Correlation between market segmentation, industrial product features and context in design assessment

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Abstract. When referring to product design assessment, even with a standard evaluation format, the perspective from which the criteria are approached differs strongly from one market category to another, this having a direct impact on the accuracy of the method. In order to achieve an objective assessment, the product must relate to a frame of reference in accordance with the product’s destination, taking into account the user specifications and the actual experience of use. This paper represents the study of correlations between the market segment, product features and context and their degree of interdependence. Thus, analysing the relations between sections, the representative influence formulas for each considered feature were deduced, highlighting the extent to which the user’s typology and context relate to the product features.

1. Introduction
When addressing design assessment one of the major concerns is the extent to which the assessment can be considered objective. There is the question if the assessment can be approached from an unbiased perspective or is it possible that the method could be quantified and related to a proposed standard assessment system so that the results are as relevant as possible.

Based on a study of the subjectivity of design history Lees-Maffei and Fallan [1] identified the personal influence as a significant factor in design. The debates are even greater when the strong association between design and aesthetics is made. Atalay [2], studying Kant's approach to the theory of aesthetics, addressed the concept of subjectivity and demonstrated at the same time the existence of a component of universal validity. Considering the interpersonal validity, Travainini [3] also talks about a shared criteria of correctness, component of analysis similar to Cheng [4] which recommends criteria-marking scheme in order to make the transition from subjectivity to objectivity in design assessment.

The doubt of subjectivity cannot be completely removed but it can be controlled, as Ulrich and Eppinger [5] state that design is subjective but at the same time, you can determine qualitatively if the design has achieved its objectives. Thus, it remains the obligation of the assessor to fully research the entire context of the product and analyse based on criteria that relate to generally valid standards. A systematic approach that provides quantitative results can be achieved, but the relevance of the results depends on the insight on the correlation between the product and the purpose for which it was designed, the objectivity of the assessment being influenced by the in-depth knowledge of the consumer's profile and the extent to which it is taken into account, since the degree of objectivity can be increased by establishing a more precise structure as a frame of reference.
The consumer behaviour has often played a central role in marketing, the consumer being seen as decision maker [6] for which strategies have been developed to ensure that the product is designed to meet its requirements as its influence determines the marketing strategies [7][8], although there is also the possibility in which marketing ends up influencing the buyer behaviour [9].

In regards to the consumer and its correlation with the purchase decision, Lancaster [10] finds that the features of the product that influence utility are taken into account and not the product in fact. In this case, what can determine a certain feature and what it relates to, as the buyer may not be the actual user of the product and the role of the customer being different from that of the consumer [11]. For example, in the case of a toy intended for infants, the sizing of the product has to take into account the sizing restriction of the user, but in terms of colour scheme, although it must be appropriate for the user, it also influences the buyer (in most cases the parent, or an adult in question) and in the end, affects the purchase decision. Market segmentation can be somehow conditioned by the customer, however, it is the role of the designer to take into account the distinction between the two and to include as much as possible features that satisfy both categories, starting from the user especially if it is the case when a certain feature of the product may affect safety.

2. Sections of analysis – market segment, product features and context

The present paper is meant to study the relations between the user and the product, how product features can be influenced and also the way in which one feature can influence the other and how all this correlates, as the assessment must relate to product typology in accordance with its purpose, being considered all relevant parameters involved in the final design of the product.

2.1 Market segmentation

In order to best meet consumer requirements, market segmentation is used to facilitate the development of customized products for a particular category of consumers. The most common market segmentation categories are demographic such as age or gender, geographic with direct reference to location, psychographic which involves personality traits and what derives from it and behavioural segmentation based on purchase behaviour such as usage rate [12][13][14]. As pointed out by Dolnicar et al. [14], there is no ideal market segment but the most suitable for the given situation, although as proven before certain demographic variable are more significant than others [15]. Thus in the present paper, it was considered the market segmentation with the highest correlation with the product features. Were selected the segment criteria that can be applicable on an extended range of product types and having major impact, demographic such as age, gender, educational level, income and also culture, as a form of geographical and psychographic segmentation related to location with implications in product symbolism.

The product assessment determines whether the product itself is suitable, however, reporting to a proposed market segment is not just a simple reference of the product to one criterion since the segment criteria are also correlated and can influence each other. For instance, the buying habit differs depending on the income level [16], income being a complex variable in market segmentation and it relates also with education [17][18] and with the consumer’s location, as developed countries also imply a better standard of living and wealth. Income is also linked to a number of inequalities, such as that in relation to age [19] or the controversial gender pay gap [20]. The relation between gender and education [21] or gender and income highlights the difference between consumer and buyer, although women’s incomes are overall lower, they are most often the decision makers when it comes to purchases [22] and it gets even more intricate when it comes to gender in relation to product features. As products with masculine traits are supported to the detriment of feminine ones, men are rejecting the idea of feminine products while women tend to accept products with masculine details [23]. An alternative to the ambiguity of gender traits could be set by the designer itself who would have the power to reduce stereotypes by creating genderless design [24], all the more so as the perception of gender related details tend to become an ever-changing factor.
2.2 Product features

Product features are elements of design and represent the characteristics that define the product, also referred to as products’ physical properties [25], aesthetic attributes [26] or even principles of product semantics [27] and generally include colour, line, shape, form, weight, texture etc. as descriptive elements that, altogether, define the product. As a frame of reference in this study, the products’ features have been narrowed to four major categories that integrate all relevant characteristics into a compact structure as colour (hue, brightness, saturation etc.), shape (line, contour, form etc.), material (texture, surface etc.) and dimension (size, weight, volume etc.).

The correlations between features are complex, although sometimes obvious when they influence each other directly such as the material in its natural form is already defined by a chromatic scheme or if the weight of the material changes implicitly the weight of the product will change, or the case of shape limitation for material because of geometry restrictions. As it can be seen in Table 1, some correlations are more difficult to detect, especially the perceptual ones in which the way a feature is perceived changes depending on the influence of another one, for example, changing a parameter such as shape can influence the perception on product dimension [28][29].

In the table below are analysed the four proposed features and the type of influence relations between them, that can be both physical and direct or perceptual and indirect and each of these may have a different degree of impact on their relation of interdependence.

| Prior research | Statements and findings | Type of influence | Direction of influence | Considered features |
|----------------|-------------------------|-------------------|------------------------|--------------------|
| Bloj M G, Kersten D and Hurlbert A C [30] | The degree of illumination of three-dimensional shapes influence the perception of colour. | perceptual | ← | Colour Shape |
| Kingdom F A A, Wong K, Yoonessi A et al. [31] | Colour contrast has an impact on the perceived shape and texture. | perceptual | → | |
| Frayman B J and Dawson W E [28] | The shape of an object and the way it is presented influence the perception of apparent volume. | perceptual | → | Shape Dimension |
| Sevilla G and Kahn B E [29] | The complete or incomplete shape of a product has an influence on the perception of sizing. | perceptual | → | |
| Hodgson S N B and Harper J F [32] | The materials may have constraints related to size, shape or geometry. | physical | ← | Dimension Material |
| Miltenović A, Banić M, Miltenović V [33] | The material used for lightweight design must take into account the constraints related to stiffness and strength. | perceptual | → | Material Colour |
| Fleming R W [34] | The surface glossiness of the material affects the perception on size. | perceptual | ← | |
| Kesteren I E H, Stappers, P J and Brujin J C M [35] | Colour is considered one of the sensory properties in relation to the emotional experience with the material. | physical | → | |
| Piselli A, Colombo S, Faucheau J et al. [36] | The sensory properties of smart materials can affect the sensory language of the product represented in this case by colour, shape and texture. | perceptual | → | Material Colour |
| Granzer J J M, Vergne R and Gegenfurtner K R [37] | The roughness and glossiness of the material have effect on colour perception. | perceptual | ← | |
Table 1. Influence relations between features (b)

| Reference          | Description                                                                 | Direction       | Relation |
|--------------------|-----------------------------------------------------------------------------|-----------------|----------|
| Oyama T and Nanri R [38] | The hue and brightness of the colour affects the perception on size.        | perceptual      | → Colour Dimension |
| Hagtvedt H and Brasel S A [39] | Colour saturation influences the product size perception.                  |                  |           |
| Weaver P M and Ashby M [40] | The material and the shape are connected as the shape in which a material can be formed is limited by the material itself. | physical      | ←          |
| Hodgson S N B and Harper J F [32] | Materials may have constraints related to size, shape or geometry.        |                  |           |
| Vangorp P, Laurijssen J and Dutre P [41] | The material can be affected by the perception of shape or illumination. | perceptual      | →          |

As it can be seen in Table 1, it is relevant not only the type but the direction of influence. Therefore, as presented in Figure 1, all the features are related more or less with each other and even the direction may differ. For example, the relation between material and dimension, as seen before, they are correlated but changing the product’s dimension it won’t change its material, it is a physical influence in one direction, material to dimension [32][33], however, there is as well a perceptual influence because the material can be defined by a certain colour and implicitly hue, or shine and glossiness etc. and its perception has an influence on product dimension [34].

![Figure 1. Direction and type of influence between product features.](image)

Considering the relations between product features, there are connections that although do not have a component of influence, there is to be considered the possibility of perceptual interdependence, for example, certain shapes are correlated with different meanings for the materials [42], affective association with a colour differs when it is perceived on different materials [43] and also, there are several recent studies [44] [45] [46] that while contradict Kandinsky [47] in shape-colour associations, they have some common points. In this case it is not highlighted on how changing the shape parameters can influence the perception of colour or vice versa, however, there are preference associations with a higher degree of occurrence, for example the association between circular shapes and the colours red or yellow.

Whether it is a simple link of preference or they even have a direct impact on the product itself, it is important to understand the correlations between features, as they play a major role in product design and the assessment phase and improvement of the product. The assessment highlights which feature needs improvement but if either one in question is modified, the change itself may affect another feature and eventually the entire product, being necessary to acknowledge the relations between them in order to obtain the desired product.
2.3 Product and context of use

Design, furthermore than relating a product to a specific consumer profile considering technical or ergonomic restrictions, it exceeds them and incorporates aesthetic and symbolism elements, therefore the culture through its implications becomes an integral part of the product details and their significance. The cultural meaning of goods [48] is reflected both by symbolism in the relation to the consumer tradition as a part of the market segment and also in the cultural context of the product that involves a historical analysis and past references [49] that provide insights in the way it and its features evolved over time, understanding the specific trends and as well as the evolution of attributes through brand identity and differentiation [50].

The context and the extent to which it is attractive also has the power to change the perception of product quality [51] and ensure the effect on the purchase decision. Above that, in the development stage, the product usability [52] must be fully understood and the product, through its attributes, must take into account the circumstances of use. In addition, there is the situation in which it is evaluated the way the product integrates in the environment and by technotope analysis it is studied the relation of coexistence between the product and the environment [53]. Thus, in this paper, as presented in Figure 2, the context was proposed as a third category of relational analysis and includes a historical branch with the product’s cultural implications and its evolution in time and a secondary one with reference to the environment and how the product is correlated to its context of use.

3. Study of correlations between sections

The elements of each proposed section were presented in Figure 2, alongside with the specific correspondent, section A for the user (market segment), B for the product features (these having a central role in the relation between the other two sections) and section C for context.

![Figure 2. Proposed analysis sections.](image)

In the previous chapter it was established how the elements impact each other within the same section. In order to determine how the product features are related to the market segment or context and to establish the existing connections, in Table 2 are presented previous studies that analyse the relations between sections. The correlations are intricate and the absence of a mention does not represent the absence of the corresponding connection, they just are not part of the prior research in question, as the studies do not contradict but approach the subject from different perspectives.
Table 2. Correlations between sections (a)

| Prior research | Statements and findings | A. Market segment | B. Product feature | C. Context |
|----------------|-------------------------|------------------|-------------------|------------|
| Therrell J A [54] | The product features must be age-appropriate from the perspective of size, shape, material and colour. | A1 | B1, B2, B3, B4 | |
| Holbrook M B and Schindler R M [55] | The customer preferences are defined by nostalgic influences related to age and time frame. | A1 | | C1 |
| Lesot M J, Bouchard C, Detyniecki M, et. al. [56] | The shape has meaning associations in relation to femininity and masculinity. | A2 | B2 | |
| Jadva V, Hines M and Golombok S [57] | There are associations between the child's gender and product colour or shape preferences. | A2 | B1, B2 | |
| Tilburg M and Lieven T [58] | Product gender can be considered from the perspective of colour, shape, material and size. | A2 | B1, B2, B3, B4 | |
| Kessous A and Roux E [59] | As a link between age and tradition, nostalgia in approaching products is described as a connection to the past. | A1, A5 | | C1 |
| Sliburyte L and Skeryte I [60] | Colour perception differs depending on demographic factors such as age, gender and education. | A1, A2, A3 | B1 | |
| Arabi A [61] | Consumer behaviour through the influences of age, gender and culture shows variations in colour selection. | A1, A2, A5 | B1 | |
| Westland S and Shin M J [62] | Colour preferences vary depending on gender and age, ethnicity being also relevant. | A1, A2, A5 | B1 | |
| Tilley A R [63] | Age, gender and ethnicity are relevant in reporting to product size. Their relation to the environmental context must take into account also the scale, movement, contrast and colour. | A1, A2, A5 | B1, B2, B4 | C2 |
| Karana E, Hekkert P and Kandachar P [64] | In the selection of the material (through its shape, meaning and other properties) both the typology of the user and the context of use must be considered. | A1, A2, A3, A5 | B2, B3 | C2 |
| Panero J and Zelnik M [65] | Anthropometry is influenced by age, gender, culture and socioeconomic status. Also, the dimensions are related to the type of activity of the context of use. | A1, A2, A3, A4, A5 | B4 | C2 |
| Crilly N, Moultie J and Clarkson P J [66] | The personal characteristics and the culture of the consumer are related to the visual attributes and the context of use of the product. | A1, A2, A5 | B1, B2, B3, B4 | C2 |
| Choate J M [67] | There are correlations between age, education, culture and socio-economic status in relation to colour preferences. | A1, A3, A4, A5 | B1 | |
| Bloch P H [68] | The consumer characteristics and the cultural traits have influence on the products’ form (described as shape, scale, material, colour etc.). | A1, A2, A3, A4, A5 | B4, B5, B3, B4 | |
| Zuo H, Hope T, Castle P et. al. [69] | In approaching the material, both the category of subjects and the environmental context are taken into account. | A1, A2, A3, A4, A5 | B3 | C2 |
| Viková M, Vik M and Kania E [70] | Colour preferences vary and are influenced by cultural references. | A5 | B1 | |
| Bluntzerza J B, Ostrosib E, Sagot J C [71] | There are correlations between the shape of cars and the cultural identity of a country. | A5 | B2 | |
The relations between the sections were structured and displayed in the proposed correlation matrix (Figure 3), in which was presented the graphic and numerical notation of the sections’ relations. The connections were noted according to the degree of interdependence, where a relation of rank 3 is considered of high impact, rank 2 of medium impact and rank 1 for minimum impact, being also the possibility of no correlation. The missing link is between age and gender, although there is a well-known gender difference in life expectancy, it cannot be determined a direct connection between gender and age relevant to the proposed subject.

![Correlation Matrix](image)

**Figure 3.** Correlation matrix between the three sections (graphic and numerical version).

When analysing the matrix, it can be seen that although two elements are defined by the maximum correlation, each in turn can be strongly influenced by another element, for instance, the connection between the product dimension and user age, as the age also has a rank 3 link to the context of use, both through the environment that is specific to it and through the temporal affinity influences that can be found in the product details, since it is a strong connection between the user age and historical frame.

### Table 2. Correlations between sections (b)

| Source | Description | A₁ | B₁ | B₂ | B₃ | C₁ | C₂ |
|--------|-------------|----|----|----|----|----|----|
| Zhang Y, Feick L and Price L J [72] | Preferences for angular versus rounded shapes differ in relation to cultural influences. | A₅ | B₂ |
| Karana E [73] | The meaning of the material, even by the form in which it is presented, is influenced both by culture and history. | A₅ | B₂, B₃ | C₁ |
| Xue H and Woolley M [74] | Through cultural nostalgia, the designer has the opportunity to use product attributes traced in the past in order to evoke familiarity. | A₅ | C₁ |
| Wastie I and Wouters I [75] | In the selection of the material in architecture, are relevant both the material’s physical properties and the processes involved as well as the meaning of the cultural and use context. | A₅ | B₃ | C₁, C₂ |
| Dumitrescu A, Ulmeau M E and Crăciun A E [53] | Colour is a relevant factor in the harmonious relation between the product and its context of use. | B₁ | C₂ |
| Brooker G and Stone S [76] | The elements of form and structure of the interior space are associated in relation with the history and context of the environment. | B₂ | C₁, C₂ |
| Tseng Y S and Ho M C [77] | Integrating product elements that invoke the past is a design strategy meant to generate emotional response from the consumer. | B₁, B₃ | C₁ |

The meaning of the material, even by the form in which it is presented, is influenced both by culture and history. The missing link is between age and gender, although there is a well-known gender difference in life expectancy, it cannot be determined a direct connection between gender and age relevant to the proposed subject.

When analysing the matrix, it can be seen that although two elements are defined by the maximum correlation, each in turn can be strongly influenced by another element, for instance, the connection between the product dimension and user age, as the age also has a rank 3 link to the context of use, both through the environment that is specific to it and through the temporal affinity influences that can be found in the product details, since it is a strong connection between the user age and historical frame.
4. Product features in relation to the market segment and context
In order to deduce the implications and the way the product features are influenced, following the interpretation of the matrix (Figure 3) and the influence relation between features (Figure 1), the representative formulas for each feature were concluded as follow, equation (1) for colour, equation (2) for shape, equation (3) for material and equation (4) for dimension, as the corresponding indices are presented in Figure 2.

For each feature, the first relation represents its relation to the market segment and context, meaning the elements on which it is conditioned in its analysis, and the second one represents the correlation of influence within the same section and how it can affect another feature or can be affected in turn. In which case, it was noted with minus if it has influence on another feature (implicitly the other feature is influenced by it), with plus if it is influenced by another feature or plus and minus if it is bidirectional in the relation of influence.

4.1 Colour
The colour is primarily correlated with gender-specific associations [57][58][60][61][62][66][68], cultural meaning [61][62][63][66][67][68][70] and also environment [53][63][66] as the colour of the product is related to the context. Secondary, colour schemes should be age appropriate [54][60][61][62][63][66][67][68], not necessarily as a restriction as there are chromatic preferences depending on the age segment. Additionally, colour is related with the educational level [60][67][68] and history [77] as some shades are specific for certain historical periods, for instance, as art-deco is associated with golden metallic details. Although with less importance, the income [67][68] is also related to colour with associations regarding socio-economic status.

In its relation with the other features, the colour can be generated directly by the natural shade of the material [35][36][37], association that can be excluded if artificial dyes are used to cover the surfaces. In terms of connection with shape, the colour may influence [31] or be influenced by it [30] as it may affect also the perception on size [38][39], for instance, the light-coloured details seem larger and the dark ones seem smaller by comparison.

\[
B_1 = \begin{cases} 
3(A_2 + A_5 + C_2) + 2(A_4 + A_3 + C_1) + 1A_4 \\
\frac{3}{2}B_3 \pm 1B_2 - 1B_4
\end{cases} \quad (1)
\]

4.2 Shape
The shape of the product is firstly related to gender [56][57][58][63][64][66][68], there are gender preferences and among others, rounded shapes are associated with femininity and those defined by straight lines with masculinity. Secondary, the shape is related to ergonomic limitations bound to age [54][63][64][66][68] or ease of use and also cultural symbolism [63][64][66][68][71][72][73] and historical associations [73][76][77] most often given by design trends. Lastly, there are shape preferences according to the consumer’s socio-economic status [64][68] and also associations between shape and environment [63][64][66][76] all the more so from an architectural point of view.

Physically, shape has technical limitations in relation to the material [32][40] and it can as well affect the perception of it and its reflectance [41]. Furthermore, the perception on shape can be influenced by colour [31] and it can influence it [30] as well as the dimension [28][29].

\[
B_2 = \begin{cases} 
3A_2 + 2(A_1 + A_5 + C_1) + 1(A_3 + A_4 + C_2) \\
\pm 2B_3 \pm 1B_1 - B_4
\end{cases} \quad (2)
\]

4.3 Material
Material is strongly related to cultural symbolism [64][66][68][69][73][75] and the product’s historical [73][75][77] evolutionary analysis. Of medium rank, is the relation with education [64][68][69] and associated preferences and also income [68][69] (for example, the price for the same product can differ with different materials, that could be the case for jewellery, textile products etc.) and finally context,
since the product material should be adapted to the environment [64][66][69][75] both by colour and texture. Furthermore, although it is less important in this situation, similar to the shape case, the material too must be age-appropriate [54][64][66][68][69] especially if it involves safety in use. As far as gender [58][64][66][68][69] is linked to material, there are specific associations, as is the case with metallic products that are considered masculine.

In relation to the other features, as mentioned, material can define the colour of the product [35][36][37], may physically limit the form [32][40] and be perceptually influenced by it [41], however in its relation to dimension [32][33][34], the material determines the entire weight of the product, which has a direct impact, but does not directly affect its size.

\[
B_3 = \begin{cases} 
3(A_5 + C_1) + 2(A_3 + A_4 + C_2) + 1(A_1 + A_2) \\
-3B_1 \pm 2B_2 - 2B_4
\end{cases}
\]  

(3)

4.4 Dimension

The product dimension has an important relation with age [54][66][68] and implicitly with anthropometric limitation [63][65]. In the case of other ergonomic recommendations, gender [58][63][65][66][68] is relevant too in association to dimension. Regarding the size of the product and context, it’s recommended that the product is scaled to the dimension of the room or any other environment of use [63][65][66]. In its relation to education and income, there are associations with socio-economic status [65][68] and it’s not necessarily a good or a bad thing depending on the situation. Additionally, there is a link between the size of the product and socio-cultural meaning [63][65][66][68] as well as historical research that is relevant in fully understanding the way the product changed over time and evolved both technologically and through its aesthetic attributes, in this case the relation in time with the product size.

Within the same section, dimension is influenced through its weight [32][33] and size perception [34] by the material. In addition, as previously presented, the perception on product size differs also due to colour [38][39] or shape variations [28][29].

\[
B_4 = \begin{cases} 
3A_1 + 2(A_2 + C_2) + 1(A_3 + A_4 + A_5 + C_1) \\
2B_3 + 1(B_1 + B_2)
\end{cases}
\]  

(4)

Thus, when approaching an industrial product from the perspective of design assessment, for each attribute, it is recommended to consider it depending on the product typology, taking into account, gradually, the degree of interdependence of its relation to the market segment and context.

![Figure 4. Product features in relation to market segment and context.](image_url)
5 Conclusions
Within the paper, the proposed sections and subordinated elements were studied in turn, the market segment (age, gender, education, income and culture), the product features (colour, shape, material and dimension) and the context (history and environment), being analysed both the relations within the same section and the general correlations between them. The results were centralized and presented in the matrix of correlations along with the degree of impact between elements, from which the corresponding formulas for attributes were deduced, being presented the way that a product feature is influenced. Thus, the purpose of this paper is to help designers, either in product development or in assessment both after and before the final production (in the concept phase) by approaching the features based on the hierarchy of influence elements within the market segment and the product’s context of use, being established the extent and the direction in which a feature is affected. Improving the product by modifying a certain feature, the proposed study highlights also what other feature is affected or what can influence it in turn, in order to achieve the desired results.

The presented study is not an actual assessment method and does not approach the industrial products from the perspective of the importance of aesthetics, ergonomics, symbolism etc. [78] However, it takes those principles into account and represents a foundation in design, since the proposed matrix of correlations is set as a frame of reference of the product in relation to its purpose and the perspective of use. As Dumitrescu states, except for functionality, product attributes cannot be considered absolutely positive or negative [79], the design assessment must account for the purpose of the product and the values of the market segment [80].

In regard to the study limitations, were considered the sections elements with major impact in the interdependence relation, thus in order to increase complexity, the market segment can be approached from an elaborate perspective that includes more from the other market segmentation categories with implications in detail in lifestyle or purchase behaviour. Furthermore, although they were implicitly included in the product features, the subordinate features could be studied individually such as considering the texture separately and not as an integral part of the material, as may be the case for brightness or gloss and colour, or other relevant subordinate features.

References
[1] Lees-Maffei G and Fallan K 2014 It's personal: subjectivity in design history Design and Culture 7 pp 5-27
[2] Atalay M 2007 Kant’s aesthetic theory: subjectivity vs. universal validity Percipi 1 pp 44-52
[3] Travanini C 2008 Aesthetic Value Judgements and the Challenge to Objectivity vol 8 ed Dorsch F and Ratuo D E (Fribourg: Proc. of the European Society for Aesthetics) pp 515-526
[4] Cheng L C 2014 From Subjectivity to Objective Evaluation: A Techno-Rationalist Approach of Assessment Design for Art & Design Education (Penang: Int. Colloquium Of Art And Design Ed. Res.) pp 195-200
[5] Ulrich K T and Eppinger S D 2014 Diseño y Desarrollo de Productos (New York: McGraw-Hill, 5th edition) p 223
[6] Solomon M, Bamossy G, Askegaard S and Hogg M 2006 Consumer Behavior, A European Perspective (London: Prentice Hall, 3rd ed.)
[7] Peter J P and Olson J C 2010 Consumer Behavior and Marketing Strategy (Boston: McGraw-Hill/Irwin, 9th edition)
[8] Barmola K and Srivastava 2010 The role of consumer behaviour in present marketing management Productivity 51(3) pp 268-275
[9] Correard S and Amrani H E 2011 The Impact of Marketing on Customer’s Behaviour, Influence or Manipulation? (Halmstad: Dissertation paper Halmstad University)
[10] Lancaster K J 1966 A new approach to consumer theory The J. of P. E. 74(2) pp 132-157
[11] Datta S 2016 Customer vs consumer – a different perspective Int. J. in Mgt. and Soc. Sci. 4(9) pp 109-114
[12] Tyman C A 1987 Marketing segmentation J. of Mktg. Mgt. 2(3) pp 301-335
[13] Martin G 2011 The importance of marketing segmentation Am. J. of Bus. Ed. 4(6) pp 15-18
[14] Dolnicar S, Grün B and Leisch F 2018 Market Segmentation Analysis (Electronic book retrieved from https://www.econstor.eu/bitstream/10419/182365/1/978-981-10-8818-6.pdf) pp 42-45
[15] Patel J and Bansal A 2018 Effect of demographic variables on e-marketing strategies: A review Int. J. of Ac. Res. and Dev. 3(1) pp 311-321
[16] Ramya N and Mohamed S A 2016 Factors affecting consumer buying behavior Int. J. of App. Res. 2(10) pp 76-80
[17] Wolla S A and Sullivan J 2017 Education, income, and wealth Federal Reserve Bank of St. Louis - research.stlouisfed.org
[18] Blanden J and Gregg P 2004 Family income and educational attainment: a review of approaches and evidence for Britain Oxford Rev. of Econ. Pol. 20(2) pp 245-263
[19] Wang C, Wan G, Luo Z and Zhang X 2017 Aging and inequality: the perspective of labor income share ADBI Wrk. Pap. Ser. (764)
[20] Grybaite V 2006 Analysis of theoretical approaches to gender pay gap J. of Bus. Econ. and Mgmt. 7(2) pp 85-91
[21] Smyth E 2007 Gender and education Int. St. in Educ. Inequality, Theory and Policy 1 pp 135-153
[22] Moss G 2016 Gender, Design and Marketing (New York: Routledge)
[23] Neale L, Robbie R and Martin B A S 2016 Gender identity and brand incongruence: when in doubt, pursue masculinity J. of Strategic Marketing 24(5) pp 347-359
[24] Cakiroglu I 2017 Genders of products: creating genderless design Conf. Senses & Sensibility’17: Design Beyond Borders and Rhizomes (Funchal: Research Centre in Design and Communication)
[25] Blijlevens J, Creusen M E H and Schoormans J P L 2009 How consumers perceive product appearance: the identification of three product appearance attributes Int. J. of Design 3(3) pp 27-35
[26] Johnson K W, Lenau T and Ashby M F 2003 The aesthetic and perceived attributes of products Int. Conf. on Engg. Design ICED (Stockholm) ed. Norell M (Glasgow: The Design Society)
[27] Sunde H 2017 Product semantics, how design can affect user response and behavior Norwegian Univ. of Sci. and Tech. NTNU pp 1-13
[28] Frayman B J and Dawson W E 1981 The effect of object shape and mode of presentation on judgments of apparent volume Perception & Psychophysics 29(1) pp 56-62
[29] Sevilla G and Kahn B E 2014 The completeness heuristic: product shape completeness influences size perceptions, preference, and consumption J. of Mktg. Res. 51(1) pp 57-68
[30] Bloj M G, Kersten D and Hurlbert A C 1999 Perception of three-dimensional shape influences colour perception through mutual illumination Nature 402 pp 877-879
[31] Kingdom F A A, Wong K, Yoonessi A and Malkoc G 2006 Colour contrast influences perceived shape in combined shading and texture patterns Spatial Vision 19(2-4) pp 147-159
[32] Hodgson S N B and Harper J F 2004 Effective use of materials in the design process – more than a selection problem The 7th Int. Conf. on Engg. and Product Design Ed. (Delft: Delft University of Technology)
[33] Miltenović A, Banić M and Miltenović V 2014 Role and importance of lightweight design in the product development COMETa 2nd Int. Sci. Conf. (Jahorina: University Of East Sarajevo) pp 529-538
[34] Fleming R W 2014 Visual perception of materials and their properties Elsevier - Vision Res. 94 pp 62-75
[35] Kesteren I E H, Stappers, P J and Bruijn J C M 2007 Materials in products selection: tools for including user-interaction in materials selection Int. J. of Design 1(3) pp 41-55
[36] Piselli A, Colombo S, Faucheu J, Delafosse D and Curto B 2018 Educational tools to teach design students the dynamic behaviours of smart materials 5th Int. Conf. for Design Ed. Res. (Ankara: Middle East Technical University)
[37] Granzier J J M, Vergne R and Gegenfurtner K R 2014 The effects of surface gloss and roughness on color constancy for real 3-D objects J. of Vision 14(2) pp 1-20
[38] Oyama T and Nanri R 1960 The effects of hue and brightness on the size perception Japanese Psy. Res. 2(1) pp 13-20
[39] Hagtvedt H and Brasel S A 2017 Color saturation increases perceived product size J. of Cons. Res. 44(2) pp 396–413
[40] Weaver P M and Ashby M 1996 The optimal selection of material and section-shape J. of Engg. Design 7(2) pp 129-150
[41] Vangorp P, Laurijssen J and Dutre P 2007 The influence of shape on the perception of material reflectance ACM Transactions on Graphics 26(3) pp 1-9
[42] Karana E, Weelderen W and Woerden E J 2007 The effect of form on attributing meanings to materials Proc. in ASME Int. Design Engg. Tech. Conf. vol 37 (Las Vegas: Computers and Information in Engineering Conf.)
[43] Ulusoy B and Olguntürk N 2017 Understanding responses to materials and colors in interiors Wiley Periodicals 42(2) pp 261-272
[44] Dreksler N and Spence C 2019 A critical analysis of colour–shape correspondences: examining the replicability of colour–shape associations i-Perception 10(2) pp 1-34
[45] Chen N, Tanaka K, Matsuyoshi D and Watanabe K 2015 Associations between color and shape in Japanese observers Psy. of Aesthetics, Creativity, and the Arts 9(1) pp 101-110
[46] Wuerger S and Makin A 2013 The IAT shows no evidence for Kandinsky's color-shape associations Frontiers in Psychology 4(616) pp 1-7
[47] Kandinsky W 1914 The Art of Spiritual Harmony (Boston and New York: Houghton Mifflin Company)
[48] McCracken G 1986 Culture and consumption: a theoretical account of the structure and movement of the cultural meaning of consumer goods J. of Cons. Res. 13(1) pp 71-84
[49] Derbyshire J and Giovannetti E 2017 Understanding the failure to understand New Product Development failures: Mitigating the uncertainty associated with innovating new products by combining scenario planning and forecasting Tech. Fcest. & Soc. Chg. 325 pp 334-344
[50] Farhana M 2012 Brand elements lead to brand equity: differentiate or die Inf. Mgmt. and Bus. Rev. 4(4) pp 223-233
[51] Schnurr B, Brunner-Sperdin A and Stokburger-Sauer N E 2017 The effect of context attractiveness on product attractiveness and product quality: the moderating role of product familiarity Mktg. Letters 28(2) pp 241-253
[52] Chamorro-Koc M and Popovic V 2008 Context-of-use and the design of user-product interactions: exploring causal relationships Proc. of the Design Res. Soc. Conf. (Sheffield: Sheffield Hallam University)
[53] Dumitrescu A, Ulmeanu M E and Crăciun A E 2020 Testing the technotope concept UPB Sci. Bulletin, Series D 82(3) pp 241-250
[54] Therrell J A 2002 Age determination guidelines: Relating children’s ages to toy characteristics and play behavior Cons. Product Safety Commission (SUA: Electronic paper retrieved from https://www.cpsc.gov/s3fs-public/pdfs/blk_pdf_adg.pdf) pp 8-10
[55] Holbrook M B and Schindler R M 1996 Market segmentation based on age and attitude toward the past concepts, methods, and findings concerning nostalgic influences on customer tastes J. of Bus. Res. 37 pp 27-39
[56] Lesot M J, Bouchard C, Detyniecki M and Omhover J F 2010 Product shape and emotional design - an application to perfume bottles Int. Conf. on Kansei Engg. and Em. Res. (Paris: Arts et Métiers ParisTech)
[57] Jadva V, Hines M and Golombok S 2010 Infants’ preferences for toys, colors, and shapes: sex differences and similarities Arch. of Sexual Behaviour 39(6) pp 1261-1273
[58] Tilburg M and Lieven T 2013 You sexy thing: product design as a source of product gender and product value 41st Conf. of the Eur. Mktg. Assoc. (Istanbul: Istanbul Technical University)
[59] Kessous A and Roux E 2008 Nostalgia as connection to the past: A semiotic analysis *Qual. Mkt. Res.* 11(2) pp 192-212
[60] Sliburyte L and Skeryte I 2014 What we know about consumers’ color perception *Proc. Soc. and Beh. Sci.* 156 pp 468-472
[61] Arabi A 2017 Influence of colors on consumer behavior “Conceptual and theoretical approaches” *Acad. Brâncuși, Economy Series* (3) pp 163-170
[62] Westland S and Shin M J 2015 The relationship between consumer colour preferences and product-colour choices *J. of the Int. Colour Assoc.* 14 pp 47-56
[63] Tilley A R 1993 *The Measure of Man and Woman: Human Factors in Design* (New York: Watson-Guptill Publications) pp 10-55
[64] Karana E, Hekkert P and Kandachar P 2010 A tool for meaning driven materials *Elsevier – Materials and Design* 31(6) pp 2932-2941
[65] Panero J and Zelnik M 1979 *Human Dimension and Interior Space* (London: Architectural Press Ltd) pp 73-113
[66] Crilly N, Moultrie J and Clarkson P J 2004 Seeing things: consumer response to the visual domain in product design *Elsevier - Design Stud.* 25(6) pp 547-577
[67] Choate J M 1977 *Color Preferences Relative to Demographic Factors, Personality, and Self-Concept With Implications for Homemaking Education* (Lubbock: Dissertation paper Faculty of Texas Tech University)
[68] Bloch P H 1995 Seeking the ideal form: product design and consumer response *J. of Mktg.* 59(3) pp 16-29
[69] Zuo H, Hope T, Castle P and Jones M 2001 An investigation into the sensory properties of materials *In Proc. of The 2nd Int. Conf. on Affective Human Factors Design* (London: Asean Academic Press) pp 500-507
[70] Viková M, Vik M and Kania E 2015 *Cross-Cultural Variation of Color Preferences* (Liberec: Technical University of Liberec) pp 285-288
[71] Bluntzer A B, Ostrosib E and Sagot J C 2014 Car styling: a CAD approach to identify, extract and interpret characteristic lines *24th CIRP Design Conf.* vol 12 (Belfort: Elsevier) pp 258-263
[72] Zhang Y, Feick L and Price L J 2006 The impact of self-construal on aesthetic preference for angular versus rounded shapes *Soc. for Pers. and Social Psy.* 32(6) pp 794-805
[73] Karana E 2010 How do materials obtain their meanings? *METU JFA* 27(2) pp 271-285
[74] Xue H and Woolley M 2013 Creatively designing with/for cultural nostalgia: designers' reflections on technological change and loss of physicality *Proc. Conf. IASDR* (Tokyo: Int. Assoc. of Soc. of Design Res.)
[75] Wastiels L and Wouters I 2008 Material considerations in architectural design: a study of the aspects identified by architects for selecting materials *Proc. Conf. Design Res. Soc.* (Sheffield: Hallam University)
[76] Brooker G and Stone S 2007 *Form and Structure in Interior Architecture* (Lausanne: VA Publishing SA)
[77] Tseng Y S and Ho M C 2011 Designing the personalized nostalgic emotion value of a product *Design, User Experience, and Usability. Theory, Methods, Tools and Practice* pp 664-672
[78] Crăciun A E 2019 Strategic outlook in industrial design assessment based on product category *IOP Conf. Ser.: Mater. Sci. Eng.* 682 012006
[79] Dumitrescu A 2013 *Tratat de Design* (București: Editura Academiei Române) p 610
[80] Dumitrescu A and Crăciun A E 2019 Testing criteria for a complex assessment method for industrial design *34th IBIMA Conf.* WOS:000556337401026 pp 653-664