Kansei Engineering: a tool for evaluating chromatic integration of architecture in landscape.

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ABSTRACT

Kansei Engineering was developed by Professor Nagamachi at the Kure Institute of Technology (Hiroshima, Japan). This methodology aims to relate product design with the sensations it awakens in users. Study of observers' emotional responses to variations in product attributes enables this information to be included in the design process in order to create products that satisfy users' needs. This communication aims to analyse the application of Kansei methodology as a tool for evaluating the chromatic integration of architecture in landscape. Given that chromatic integration of architecture with its surroundings is aimed at improving the sensations perceived by observers, the sensations associated with the concept of integration need to be defined and quantified. When this set of impressions or emotions has been defined they can be related to the different chromatic parameters in the architecture. Kansei Engineering applications are mainly found in the field of product design, where colour is studied as a product attribute, and variations can influence the observer's emotional response. Several works apply Kansei Engineering in the urban space to determine citizens' perceived impressions, such as the relationship between pedestrians' impressions of certain areas of the city and the neighbourhood they choose to live in. The communication begins with the state of the art on Kansei Engineering applications, for evaluating urban and landscape spaces and product evaluation, considering colour as the study attribute. After this analysis, an action protocol is proposed for application to studies on the chromatic integration of architecture in urban and natural environments.

Keywords: Kansei Engineering, chromatic integration, architecture, landscape

1. INTRODUCTION

Studies on perception of the environment show that assessment of the environment is a complex process involving emotional responses with cognitive judgments about environmental characteristics. The aesthetic response to an environment starts with the initial sensory impression, but with the addition of post-perceptual factors, such as knowledge, and a kind of internal critical discussion about the scene before us, the response changes (Bell, 2001).

The integration of architecture in its environment has been studied extensively in the rural environment (Cloquell-Ballester et al., 2011, Garcia et al., 2006). These authors consider color as one of the aspects that define the relationship between a building and its surroundings. Furthermore, the literature on the "Aesthetic response to building attributes" also suggests that the color of facades is an attribute worth studying as it can influence the aesthetic response to buildings (O'Connor, 2008). However, although there is an extensive literature on the visual impact of buildings and their integration in the environment, they do not provide an in-depth analysis of the structure of observers'

emotional reactions and how that relates to their overall assessment. Analysing this emotional structure requires techniques which enable measurement of human perceptions of products and the words people use to communicate their perceptions.

2. KANSEI ENGINEERING

From the area of user-oriented product development, the Kansei Engineering technique has been applied, which is able to quantify perceptions and relate them to design criteria. Nagamachi defines Kansei Engineering as a "translating technology of a consumer's feeling and image for a product into design elements" (Nagamachi, 1995). Kansei Engineering is a methodology developed in the 1970s in the Kure Institute of Technology (Hiroshima, Japan).

The introduction of a Kansei Engineering system requires the following process (Schütte et al., 2004). In a first phase, user response is obtained and quantified in terms of evaluating the product's "sensorial attributes". The most commonly used technique for measuring user perception of a product in Kansei Engineering studies is semantic differential (Osgood et al., 1957). It can currently be considered the most powerful quantitative technique available for measuring the affective significance of concepts (Ishihara et al., 1997). This technique consists in following a given structure in questionnaire design using kansei words as scales for evaluating the sample stimuli. Principal components factor analysis is the technique most commonly used to reduce dimensionality. The advantage of this technique is that the emotional attributes used to find relations with design parameters are not defined by experts but by the consumers themselves. In this way, it can be ensured that the perceptions to be measured are really those valued by the consumers or users and those they are capable of expressing. In a second phase, after obtaining users' affective dimensions or semantic axes (kansei words), attempts are made to obtain inference rules between the design elements and semantic axes or perception variables. The most commonly used statistical technique to obtain this relationship is known as Hayashi's (Hayashi, 1976) Type I Quantification Theory. It is a linear regression statistical technique for quantitative variables.

There are very numerous applications of Kansei Engineering in other areas. For example, in the automotive industry for the design of steering wheels, speedometers or frontals (Nagamachi, 2002, 1995). In the field of telephony (Lai et al. 2006), footwear (Alcántara et al., 2005), wine glasses (Petiot and Yannou, 2004), cameras (Yang, 2011), tools (Vergara et al., 2011), industrial machinery (Huang et al., 2011) and even of sports mascots (Lin et al., 1999). However, use in the field of architecture is still scanty, where the only studies found focus on the design of facades (Nagasawa, 1995), real-estate products (Llinares and Page, 2007) and even the design of public spaces (Kang and Zhang, 2010) and users' perceptions of different city areas (Llinares and Page, 2008). In all these works the colour is studied as an attribute of the product, among other design parameters such size, shape, texture and style. All these parameters can influence to the user's emotional response to a greater or lesser extent and therefore acceptance or rejection of the product. In the area of the impact of colour in urban landscape, we find the work by Kinoshita et al. (2006). These authors propose to colour planning support system for townscapes. This system is based on the evaluations of three models: (1) a Kansei evaluation model that relates town impressions and street colours of the townscape, (2) the color harmony model and (3) the cost evaluation model.

3. PROPOSED METHOD

Below is the proposed scheme for the application of Kansei Engineering for evaluating chromatic integration of architecture in landscape.

Phase 1. Modeling user perception

The objective of this phase is to extract semantic space structure sensory attributes defining the concepts under which the user perceives the landscape. This set of words or semantic field constitutes valuable knowledge for assessing landscapes from the observer's own language. This phase requires the following steps:

- Creation of a word list by collecting expressions that non experts and professional observers use to describe the emotional reaction to the landscape under study.
- Creation of stimuli that provide information on the different models of chromatic integration of architecture in the environment.
- Development of the field study to obtain basic evaluations of the landscapes under study.
- Extraction of semantic axes or emotional attributes that qualify observers' perception of landscapes.
- Analysis of the relationship between semantic axes and the observer's overall assessment.

Phase 2. Generating design criteria.

The aim of this phase is to define guidelines or design criteria related to colour, based on modeling perception obtained in the previous phase. The development of this system requires the following tasks:

- Measurement of the chromatic composition of landscapes by objectives indicators.
- Creation of representations by virtual simulations: After identifying the different colour compositions that in some degree can determine perception of the landscape, we then create virtual stimuli. These simulations make it possible to modify the study variables independently.
- Development of the field study to obtain a base of simulated landscape assessments.
- Definition of chromatic strategies for improving the integration of architecture in the landscape.

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