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Research Article

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Colour Perception and Visitor Experiences of Urban Parks as Influenced by an Intense Colourful Urban Artefact: An In-situ Quasi-experiment

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Abstract

Purpose

Colourful street furniture, fitness and playground equipment has become increasingly common in contemporary urban green spaces. The study aims to increase knowledge about their influence on human perception of urban park settings, and explore the perceived interaction between an orange-coloured urban artefact and the colour schemes of a public park.

Design/Methodology/Approach

This study consisted in first reviewing 794 park visitors through formal observations, and applying the semantic environmental description (SMB) on 102 individuals (park visitors). The analysis of the SMB dimensions used an analysis of variance with a 3x2 factorial design and the perceived colours measured with Royal Horticultural Society (RHS) colour charts.

Findings

The findings from the study show that placing intense colourful artefacts in various park environments can both increase and decrease experienced pleasantness and change the overall perceived characteristics of colour (colour contrast).

Research Limitations

The limitation of this study was that only a monochromatic coloured (orange) object with a specific structure and scale was used and that complementary colour combinations were not investigated. The experimental design did not allow a completely randomized design of the individuals in the study.

Social/Practical Implications

Given the results from the study, we propose that municipalities and landscape architecture offices involved in the planning, design and management of urban green spaces should pay just as much attention to the placement of urban artefacts in a public outdoor context as to the design of the artefacts themselves. Discussing these issues across the planning and management level can help increase consciousness of the impact of intensely colourful street furniture on park visitors colour perception and experiences.

Original/Value

The number of studies on this subject is very limited and performing this study is considered to contribute to the understanding of coloured urban artefacts in urban green spaces.

Keywords: aesthetic value, colour contrast, semantic environmental description

INTRODUCTION

Visual qualities in an urban area plays an essential role in the relationship between humans and environment. Understanding human conceptualization and visual qualities in an urban environment entails humans to refer to the meanings that commonly associate with their spatial experiences (e.g. Alpak et al., 2020; Tsaur et al., 2014; Tuan, 1979). From that aspect, visual and spatial experiences and related visual qualities are key attributes for human perception and judgements of aesthetic liking. In order to satisfy aesthetic perception and related positive experiences of the audience, an outdoor environment should be carefully designed and planned (Li & Gao, 2020), where the visual components (light, form, and colour) should be arranged in satisfying patterns (Dee, 2012; Bell, 2012). Visual qualities in outdoor environments have proved to be an essential part of human experience of the landscape (Arriaza et al., 2004), and studies on visual quality have often focused on the characteristics of a landscape and the individual features within it (van den Bosch & Ode Sang, 2017; Wang et al., 2016; Ode et al., 2009; Arriaza et al., 2004). Studies have also shown the visual qualities generated by a high level of vegetation (Wang et al., 2019; Peschardt et al., 2014; Nordh & Østby, 2013; Arriaza et al., 2004), where flower colour diversity can generate positive aesthetic response (Hoyle at al., 2018). Other research has examined the interaction between colours (e.g. Foster, 2011; Green-Armytage, 2006). For example, Oleksiichenko et al. (2018), Polat and Akay (2015) and Arriaza et al. (2004) found that colour contrast in a landscape context is a positive parameter in the assessment of visual beauty. These studies also showed that perceived lack of colour contrast, both in urban and rural landscape contexts, reduces landscape visual quality (Polat & Akay, 2015; Arriaza et al., 2004).

This paper explore a colourful urban artefact interaction between visitor's visual experiences and public park environments. According to Calafiore et al. (2017) urban artefacts relates to elements in an urban environment that are designed to be included in an urban system, a component that are constructed (physical structure and qualities), with specific thoughts of usefulness and normative constraints. In the planning process of urban artefacts it is crucial to recognize the actual use of the functional (expected) and social (unexpected) aspects of the urban artefact (Calafiore et al., 2017), this in order to be aware of the different roles and multiple perspectives that an urban artefact can give rise to depending on its actual use.

From the above perspectives, contemporary landscape architecture's frequent use of colourful urban artefacts (Figure 1, left), e.g. benches, planter boxes, fitness and playground equipment or large-scale 'painted' neighbourhoods like the 'Red Square' in Superkilen, Denmark (BIG, 2012) in urban green spaces, raises questions regarding the impact of urban artefacts on human experiences and social interaction. The relevance of addressing such questions is underlined by studies showing that intense

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coloured urban artefacts (red, orange, yellow) placed in an urban landscape have the ability to affect levels of arousal (Wilms & Oberfeld, 2018; Al-Ayash et al., 2015) and thereby also visual experience of pleasantness (Abdulkarim & Nasar, 2014a; Motoyama & Hanyu, 2014). It is also notable that urban artefacts have the ability to make urban environments more liveable in the perspective of being visitable and have restorative effects on the visitor´s (Abdulkarim & Nasar, 2014b).

According to Berlyne (1971), positive human experiences, such as a perception of pleasantness, are linked to the experienced optimal level of arousal (immediate response and intensity level to a stimuli) and moderate novelty (the quality of being surprised), where pleasantness is connected to aesthetic values (Berlyne, 1971). In contrast, perceived distressing stimuli can lead to changes in levels of arousal and overwhelm humans, which again generate changes in perceived pleasantness (Berlyne, 1971). Abdulkarim & Nasar (2014a) and Motoyama & Hanyu (2014) showed that urban artefacts with both subdued and powerful colour schemes incorporated in various urban green contexts (green and grey environments) can change human perception and influence human experiences. For example, an orange artefact placed in an environment with a low proportion of vegetation has been found to increase arousal and reduce pleasantness, and the presence of a silvery art work placed in surroundings with a high proportion of green environment reduced experiences of being safe and relaxed (Motoyama & Hanyu, 2014).

The interrelationship between visual qualities and humans is essential in understanding public art in outdoor environments (Knight, 2008) and, by extension, how we perceive and experience urban artefacts in urban green spaces. Since colours on urban artefacts and visual properties, such as colour contrast, can affect humans' visual experiences, it must be considered that placing, e.g., coloured street furniture in an urban landscape, does not automatically make that bright and intense artefact appreciated by humans.

The main objective in this study was therefore to understand how a colourful urban artefact influences human experience of urban green space with varying amounts of vegetation. Combined studies of colour perception and environmental assessments methods can likely contribute to an increased understanding of human experiences in urban green contexts. From that perspective, the semantic environmental description (SMB), abbreviation from the Swedish terminology (Küller, 1991) is used in this study to relate park visitor experiences to coloured artefacts placed in a public park in southern Sweden. This method does not connect individual landscape features to the assessed results (Karlsson et al., 2003; Küller, 1991), so inclusion of an interpretation step to validate the outcomes was applied. In this study, we use colour assessment as an interpretation step, where the degree of pleasantness in relation to colour space is measured with the standardised SMB method (Küller, 1991).

The study was guided by the following research questions:

- How are visitor experiences in relation to a public park environment, measured with the SMB scale, changed when an orange urban artefact is added?
- How do visitors experience urban park settings with different proportions of grey and green surroundings, and how is the experience influenced when an orange colourful urban artefact is added?

Figure 1. Left: Intense yellow and orange street furniture in a public square in Sweden designed by Karavan landskapsarkitekter, 2016. Photo: Alex Giacomini. Right: Contemporary landscape architecture in Yongningjjang river park, China, designed by Kongiian Yu and Turenscape, 2004. (The photos are used with permission)

MATERIALS AND METHODS

The study was conducted as a quasi-experiment during late summer (August-September). This time was chosen since the weather was likely to be good, encouraging outdoor activities such as visits to urban parks and other green spaces. During the study hours, the average daytime temperature was 22 °C, with sunny/partly sunny weather.

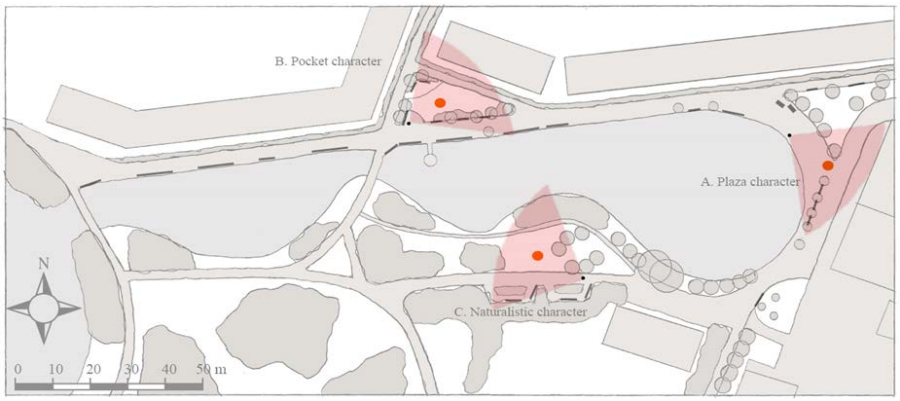

Figure 2. Map of the study area in Strandparken, Lomma, Sweden, showing A. Plaza character, B. Pocket character and C. Naturalistic character as used in the experiment. Orange dots indicate the location of the orange urban artefact, black dots the visual basis and the light pink angle the perceived landscape.

The study comprised a pre-study to identify the everyday park visitor by using formal observations (walk through the park), followed by two main phases. These two phases included a self-completion questionnaire (SMB) and determination of colours using RHS colour charts. The pre-study and the studies in the areas B (Pocket character) and C (Natural character) were conducted in 2015. In 2018, area A (Plaza character) was evaluated.

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Study site and environments

The study was implemented in the northern part of Strandparken (Figure 2) in the municipality of Lomma, southern Sweden. This park was selected because of the mixture of urban and nature-inspired park setting, common in many public parks in Europe. The park was established in the 1980s and is surrounded by residential buildings, homes for the elderly, and preschools, and contains a variety of green environments (solitary trees, thickets of trees and shrubs, hedges, lawns) and grey environments (paths, buildings).

Three areas in the park were chosen to represent differences in terms of the relationship between grey and green environments: A = Plaza character; B = Pocket character; and C = Natural character.

The proportions in the investigated sites were as follows:

A: Plaza character: 75% grey environments (buildings, etc. 36%; paths 39%), 23% green environments (solitary trees and hedges 19%; lawns 4%) and 2% water.

B: Pocket character: 45% grey environments (buildings, etc. 30%; paths 15%), 50% green environments (solitary trees and hedges 25%; lawns 25%) and 5% water.

C: Naturalistic character: 15% grey environments (buildings, etc. 3%; paths 12%), 85% green environments (thickets of trees and shrubs and solitary trees 60%; lawns 25%).

The park environments were assessed from a fixed location, with an observation range of approximately 60°. The fixed locations were the visual basis for this study (see black dots in Figure 2), and were selected to ensure the visual representation of the three common urban park characters in the study. The orange artefact was positioned between 12 and 17 metres from the fixed location in areas A, B and C (orange dots in Figure 2).

To obtain an overview of the observed relationship of grey and green environments, the percentage of grey-green environments in the perceived areas was calculated from photos using the grid tool in Adobe Photoshop CS6. The images were taken to form a photomontage with a 60° angle, and to, as far as possible, represent the perceived landscape from the fixed locations in area A, B and C (see light pink angle in Figure 2).

Coloured urban artefact

The orange urban artefact was made of wooden sticks (2.5 cm in diameter), ranging in length from 1.50 to 1.70 m, painted in an intense orange hue and placed in a distinct circular pattern with a diameter of 2.5 m. The orange hue was chosen to reflect today's common practice of placing orange street furniture, e.g. benches, planter boxes, fitness and playground equipment, in urban green spaces. Orange hues are used to attract attention and create contrast in landscape architecture. Examples are the orange art installation 'The Gates' (Christo & Jeanne-Claude, 1979-2005) placed in Central Park, New York City, the hospital garden

'Rigets have' in Copenhagen, Denmark (LAND+, 2008) and the Yongningjjang river park, China (Turenscape, 2004) with orange contemporary landscape architecture (Figure 1, right) as well as intense orange street furniture forming a focal point (Figure 1, left) in a public square in Bollnäs, Sweden (Karavan landskapsarkitekter, 2016). The orange hue was also chosen for its capacity to influence levels of arousal (Hanada, 2018; Costa et al., 2018; Al-Ayash et al., 2015) and its ability to enhance activity in the human body (Clark & Costall, 2008). Figure 3 shows the orange urban artefact incorporated in area A (plaza character), area B (pocket character) and in area C (naturalistic character) in Strandparken, Sweden.

Figure 3. Photomontage (60°) showing the perceived landscape from the fixed locations (see Figure 2). From the top to the bottom: Plaza character (A), Pocket character (B) and Naturalistic character (C) with the presence of the orange urban artefact.

Data collection

Walk through the park – a pre-study phase to capture the everyday visitor

In order to capture the everyday visitors in the studied park, formal observations (Robson, 2011) were conducted on three randomly chosen weekdays (Tuesday, Thursday and Friday) during one week in three periods per day: 9.00-11.00, 12.00-14.00 and 15.00-17.00. The observation involved a systematic walk through the park, visiting four sub-areas each hour and making a 15-minute visual scan in each area. The sub-areas were chosen to cover the everyday park visitors in the best possible way, and were located in the north, east, south and west parts of the park.

During the walks, a total of 794 individuals assessed to be older than 20 years old were visually observed and categorised in terms of age and

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gender (Table 1). Generally, the number of visitors in the park between 9 am and 5 pm was low.

Visitor´s younger than 20 years were not included, because there were too few visitors in this age range. To ensure the correct classification of gender and age, the observations were made at a distance of two to ten metres from the individuals. It could be a difficult task to determine a person's age and in some cases gender, so the ages and genders of the observed visitors shown in Table 1 are estimates.

Table 1. Park visitors in Strandparken, divided into estimated age and gender during three weekdays in August 2015. Number of observations: 794.

Variable	Category	n (%)
Age	20-35	103 (13.0)
	36-50	79 (9.9)
	51-65	100 (12.6)
	Over 65	512 (64.5)
Gender	Female	491 (61.9)
	Male	303 (38.1)

Semantic Environmental Description (SMB)

In the second phase of the study, the semantic environmental description (SMB), was employed. SMB involves the use of a standardised questionnaire developed to systematically describe an interior, exterior or simulated environment (Bengtsson et al., 2015; Küller, 1991; Küller, 1975). The questionnaire comprises 36 adjectives scaled from 'slightly' (1) to 'very' (7), and is clustered into eight dimensions (Table 2).

The SMB questionnaire was distributed to a representative sample of 102 individuals (park visitors) in six groups (n = 17), with attention paid to a balanced age and gender distribution (Table 1). There were six situations, with the following notation:

Area A: Plaza character with no urban artefact (A1),
Plaza character with orange urban artefact (A2).
Area B: Pocket character with no urban artefact (B1),
Pocket character with orange urban artefact (B2).
Area C: Naturalistic character with no urban artefact (C1),
Naturalistic character with orange urban artefact (C2).

A group size of 15-20 individuals is considered to be reliable with high stability when a systematic description of the environment (SMB) is desirable (Küller, 1975). The participants who responded to the SMB questionnaire were selected to match the everyday (weekday) park visitors and were all familiar with the park environment, which is argued to be an important factor in increasing the consistency of the SMB methodology (Karlsson et al., 2003). All respondents answered directly adjacent to the studied areas and each respondent only participated in one experimental setup.

Table 2. Descriptions of the eight (SMB) dimensions, and adjectives included in each dimension. A plus sign indicates adjectives for which the answer 'very' (7) was positive, while a minus sign indicates adjectives for which the answer 'slightly' (1) was positive. To make the adjectives comparable in the calculation of the mean value for a SMB dimension, the adjectives with a minus sign were transformed as "8-given answer".

SMB dimension*	Description	Adjective in each SMB dimension
Pleasantness	The degree of pleasantness, beauty and security in the environment	stimulating (+), secure (+), idyllic (+), good (+), pleasant (+), ugly (–), boring (–), brutal (–)
Complexity	The degree of variation, intensity, contrast and abundance in the environment	varied (+), lively (+), composite (+), subdued (–)
Unity	The fit of the different parts of the environment into a coherent whole	functional (+), of pure style (+), consistent (+), whole (+)
Enclosedness	A sense of spatial enclosure	closed (+), demarcated (+), open (–), airy (–)
Potency	An expression of power latent in the environment	masculine (+), potent (+), feminine (–), fragile (–)
Social status	Evaluation in socio-economic terms and in terms of maintenance	expensive (+), well–kept (+), lavish (+), simple (–)
Affection	An age aspect and a quality of recognition	modern (+), new (+), timeless (–), aged (–)
Originality	The unusual and surprising in the environment	curious (+), surprising (+), special (+), ordinary (–)

*Source: Küller (1975), Küller (1991) and Bengtsson et al. (2015).

Statistical analysis

Analysis of variance was used to explore the effect of the Plaza, Pocket and Naturalistic character and the urban artefact. The argument for using analysis of variance is that a group size of 17 in a completely randomized balanced design with Likert items ranging from 1 to 7 is enough to guarantee that the test quantities are distributed as stated in the test. In all statistical analyses, the significance level was 0.05, and Tukey's test was used to test for pairwise differences. Since the effect of age of the respondent had no significant effect, it was not included in the final models.

The analysis of variance for the SMB dimensions used a 3x2 design, with the factors character, urban artefact, and the interaction between character and urban artefact.

In further analyses, the adjectives were considered separately, using the same 3x2 factorial design.

When the marginal effects of character and urban artefact were considered separately, PROC MIXED with LSMEANS and SLICE in SAS software[1] was used.

[1] SAS 9.4. Copyright (c) 2002-2012 by SAS Institute Inc., Cary, NC, USA.

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Determination of colours using the Royal Horticultural Society (RHS) colour chart

Colour assessment formed the basis of the third phase of the study, to examine how the SMB results relate to the park environment with particular focus on the colour spectrum. The main author, with professional qualifications in fine art and landscape architecture, conducted the assessment of the dominant colours. To ensure reliability, the Ishihara colour blind test (24 Plates Edition, 2017) was carried out before the colour assessment. The perceived colour schemes were assessed from the fixed locations (see Figure 2), in a visual scan (60°), lasting for at least 3 minutes between 10 am and 2 pm. The colours were assessed with similar weather conditions (sunny/partly sunny) as during the questionnaire sessions.

Analysis of the observed colours using the RHS colour chart

The three investigated characters (Plaza, Pocket and Naturalistic) were fairly uniform in terms of the colour spectrum, and each could be described by three colours considered to reflect the colour schemes of each area investigated. The three main perceived colours were determined with the RHS colour chart system (6th Edition) in each experimental setup, and named according to the same system.

RESULTS

An orange urban artefacts' effect on perceived dominant colours and colour proportions

Without the orange urban artefact the result was as follows. The dominant perceived colours in the Plaza character were light greyish olive, moderate orange yellow, and moderate yellowish green. In the Pocket character, strong yellow green, light greyish olive and pale yellow nuances were the dominant perceived colours, and in the Naturalistic character the yellow green hues dominated (moderate yellow green, strong yellow green, moderate yellowish green) (Table 3).

The presence of the orange urban artefact changed the perceived dominant colours. In the Plaza character, the dominant colours were pinkish grey, strong orange, and moderate yellowish green. In the Pocket character, the colour perception was dominated by moderate green, strong orange and light orange yellow. In the Naturalistic character, moderate green, strong orange, and moderate yellow green dominated the colour vision (Table 3).

The colour analysis revealed that distinct differences in the colour contrast between the characters occurred when the orange urban artefact was present in the investigated areas. In the Naturalistic character, the perceived bright orange hue was complemented with perceived green hues (moderate green, moderate yellow green), while in the Plaza and Pocket character the orange perceived hue was complemented with green hues (moderate green, moderate yellowish green), as well as light orange yellow and pinkish grey colours. The

analysis showed that a colour contrast effect was noticeable in the Naturalistic character, but less obvious in the Pocket and Plaza character. The visible contrast effect in the Naturalistic character was perceived due to the correct proportions between a lot of green vegetation in combination with a strong orange hue. In contrast, the proportions between the predominance of greyish colours in the Plaza character and the incorporated orange urban artefact gave rise to no such effect (Table 3).

According to Itten (2003), areas with the right quantitative proportions have the ability to give rise to a colour contrast effect. Our analysis showed that the Naturalistic character with presence of the orange urban artefact generated the right proportions between green and orange hues for a complementary and cold-warm contrast to occur (Table 3).

Table 3. Perceived dominant colours in the studied areas, assessed with the RHS colour chart system in sunny/partly sunny weather. The perceived dominant colours in each area (A1, A2, B1, B2, C1, C2) were assessed by the main author in partly sunny weather and determined with the RHS colour chart (6th edition). In A2, B2, C2 the strong orange hue refers to the perceived colour of the urban artefact.

Place character	RHS colour names	Pinkish Grey	Light Greyish Olive	Moderate Green	Moderate Yellowish Green	Moderate Yellow Green	Strong Yellow Green	Moderate Orange Yellow	Pale Yellow	Light Orange Yellow	Strong Orange
	RHS code	201 D	197 C	135 B	137 D	139 C	143 C	164 C	165 D	24 C	24 A
A1 – Plaza character											
A2 – Plaza character with urban artefact											
B1 – Pocket character											
B2 – Pocket character with urban artefact											
C1 – Naturalistic character											
C2 – Naturalistic character with urban artefact											

Semantic Environmental Description (SMB) of the physical characters and changes caused by adding an orange urban artefact.

Without the urban artefact, the results showed that the respondents characterised both Plaza character, Pocket character and Naturalistic character in the park environment as being attractive. The statistical analysis for the eight SMB dimensions showed significant results for the dimensions 'pleasantness' and 'originality'. The other six dimensions were not significant (results not presented) and therefore the analysis focused on 'pleasantness' and 'originality' and the adjectives related to them.

The only overall significant difference for the characters in the SMB dimensions was the average score for 'pleasantness', where the value was higher for Pocket than for the Plaza character.

The mean values and standard deviations for all SMB dimensions and the adjectives for pleasantness and originality are shown in Table 4. The

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standard deviation for some of the adjectives were large (maximum 2.3) expressing the fact that the interpretation of the adjectives could be different for different persons.

Table 4. Average scores and standard deviation (n = 17 for all sceneries) given by respondents for the SMB dimensions, and the adjectives included in the SMB dimensions 'pleasantness' and 'originality'. The table show the results from Plaza character without (A1) and with (A2) urban artefact, Pocket character without (B1) and with (B2) urban artefact and Naturalistic character without (C1) and with (C2) urban artefact.

SMB Dimension		**Area A1 mean (sd)**	**Area A2 mean (sd)**	**Area B1 mean (sd)**	**Area B2 mean (sd)**	**Area C1 mean (sd)**	**Area C2 mean (sd)**
Pleasantness		4.9 (1.2)	4.6 (1.0)	5.9 (0.8)	5.8 (0.7)	5.4 (0.9)	5.9 (0.7)
Complexity		3.3 (0.9)	3.3 (1.1)	3.6 (0.8)	3.7 (0.8)	3.9 (0.9)	4.1 (0.8)
Unity		4.8 (1.1)	4.6 (0.8)	4.9 (0.7)	4.7 (0.8)	4.6 (0.8)	4.8 (0.9)
Enclosedness		3.4 (0.9)	3.4 (1.4)	2.5 (0.9)	3.0 (0.8)	3.3 (1.0)	3.2 (0.8)
Potency		4.4 (0.6)	4.1 (0.9)	4.5 (0.7)	4.1 (0.5)	4.6 (0.7)	4.4 (0.7)
Social Status		3.8 (1.5)	3.4 (1.0)	3.8 (1.0)	3.8 (1.1)	4.2 (1.0)	4.1 (1.0)
Affection		4.3 (1.1)	4.3 (0.8)	4.3 (0.8)	3.9 (0.6)	4.2 (0.8)	4.1 (0.8)
Originality		2.9 (1.2)	2.9 (1.4)	3.3 (1.1)	3.9 (0.9)	3.4 (1.1)	4.0 (1.1)
SMB Dimension	**Adjective**	**Area A1 mean (sd)**	**Area A2 mean (sd)**	**Area B1 mean (sd)**	**Area B2 mean (sd)**	**Area C1 mean (sd)**	**Area C2 mean (sd)**
Pleasantness	Stimulating (+)	3.5 (1.7)	3.5 (1.9)	5.1 (1.5)	5.4 (1.1)	5.4 (1.5)	5.2 (1.7)
	Secure (+)	6.0 (1.1)	5.4 (1.7)	6.5 (0.8)	5.3 (1.2)	5.2 (1.4)	5.5 (1.2)
	Idyllic (+)	3.9 (1.8)	3.3 (1.6)	5.5 (1.7)	5.5 (1.5)	4.2 (1.4)	5.4 (1.3)
	Good (+)	5.2 (1.1)	4.6 (1.6)	5.9 (1.0)	5.9 (0.9)	5.1 (1.4)	6.1 (1.0)
	Pleasant (+)	5.5 (1.5)	4.2 (1.6)	5.8 (1.4)	5.9 (1.2)	5.5 (1.2)	5.9 (1.0)
	Ugly (–)	3.3 (2.1)	2.6 (1.9)	1.8 (1.5)	2.0 (1.6)	2.0 (1.7)	1.8 (1.0)
	Boring (–)	3.6 (2.3)	3.5 (1.9)	2.6 (1.7)	1.7 (0.9)	2.7 (1.7)	2.0 (1.1)
	Brutal (–)	2.1 (1.6)	1.9 (1.5)	1.6 (1.1)	1.5 (0.6)	1.6 (0.8)	1.4 (0.5)
Originality	Curious (+)	2.2 (1.6)	3.0 (1.9)	2.1 (1.5)	2.4 (1.7)	2.8 (1.6)	2.7 (1.7)
	Surprising (+)	2.6 (1.8)	2.5 (1.8)	3.3 (1.5)	3.9 (1.5)	2.9 (1.4)	4.3 (2.1)
	Special (+)	3.4 (2.0)	3.1 (1.9)	3.7 (2.2)	4.4 (1.5)	3.9 (1.5)	4.5 (1.5)
	Ordinary (–)	4.6 (1.3)	4.9 (1.7)	3.7 (1.6)	3.3 (1.3)	3.9 (1.4)	3.5 (1.7)

In the analysis of the factorial model, the result of the comparison between the Plaza, Pocket and Naturalistic characters could be different with or without the urban artefact, even if the interaction was not significant. Therefore, the comparison is divided into characters without urban artefact and characters with urban artefact in Table 5, The significant effects of the urban artefact for each character analysed separately are also given in Table 5.

Orange urban artefact's effect on park visitors' experiences of 'pleasantness' and 'originality' when comparing the physical characters

The results with the urban artefact present are shown in Table 5. The Plaza character had a significantly lower value than the Pocket and the Naturalistic character on the SMB dimension 'pleasantness', meaning that the incorporated urban artefact made the Naturalistic character more pleasant in relation to the Plaza character, and this was also true for the SMB dimension 'originality'. The Plaza character had a significantly lower value than the Pocket character and the Naturalistic character for the adjectives 'stimulating', 'idyllic', 'pleasant', and 'good', and a higher value for 'boring' (SMB dimension 'pleasantness'). This means that the incorporated orange urban artefact made the Pocket and Naturalistic character more stimulating, idyllic, pleasant and better in relation to the Plaza character, while the presence of the orange urban artefact made the Plaza character more boring in comparison with the Pocket and Naturalistic character. When the urban artefact was present, the value for the Naturalistic character was significantly higher than for the Plaza character for the adjective 'special' (SMB dimension 'originality'), meaning that the difference between these two characters in the adjective 'special' increased when the urban artefact was present (Table 5)

Comparing the effect of with and without orange urban artefact for each physical character in relation to the adjectives in the SMB dimensions 'pleasantness' and 'originality'

When the urban artefact was incorporated in the Naturalistic character the area was perceived as being significantly more idyllic and better, and generated the experience of being surprised. The Pocket character with the urban artefact had a significantly lower value than without the urban artefact for the adjective 'secure', so incorporated urban artefact in the Pocket character led to the area being perceived as less secure. The Plaza character with the urban artefact had a significantly lower value than without the urban artefact for the adjective 'pleasant', so an incorporated urban artefact in the Plaza character made visitors perceive the area as less pleasant. These results are shown in Table 5.

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Table 5. SMB dimensions and adjectives in the dimensions for which significant results were obtained in statistical analyses for Plaza character (A), Pocket character (B) and Naturalistic character (C) with incorporated orange urban artefact.

SMB dimension		**Significant results***	**Effect of orange urban artefact**
Pleasantness		The value for area A was lower than for area B and C with urban artefact ($p < 0.001$).	The incorporated orange urban artefact made the Pocket and Naturalistic character more pleasant in relation to the Plaza character.
Originality		The value for area A was lower than for area C with urban artefact ($p = 0.01$).	The incorporated orange urban artefact made the Naturalistic character more unusual and surprising in relation to the Plaza character.
SMB dimension	**Adjective in SMB dimension**	**Significant results**	**Effect of urban artefact**
Pleasantness	Stimulating	The value for A was lower than for area B and C with urban artefact ($p < 0.001$).	The incorporated orange urban artefact made the Pocket and Naturalistic character more stimulating in relation to the Plaza character.
	Secure	The urban artefact had a lower value than without artefact for area B ($p = 0.007$).	The incorporated orange urban artefact made the Pocket character less secure.
	Idyllic	The value for area A was lower than for area B and C with urban artefact($p < 0.001$). The urban artefact had a higher value than without artefact for area C ($p = 0.03$).	The incorporated orange urban artefact made the Pocket and Naturalistic character more idyllic in relation to the Plaza character. The incorporated orange urban artefact made the Naturalistic character more idyllic.
	Good	The value for A was lower than for area B and C with urban artefact ($p < 0.001$). The urban artefact had a higher value than without urban artefact for area C ($p = 0.02$).	The incorporated orange urban artefact made the Pocket and Naturalistic character better in relation to the Plaza character. The incorporated orange urban artefact made the Naturalistic character better.
	Pleasant	The value for A was lower than for area B and C with urban artefact ($p < 0.001$). The urban artefact had a lower value than without urban artefact for area A ($p = 0.005$).	The incorporated orange urban artefact made the Naturalistic and the Pocket character more pleasant in relation to the Plaza character. The incorporated orange urban artefact

			made the Plaza character less pleasant.
	Boring	The value for area A was higher than for area B and C with urban artefact (p = 0.004).	The incorporated orange urban artefact made the Plaza character more boring in relation to the Plaza and Naturalistic character.
Originality	Surprising	The value for area A was lower than for area B and C with urban artefact (p = 0.005). The urban artefact had a higher value than without urban artefact for area C (p = 0.02).	The incorporated orange urban artefact made the Naturalistic character more surprising in relation to the Plaza and Pocket character. The incorporated orange urban artefact made the Naturalistic character more surprising.
	Special	The value for area C was higher than for area A with urban artefact (p = 0.03).	The incorporated orange urban artefact made the Naturalistic character more special in relation to the Plaza character.
	Ordinary	The value for area A was higher than for area B and C with urban artefact (p = 0.004).	The incorporated orange urban artefact made the Plaza character more ordinary in relation to the Pocket and Naturalistic character.

*The p-values given for the comparison between the characters are for the overall difference between the three characters.

DISCUSSION

According to Wilms and Oberfeld (2018), Al-Ayash et al. (2015) and Berlyne (1971), bright and intense colours have the ability to affect levels of arousal and thereby experienced positive or negative aesthetic pleasure. High values on the SMB dimension 'pleasantness' and 'originality' indicate the assessed environmental quality to be pleasant, secure, beautiful, novel and surprising, with elevated levels of interest and attention, while a low value on the SMB dimension 'pleasantness' indicates a shift of the optimal stimulus situation (Küller, 1991; Janssens & Küller, 1989).

Our study shows that placing an orange urban artefact in a predominantly greenish environment (Naturalistic character) gave rise to a significantly higher value on the SMB dimensions 'pleasantness' and 'originality' and some of their related adjectives, but this was not the case when the same urban artefact was placed in a predominantly greyish environment (Plaza character). The results are in line with the study by Motoyama and Hanyu (2014), showing that a vertical orange urban artefact in a regular pattern incorporated in surroundings that contain low proportion of vegetation gave rise to high levels of arousal and reduced pleasantness as a consequence. The result may depend on the surrounding environmental

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colour combinations and lack of perceivable colour contrast in the Plaza character. The form and structure of the orange urban artefact (vertical sticks in a circular pattern) in this study, together with the surrounding build environment, may also have influenced the results. One interpretation is that the Plaza character with incorporated intensive urban artefact was probably perceived as being too complex and, in a way, too distressing to really understand. Following this line of thinking street furniture and colourful paved surfaces with intense colours, e.g. red, orange or yellow hues, arguably needs a high percentage of green vegetation to have the potential to be perceived as a pleasant and a positive aesthetic contribution to a park environment. When considering that the orange urban artefact applied in this study were less obvious than urban artefacts used in contemporary landscape architecture, it is likely that the also even more dominant additions of intense colours will affect perceived colour contrasts as well as human experiences.

The observed fluctuations in levels of arousal when intensive colours were added in the three different park characters is supported by Wilms and Oberfeld (2018), Al-Ayash et al. (2015) and Berlyne (1971). The placement of a bright and intensely coloured urban artefact in a predominantly green environment generates activation (surprising and unusual in the environment) as well as perceived surprise of moderate arousal between the intense urban artefact and the surrounding green environment. Another contributing factor behind the arousal effect might be that the orange urban artefact represents a cultural input and a sign of engagement in a rather static and monotonous environment.

Effect of orange urban artefact on perceived colour contrast in urban park

The effect of colour contrast in urban green spaces has proved to be essential in the assessment of visual beauty (e.g. Oleksiichenko et al., 2018; Polat & Akay, 2015; Arriaza et al., 2004) where perceived complementary contrast can be related to positive visual quality and positive experiences (Polat & Akay, 2015; Eroğlu et al., 2012). The results of the present study details this understanding by showing that the orange urban artefact had the capacity to change the overall perceived characteristics of colour in each studied character. This means that the surrounding proportions have an unneglectable impact on the perceived colours and thereby the possibility for a colour contrast to occur. This leads to the conclusion that bright and intensely coloured urban artefacts have the ability to transform the perceived colour situation and related human experiences. In this perspective, knowledge of potential changes in human colour perception seems to be a factor that should be considered in planning processes. According to Itten (2003), proportions between colours as well as surrounding colour fields change colour perception and perceived colour contrasts. This suggests that intense colours, such as red and orange hues on, for example, benches, planter boxes or playground equipment placed in an area comprising a high

percentage of greenery may offer experiences of variation, through intensity and a perceivable complementary and cold-warm colour contrast.

Methodological considerations

The main limitation of this study was that only a monochromatic coloured object with a specific structure and scale was used, and that supplementary colour combinations were not explored. However, other studies contribute to the discussion on placing colourful objects in the urban landscape (Abdulkarim & Nasar, 2014a; Abdulkarim & Nasar, 2014b; Motoyama & Hanyu, 2014).

In our study we applied a technique to connect perceived characteristics of colour effects to the assessed SMB results. The two methods complemented each other and broadened the discussion about the incorporation of a colourful urban artefact in a public park. Though the methods used could have been complemented with a phenomenological approach to provide other perspectives for comprehensive planning of urban green spaces.

The study focused on the visual aspects and omitted confounding variables, such as noise and smell. However, the sounds and smells were similar throughout the park, so we argue that these senses had limited impact on the results of the study. Hence in-depth studies of human reactions in relation to long-term studies, perceived active or passive colours, seasons changes and various distances might enable insights valuable to the understanding of human experiences in the outdoor environment.

Küller (1975) states that 15-20 respondents are enough for stability in the result, and we had 17 respondents per situation. This is about the same number as in other studies based on SMB (Karlsson, et al., 2003; Bengtsson et al., 2015).

In this study, the variation is large in relation to the differences between the mean values, but there are interesting significant results on the relationship between intensely coloured urban artefacts, urban green spaces and human experiences. However, in future studies, it would be interesting to see how much more respondents or another research design could reduce the standard errors in the model.

CONCLUSION

This study explored the interaction between an intensely coloured (orange) urban artefact and three park settings with differing proportions of grey and green. Our results are in line with earlier studies, showing that perceived colour contrasts can generate positive experiences and that urban artefacts with an intense colour in an urban landscape may bring about essential and important changes of perceived visual quality and experienced pleasantness. In contrast to other studies, our study shows that an intense coloured urban artefact influences levels of arousal and generate both negative and positive human experiences.

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From this point of view, awareness of landscape colours should be of high priority when installing intensely coloured benches, planter boxes, playground and fitness equipment.

It is proposed that municipalities and landscape architecture offices involved in the placement of coloured urban artefacts should pay just as much attention to the placement of urban artefacts in a public outdoor context as to the design of the urban artefacts themselves. From this perspective the modes of development is an important factor (designer's perspective) both in the design process and in placement of urban artefacts. However, a multiple perspective between the design of urban artefacts and the social use are to be preferred in order to satisfy unexpected scenarios and activities in direct or indirect connection to urban artefacts. It is central to discuss these issues at planning and management levels to increase awareness of the impact of intensely colourful urban artefacts on the quality of life and visitor´s attitudes. Further research and discussions in the academy (research and teaching situations) into the effect of intense colourful urban artefacts on humans in urban green spaces and other urban open space could help provide a more solid knowledge-base as a basis for development of evidence-based guidelines for practitioners.

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CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

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ETHICS COMMITTEE APPROVAL

Ethics committee approval was not required for this article.

LEGAL PUBLIC/PRIVATE PERMISSIONS

In this research, the necessary permissions were obtained from the relevant participants (individuals, institutions, and organizations) during the survey and in-depth interviews.

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