Influence of Familiarity-Novelty Ratio on Product's Aesthetic Quality

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Abstract: The design research focused in the last decades on issues that can be scientifically studied. One of these issues is the familiarity-novelty ratio. In the beginning, theoretical considerations lead to the idea that familiar and novel elements should balance in the product design. Later, experimental researches confirmed the theory. In this stage, new jargon terms and different models were introduced. This paper presents the experimental findings regarding the best pair of terms to be used in communication, the differences between product classes in regard to familiarity-novelty ratio and evidence in favour of one conceptual model.

Key-Words: familiarity-novelty ratio, typicality, aesthetic preference

1 Introduction
The design team has the top-priority objective to create a product that will be a market success. In order to achieve this objective, the product should exceed its competition in all or almost all aspects: functionality, aesthetics, ergonomics, manufacturability and price. This is the reason why specialists from each of the above fields join the design team.

One problem of their collaboration is the language used. It is known very well that specialists of a single field tend to develop a very particular language, known as professional jargon. But to be able to communicate efficiently, all the specialists that compose the design team should speak the same common language free of professional jargon terms. This is one aspect that will be dealt later in the present paper.

Another aspect that will be studied in this paper is a particular product aesthetics dimension, respectively the familiarity-novelty ratio. The latent conservatism of the general public rejects the products that have a total innovative design. On the other hand, if all the products will look the same as the prototype of product class, the market will offer just banal and boring products for decades. It is obvious that the products should include both elements (novel and familiar) in their design. But how many novelty elements and how many familiar elements? The famous American designer Raymond Loewy translated this need for balance between new and old in the MAYA concept. MAYA stands for “Most Advanced, Yet Acceptable” – a product should be as advanced in its industrial design as the market accepts [1]. The value of this concept is demonstrated by the fact it is often quoted in the scientific papers of the last decade.

It is evident that the industrial designer should seek the best balance of familiar and novel elements for the product he/she is developing. Several empirical and experimental researches tackled this problem.

Whitfield and Slatter formulated the preference for prototype theory. They called prototypes the classical and fundamental products. Their theory stipulates that people’s aesthetic preference for an object increases proportionally with the deepening of object’s prototypal character. [2]

On the contrary, Veryzer and Hutchinson discovered that the relationship between prototypicality and aesthetic preference is negative linear [3]. Avoiding terms used by other researchers, Radford and Bloch investigated the influence of “newness” on affective reactions in product world. They established that newness in high levels triggered high positive affective reactions in human beings and newness in low levels – low positive reactions. [4]

An interesting discovery was made by Leder and Carbon when studying the aesthetic preference in the matter of car interiors. The subjects changed their preference for classical interiors to innovative ones after repeated exposures. [5]

But not always typicality is a relevant characteristic in product preference. Ward and Loken established that typicality is not influencing people’s preference when it comes to products from
prestige, exclusivity and distinctiveness area. People choose rather novel-looking products [6]. Other researches revealed that products’ aesthetic value is significantly influenced by the cumulative action of prototypicality and innovation rather than by the action of the two factors considered individually and in isolation. [7]

Probably the most famous model of familiarity-novelty influence on product aesthetic preference is that proposed by Berlyne decades ago. This model hypothesises that products with a relatively mean level of novelty are the favourite over those with a very high level of novelty or a very high level of familiarity. The graphical expression of this model is an inverted U-shape curve [8].

Some researches confirmed the Berlyne’s model [9, 10, 11]. Also, Hung and Chen discovered, during their research focused on 88 chairs, that this model is true [12]. However, other researches challenged the Berlyne’s model [13].

2 A Problem of Terminology

As it can be observed, the topic of novelty-familiarity ratio involves some terms that require further explanations. They are analysed below.

Typicality, sometimes prototypicality, designates the degree to which a product can stand for a whole class of products [3, 7, 14]. The antonym of typicality is novelty. Berlyne identified two sorts of novelty: absolute novelty (a product that has never been seen before) and relative novelty (a product with elements seen before) [15].

Typicality can be expressed in different ways. For example, in some researches, typicality was substituted by goodness of example [7, 16]. Considering the sources, Barsalou proposed three determinants: similarity to the ideal of the product class; similarity to the central tendency of the product class, and frequency of instantiation (frequency of appearance of product as a representative of the class) [16].

Both prototypicality and innovativeness are two terms that are complicated to operate due to the fact that the public understands with difficulty their true nature. That leads to two types of problems. First, there will be problems in the communication within the design team. Second, common people involved in the customer research will not fully understand the issue.

Therefore, it is necessary that the terms should be replaced by other terms with a clearer meaning. This is one of the aims of the present research: to determine which is the best pair of terms to substitute (proto)typicality and innovativeness.

For each of these two terms, several variants exist, as follows:

- **Typicality:**
  - Familiarity;
  - Representative character;
  - Central tendency.

- **Innovativeness:**
  - Novelty;
  - Originality;
  - Unusualness.

**Familiarity** describes how accustomed is the viewer with the product’s aesthetic features. Familiarity indicates the extent to which the viewer has expected to see these aesthetic features in a particular product. Familiarity’s extreme values are: familiar and unexpected.

The **representative character** expresses the extent to which the analysed product can be considered representative for its class. The representative character indicates the goodness of example, respectively how good is the considered product in describing its class of products. The extreme values of representative character are: exemplary and atypical.

The **central tendency** indicates the degree in which the analysed product holds a central position in its class of products, respectively displays a medium resemblance to the other products of its class. The extreme values of central tendency are: central and peripheral.

**Novelty** expresses the degree in which the analysed product distinguishes itself from the traditional features of its class of products. Novelty’s extreme values are: innovative and old-fashioned.

**Originality** indicates the product’s property of being capable to be distinct. The originality refers to the fact that the product’s aesthetic features were not copied from another product. The extreme values of originality are: original and copied.

**Unusualness** refers to the product’s property to distance aesthetically from the mundane product. The extreme values of unusualness are: unusual and banal.

So, the antagonistic terms were grouped in pairs. They will be investigated during the present research:

- familiar – unexpected;
- exemplary – atypical;
- central – peripheral;
- old-fashioned - innovative;
- copied – original;
- banal – unusual.
3 A Problem of Usability

Regardless the model (linear or inverted U-shaped), all researches indicated that the familiarity-novelty ratio is a determinant of aesthetic preference for products. In order to be useful for the industrial designer, some aspects of the familiarity-novelty ratio should be clarified.

First, is the familiarity-novelty ratio active for all classes of products? Do exist classes of products that are not aesthetically influenced by familiar features or novelty features or a combination of these two types?

Second, is there a certain value (with a degree of approximation) for the familiarity-novelty ratio that ensures maximum aesthetic success for all the classes of products? Or each class of products has its own successful value for the familiarity-novelty ratio? If yes, which is this value?

Third, which model is the true one? If the linear model is the true one, some questions will receive a quick answer. If the inverted U-shaped model is that one true, more researches will be needed.

These three aspects and the problem of the efficient pair of terms were targeted when an experiment was designed by the author of the present paper. The experiment design is presented below.

4 Experiment Design

The author of the present paper designed an experiment with three aims:

1. establish the best pair of terms to be used when describing the familiarity-novelty ratio;
2. identification of differences in the action of familiarity-novelty ratio in the case of different classes of products;
3. discovery of evidence in favour of one model (linear or inverted U-shaped).

The subjects of the experiment were four (very different) classes of products:

- sofas;
- rolling luggage;
- toasters;
- personal computers.

From hundred of product photos, only four photos were selected for each class of products. In each class, the selected photos indicated different familiarity-novelty ratios. The selected photos were assembled in a digital presentation, each class having dedicated one slide. The order of photos in each slide was completely random, avoiding any linear increase or decrease of the ratio. The selected photos (P1-P16) are displayed in Fig. 1 – 4.
The next phase of experiment design was the establishment of the experimental methodology. The experimental methodology consisted in the following steps:

1. The coordinator of the experiment explains to participants the concept of familiarity-novelty ratio and the significance of all the associated terms (see the end of paragraph 2). No conceptual model is presented.

2. Each participant examines carefully each slide of the digital presentation (containing each 4 product photos).

3. Each participant evaluates on a 5 point Likert scale the familiarity-novelty ratio for each product, using different pair of terms as criterion. Value “1” is assigned to the left term and value “5” – right term. (Some pairs of terms were inverted to avoid copying the results.)

4. Each participant evaluates on a 5 point Likert scale the aesthetics of each product, using the pair “beautiful-ugly” as criterion. Participants are instructed to think at beauty in terms of personal choice rather than impersonal aesthetic assessment.

5 Results of Experiment

The experiment was performed using 219 participants. All participants were young (22-24 years old). The gender distribution of the sample was as follows: 110 female and 109 male. All experiment sessions were supervised by the author of the present paper, so uniform conditions for explanations and knowledge support were ensured during experiment.

Each participant noted down his/her evaluation marks on a printed form. All the forms were collected and the raw results were recorded on a computer spreadsheet (one worksheet for each pair of terms).

There were calculated the variance and the mean for each product and pair of terms. The variance spanned from 0.69 to 1.76. The narrowest interval for variance was for “old-fashion – innovative” (minimum 0.89 and maximum 1.66). The widest interval for variance was for “central - peripheral” (minimum 0.92 and maximum 2.35). This indicates that the results for “old-fashion – innovative” are much concentrated around the mean and the results for “central - peripheral” are more dispersed around the mean.

<table>
<thead>
<tr>
<th>Mean</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>P7</th>
<th>P8</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2.00</td>
<td>1.70</td>
<td>4.15</td>
<td>4.10</td>
<td>1.67</td>
<td>2.55</td>
<td>2.22</td>
<td>2.90</td>
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<td>2.08</td>
<td>1.71</td>
<td>4.14</td>
<td>3.91</td>
<td>1.83</td>
<td>2.69</td>
<td>2.17</td>
<td>2.71</td>
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<tr>
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<td>1.78</td>
<td>3.77</td>
<td>3.77</td>
<td>1.97</td>
<td>2.75</td>
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<td>Old-fashion – innovative (1 – 5)</td>
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<td>1.50</td>
<td>3.09</td>
<td>3.39</td>
<td>1.41</td>
<td>1.63</td>
<td>2.48</td>
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<td>1.45</td>
<td>1.48</td>
<td>2.98</td>
<td>3.46</td>
<td>1.63</td>
<td>1.64</td>
<td>2.48</td>
<td>2.73</td>
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<tr>
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<td>1.06</td>
<td>3.22</td>
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<td>1.07</td>
<td>1.56</td>
<td>1.75</td>
<td>2.32</td>
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<tr>
<td>Beautiful-ugly (1 – 5)</td>
<td>2.58</td>
<td>3.62</td>
<td>3.07</td>
<td>3.88</td>
<td>3.05</td>
<td>2.57</td>
<td>3.16</td>
<td>4.02</td>
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<table>
<thead>
<tr>
<th>Mean</th>
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<th>P10</th>
<th>P11</th>
<th>P12</th>
<th>P13</th>
<th>P14</th>
<th>P15</th>
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<tbody>
<tr>
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<td>3.40</td>
<td>3.11</td>
<td>4.51</td>
<td>1.43</td>
<td>1.37</td>
<td>1.71</td>
<td>3.03</td>
<td>4.17</td>
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<td>4.24</td>
<td>1.64</td>
<td>1.83</td>
<td>1.88</td>
<td>3.06</td>
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<tr>
<td>Central – peripheral (1 – 5)</td>
<td>2.97</td>
<td>2.91</td>
<td>4.02</td>
<td>1.94</td>
<td>2.12</td>
<td>1.99</td>
<td>3.03</td>
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<td>1.96</td>
<td>3.63</td>
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<td>0.19</td>
<td>1.57</td>
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<td>2.04</td>
<td>3.64</td>
<td>1.07</td>
<td>1.09</td>
<td>1.55</td>
<td>2.46</td>
<td>3.48</td>
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<tr>
<td>Banal – unusual (1 – 5)</td>
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<td>2.17</td>
<td>3.69</td>
<td>0.60</td>
<td>0.32</td>
<td>1.24</td>
<td>2.43</td>
<td>3.52</td>
</tr>
<tr>
<td>Beautiful-ugly (1 – 5)</td>
<td>3.14</td>
<td>2.55</td>
<td>4.15</td>
<td>3.08</td>
<td>1.68</td>
<td>3.14</td>
<td>3.42</td>
<td>4.59</td>
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</tbody>
</table>
Table 2. Correlation coefficients across the classes

<table>
<thead>
<tr>
<th>Correlation coefficient</th>
<th>Familiar – unexpected</th>
<th>Exemplary – atypical</th>
<th>Central – peripheral</th>
<th>Old-fashion – innovative</th>
<th>Copied – original</th>
<th>Banal – unusual</th>
</tr>
</thead>
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<tr>
<td>0.60</td>
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<td></td>
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<td></td>
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<tr>
<td>0.50</td>
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<td>0.51</td>
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<tr>
<td>0.78</td>
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<td>0.74</td>
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<tr>
<td>0.69</td>
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</tbody>
</table>

This is a clue that the “old-fashion – innovative” pair of terms is better understood by participants than the “central - peripheral” pair. Also, “copied-original” pair scored well.

The means are displayed in Table 1. Even some values in Table 1 can indicate some degree of correlation between the familiarity-novelty ratio and aesthetic preference, there was used a standard statistical indicator to determine if there exists a correlation. This indicator was the correlation coefficient. Considering all 16 products as a whole, the correlation coefficients for each of the pairs expressing the familiarity-novelty ratio against the beautiful-ugly criterion are indicated in Table 2.

So, all the pairs of terms indicate a correlation (in a variable degree) with the product aesthetics. But, two pairs scored considerably: “old-fashion - innovative” and “copied - original” with coefficients exceeding 0.7. Even so, no correlation coefficient scored more than 0.9, so the correlation between the familiarity-novelty ratio and product aesthetics cannot be considered as determined – it is strong for the best pairs.

In this situation, a certain question arises: Is all the data consistent? This question lead to the formulation of the null hypothesis: All the experimental data is consistent. A single factor ANOVA was applied and the result was:

\[ F(15,113) = 2.09 < F_{cr} = 2.35 \]  \( (1) \)

The calculation failed to reject the null hypothesis, so all the data is consistent. In order to detect the differences in the action of familiarity-novelty ratio in the case of different classes of products, there were calculated the correlation coefficients for all the four classes involved in experiment. The results are displayed in Table 3.

From the results presented in Table 3, it can be observed that the correlation between familiarity-novelty ratio and product aesthetic is rather weak for sofas, medium for rolling luggage, medium for toasters and quite determined for personal computers. So, the first conclusion for this part of the experiment is that a considerable difference exists between different classes of products in relation to the analysed issue.

Table 3. Correlation coefficients by classes

<table>
<thead>
<tr>
<th>Correlation coefficient</th>
<th>Sofas</th>
<th>Luggage</th>
<th>Toasters</th>
<th>Computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familiar – unexpected</td>
<td>0.30</td>
<td>0.46</td>
<td>0.59</td>
<td>0.91</td>
</tr>
<tr>
<td>Exemplary – atypical</td>
<td>0.24</td>
<td>0.21</td>
<td>0.58</td>
<td>0.86</td>
</tr>
<tr>
<td>Central – peripheral</td>
<td>0.27</td>
<td>0.24</td>
<td>0.68</td>
<td>0.82</td>
</tr>
<tr>
<td>Old-fashion - innovative</td>
<td>0.37</td>
<td>0.76</td>
<td>0.73</td>
<td>0.99</td>
</tr>
<tr>
<td>Copied – original</td>
<td>0.49</td>
<td>0.84</td>
<td>0.73</td>
<td>0.94</td>
</tr>
<tr>
<td>Banal – unusual</td>
<td>0.40</td>
<td>0.74</td>
<td>0.60</td>
<td>0.96</td>
</tr>
</tbody>
</table>

Because there is a determined correlation just in the case of computers, the data was plotted first for computers. It resulted a series of plots close to the shape a line. In Fig. 5, it is displayed the actual curve drawn between the points for the correlation between “old fashion - innovative” and “beautiful - ugly” parameters. The associated line has the equation:

\[ y = 0.83 \times x + 1.6 \]  \( (2) \)

The associated \( t Stat \) for this set of data is 9.8 that means the equation coefficients are highly significant. Also, the data was plotted for sofas, rolling luggage and toaster. None plot resembled a line nor an inverted U. The plots were like a sinusoid (sofas) or an U (rolling luggage and toasters).

Fig. 5. Correlation between old fashion – innovative ratio and product aesthetics
6 Conclusions
The first issue investigated during experiment was the identification of the best pair of terms to be used for familiar-novelty ratio. It was found out that “old fashion – innovative” is the best pair of terms and it is recommended to be used in the communication within the design team and, also, in the interaction with common people during customer research.

The second issue was the detection of possible differences between the classes of products regarding the influence of familiar-novelty ratio on the product aesthetics. Using the correlation method, it was discovered that such differences do exists. The correlation is determined in the case of computers, medium for rolling luggage and toasters, and rather weak for sofas.

The third issue was the finding of some evidence in favour of a model (linear or inverted U-shaped). Even the correlation was not significant for sofas, rolling luggage and toasters, plots were drawn, but their shape did not resembled to a line nor an inverted U. In the case of computers, it was discovered that the linear model is highly significant.

Regarding the practical consequence of the above findings, it can be concluded that in the case of computers designer should seek to include as many visual innovative elements as possible and neglect visual traditional elements. This recommendation can be extended to all electronic products and to all products that use high technology.

The present research focused on the youth segment. Further researches should investigate if the market segmentation influences significantly the perception of familiar-novelty ratio.

References: