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The Effect of Symmetry on the Perception of Happiness and Boredom in Design Products

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***Abstract*—**The present research investigates the effect of symmetry on the perception of happiness and boredom in design products. Three experiments were carried out in order to verify the degree of the visual expressive value on different models of bookcases, wall clocks, and chairs. 60 participants directly indicated the degree of happiness and boredom using 7-point rating scales. The findings show that the participants acknowledged a different value of expressive quality in the different product models. Results show also that symmetry is not a significant constraint for an emotional design project.

***Keywords*—**Product experience, emotional design, symmetry, expressive qualities.

I. Introduction

THE expressive value of design products is a key aspect of the user experience. In a design project, the choice of a determined expressive perceptual property can truly be a deliberate emotional communicative goal. On the other hand, a large number of studies show that the perceptual properties of design products can also affect a specific emotion [1]-[4]. For example, a study of mobile telephones has demonstrated that different product attributes (such as the shape of navigation button, number of differently shaped buttons, size of navigation button, etc.) can elicit different emotional experiences [5]. Additionally, with the use of different mobile telephones further studies have measured the specific emotional responses of amusement, disgust, pleasant surprise, contempt, etc. [6]. Several studies have showed the effect of curvilinearity on user emotional experience. The curvilinear shape of internal spaces is deemed to be an elicitation of feelings of joy, harmony and well-being [7] as well as the feeling of pleasantness and the reduction of stress [8]. Curvilinear interior settings elicit also higher amounts of pleasant-unarousing emotions, such as feeling relaxed, calm, and peaceful, than the rectilinear settings [9]. Moreover, through the use of a functional magnetic resonance imaging (fMRI) technique, neuroscientists have found that curvilinear stimuli activate the anterior cingulate cortex, which is generally involved in the processing of emotional stimuli [10].

A large number of design papers deal with colour and emotions [11]. For example, studies on the impact of colour on performance attainment have found that the colour red evokes an avoidance motivation [12]. However, a room painted in red elicits more anxiety than a room painted in Baker-Miller pink [13]. Other studies have investigated the colour of paper on which several tales of violence were written. Emotional reactions to the tales were influenced by the colour of the paper. The readers were less upset when tales were presented on pink paper rather than on blue or white paper [14].

Unlike most studies of design previously cited, the present research does not consider the emotional effect on the user but the perception of expressive emotion [15]. It is also because emotion perception is the expressed emotions that the user perceives or recognizes (e.g., a sad expression) without necessarily feeling an emotion [16]. Researchers largely agree that the subjective experience of emotion and the emotion perception are just different components of emotion [17], [18]. Thus, in the design field, an expressive quality can express a determinate character of the design product and the designer can communicate, through specific perceptual properties, the presence of that emotional character.

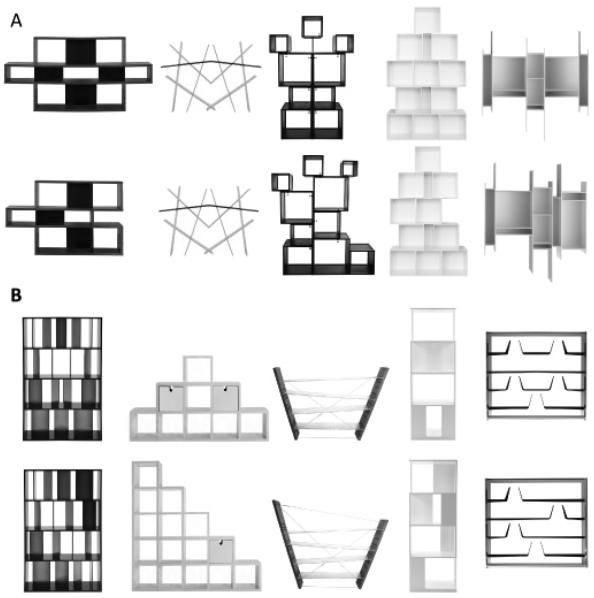

Fig. 1 Stimuli used in Experiment 1. The symmetric models (A) and the asymmetric models (B)

The aim of the present research is to study the influence of the symmetry on the perception of expressive emotional qualities.

Symmetry is a relevant factor of design. Several studies demonstrate that symmetric shapes are more attractive than asymmetric ones [19]-[22]. Within the field of design, recent studies have found that the aesthetic preference of vases

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increases with the symmetry [23], [24]. By examining the influence of symmetry in brand imagery on customer response, it was claimed that symmetry has a relevant effect on formulating brand personality perceptions. In particular, it has been found that asymmetric brands are more exciting and appear daring, trendy, up-to-date, etc. Conversely symmetric brands, through low levels of arousal, appear luxurious, prestigious, tasteful, etc. [25].

Fig. 2 Stimuli used in Experiment 2. The symmetric models (A) and the asymmetric models (B)

In this research, three experiments were carried out in order to investigate the effect of symmetry on the perception of happiness and boredom in design products (bookcases, chairs, and wall clocks, respectively in three experiments).

II. General Method

A. Participants

The participants consisted of 80 volunteers (44 females and 36 males), ranging in age from 18 years to 57 years, with normal or corrected to normal vision. None of the participants took part in more than one study.

B. Apparatus and Stimuli

All the stimuli were presented on a monitor screen with a resolution of 1024 × 748 pixels, and at a viewing distance of approximately 50 cm. The experiments were conducted under computer control, with a program written in Java that arranged the order of stimuli, presented them on the monitor, and recorded the subject's responses. The stimulus presentation consisted of 10 symmetric images (Figs. 1 (a), 2 (a), 3 (a)), with the longest side that had a visual angle of 16°, placed at the centre of the screen. The images had been modified by Adobe Photoshop in order to obtain 10 asymmetric images (Figs. 1 (b), 2 (b), 3 (b)). Bilateral symmetry was used in these experiments. In fact, bilateral symmetry is the most rapidly detected form of symmetry [25].

C. Procedure

At the beginning of the experiment, each participant sat in front of a screen and received oral instructions. On each trial, one of the stimuli was presented at the centre of the screen.

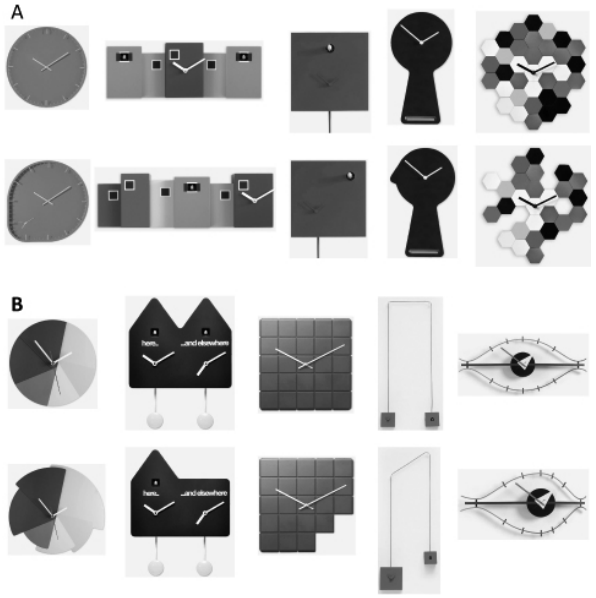

Fig. 3 Stimuli used in Experiment 3. The symmetric models (A) and the asymmetric models (B)

A 7-point rating scale was placed under the stimuli. Participants indicated the degree of the visual expressive value (happiness, boredom, and again happiness respectively in the three experiments) of the products and responded by mouse. A new image was presented in each trial so that a repetition of the same image was avoided. Each of the ten images was presented twice (16 trials). The trials were presented to each participant in an individually randomized order.

D. Data Analysis

An ANOVA for two factors: between-participants GROUPS (symmetry and asymmetry) and within-participants DESIGN PRODUCT (10 different models) was carried out on the degree of perceptual happiness. A post-hoc t test was used as well for pairwise comparisons.

III. Experiment 1

The first experiment verified the effect of symmetry on the perception of happiness in 10 different models of bookcases.

Results are shown in Fig. 4. The analysis of variance showed that the main effect for GROUPS (symmetry and asymmetry) was not significant ($F(1, 18) = .11$, $p = .74$). In addition, the factor DESIGN PRODUCT was not significant ($F(9,126) = .88$, $p = .54$).

IV. Experiment 2

The aim of the second experiment was to test the effect of symmetry on the perception of boredom in different models of the chair.

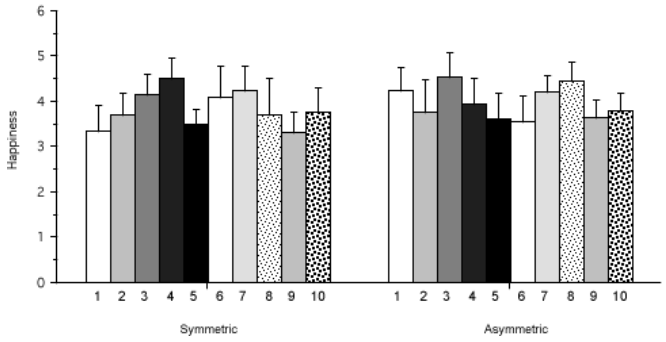

Fig. 4 Results of Experiment 1. Mean values of the rating (happiness) are reported on the ordinate. The 10 models of bookcase are reported on the abscissa. The error bars represent standard errors.

Fig. 5 shows the results of Experiment 2. ANOVA showed that the GROUPS factor (symmetry and asymmetry) was not significant ($F(1,18) = .46$, $p = .51$) but the factor DESIGN PRODUCT was significant ($F(9,162) = .93$, $p < 0.001$). These results indicate that the participants acknowledged a different value of boredom in the different chair models. Post hoc comparison revealed significant differences between model 2 and model 6 ($p < .001$), between model 3 and model 6 ($p < .05$), and between model 4 and model 6 ($p < .005$). The post-hoc comparison showed also that models 3, 4, 5, and 7 differ from models 1, 8, 9, and 10 taken together ($p < .05$). This result reveals an effect of lightness on the perception of boredom. The light models are perceived as being boring than dark models.

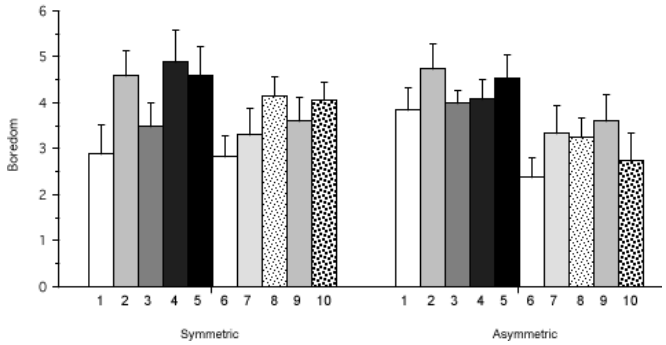

Fig. 5 Results of Experiment 2. Mean values of the rating (boredom) are reported on the ordinate. The 10 models of chairs are reported on the abscissa. The error bars represent standard errors

V. Experiment 3

A third experiment was performed in order to study the effect of symmetry on the perception of happiness in different models of wall clocks.

Fig. 6 shows the results of Experiment 3. ANOVA showed that the GROUPS factor (symmetry and asymmetry) was not significant ($F(1,18) = .37$, $p= .55$) but the factor DESIGN PRODUCT was significant ($F(9,162) = 2.39$, $p < .05$). This result confirms the result that was previously obtained in experiment 2. The participants acknowledged a different value of happiness in the different wall clocks models. Post hoc comparison showed that there were significant differences between models 8 and 7 ($p < .001$), models 8 and 3 ($p < .01$), models 8 and 10 ($p < .05$), models 7 and 9 ($p < .01$), models 7 and 4 ($p < .05$), models 7 and 2 ($p < .01$), models 7 and 1 ($p< .05$).

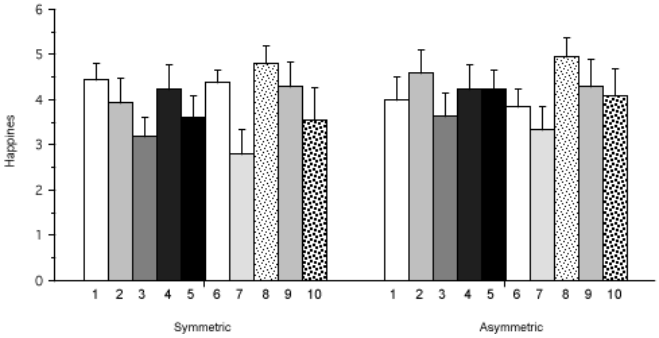

Fig. 6 Results of Experiment 3. Mean values of the rating (happiness) are reported on the ordinate. The 10 models of wall clocks are reported on the abscissa. The error bars represent standard errors

VI. Conclusions

The results of experiments 2 and 3 reveal that observers perceive different values of emotional expressivity in different design products. These results can be explained by both local and global factors. In addition to the local effect of lightness (experiment 2), the influence of other perceptual properties (such as size, shape, colour, etc.) is possible. The global character of the product could also have an impact on the emotional expressivity [6]. In any case, the results obtained confirm that the user perception is highly influenced by the expressive qualities of products [15].

The results also show that symmetry does not have an effect on the expressive perception of happiness and boredom in design products. However, this result is not consistent with literature. As we have seen, symmetry is considered a significant factor in aesthetic shape preference [19]-[25]. Therefore, it is possible to suggest that response to aesthetic preference and perception of expressive value can be independent. These findings are substantial when it comes to designing. In fact, it can be assumed that symmetry is not a crucial visual constraint on expressive emotional design.

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