

Designing “Flourishing” into Green Environment for Taipei City

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Abstract. Taipei City became the World Design Capital 2016 with the slogan of “Adaptive City” and “Adaptive Design”. When seeking strategies to green environment, this study was adopted a new adaptive approach with semantic differential analysis and questionnaires to show how to design flourishing by conducting a preference cognitive test marked by “morphology” for ecological sustainability, especially in interior space. The analytic results showed that the morphological components of preference ranks from top were: repetition, proportion, gradation. And too complicated or too simple the change of morphological components did both affect viewers’ preference; also the presence of morphologies had an emotional effect on the viewers. It should be emphasized on morphological elements and form of aesthetic principles to achieve a balanced proportion of design for indoor vertical greening environment and spatial atmosphere, for the purpose of creating good flourishing visual experience.

Keywords: Image Analysis, Indoor Vertical Greening, Environmental Perception, Morphological Design.

1 Introduction

ICSID (International Council of Societies of Industrial Design) had announced Taipei City the World Design Capital 2016 with the slogan of “Adaptive City” and “Adaptive Design”. It gave Taipei an opportunity to show Taipei City of sustainable development with good life quality, health, and ecological sustainability. Because of growing urban population lead to dense building mass layout, reduction of green spaces, destruction to ecological cycle system and acceleration of global warming. Vertical greening came up as a feasible solution to the problem. It didn’t take up much space while managing to restore the ecological environment and purify the air through the green plants’ self-adjustment ability. More importantly, vertical greening could bring indoor visual pleasure and flourishing space to comfort the physical and psychological perception of indoor viewers. In recent years, there was a rising demand for vertical greening in interior design (e.g., public space, business space,

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restaurants) in Taiwan as well as its multiple forms, which signified a trend in the future and importance of this study.

In retrospect of past research of vertical greening in Taiwan were focusing on aspects such as building techniques, plant effectiveness [1-3], physical effectiveness of indoor and outdoor vertical greening of buildings [4] and psychological impact of indoor environment on the viewers [5-7]. However, all the researches above hadn't discussed the impact of morphological and shaping preference on indoor vertical greening. This research was adopted a new approach of image preference to study the viewers' attitude towards their visual and psychological feelings. Morphological design could have a direct impact on the basis of users' perception of the contour of the form. Therefore, this research investigated the landscape form and image preference through users' perception. Then designed questionnaires focused on image analysis and semantic differences are given to users to test their preference cognitions marked by "morphology", to study the impact and importance of morphology. The survey results was assessed by Excel and analyzed by statistics software Windows SPSS 18 with the function of One-Way ANOVA. This study concluded the specific form trail and morphological perception of preference and appropriate presence of flourishing images in the interior green environment designed in the aim of providing reference for future design of indoor vertical greening that catered to preference of viewers' from different backgrounds.

2 Study Design

Psychology Dictionary defined image as "a mixture of subjective judgment preferences and attitudes of a wide range of things". Kevin Lynch [8] regarded image as a vast reference structure which could organize activities, beliefs and knowledge, and could play a social role to provide communities with materials of symbol and collective memory to give viewers a sense of emotional security. Kotler [9] put forward that image is an object, which could generate a group of perception, belief and ideas. Gartner [10] proposed that image should include cognitive, affective and cognitive behaviors. Through above it could be concluded that image was an accumulative psychological picture based on personal sensory perception and subjective empirical background. Therefore, landscape image was a product of interaction activities between viewers and environment, and this image could be referred to and studied to help understand and experience the whole environment. To shape the image, we needed a specific basic form which called "morphology", and that's why this research started from a perspective of morphology to study viewers' preference for the design for indoor vertical greening. To do so, we adopted one of the researching methodologies - semantic differential analysis to do a quantitative evaluation of preference degree. The study included three phases: representative morphological screening, defined the measuring gauge of emotional adjective, and questionnaire on perceptual preference as shown in Fig.1.

2.1 Phase I Study: Representative Morphological Screening

The objective of form was always in pursuit of beauty. Aesthetic Principles were people's reflection over natural and man-made beauty concluded after long-term

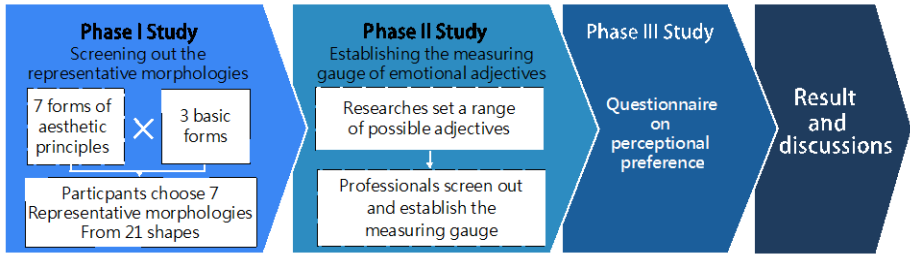


Fig. 1. Research process

organized, systematic research, and served as basis of interpretation or creative aesthetic forms [11]. Altogether 7 aesthetic principles such as Repetition, Eurhythm, Proportion, Gradation, Contrast, Balance and Unified were studied and found after screening out those of semantic similarity [11-17]. Besides, square, triangle and circle were the basic forms of all morphology [18]. Under the guideline of the two principles above, 21 morphologies in this research on indoor vertical greening were designed as shown in Fig. 2.

For the purpose of the research, the questionnaire was designed in a structured way investigating both professionals with designing background and non-professionals. Professional designers were mainly practitioners in architecture, landscape, interior design, and gardening; while non-professionals were mainly students as Evans and wood [19], Chen and Lin [3] pointed out that the results of evaluation on students were much the same as those on general public.

97% of the 100 questionnaires were valid for further analysis. The socio-demographic characteristics of the participants were carefully monitored. In terms of participants' gender, the male to female ratio was 1:1.37. The age group was between 21-50 years old and half of the participants had professional design background. The research result showed that the participants' preference for the form of aesthetic principles was ranked in the order below: “Repetition”, “Proportion”, and “Gradation”. The statistic result of representative morphological preference for different was shown in Fig. 2.

2.2 Phase II Study: The Measuring Gauge of Emotional Adjective

To understood the preference of viewers for the morphological design for indoor vertical greening, we compiled terms from related references on the methodology of semantic differential analysis and chose “general emotional adjectives” as benchmark measurement with spectrum from extreme negative attitudes to positive attitudes. Also general emotional adjectives used by previously researches on landscape environment were taking into consideration [20-25]. For first preliminary step, we chose 51 adjectives (Table 1) that are easy to understand, frequently used and clear to express emotional response to the morphology. Secondly, another questionnaire was






















The Form of Aesthetic Principles Basic form	Repetition	Eurythmy	Proportion	Gradation	Contrast	Balance	Unified
Square							
	24%	53%	50%	24%	37%	40%	17%
Triangle							
	29%	16%	24%	46%	32%	17%	47%
Round							
	47%	31%	26%	30%	31%	43%	36%
The Form of Aesthetic Principles Preferences (%)	20%	17%	20%	19%	13%	4 %	7 %

Fig. 2. Morphological design and preference for the seven forms of aesthetic principles

administered to professionals with a design career. The participants of this questionnaire were required to pick out one suitable word that could best describe their preference for the seven representative morphologies (Fig. 2) in Phase I study from the 51 emotional adjectives. The 10 emotional adjectives with highest reference frequency in the result were in bold font as shown in Table 1. 85% of 40 questionnaires are valid for analysis. Participants’ socio-demographic characteristics: the male to female ratio was 1. The age group was between 21-50 years old. The non-professional to professional ratio was 1:3.

Table 1. The 51 emotional adjectives screened out in the preliminary step and the 10 emotional adjectives with highest reference frequency (times of reference)

<u>amazing</u> (16) <u>attention</u> (20) <u>bored</u> (19) <u>bother</u> (19) <u>calm</u> (23) <u>control</u> (33) <u>interesting</u> (27) <u>monotone</u> (22)	<u>mysterious</u> (21) <u>lead</u> (38) <u>rigid</u> (35) <u>tenseness</u> (17) <u>vivid</u> (26)	anger antipathy anxiety aroused atease beautiful careful chaos	cheerful cozy dangerous dejection desirous droopy euphoria favorite	Fear Gloomy harmonious Inspire Intimate joy lively loneliness	melancholy merry mild relaxed relieved serene serious shock	solemn stimulate suffering tired vigilance weary
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This research had also matched pairs of words with opposite meanings in the top 10 emotional adjectives screened out in the preliminary step from the measuring gauge of semantic differential analysis. So another 3 adjectives were added to the pairs in underline font as shown in Table 1 and then formed 10 measuring gauge projects.

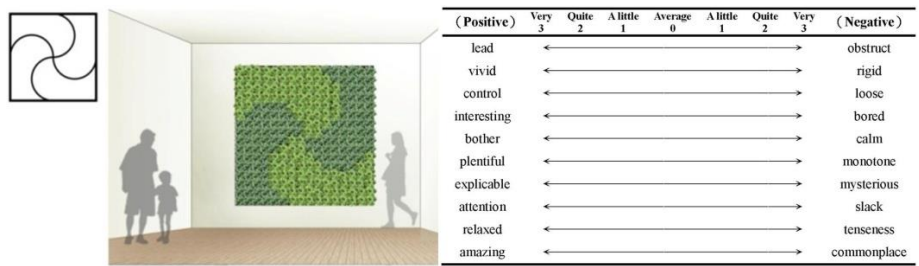


Fig. 3. Questionnaire and measuring gauge model of semantic differential analysis

Therefore, the final measuring gauge for the preference for indoor vertical greening was shown in Fig.3 to evaluate participants’ perceptual preference for different morphologies.

2.3 Phase III Study: Questionnaire on Perceptual Preference

The questionnaire was divided into two parts. The first part was seven simulated diagrams as shown in Fig. 2 by two plants with high landscape preference: silver-net (*Fittonia verschaffeltii*) and ivy (*Hedera helix*) [26]. The simulated diagrams on the questionnaire were also arranged according to the principles proposed by Wu [27] on the visual scan sequence of flat images: center, stretching, and direction, etc. In addition, the singlet draft to help participants understand the morphologies was attached as reference. On the right column of each group, ten measuring gauges of adjectives were listed to be ticked by participants as they chose the one that could best describe their emotion and preference for the representative morphologies to examine the relationship between morphological image of indoor vertical greening and the environmental perception. The second part included six questions to investigate participants’ background information and familiarity with the environment in order to conduct further analysis on differences between morphological perceptions of indoor vertical greening.

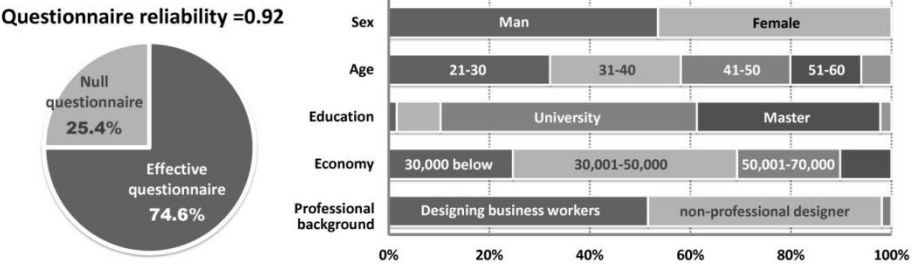


Fig. 4. Feedback of questionnaire of perception preference

Questionnaires on perception preference for morphological design of indoor vertical greening were designed on a judgment sampling method, selecting specific samples and issuing site. The participants of this questionnaire were: 1) professional with design background in architecture, landscape, and interior design, especially gardeners and garden companies. 2) non-professionals mainly regular visitors to flower fairs and interested in plants arrangement. The feedback and analysis of this questionnaire were shown in Fig. 4. Statistic software included Excel and Windows SPSS 18 (One-Way ANOVA function) were used to evaluate participants' preference for morphological design of indoor vertical greening and the differences between participants with different backgrounds.

3 Results and Discussion

3.1 Analysis on Preference for Morphological Designs of Indoor Vertical Greening

In analysis on preference for morphological designs of indoor vertical greening, participants presented seven emotional adjectives towards different morphological representatives as was illustrated in Fig. 5.








	Repetition	Eurhythmmy	Proportion	Gradation	Contrast	Balance	Unified
Principles and Form							
Perceptual Analysis of Morphological Design	Circle: movement, simplicity Repetition: wave, extroverted charm	Square: stability, quantity Eurhythmms: sequence, powerful, reasonable	Square: stability Proportion: relativity, stretching	Square and Triangle: stability & flexibility Gradation: mathematics, changeable, attractive	Square: clarity, certainty Contrast: different arrangement, poor readability	Circle: enclosure, geniality Balance: physics, psychology, poor guidance	Triangle: activity, de-pointing Unified: interconnectness, vitality
Emotional Adjectives	lead vivid interesting	lead control	Lead vivid control interesting plentiful attention relaxed	lead vivid control interesting plentiful explicable attention	rigid bored calm monotone	rigid bored monotone	lead vivid control interesting plentiful
Preference Reaction	Positive	Positive	Positive	Positive	Negative	Negative	Positive

Fig. 5. Emotional adjectives toward seven representative morphologies

Results showed that the main factor to viewer's morphological perception lay in the constitution of the form of aesthetic principles instead of morphological elements

of point, line and surface. Morphologies with high preference should have the features include visual guidance, understandable composition, vitality with movement, and changeable elements in composition, etc. So that they could generate a positive attitude from the viewers characterized by adjectives like vivid, interesting, amazing, control, bother, plentiful and lead. In conclusion, morphological design of indoor vertical greening would have a direct influence on viewers’ emotional perception.

3.2 Analysis on Difference in Preference for Morphological Designs of Indoor Vertical Greening between Viewers with Different Background

This research discussed the difference between viewers’ perception in three dimensions: morphological design, morphological preference and design perception. Results showed that one factor of background attribute had a decisive influence on the preference for morphological design, especially between those who had and had not accept professional training of design. Besides, among the emotional adjectives described the morphological designs, word pairs with most significant difference appeared to be of positive attitude (Fig. 6), while word pairs without such difference showed neutral attitudes. Emotional description involved words like attractive, active and vital exerted great impact on participant’s morphological preference and therefore came a strong positive attitude (Table 2).

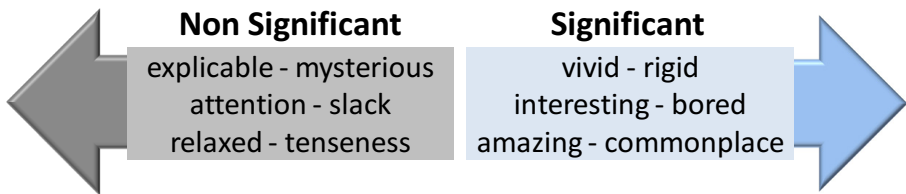


Fig. 6. Emotional adjectives in morphological design

When discussing the morphological preference, the only factor that exerted a difference is “gender”. The most significant difference factor was “background” ($P < 0.01$) which meant a huge disparity between professional and non-professional participants’ perception. On the other hand, judged by participants’ reaction, the difference was most significant between morphological components of “Gradation” and “Balance” (Table 3). The gradation created by staggering of vertical, horizontal lines slashes could generate a sense of change and rhythm while the balance caused by an equalizing arrangement of circles could lead to a stable and simple composition. In the measuring gauge of preference for morphological design, “Gradation” signifies a positive attitude while “Balance” the opposite. This meant that too complicated or too simple a design could both affect participants’ choice on differential preference.

Table 2. Result of program on affect of different emotional adjectives

Adjective Scale	Item of Form	Significance Level of Variable
vivid—rigid	Eurythmy	Sex
	Gradation	Education 、 Professional background
	Contrast	Professional background
	Balance	Economy 、 Professional background
	Unified	Professional background
interesting—bored	Gradation	Professional background
	Contrast	Professional background
	Balance	Economy 、 Professional background
	Unified	Professional background
amazing—commonplace	Eurythmy	Economy
	Gradation	Professional background
	Contrast	Professional background
	Balance	Professional background
	Unified	Professional background

Table 3. Significant difference in morphological preference caused by background attributes

Source Adjective Scale	Mean	Std. Deviation	Mean Square	F	Sig.
Gradation	2.700	0.910	0.809	4.695	0.010
Balance	3.270	0.841	0.672	9.099	0.000
Unified	2.930	0.815	0.630	9.379	0.000

312 Valid Samples / * $P < .05$, $P < .01$

Results showed that under different conditions, the factor of “working experience” would have the most impact on perception of design. The information participants knew about the research, their preference for the subject, whether they were involved in related careers, and whether they had a stable income were all conditions that had comprehensive judgment for participants to be regard as indication of viewers’ familiarity with the environment.

4 Conclusion

Research had yielded four results between the features of morphological images and perception preference. First, the morphological components of preference should have the following features: directional guidance, grouping effect, vitality, distinct morphological components, readability, flexible composition elements. The preference ranks

from top were: repetition, proportion, gradation, while “balance” was not a favorable form of aesthetic principles. Second, the morphological perception of preference should have the following features: positive emotions, attractively, and other strong positive emotions connected with sense of vitality, change and direction. Representative description of such preference included: vivid, interesting, amazing, control, bother, plentiful and lead. Third, the presence of morphologies had an emotional effect on the viewers, but the effect mainly lay in the form of aesthetic principles instead of the morphological elements like point, line and surface. Fourth, too complicated or too simple the change of morphological components could both affect participants’ choice on differential preference. As a result, it should be emphasized on morphological elements and form of aesthetic principles (point, line, and surface) to achieve a balanced proportion of the impact generated by the presence on viewer’s physiological and psychological action.

In addition, according to analysis under other variable condition of the background, we got another few conclusions. First, the gender had a direct effect on preference, in particular the preference on morphological perception. Second, age didn’t have significant impact on the research. Third, background attributes mattered a lot. While non-professionals reaction to morphological preference tended to go to extremes, professionals reaction are much the same, which meant professional training and applied experience related to familiarity with the environment would exert a direct influence on the preference for the morphological design of indoor vertical greening.

As was shown in the research, when decorating the internal surface with vertical greening, designers should take into consideration the ethnic background, environmental properties and spatial atmosphere, etc. For example, in a women’s department store, the morphological components should pay attention to the rhythm suitable to the atmosphere and round shaping preferred by women; while in a gym for men, it was recommended to apply a composition of horizontal or vertical lines and slashes preferred by men and suitable rhythm. Offices where with high density population weren’t suitable for dull or quiet decoration, it was suggested that the plan design cater to viewers preference for morphological presence. In the future promotion of indoor vertical greening, its advantage to indoor environment, spatial atmosphere and perception of viewers should be highlighted, for the purpose of creating good flourishing visual experience.

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