DETERMINATION OF LANDSCAPE AESTHETIC VALUE IN DEVELOPING QUESTIONNAIRE SURVEY FOR CAMPUS PLANTING COMPOSITION

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ABSTRACT:
In landscape aesthetics, planting composition is significant in revitalizing the surrounding environment. Expert judgments are essential in landscape aesthetic decisions. This article examines the experts-based approach in assessing scenic beauty based on the objective paradigm. The objective paradigm has extensively used and recognized by the art and design-based professionals. The aim of this study is to determine the selected scene for landscape preference survey. The experts are selected from the landscape architecture field with knowledge in planting design, composition and other inherent physical features of the landscape. Those attributes are used to assess the physical quality of planting composition in the campus landscape. Using the Likert scale, 10 of the experts have rated the 95 photographs of campus planting area. The pictures were presented on a separate colour slide format as a mechanism to ascertain the visual preference of experts. The design of the questionnaire consists of the principles and elements of planting design. R programming was used as a method to analyze data. The findings show that the variety of plants based on the experts' choice with a high preference which equal to complexity. The results are useful in developing a questionnaire survey for campus planting design.

Key-words: *Planting composition, landscape aesthetic, expert, objective paradigm*

1. INTRODUCTION

In planting design practice, vegetation is an element that able to manipulate the varying level of landscape aesthetic quality in green spaces (Liu and Schroth, 2019; Soemardiono, Rachmawati, Ardianta and Nugroho, 2019). Planting is valuable to reduce carbon dioxide (Merry, Bettinger, Siry and Bowker, 2015). It can create a real modification in landscape aesthetic when the properties of plants are well accomplished with principles of planting design (Yilmaz, Özgüner and Mumcu, 2018). Thus, the designers able to guidance viewers' perception of aesthetic and increase satisfaction through planting design principles (Yilmaz et al., 2018). The judgment of the landscape aesthetic quality can be determined by using attributes and properties of vegetation such as shape and form, colour, scale, texture, composition, uniqueness, variety and unity (Lothian, 1999; Daniel, 2001; Jamilah and Nur Shazwani, 2014; Polat and Akay, 2015; Yilmaz et al., 2018). Based on these properties, one

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who is a highly skilled observer or expert can validate the impact of aesthetic for some landscapes area (Jamilah and Nur Shazwani, 2014). Besides, research that falls in this paradigm is mostly concerned with procedures for recognizing specific characteristics (Zube, Sell and Taylor, 1982) or objective measurement (Kuper, 2017).

1.1. The objective paradigm in perceiving landscape aesthetic

In this study, the objective measurement or also known as the objective paradigm, is concerned with the physical setting of planting design principles and elements within the context of the campus landscape. The principle of unity and variety may underlie all major principles in planting design (Robinson, 2004). Unity is similar to the design like coherence, which generates the harmony and balance in aesthetic, binds the overall elements into a unified design, and creates space with an orderly arrangement of planting (Robinson, 2004). While, variety is a related perception to complexity, and accomplished with a series of plants which comprises a diversity of planting design elements (Robinson, 2004). Principles and objectives that landscape designers and planners have been applying for the last several hundred years support the implication that coherence and complexity are essential to creating landscapes that people like (Kuper, 2017). Later, Liu and Schroth, (2019) conducted a survey where coherence, complexity and legibility are rated high for open landscape scene.

In the present paper, we propose to analyze the experts' determination of landscape aesthetic value in planting composition scene. Then, the findings will assist researchers in developing a survey for public perception based on experts' demand. In order to achieve the objective measures, the information processing theory by Kaplan and Kaplan (1989) is used in this study as a formal description with indicators like coherence, complexity, legibility and mystery. Thus we have chosen this theory as a preference factor concerning planting composition attributes. The methodical relevance of our study is related to measuring students' green spaces development on campus. This method should be the first step before developing a questionnaire survey to obtain a valid result and avoid misconception.

2. STUDY AREA

In recent years, there are numerous studies related to the campus landscape. Some of the scholars report campus landscape is able to improve health (Lau, Gou and Liu, 2014), learning ecosystem (Scholl and Gulwadi, 2018), academic performance (Kweon, Ellis, Lee and Jacobs, 2017), stress and mental fatigue (Li and Sullivan, 2016). The placement of vegetation throughout the campus has an incredible impact on how students psychologically relate to their university (Stepan, Schuster, Cole, Davision and McKay, 2014; Hipp, Gulwadi, Alves, and Sequeira, 2015). Therefore, the pattern of planting arrangement should include an emphasis on enhancing visual aesthetic quality within the campus landscape. However, the component of landscape properties such as planting composition has rarely discussed in campus landscape studies. Lipscomb and Rollings (2017) found that planting is a component in the workplace setting and is an important predictor for task performance as well as improving the well-being of workers.

In conjunction with previous studies, this research observed a campus with a large green space area. According to UI GreenMetric World University Ranking, Universiti Putra Malaysia (UPM) has been listed as one of the highest-ranking universities in Malaysia. The main campus of UPM is located in Serdang, Selangor Darul Ehsan (**Fig. 1**). UPM has a strategic location and can be categorized as a suburban area which is around 12 KM to

Putrajaya and 25 KM to Kuala Lumpur city centre. The boundary land covers an area of 1245.056 hectares (which covers from the north campus to the south campus). The north campus (**Fig. 2**) consists of academic and administrative buildings while the south campus comprises of college and sports centre area.

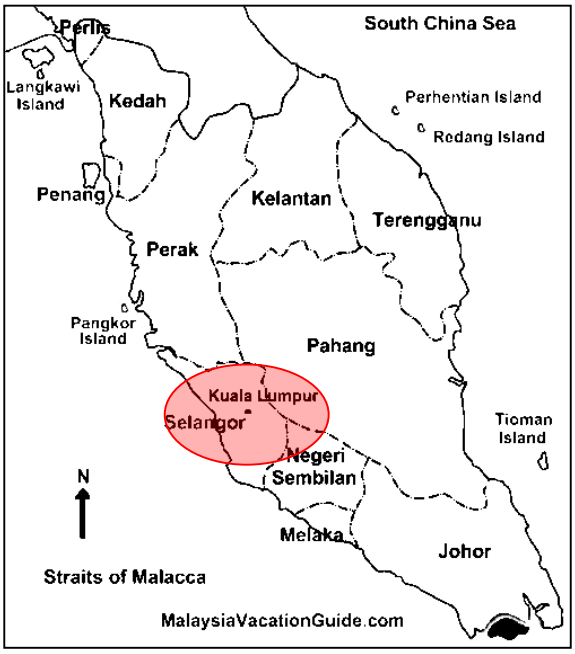

Fig. 1. UPM is situated in a suburban area in Selangor, Malaysia
(Source: MalaysiaVacationGuide.com)

Fig. 2. North campus is the main survey area in UPM which consists of academic and administrative buildings *(Source: https://akademik.upm.edu.my/dokumen/BGAKA1_NORTH_CAMPUS)*

UPM has 15 faculties offering a variety of academic programmes at its main campus. North campus is selected as the main study area in UPM because the students ultimately utilize the faculties. According to Hanan (2013), students are bound with places that they live in, study, play and move around from one activity to another on a daily basis. Each student has a home base around which his or her daily campus activities circulate (Hanan, 2013). She added, the home base is usually the students' major department, where they take most of their classes, meet their adviser, and attend departmental events. On that note, this survey has been conducted around all faculties in UPM Serdang.

3. METHODOLOGY

3.1. Photograph collection

This research used the photograph-based sampling (Daniel and Boster, 1976) as an evaluation method in the campus green spaces. The photographs were taken around the faculties green spaces that represent the vibrant spaces in the study area. The time control during the photo-shoot was between 9.00 a.m. to 11.00 a.m. and 2.00 p.m. to 4.00 p.m. The photos ideally taken in bright conditions with lots of sun (ideally sunny conditions), if in cloudy sky conditions, it must convince that the scene still gets enough sunlight (Lothian, 2000). Lothian (2000) also suggests avoiding taking photos too early in the morning or the late afternoon. The panoramic photograph (Polat and Akay, 2015; Hoyle, Hitchmough and Jorgensen, 2017; Yilmaz et al., 2018) employed in obtaining the planting scenes. Dupont, Antrop and Eetvelde (2014) reveal that people generate more fixations in panoramic photographs. A larger amount of fixations in the same observation time will increase the observer's capacity to recognize and memorise the scene Duchowski (2007).

The authors took a pool of 95 photographs. Photographs were shot more than one sceneries in a wide-ranging style that able captured the planting composition scenes. Pictures with similar planting compositions criteria should be excluded. Before that, the original photographs were stitched together to create panoramic view images using PhotoStitcher software. All the photographs taken used the Nikon DSLR camera with 18-105mm lens. Moreover, a mechanism to control all pictures taken was used tripod-based to balance the quality of images and angles. The tripod also assists the researcher to manage the view of planting on human eye-level. Then, the selection of images done through a discussion among experts that were invited by the researcher.

3.2. Planting composition survey

This article examines the contribution of an expert in assessing landscape planting based on the objective paradigm, which consists of elements and principles of planting design and concurrent with a preference matrix based on Kaplans' theory. The purpose of the expert assessment is to determine the selected planting scene before conducting a perception-based survey. This process is significant in understanding the content in each landscape scene via expert, coupled with people's perception. Indeed, this method was used to avoid bias in selecting the images for the survey. The relationship between principles of planting design and Kaplans' theory was used to develop the matrix. The matrix was developed to assess expert judgment on the visual properties of plants with design principles and Kaplans' preference matrix (**Table 1**).

Table 1.

The matrix relationship between planting design properties and information processing theory

Visual properties of plants (Robinson, 2004; Leszczynski, 1999)	Visual composition principles (Robinson, 2004; Bell, 2004)	Information processing theory (preference matrix) – (Kaplans, 1989)
Form **Texture**	Balance Order	→ Coherence
Colour **Line**	Harmony Contrast	→ Complexity
	Emphasis Scale	→ Legibility
	Rhythm Sequence	→ Mystery

Kaplan (1975) has recommended the aesthetic judgment of the landscape should embrace the pure evaluations by individuals with the required skills and value judgments, which are typically experts comprising landscape architects (Daniel and Vining, 1983). Evaluations made by ten experts who randomly selected from landscape architecture departments. Five of them are corporate members of landscape architect and the other five experts possess more than five years of teaching experience in planting design courses. They also have a PhD degree in landscape architecture.

In the expert-based method, the structures of plants usually assessed according to form, line, scale, emphasis, contrast and other formal attributes in planting design which regarded to be indicators of landscape quality (Daniel, 2001; Yilmaz et al., 2017). In this research, a similar scheme has applied to evaluate planting composition. **Fig. 3** shows an example of the form used in this survey. The experts were asked to assess each planting photographs based on the Likert scale. The assessment was conducted using a five-point Likert scale ranging from 1 = 'very poor' to 5 = 'excellent' (Gerstenberg and Hofmann, 2016; Polat & Akay, 2015; Raskovic and Decker, 2015). The five-point scale can provide immediate response and eliminate any lengthy decision by respondents (Noriah, 2004). Typically, a scale which exceeds five points would be too complex for the respondents to make fine judgment towards particular questions.

All photographs were provided on a separated colour slides format and shown on an LCD screen. The experts were briefed to choose the best pictures to be selected or removed. The selection is useful in assisting the researcher in developing a questionnaire for a real survey later. From the 95 photographs taken, experts have voted 51 images which are considered appropriate for perception-based assessment. Experts have selected the 51 pictures due to the content of planting composition, quality of photographs, better angles of panoramic views and less redundancy or similar criteria of planting design. The collected data analyzed with the R Programming Software because of the ability of this software to analyze big data. The frequency value of rating evaluation has been calculated. Following the expert evaluations, the results visualized on photo analysis. As a result, planting composition attributes determined as contributors in the assessment of landscape aesthetic quality for campus green spaces.

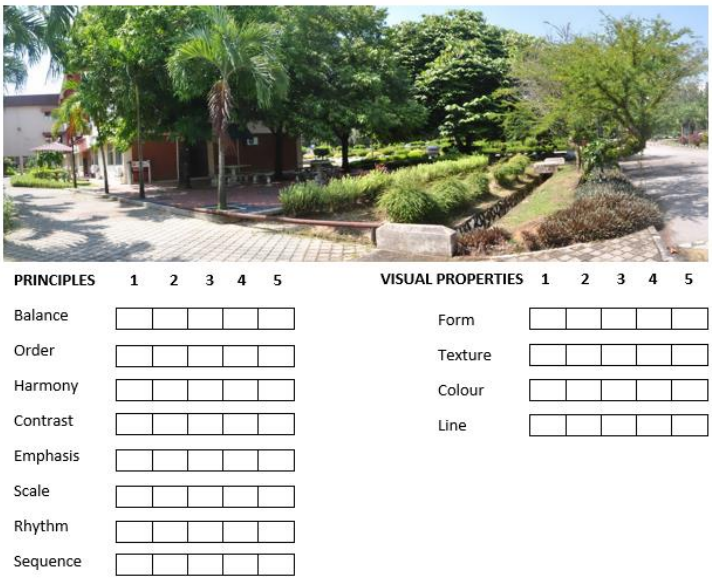

Fig. 3. The example of assessment form for campus planting composition scene

4. RESULTS AND DISCUSSIONS

There were 51 photographs chosen by ten experts. The experts have a similar opinion on 16 images. Albeit some experts have rated different scale for different principles, but all of them have selected these 16 images. The images shown here are some examples of the images which all experts agreed to be included in the real questionnaire later. The characteristics of these examples reflect the coherence and complexity design as the dominant selection. The variety of forms and textures clearly demonstrated in the images (**Fig. 4**). As supported by Robinson (2004), variety is the principle that is related to complexity, which can be succeeded with a series of plants species and cultivars, as shown in **Fig. 5**. While coherence is the theory that extends from the repetition element and the presence of balance and order arrangement (**Fig. 6**).

Fig. 4. The example of campus planting composition scene with a variety of forms and textures

Fig. 5. The example of campus green space with a different range of plant species and cultivars

Fig. 6. The campus planting design with coherence setting which extends from the repetition element and the presence of balance and order arrangement

Concerning Kaplan and Kaplan (1989) definition on the variables of aesthetic preference, the viewers′ evaluate coherence as the pleasantness of the views, complexity as the functional setting, and legibility as the orientation able to assist at the planting design stage. These three examples reflect the experts' evaluation towards landscape aesthetic in planting composition for campus landscape design. Open spaces like **Fig. 6** or enclosed spaces create different effects on visual and encourage diverse aesthetic experiences (Liu and Schroth, 2019). This planting scene is the highest rating because it is highly visible, well-structured and provides a pleasant view (Liu and Schroth, 2019).

Fig. 7 shows the distribution principles of planting composition attributes for mostly agreeable photographs by all experts. The figure shows that 16 images have been highly rated with balance and harmony, and moderately rated with emphasis and scale. Balance and harmony have been discussed earlier as having similar criteria with coherence and complexity design. The findings show that most of the characteristics of planting composition in this context exhibited that complexity and coherence are the major contributors to visual aesthetic quality.

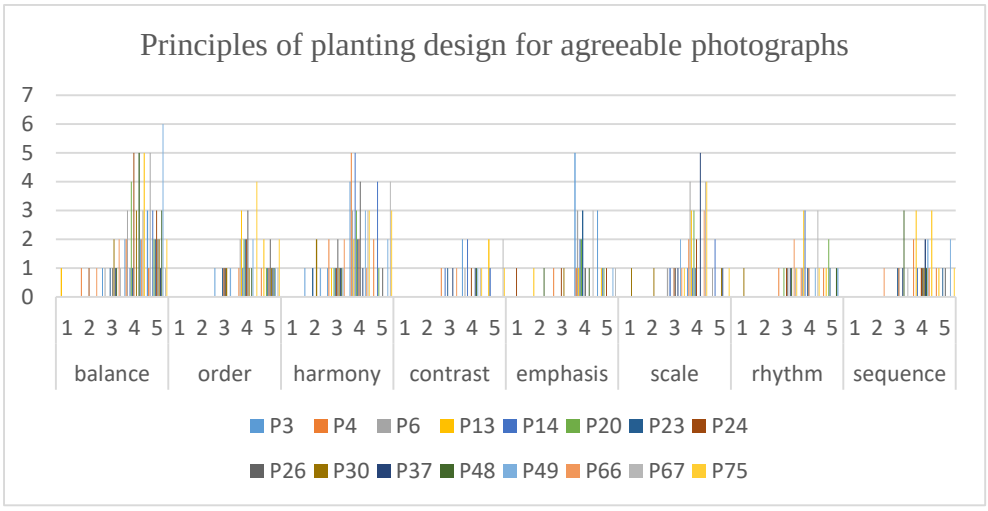

Fig. 7. The 16 photographs with all experts voted for campus planting composition scene

Based on these results, we can determine that planting composition attributes such as balance and variety of planting elements couple with order arrangement are the visual predictor towards landscape aesthetic rating by skills judgments.

5. CONCLUSION

Landscape aesthetic studies have identified a variety of ways in which they can be classified by the objectivist and subjectivist paradigms. This paper presented an objective paradigm which should be used to classify the perception studies at a fundamental level. Basically, this paradigm contrasts in viewing landscape quality as an inherent physical attribute. The physical attribute involves formal aesthetic values such as form, texture, colour, balance, order, rhythm, harmony, and complexity. These attributes can be viewed in objectivist terms by experts. The findings show the objective characteristics of planting scene achieve a high rating, which includes coherence and complexity that are related to the principles of balance and harmony and have found to be a major contributor in the planting composition in the campus green spaces. Along with preference rating, complexity and variety of plants are the experts' choice. The results are useful in developing another research to compare the public response in identifying the most preferred planting composition which is able to influence the well-being of people and society in general.

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