A Study on the Relationship between Design Elements of Outdoor Leisure Spaces and Types of Leisure Activities in Sustainable Community Development – A Case Study on Tainan, Taiwan

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A Study on the Relationship between Design Elements of Outdoor Leisure Spaces and Types of Leisure Activities in Sustainable Community Development – A Case Study on Tainan, Taiwan

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Abstract. Sustainable community development encompasses three aspects: “Lifestyle”, “Production” and “Ecology”. Among them, “Lifestyle” is closest to people and reflects basic human needs. Creating outdoor spaces that encourage residents to engage in leisure activities will not only provide them with spiritual sustenance but also fulfil one of the key criteria in sustainable community development. This study explores the relationship between design elements of outdoor leisure spaces and types of leisure activities from residents' perspective with the goal to inform future spatial planning. The study collected 365 valid questionnaires from Tainan residents. Factor analysis was used to extract factors from design elements of outdoor leisure spaces, and regression analysis was applied to understand the effect level. The result shows design elements have positive effect on the types of leisure activities. In addition, different elements exert different influences on the choice of activities.

1. Introduction

As awareness in sustainable development and popularity in leisure and recreational activities grow, what people demand from their public leisure spaces are also changing with the times or their personal needs. Residents enjoy leisure activities both inside their homes and in their surrounding environment [1]. The community is the basic building block of a city. Public leisure spaces in a community not only serve as open space but also as a platform for residents' outdoor living and voluntary daily activities. Leisure activities undertaken by residents in the community are varied [2]. However, living in a crowded city, they also tend to choose certain types of leisure activities under the influence of external environmental factors. It is important to meet their leisure needs while ensuring sustainable development.

2. Design Elements of Community Outdoor Leisure Space and Types of Leisure Activities

Undertaking leisure activities in the community has a positive effect on lifestyle [3]. From the perspective of urban planning, the community environment can be spatially subdivided into architecture and town planning, transport links and green space [4]. Kevin Lynch asserts six spatial elements in site planning: paving, street furniture, buildings, open spaces, artifacts and plants [5]. Abbasi argues that different types of space (such as streets, green space, parks, squares, etc.) have effect on our physical, mental health and quality of life [6]. However, studies have shown that main factors affecting residents' utilization rate of outdoor spaces are distance, attractiveness of space [7]
and space maintenance [8]. Providing more and better spaces in the community is a good way to promote physical activities and improve quality of life.

Therefore, we must understand elements of the natural and built environment in the community in order to design better outdoor leisure spaces [9] and attract residents to engage in diversified leisure activities in the outdoors.

The objectives of the study may be summarized as follows: 1. Understand how residents evaluate outdoor leisure spaces. 2. Understand what types of leisure activities resident undertake. 3. Explore the relationship between design elements of outdoor leisure spaces and types of leisure activities.

3. Research Methods
This study explores the relationship between design elements of outdoor leisure spaces and the types of leisure activities from the perspective of residents. We used factor analysis to extract factors from the design elements of outdoor leisure spaces, and then applied regression analysis to understand the effect level.

3.1 Measurement Scale
After reviewing and compiling past literature, the study proposes 6 dimensions and 30 items as a scale for design elements of community outdoor leisure spaces. The dimensions include: “Public Art and Signboard”, “Communication Space”, “Park”, “Passage”, “Night Illumination” and “Circulation”. The scale for the types of leisure activities uses 4 dimensions: “Social”, “Exercise”, “Recreation” and “Knowledge and Culture”.

3.2 Scope and Subject of Research
Tainan is the cultural and historical hearth of Taiwan, and its residents serve as the subjects of the study. The stratified-quota sampling method was used and a comparison was made with the general population to ensure the profile of variables fits the general population. 377 questionnaires were distributed and 365 valid ones were returned. The study sites are shown in Figure 1.

Figure 1. Maps of the study site.
4. Research Analysis

4.1 Reliability Analysis
The Cronbach’s \( \alpha \) for design elements of community outdoor leisure spaces is 0.943, and the Cronbach’s \( \alpha \) for types of leisure activities is 0.688. According to the reliability standard of Cronbach’s \( \alpha \), \( \alpha \geq 0.70 \) represents high reliability, and \( 0.70 \leq \alpha \leq 0.6 \) represents medium reliability [10]. The Cronbach’s \( \alpha \) for types of leisure activities is 0.688, meaning the reliability of the questionnaires is acceptable.

4.2 Factor Analysis of Design Elements of Community Outdoor Leisure Spaces
Principal component analysis was used to extract factors and varimax rotation was applied. KMO and Bartlett’s test were used to test the appropriateness of factor analysis, and then the derived factors were named. Referencing past literature, the factors were named as follows: “Public Art and Signboard”, “Communication Space”, “Park”, “Passage”, “Night Illumination” and “Circulation”. Factor analysis of the design elements is shown in Table 1 below.

| Items |
|-------|
| Public Art and Signboard | Communication Space | Passage | Park | Night Illumination | Circulation |
| A35 Styles of the signboard in communication space are varied. | .790 | .114 | -.115 | .116 | .196 | .137 |
| A34 Public art installations in the communication space are pleasant. | .786 | .170 | .015 | .255 | .090 | .100 |
| A7 Public art installations along the passage are pleasant. | .757 | .052 | .286 | .177 | .096 | .109 |
| A21 Public art installations in the park are pleasant. | .754 | .134 | .151 | .371 | .108 | .037 |
| A8 Styles of signboards along the passage are varied. | .745 | .057 | .239 | .007 | .030 | .134 |
| A5 Styles of street furniture along the passage are varied. | .529 | .130 | .264 | -.073 | .020 | .354 |
| A41 The active crowd in the communication space makes one feel energetic. | -.018 | .701 | .045 | .295 | .082 | .219 |
| A28 The communication space is accessible. | .260 | .700 | .193 | -.094 | .108 | .141 |
| A39 Natural illumination of the communication space is adequate. | .037 | .686 | .241 | .026 | .242 | .097 |
| A30 Maintenance of the communication space is good. | .168 | .649 | .165 | .377 | .075 | .152 |
| A29 The scale of the communication space is appropriate. | .214 | .632 | .094 | .472 | -.014 | .190 |
| A36 Paving in the communication space is well maintained. | .187 | .425 | .384 | .338 | .209 | .054 |
| A9 Paving along the passage is well maintained. | .210 | .165 | .707 | .111 | .150 | .119 |
| A10 Planting along the passage is diversified. | .135 | .146 | .698 | .115 | -.109 | .180 |
| A14 The active crowd along the passage makes one feel energetic. | .202 | .385 | .559 | -.071 | .157 | .161 |
| A11 The passage is well shaded. | .376 | -.131 | .516 | .241 | .182 | .184 |
| A6 The scale of the passage is appropriate to the surrounding buildings. | .126 | .132 | .492 | .301 | .065 | .283 |
| A12 Natural illumination along the passage is adequate. | -.026 | .291 | .458 | .163 | .332 | .289 |
4.3 Correlation Analysis

Pearson product-moment correlation coefficient was used to probe the correlation level between two variables. The result shows design elements of outdoor leisure spaces and types of leisure activities have significant correlation, where the correlation coefficient is 0.310 (shown in Table 2) indicating moderate correlation (**P<0.01). That means design elements have significant effect on the types of leisure activities, and it is worthwhile to analyse the effect level of the factors.

Table 2. Correlation analysis of design elements of community outdoor leisure spaces and types of leisure activities

| Design Elements of Community Outdoor Leisure Space | Pearson Correlation | Sig. (2-tailed) | Types of Leisure Activities | Pearson Correlation | Sig. (2-tailed) |
|--------------------------------------------------|---------------------|-----------------|------------------------------|---------------------|-----------------|
| Design Elements of Community Outdoor Leisure Space | 1.000               | 0.310**         | Types of Leisure Activities | 0.310**             | 0.000           |
| Types of Leisure Activities                      | 0.310**             |                 |
| **. Correlation is significant at the 0.01 level (2-tailed) |

**Figure 2. Structure of the study construct**
4.4 Multiple Regression Analysis of the Factors of Construct

To address the problem of multi-collinearity, multivariate regression analysis was done first to reduce the error probability of amplification type I. The result showed X1, X2, X3, X4, X5 and X6 have significant effect on Y1, Y2, Y3 and Y4, meaning multiple regression analysis of the factors is feasible. The structure of the study construct is shown in Figure 2.

The types of leisure activities were taken as dependent variables and the factors of design elements of community outdoor leisure spaces as independent ones in the multiple regression analysis (shown in Table 3). The result shows “Public Art and Signboard” and “Communication Space” have significant effect on “Social” and “Communication Space” with medium effect size (0.213); “Public Art and Signboard” has significant effect on “Exercise” (0.145); “Communication Space”, “Passage” and “Night Illumination” have significant effect on “Recreation”; “Public Art and Signboard”, “Night Illumination” and “Passage” have significant effect on “Knowledge and Culture”, and “Public Art and Signboard” has medium effect size (0.264). The hypothesis of the study was confirmed.

Table 3. Regression analysis of the factors of design elements of community outdoor leisure spaces and types of leisure activities

| Dependent Variable | Public Art and Signboard | Communication Space | Passage | Park | Night Illumination | Circulation | R   | R²   | F    |
|--------------------|---------------------------|---------------------|---------|-----|-------------------|-------------|------|------|------|
| Social             | Beta 0.094                | 0.213               | -0.026  | 0.070 | 0.011             | -0.111      | 0.260| 0.068| 4.340*** |
|                    | T 1.461*                  | 2.982**             | -0.358  | 0.928 | 0.181             | -1.681      |      |      |      |
| Exercise           | Beta 0.145                | 0.138               | 0.099   | 0.009 | 0.004             | -0.061      | 0.288| 0.083| 5.381*** |
|                    | T 2.282*                  | 1.938               | 1.362   | 0.116 | 0.073             | -0.923      |      |      |      |
| Recreation         | Beta -0.069               | 0.184               | 0.150   | -0.022| 0.175             | -0.115      | 0.326| 0.106| 7.084*** |
|                    | T -1.092                  | 2.632**             | 2.085   | -0.298| 2.921**           | -1.780      |      |      |      |
| Knowledge and Culture | Beta 0.264                | -0.009              | 0.093   | -0.018| 0.164             | -0.220      | 0.344| 0.118| 8.007*** |
|                    | T 4.238***                | -0.132              | 1.297   | -0.251| 2.763**           | 3.429**     |      |      |      |

5. Result and Conclusion

The result shows design elements of community outdoor leisure space not only have positive effect on leisure activities but also influence residents' choice of the activity type. Among the factors of design elements, “Public Art and Signboard” has significant positive effect on “Social”, “Exercise” and “Knowledge and Culture”; “Communication Space” has significant positive effect on “Social” and “Recreation”; “Passage” has significant positive effect on “Recreational”; “Night Illumination” has significant positive effect on “Recreation” and “Knowledge and Culture”. It is worthwhile to mention that “Circulation” has a significant negative influence on “Knowledge and Culture”.

That is, community public art and signboards can be regarded as landmarks and embellishments in spaces, and residents engaged in social, exercise, knowledge and cultural types of activities can more readily feel these elements. Communication space provides a place for residents to stay and communicate. Whether alone or in a group, they need a spot to rest or interact with others, so those engaged in social and recreational leisure activities have stronger feelings for these spaces. A good passage is the only important element for residents engaged in recreational activities. Night illumination not only provides ambient lighting but also becomes an important element in shaping the atmosphere, making residents engaged in recreational and knowledge and cultural activities more sensitive to changes in the environment. The quality of circulation significantly affects the feeling of residents engaged in knowledge and cultural activities. The residents also consider that the higher quality of circulation, the larger volume of traffic, and there will be more external interference, which will reduce the willingness to engage activity in the space. Conversely the lower quality of circulation,
the smaller volume of traffic, and there will be less external interference, the possibility of choosing to engage in knowledge and cultural activities here will increase.

Over all, residents with access to a quality outdoor leisure environment tend to engage more in outdoor leisure activities. Creating a quality environment as such requires planners to make field observations and converse with residents and then plan and design suitable spaces that encourage them to participate in outdoor leisure activities during their spare time. Ultimately, residents' needs are met and sustainable development of the environment is made possible.

However, some more questions remain to be answered: how do leisure spaces in different communities satisfy their residents' desire in leisure activities? How do planners promote residents' engagement in outdoor leisure activities to help them relax, adjust the pace of life and face challenges in school or work with renewed motivation? These are issues that need to be further probed.

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