ANALYSIS OF THE CONSUMER'S VISUAL BEHAVIOUR AND ITS RELATIONSHIP TO PRODUCT PREFERENCES. APPLICATION TO CERAMIC DESIGN FEATURES

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1. ABSTRACT

The accelerated development of neurotechnology in recent years has allowed us to obtain objective measurements of human physiological parameters in a specific situation based on stimuli. For example, it is possible to measure the frequency and variation of cardiac rhythm or pupil dilation of an individual when observing a particular image, to analyse their gaze behaviour or even study their cerebral activity. Analysis of this nature is frequently used in the field of marketing, for example, in order to establish the optimum position of the brand on a product label or the most influential sequences in an advertisement. However, the possibilities for neurological techniques allow us to go further, enabling them to be used from the early stages of design. By relating physiological responses to subjective opinions about preferences and tastes of potential consumers, a more complete and objective view can be obtained regarding the influence of product design features on consumers' perceptions.

In this paper, the Eye-Tracking technique is used, which provides information about gaze behaviour, in order to complete an earlier study regarding the influence of objective design parameters of ceramic floorings on the emotional perception that the product provokes. The previous study analysed how the colour, gloss and format of a specific ceramic flooring could provoke certain perceptions and preferences. The additional study of which design features manage to most attract the gaze, relating to the opinions of the subjects of the study, provides new contributions to improve knowledge of the design of highly successful products.

2. BACKGROUND

A key aspect in the field of study of the consumer's emotional experience is the relationship between specific design attributes and perceptions generated in the consumer. The principles of Kansei engineering [1] are based on the analysis of these relationships, which contribute highly valuable information for the designers, given that it allows them to relate specific product design features to the perceptions they seek to provoke in their target clients.

In this sense, techniques have been analysed for the incorporation of emotional design into the ceramic development process [2, 3]. In particular, a previous study [4] described an experiment applying Kansei engineering principles to the design of ceramic flooring. This experiment detected the influence of certain features of the flooring (colour and gloss) on meanings generated by the product (for example, simple, bright, expensive-looking) and even on product preferences.

This study intends to go a step further in the analysis of consumer perceptions and preferences, enhancing the study with objective measuring techniques. Technological advances have allowed new tools and techniques for measuring behaviour and physiological reactions to appear, such as facial expression analysis, electroencephalography (EEG), measurement of heart beat (ECG), electrodermal activity measurements or the eye-tracking technique, which analyses visual attention.

The last technique in this list, eye-tracking, is a method for observing the user's cognitive processes and for identifying how specific visual stimuli influence eye movements [5], which can be used to discover consumer strategies and infer the underlying cognitive processing. According to Just and Carpenter [6], when an individual gazes, they are perceiving, thinking or paying attention, in which case their cognitive process can be identified by monitoring their gaze. According to Jacob and Karn [7], eye movement can reveal human perceptive, emotional and cognitive processes, thus allowing the prediction and interpretation of human behaviour.

By using the eye-tracking technique along with that of semantic differential questionnaires [8], it is possible to compare the responses regarding certain perceptions or preferences to the gaze behaviour. One study in this area [9] analysed the influence of different styles of furnishings and decoration on the perception of a flooring.

In this article, the Eye-Tracking technique is used. Eye-tracking provides information about gaze behaviour, in order to complete an earlier study regarding the influence of objective design parameters of ceramic floorings on the emotional perception that the product provokes. Using semantic differential questionnaires, the previous study analysed how the colour, gloss and format of a specific ceramic flooring could provoke certain perceptions and preferences. These results will now be supported by also comparing product evaluations and preferences and consumers' visual behaviour.

3. METHODOLOGY APPLIED

The same flooring sample was used as in the previous study. This sample was obtained by applying a complete orthogonal design based on the *colour, gloss* and *format* attributes, with 2 levels for each one. Figure 1 shows the 8 resulting combinations.

***Fig. 1**. Eight images of flooring resulting from orthogonal design.*

16 compositions were generated with 4 images of floorings in each one, distributed in two rows and two columns, in a random manner (Figure 2). In the study, the participants were men (31%) and women (69%), all of legal age. Their ages were assessed in groups: from 18 to 25 (28%), from 26 to 45 (66%), and from 46 to 65 years old (7%). Nearly half of the sample (48.3%) has ceramic flooring in the living room of their dwelling. 44.8% work in fields relating to design.

The participants saw a sequence of slides displayed on the screen. The first slide contained text, indicating to the participant the instructions for evaluating the floorings, in relation to any of the perceptions included in the study. For example: "Next, select the flooring that you consider the BRIGHTEST" (the eight perceptions considered in the study were: *"Simple and versatile", "Innovative and designer", "Bright", "Cosy", "Expensive-looking", "Elegant", "Natural" and "I like it").* The slide shown next was one of the combinations of four floorings. Following the example, the participant selected with the mouse the flooring that they judged to be the brightest. The sequence of slides followed with a new question, relating to another perception. In total there were 16 questions, given that each perception was asked twice, so that all floorings had the chance to be selected. In each case, the combinations and the order of display of the floorings were different.

The survey was carried out in-person. The images of the compositions were presented on a 24" screen, which had been previously prepared with an eye-tracker model Tobii X2-60 (Figure 3).

Fig. 2. *Example of one of the 16 compositions created for the survey.*

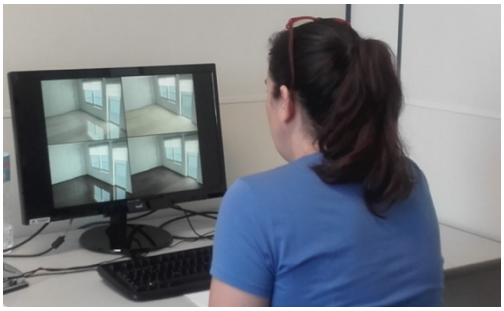

Fig 3. *Image of the study being performed*

In regard to the compositions, in order to read the eye-tracker, various Areas of Interest were defined (areas of the image to be analysed that receive special attention by the observer and where there is usually a greater density of fixations) corresponding to the flooring and environment in the image, as seen in Figure 4.

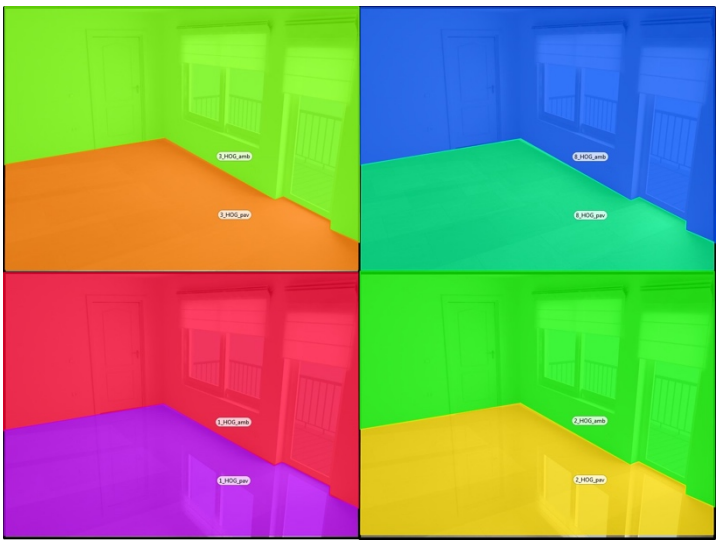

Fig 4. *Areas of Interest for the various images (flooring and environment)*

Once the experiment was completed, the data were statistically analysed. The aim was to answer several questions. Firstly, to determine if there is a meaningful relationship between the time spent looking at the floorings on the screen before responding to a question, and the flooring that is ultimately chosen as a response to that question. In addition, we will study whether the design features of the flooring (colour, gloss and format) influence the evaluation of each question, and on the time spent looking at the flooring.

To determine whether the design features influence the number of times that a specific flooring is selected, analysis of variance (ANOVA) will be applied. In the case of the possible influence of these design features on the time spent looking at a flooring, univariate analysis of variance (univariate general linear model) will be applied.

4. RESULTS AND CONCLUSIONS

The eye-tracking results allowed us to observe the scan path created by the participant, as well as the visualisation time for each of the areas (heat map), as shown in Figure 5.

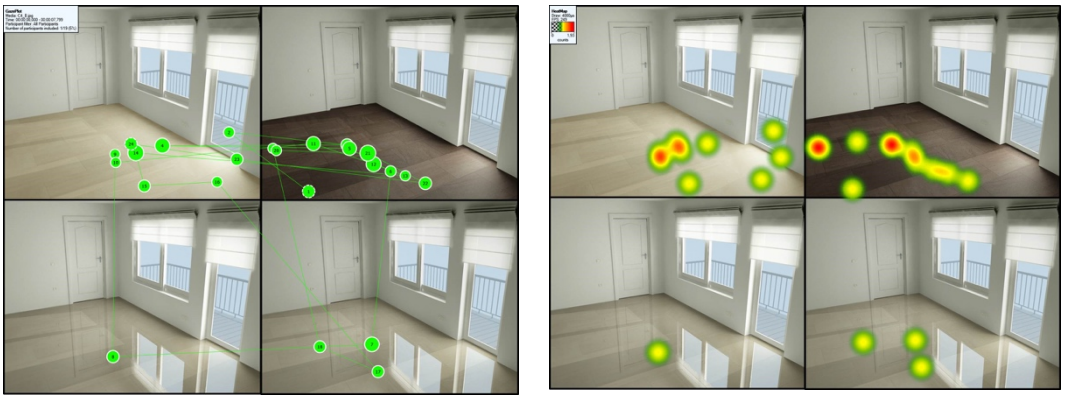

Fig 5. *Example of eye-tracker visualisation results (scan paths and heat maps)*

In regard to statistical analysis, the Kolmogorov-Smirnov test determined that, while the variable "Time" (total time spent looking at the flooring area) can be considered to follow a normal distribution, this is not the case for the variable "Selection" (number of times a flooring was selected as the response to a question). As a result, a bivariate correlation is applied between these variables, applying Spearman's Rho coefficient.

The non-parametrical correlations show that there is a positive correlation, significant to 0.01 between the variables "Time" and "Selection"; meaning that, before responding to a question, more time is spent looking at the flooring that will be chosen. This result is highly interesting, given that it shows that results similar to those of the subjective questionnaires can be obtained through objective gaze behaviour tests.

Broken down in terms of the perceptions to be evaluated, the univariate analysis of variance demonstrated that the feature "Colour" influences the selection of the flooring for the perceptions "Simple and versatile", "Innovative and designer" and "Bright". Specifically, light colour in a flooring leads it to being perceived as more simple and versatile, less innovative and designer, and brighter.

In regard to the feature "Gloss", it influences the choice of the flooring when evaluating whether it is Cosy (matte floorings being chosen as cosy), whether they are expensive-looking (gloss flooring being selected more often) and Elegant (gloss flooring being more elegant).

The format of the flooring (square or rectangular) was not significantly related to any perception. It was the least noticeable design feature in the images.

In addition, based on the analysis of variance on the variable "Selection", for each perception, in 6 of the 8 cases, a significant difference was detected in the time spent looking at the flooring, based on the influencing design feature. Therefore, for the "Bright" perception, the evaluation of which showed that the colour of the flooring was an influence (light floorings being chosen as brighter), it was detected that the light-coloured floorings were looked at for a significantly longer time than dark floorings when participants were asked to evaluate their brightness. In the same way, matte floorings, which were chosen as cosier, were looked at for a significantly greater time when participants were asked about their cosy nature. And the same occurs with gloss floorings when they were asked to select the most expensive-looking and the most elegant one. In the evaluation of "Natural" and "I like it", no influence was detected from any of the studied design features, nor were some floorings looked at for longer than others.

Table 1 summarises the results relating to the influence of the design features.

Perception	Colour		Gloss		Format
	Selection	Time	Selection	Time	
Simple and versatile	Light *				
Innovative and designer	Dark *				
Bright	Light **	Light **			
Cosy			Matte **	Matte **	
Expensive-looking			Gloss **	Gloss *	
Elegant			Gloss *	Gloss *	
Natural					
I like it					
	(*) Significant correlation at the 0.05 level (bilateral) (**) Significant correlation at the 0.01 level (bilateral)				

Table 1. *Example of eye-tracker visualisation results (scan paths and heat maps)*

Ultimately, despite the fact that relationships between the design features and the subjective perceptions generated in consumers change highly with time, some of the results obtained have been maintained from the previous study. In addition, it was possible to verify that the floorings selected by the participants are highly correlated with those that were looked at longest, which is an interesting result, given that it indicates that it is possible to know the result of the cognitive process through an objective and easily measurable parameter, such as the consumer's gaze behaviour.

5. ACKNOWLEDGEMENTS

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