N	54	54		
Video-only	Pearson Correlation Coefficient	0.349**	0.764**	1	
	P (2-tailed)	0.010	.000		
	N	54	54	54	
Audio-video	Pearson Correlation Coefficient	0.782**	0.677**	0.819**	1
	P (2-tailed)	<0.001	<0.001	<0.001	
	N	54	54	54	54

Note: **. Significantly correlated at the .01 level (2-tailed).

3.2. Factor Analysis

Factor analysis is the use of a few common factors to explain the complex relationships that exist in a larger number of variables to be observed; it is not a recombination of the original variables, but a decomposition of the original variables. Factor analysis groups variables according to their correlation magnitudes, so that variables within the same group are more correlated with each other, but variables in different groups are less correlated, and each group represents a basic structure, which is called a common factor.

Table 2. *Correlation Matrix (mean scores).*

	Audio-only	Image-only	Video-only	Audio-video
Audio-only	1.000	0.634	0.490	0.560
Image-only	0.634	1.000	0.532	0.456
Video-only	0.490	0.532	1.000	0.552
Audio-video	0.560	0.456	0.542	1.000

The correlation matrix reflects the degree of association between the independent variables. when most of the correlation matrix coefficients are greater than 0.3, it is suitable for factor analysis. the magnitude of correlation between Audio-only mean scores and Image-only mean scores is 0.634, the magnitude of correlation with Video-only mean scores is 0.490, and the magnitude of correlation with Video-only mean scores is 0.560. The correlation size between Image-only mean scores and Video-only mean scores was 0.532, and the correlation size with Video-audio mean scores was 0.456. only mean scores had a correlation size of 0.552 with Video-audio mean scores.

Table 3. *KMO and Bartlett's test.*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.713
Bartlett's test of sphericity	Approx. Chi-Square	206.737
	df	6
	Sig.	<0.001

Factor analysis test shows that the KMO coefficient is 0.713, which is greater than 0.5 and can be used for factor analysis, and the significance level is less than 0.05, which is statistically significant. The KMO statistic is taken as a value between 0 and 1. The KMO value is close to 1. The closer the KMO value is to 1, the stronger the correlation between the variables, and the more suitable the original variables are for factor analysis. Bartlett's spherical test is used to test whether the variables are independent of each other. If the variables are independent of each other, no common factor can be extracted from them and factor analysis cannot be applied. When the test result shows that $p<0.05$, it means the variables are correlated and factor analysis is valid.

Table 4. *Communalities.*

	Initial	Extraction
Audio-only mean scores	1.000	0.984
Image-only mean scores	1.000	0.843
Video-only mean scores	1.000	0.912
Audio-video mean scores	1.000	0.959

Extraction: Principal Component Analysis.

The communalities reflects the degree of explanation of the variance of the original variables by the extracted common factor, and the larger the value, the better the effect. The communalities is greater than 0.7, which indicates that the effect of extracting the common factor is good.

Table 5. *Total Variance Explained.*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative%	Total	% of Variance	Cumulative%	Total	% of Variance	Cumulative%
1	2.912	72.807	72.807	2.912	72.807	72.807	2.133	53.315	53.315
2	1.786	19.642	92.449	0.786	19.642	92.449	1.565	39.133	92.449
3	0.275	6.870	99.319						
4	0.027	0.681	100.000						

Extraction method: Principal component analysis.

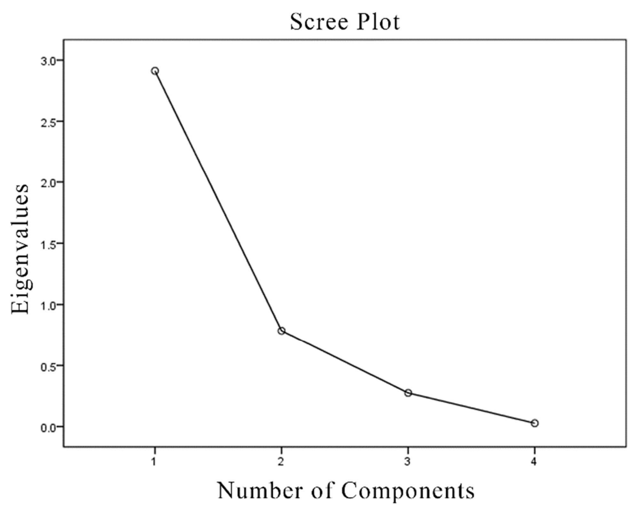

Figure 1. *Scree Plot.*

The total variance explained is to see the contribution of the factors to the explanation of the variables. The total variance explained shows that two male factors were extracted with a cumulative total variance of 92.449%. It means that the contribution of the four common factors is 92.449%, which is a good contribution rate.

As can be seen from the gravel plot, the curve drops slowly and flattens out after the second common factor. It can indicate that the extracted two common factors cover the vast majority of information of the original message.

Table 6. *Component Matrix [a].*

	Component	
	1	2
Audio-only mean scores	0.719	0.683
Image-only mean scores	0.834	-0.385
Video-only mean scores	0.877	-0.378
Audio-video mean scores	0.965	0.167
Extraction Method: Principal Component Analysis.		

a. 2 components have been extracted.

The component matrix shows that Audio-only mean scores have a loading of 0.719 on the first common factor, Image-only mean scores have a loading of 0.834 on the first common factor, Video-only mean scores have a loading of 0.877 on the first common factor, and Audio- video mean scores had a loading of 0.965 on the first common factor.

Audio-only mean scores had a loading of 0.683 on the second common factor, Image-only mean scores had a loading of -0.385 on the second common factor, Video-only mean scores had a loading of -0.378 on the second common factor, and Audio-video mean scores had a loading of 0.167 on the second common factor.

Table 7. *Rotated Component Matrix [a].*

	Component	
	1	2
Audio-only mean scores	0.159	0.979
Image-only mean scores	0.897	0.198
Video-only mean scores	0.927	0.230
Audio-video mean scores	0.667	0.717

Extraction method: Principal component analysis.
Rotation method: Varimax with Kaiser normalization.
a. Rotation converged in three iterations.

The results of the rotated component matrix show that the F1 factor has higher loadings on the Image-only mean scores and Video-only mean scores. The F2 factor has higher loadings on the Audio-only mean scores and the Audio-video mean scores.

Table 8. *Component Score Coefficient Matrix.*

	Component	
	1	2
Audio-only mean scores	-0.330	0.841
Image-only mean scores	0.525	-0.217
Video-only mean scores	0.531	-0.201
Audio-video mean scores	0.135	0.370

Extraction method: Principal component analysis.
Rotation method: Varimax with Kaiser normalization.
Component scores.

Based on the component score matrix, the common factor expression was calculated as：

$$F1=-0.330X1+0.525X2+0.531X3+0.135X4$$

$$F2=0.841X1-0.217X2-0.201X3+0.370X4$$

X1-X4 correspond to the Audio-only mean scores, Image-only mean scores, Video-only mean scores, and Audio-video mean scores, respectively.

For the common factor F1, for each increase in the Audio-only mean scores, the composite landscape evaluation score decreases by 0.330; for each increase in the Image-only mean scores, the composite landscape evaluation score increases by 0.525; for each increase in the Video-only mean scores, the composite landscape evaluation score increases by 0.531; for each increase in the Audio-video mean scores, the composite landscape evaluation score increases by 0.135.

For the common factor F2, for each increase in the Audio-only mean scores, the landscape evaluation composite score increases by 0.841; for each increase in the Image-only mean scores, the landscape evaluation composite score decreases by 0.217; for each increase in the Video-only mean scores, the landscape evaluation composite score decreases by 0.201; for each increase in the Audio-video mean scores, the landscape evaluation composite score increases by 0.370.

3.3. Evaluation Media Variability Analysis

The ANOVA showed that there was a difference between the means of the four groups of landscape evaluation scores (F=9.535, p<0.001). It is also clear from the two-by-two comparison according to the SNK method that the other three groups are statistically significant when compared to the mean of the Audio-only scores, and also according to the descriptive analysis, the mean values of the other three groups are higher than the mean values of the Audio-only scores, so it is obvious that the other three groups are higher than the Audio-only scores.

Table 9. *Analysis of variance of landscape evaluation mean scores.*

Variables	Audio-only	Image-only	Video-only	Audio-video	F	*P*
Scores, Mean±SD	3.05±0.85*	3.45±0.55	3.49±0.64	3.42±0.63	F=9.535	<.001

Note: * represents a statistically significant comparison with the Audio-only mean scores.

Table 10. *Differential analysis of landscape evaluation mean scores between male and female students.*

Variables	Male (n=54)	Female (n=54)	Statistics	*P*
Audio-only, Mean±SD	3.27±0.87	2.84±0.77	t=2.74	0.007
Image-only, Mean±SD	3.46±0.56	3.43±0.54	t=0.30	0.765
Video-only, Mean±SD	3.56±0.60	3.42±0.69	t=1.15	0.252
Audio-video, Mean±SD	3.57±0.63	3.27±0.61	t=2.54	0.013

3.4. Gender Variability Analysis

The results of the one-way analysis of variance showed that the t-value for the test of mean male Audio-only scores and mean female Audio-only scores was 2.74, with a p-value of less than 0.05, which was statistically significant. According to the descriptive analysis, the mean value of the mean male Audio-only scores was higher than the mean female Audio-only scores, so it can be seen that the mean male Audio-only scores was greater than the mean female

Audio-only scores. The t-value for the test of mean male Audio-video scores and mean female Audio-video scores was 2.54, and the p-value was less than 0.05, which was statistically significant. According to the descriptive analysis, it can be seen that the mean value of the mean male Audio-video scores was higher than the mean female Audio-video scores, so it can be seen that the mean male Audio-video scores was greater than the mean female Audio-video scores.

4. Discussion

4.1. Impact of Different Evaluation Media on Evaluation Results

Overall, the Audio-only evaluation scores in the four evaluation modes are significantly lower than the other three visual-based evaluations, reflecting the dominance of visual evaluation in landscape aesthetic evaluation on the one hand, and the lower Audio-only mean scores on the other hand due to the fact that urban parks are mostly located in the urban center, and the environment is susceptible to the surrounding noise such as traffic sound, mechanical sound and human voice in the park, and further reduces the Audio-video mean scores. Therefore, although the Audio-video mode in landscape aesthetic evaluation is the closest evaluation mode to the real environment under laboratory conditions, due to the superimposed influence of sound evaluation, for the same scene, visual perception evaluation is rated from highest to lowest as Video-only, Image-only, and Audio-video, but the difference is not significant (Table 9).

Figure 2. *Rippling water.*

Figure 3. *Flowing waterfall.*

Figure 4. *Swinging branches.*

Figure 5. *Slow-moving Tai Chi.*

If there are factors in the scene that add vividness to the landscape, such as rippling water, flowing waterfalls, swinging branches, dynamic people or boats, then the Video-only mode will be rated much higher than the Image-only mode (Figures 2-5); if there are no more attractive dynamic landscape factors in the scene, then the Image-only mode will be rated higher than the Video-only mode (Figures 6-7); When there are sounds (birdsong) in the scene that add natural interest, the Audio-video mode scores higher than the other modes.

Figure 6. *Autumn View.*

Figure 7. *Lake view.*

4.2. Soundscape Evaluation

Sounds in urban park environments usually include natural sounds and artificial sounds; natural sounds include bird and cicada songs, water and wind sounds, etc.; artificial sounds include music, radio, conversation, machinery sounds, traffic noise, etc. Related studies show that natural sounds such as insect and bird chirping and water and wind sounds are more popular, while artificial sounds such as traffic and construction sounds are less popular [10]. The more natural the sound source, the more it promotes human mental health [11]. In this study, natural sounds that could be effectively perceived and understood by visitors in Audio-only mode scored the highest, such as rhythmic and non-noisy birdsong in a quiet environment; among non-natural sounds, the sound of background music scored high. In most cases, the urban park soundscape evaluation showed that natural sounds were rated higher than artificial sounds, but the waterfall sound of natural sounds in the Audio-only mode resulted in a lower score because it was easily interpreted as environmental noise such as traffic sounds.

4.3. The Influence of Soundscape on the Aesthetic Evaluation of Landscape

Related studies have shown that in urban parks, the degree of landscape beauty is most closely coordinated with natural sound and positively correlated with the quietness of the soundscape [12]; The visual landscape rating is also enhanced by a better acoustic environment [13]. The aesthetic experience of the landscape is highest when sound and images match each other [14].

Figure 8. *Small Square.*

Figure 9. *Lake view.*

In this study, it is found that sound landscape has a superimposed effect on the visual evaluation of the landscape, as shown in Figure 8 for a small park square in the early morning, the ambient sound including birdsong and background music, the Audio-only score reaches 4.28, but the Image-only score is only 2.70, the Video-only score is only 2.56, and the Audio-video score after superimposed audio is 3.31, it can be seen that good sound landscape improves the visual evaluation score. The lake view of the park shown in Figure 9 also benefits from the superimposed effect of natural birdsong, and the Audio-video score is higher than the Image-only and Video-only scores. In the water play area of the park shown in Figure 10, children playing in the water generated more noise, and the Audio-only score was only 1.74, the Image-only score was 3.37, the Video-only score was 3.20, and the Audio-video score was 2.70, which shows that the superimposed environmental noise reduced the visual evaluation score of Audio-video. Similar results are produced in Figure 11.

Figure 10. *Water play area.*

Figure 11. *Park Bridge.*

4.4. Impact of Gender Differences on Evaluation Results

From the results of the above statistical analysis, it can be seen that the evaluation scores of males regarding Audio-only and Audio-video are higher than those of females (Table 10), showing that girls are more sensitive to the sound environment and prefer a quieter landscape environment atmosphere; while males have a higher tolerance for environmental noise, which is also consistent with the results of gender differences in environmental sound preferences in related studies [15]. In contrast, in the evaluation of

Image-only and Video-only that do not involve sound, the differences in scores exhibited by different genders are small and not statistically significant, implying that males and females are closer in visual-based evaluation.

5. Conclusions

(1) Visual landscape evaluation is better than auditory landscape evaluation in most urban park environments, while dynamic visual landscape evaluation is closer to static visual landscape evaluation; when there are dynamic factors in the environment that increase the vividness of the landscape, dynamic visual landscape evaluation is better than static visual landscape evaluation.

(2) Sound landscape will have a superimposed effect on the aesthetic evaluation of urban park landscape. Natural sounds such as birdsong in the quiet environment and artificial noises such as machinery and traffic sounds will enhance or reduce the score of landscape visual evaluation respectively.

(3) There is a significant gender difference in the aesthetic evaluation of the landscape containing sound, with women being more sensitive to sound, less tolerant to environmental noise than men, and preferring a quieter landscape environment atmosphere.

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