Evaluation of visual attributes in urban parks using conjoint analysis

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1 ABSTRACT

This paper focuses on the potential of visualization of urban park scenarios to evaluate observers' behaviour. The research applies digital representations of landscape to analyse individuals' visual preferences for existing and prospective landscapes of urban parks. The "vegetal world" of an urban park in the city of Zürich was inventoried, geo-referenced in a database and then rendered in high detailed three-dimensional models. The park site was *disaggregated* into defined visual attributes and attributes levels. From a full factorial design 64 images/profiles were declined and subsequently tested in a survey experiment. The objective of the research is to analyse the contribution of the visual attributes to the characteristics of personal safety, aesthetic and overall preference expressed by the interviewee.

The combined use of visualization methodology and conjoint analysis methods allows to identify whether and how different spatial arrangements, for selected landscape features, affect publics' preference. In fact by the analysis of the human perception and the acceptance of different digital representations it is possible to understand how individuals "experience" the landscape.

2 INTRODUCTION

The work presented in this paper is part of the EU 5th framework project Greenspace. The objective of the project is to advance the planning and the design of urban green space (Greenspace 2003). In this project methodologies are developed in order to identify the types and variety of green spaces that best satisfy people's requirements. Urban parks provide an essential contribution to the citizen's quality of life, they diffuse life long learning and encourage neighbourhood activities helping to reinforce urban communities. The Greenspace project demonstrates that, in several case study cities, citizens' involvement, with the use of interviews and surveys, can convey to a more strategic planning of green space. The project applies economic valuation methods as well as ecological, social and planning approaches. Within the project consortium (University College Dublin, Robert Gordon University Aberdeen, University of Surrey, Universidad Autonoma de Barcelona, Eindhoven University of Technology, University of Hohenheim and the Swiss Federal Institute of Technology) it was established that strategic planning can maximise the contribution that different areas of urban green space make to quality of life. Three-dimensional visualization plays a key role in the Greenspace project, by allowing people to discover existing and hypothetical scenarios of urban green sites. In particular ETH Zürich developed three-dimensional models used for the visualization of defined parks designs. Interest of the research is to establish the relative importance of selected green space attributes in order to identify the green space form that maximise public welfare.

2.1 Case study: the Platzspitz park

The most important green spaces of the city of Zürich are the greenbelts north and south of the city, the green spaces along the lake and the river Limmat, and some parks in the city. This research focuses on the visualization of two parks in Zürich: Platzspitz and Zürichhorn. In this paper the case study of the Platzspitz park is presented. Platzspitz is a relatively small formal park, situated in the dense part of the city. The park is an example of a "frozen" reality fighting against problem of under use and isolation. In the past the Platzspitz park became a haven for drug dealing and other negative activities. Today Platzspitz park is a "museal park", with a high potential to become a more "gentrified" strategic green area.

The research measures and evaluates the observers' response to hypothetical design interventions, such as the reduction of the density of trees and shrubs, obstructing the visibility, and in the same time the increase of the grass cover area. Such interventions are proposed to increase the activities in the park and therefore to improve the sense of personal safety of parks users. It is also expected that open design profiles simplify the orientation in the park and above all reduce potential "hotspots of fear" (Nasar and Jones 1997), actually present in the site.

Image 1: The Platzspitz park in Zürich

2.2 Purpose of the Visualization

The purpose of the visualization is to provide a basis from which to analyse how people interpret and react to the visual experience of hypotetical parks profiles. In fact, with the use of digital visualization methods it is possible to explore the value that people attach to different attributes related to open green spaces. Thus, visualization provides a basis for the assessment of landscape changes and enables to explore the acceptance of different design profiles. The interest of the research is to investigate, with the use of images representing overall changes or dynamics of urban parks, the level to which it is possible to visualize various potential maintenance practices, or design alternatives and scenarios. The computer visualizations of the Platzspitz park are generated combining two main domains: Geographic Information System representations (GIS), and detailed descriptions of solid geometry, realized with CAD (Computer Aided Design) software packages. The use of a GIS application for the park enables to "visualize" and to manage the spatial aspect of the data. In fact through this application it is possible to get an easier access to spatial information and moreover to visualize different developing processes into the study area. It is important to mention that the visualization of alternative designs is used with the aim to afford a more intensive relation between the parks and their potential uses and activities, and not just to simulate different aesthetical or pleasant images. In particular the application for the Platzspitz park investigates different conditions of visual impermeability. In fact, observing the respondents' behaviour for different images, it is possible to analyse and to describe the influence played by the presence or absence of vegetation barriers in the simulated park designs. The research investigates acknowledged fear problems related to urban parks. It is well documented that the presence of dense vegetation in urban parks generates fear problems (Jorgensen 2002), in particular: fear of entrapment (due to the presence of barriers to escape), and fear of concealment, because of the presence of blocked prospects (Nasar and Jones 1997).

It is believed that with the use of landscape visualization approaches, it is possible to achieve a more conscious attitude towards urban parks. In fact the assessment of people's visual preferences for different conditions of landscape quality (Daniel and Meitner 2001) can establish a useful and constructive ground of discussion for management interventions and planning design projects.

3 METHODOLOGY

3.1 The visualization

This part treats the main object of the visualization approach of the park: the vegetation world. It is assumed that the type of vegetation, with its morphology and its characteristics, is the central key for the assessment of visual parks designs. In fact according to the literature "trees are prominent in theories of environmental perception and landscape aesthetics" (Summit and Sommer 1999). Therefore the vegetal world represented for the Platzspitz park is derived from high detailed three-dimensional models. The vegetation depicted in the images is calculated with AMAP™ (Atelier de Modélisation de l'Architecture del Plantes), a software package, including the modul Glance. Glance is a plant growth simulation modelling software that follows the essential botanical rules and parameters, which are shaping the architecture of a plant, at any stage of its development and in any season. The vegetation, computed from the botanical-true models, respects the natural morphology of the plants. The vegetation represented in the images is calculated with regard to the aesthetic, and to the botanic behaviour of the plants over time. The visualization of the parameters of seasonal changes follows, as much as possible, the colours and the texture of leaves and trunks, characterizing the visible core of the park. Some examples are shown in Images 2 – 5.

As the concept of landscape quality embraces several domains it was necessary to define some limits in the visualization task. The visualization approach reflects the complexity of the characters and elements composing the park, with the aim to discover the potential and the talents of the site represented. Thus the visual approach for the park evaluates and symbolizes the Platzspitz as a specific *topos*, and not as a simple set of design options. The visualization estimates and reproduces changes or dynamics that might be happening over time, with the intention to investigate how an urban park can be safe and attractive.

Image 2: Visualization of urban park - spring

Image 3: Visualization of urban park - winter

Image 4: Visualization of urban park - spring - in detail Carpinus B.

Image 5: Visualization of urban park – winter- in detail Carpinus B.

3.2 Design criteria and statistical analysis experiment

In this part of the paper the experimental design approach that combines the visual attributes, is presented. This approach was used to construct the hypotetical parks options and to develop the digital images. The work started defining the design parameters to setup the visual alternatives for the park. The park was, disaggregated into visible and influential attributes, useful to develop controlled hypotetical scenarios. Three main visual influential attributes were identified: seasons, points of view, and vegetation spatial arrangements. Using these attributes it was created a sort of report of the park, or a dynamic visualization through the park. The Platzspitz park is represented in its developments over the time (seasonal changes) and with an imaginative walk through the site, by a sequence of static images rendered from several points of view, positioned along an imaginative route in the park. Furthermore, vegetation spatial arrangements are represented to illustrate typical formal park changes, due to natural or accidental development, such as death or growth of plants, or small formal alterations due to human interventions of maintenance or planning design. For each attribute of interest are determined four attributes levels. From the combination of the three attributes and the variation of their levels, it was created a full factorial design, representing different condition of visual impermeability in the park. The full factorial design involves 43 different profiles (see in Table 1.); this produces 64 context-setting scenarios.
Table 1.

Attributes:	*Levels:*
Seasons	1. Autumn
	2. Winter
	3. Spring
	4. Summer
Viewpoints	1. Entrance in the park
	2. Representative part of the park
	3. Children play area
	4. Path along the Limmat river
Vegetation spatial arrangements	1. “full enclosure”: vegetation in foreground and background
	2. “foreground enclosure”: vegetation in foreground
	3. “background enclosure”: vegetation in background
	4. “no enclosure”: absence of vegetation in foreground and background

All the 64 profiles were visualized with digital images. Examples of the images/profiles are shown in Images 6-13. The 64 images/profiles visualized were then assigned to evaluation sets.
The 64 images/profiles are presented into four types of evaluation sets, where the images/profiles are differently depicted and ordered. This paper aims to present the results from the assessment of the 64 images/profiles, independently from the type of evaluation set. The evaluation sets are composed by 8 questionnaires, containing 8 images/profiles each. Every questionnaire is repeated four times, this means that in the survey experiment each image/profile is depicted and assessed 16 times. The survey was conducted within a sample of 128 respondents. The respondents’ sample is composed of a selection of:

32 Citizen in Zürich 32 Landscape experts 32 Interviewee near to the park site 32 Interviewee in the park site.

It is important to remark that part of the interview was conducted face-to-face, for example interviewing the park visitors, while another part, for example the group of the citizen of Zürich, was mostly contacted via mail. Hence this group was responding to questionnaires sended by post.
The survey investigates the response variables expressed for the characteristics of personal safety, aesthetic and overall preference.
Respondents were suggested to imagine that they visit the depicted park for the first time and were then asked to assess the images/profiles using a rating scale. In order to familiarize the respondents with the digital images and allow them to setup a personal scale measure, they were shown some digital images depicting an unidentified park site. The respondents were also not informed

about the identity of the park study site, in order to avoid any possible previous induction that might influence the evaluation behaviour. The rating used scale goes from 1 to 7, for example in the case of personal safety the responses ranges from "not safe at all" to "very safe". The means of respondents' ratings of the 64 images/profiles for personal safety, aesthetic and overall preference were analysed. All tests were carried out with SPSS version 11 for Mac OS X.

Image 6: Platzspitz park - Seasonal changes: spring

Image 7: Platzspitz park - Seasonal changes: autumn

Image 8: Platzspitz park - Seasonal changes: winter

Image 9: Platzspitz park - Seasonal changes: summer

4 PRELIMINARY RESULTS

The respondents' ratings of the 64 images/profiles showed significant differences and confirmed the hypotesis that the "visual impermeability" influences publics' assessment behaviour. Mostly in the case of personal safety, it emerges clearly that profiles depicting low vegetation enclosure are evaluated as very safe. Differently in presence of dense vegetation barriers, the personal safety perception decreases, in fact the lowest safety scores correspond to the profile depicting an image with "full enclosure" vegetation, see Table 2.

Table 2.

SAFETY		AESTHETIC	
Highest rating	*Lowest rating*	*Highest rating*	*Lowest rating*
"no enclosure" vegetation	"full enclosure" vegetation	"foreground enclosure" vegetation	"full enclosure" vegetation
summer	spring	summer	winter

Image 10: Platzspitz park - Spatial arrangements: full enclosure

Image 11: Platzspitz park - Spatial arrangements: foreground enclosure

Image 12: Platzspitz park - Spatial arrangements: background enclosure

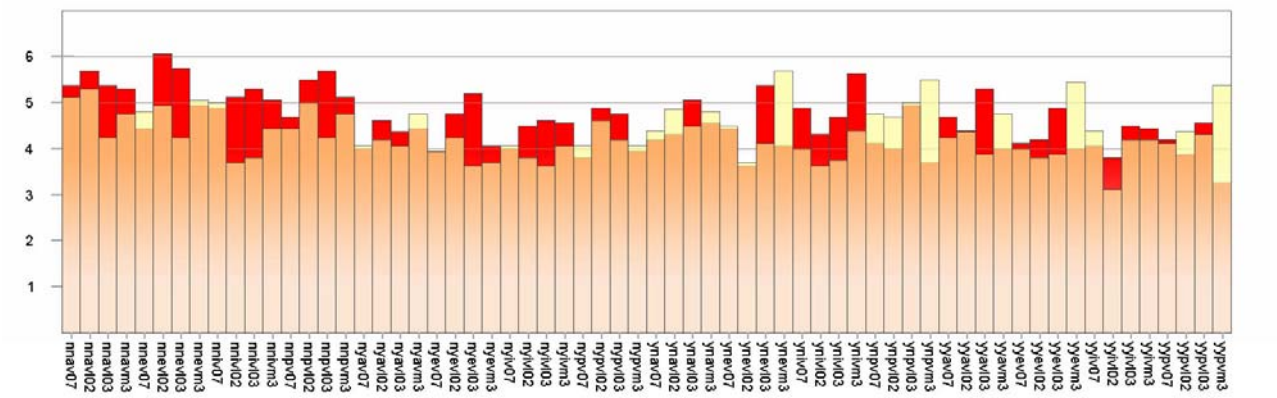
Image 13: Platzspitz park - Spatial arrangements: no enclosure

A further analysis step investigates the interactions between the characteristics of personal safety, aesthetic and overall preference, see for example Figure 1. A large part of the respondents did not distinguish very much between the two concepts of aesthetic and overall preference. It is necessary to remark that the characteristic of aesthetic indicates the simple scenic beauty of the context scenario depicted, while the overall preference implies a more personal involvement of the observer, in the evaluation of the context scenario depicted.

The research at the present is confirming that the combined use of visual attributes and statistical analysis experiments can be an effective evaluation tool to understand peoples' assessment behaviour. The intent was to develop controlled design visualization experiments for the specific context of the urban park and to describe how respondents react. Further research steps are addressed to learn from the respondents' reactions and more, to explicate their assessment behaviour. This means that the future stage of this research will be focused to analyse the visual attributes, presented in this paper, in order to investigate their specific utility and to better explain the observed preferences.

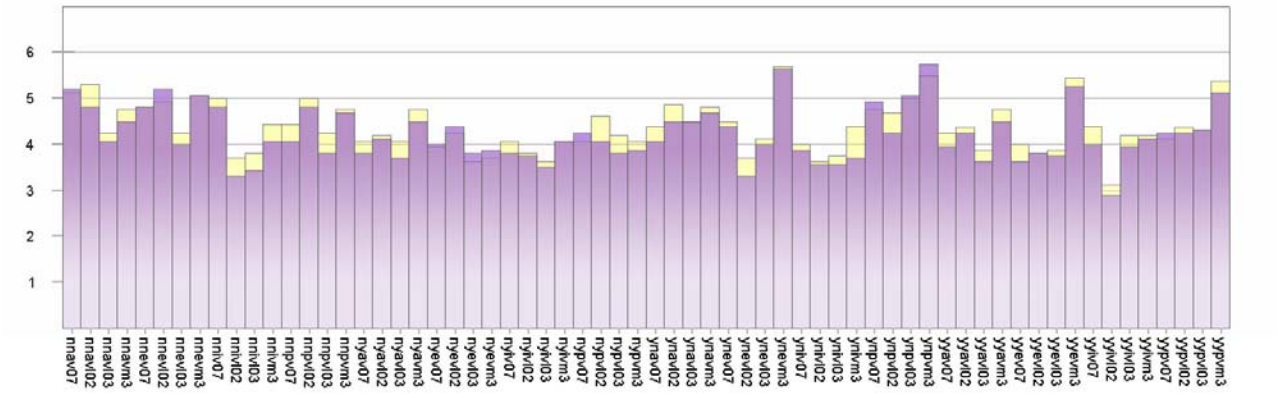
Newertheless there are some limitations to the experiment presented. In fact only a small number of attributes was varied in the full factorial design. This generated a sample of images/profiles, where differences were sometimes very low or in any case difficult to perceive. Some caution is also necessary, considering the landscape as an ensemble of visual and cultural characteristics and not as a simple composition of isolated features.

Figure 1: Evaluation of 64 images/profiles – In red values for SAFETY, in jellow values for AESTHETIC



64 IMAGES/PROFILES

Figure 2: Evaluation of 64 images/profiles – In jellow values for AESTHETIC, in violet values for PREFERENCE



64 IMAGES/PROFILES

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