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## The relationship between perceived innovativeness and emotional product responses: a brand oriented approach

### Abstract

In the recent decades the business environment has changed tremendously due to the advance of globalization and competition, changing the essentials for success. In this context, innovativeness appears to be a key ingredient to achievement and competitiveness in the new millennium. While the innovativeness of a firm can depend on and be traced through numerous factors, consumers are more likely to perceive it through product design, as this information is readily available and easily accessible to them. Product design is one of the mostly debated topics in the last years, particularly in design literature. However, in marketing, the impact of design on a number of key constructs (e.g., brand) is only scarcely studied. To this end, the impact of product design on consumer responses also appears to be a question, which is not fully explored to date.

This paper proposes that perceived brand innovativeness has a strong relationship with emotional reactions towards the design, such that the emotional responses will be more positive when the perceived innovativeness is high. To this end, an exploratory study that investigates the relationship between perceived innovativeness (of the brand) and emotional responses to a product design of that brand is conducted. The findings are evaluated through correspondence analysis and discussed from a framework that emphasizes the formation of brand knowledge. This study offers several insights for researchers and marketing practitioners, particularly on how innovativeness can contribute to building successful brands.

**Keywords:** product design, innovativeness, brand knowledge.

### Introduction

It has been long acknowledged that innovativeness is one of the most valuable assets of organizations. With the advance of globalization, and competition that extends beyond the borders, today market success depends on how innovative the firm is, rather than its capital, capacity or costs. Consumers of the new millennium seek variety and demand breakthrough products, which are unique, convenient, and affordable at the same time. In other words, today's consumers look for products that not only address the utilitarian needs effectively, but offer a hedonic value and provide a sense of uniqueness as well. In this context, product designs that can successfully combine functionality and aesthetics in an innovative way are rapidly differentiated in the market, creating a number of advantages for the firm.

While the importance of design is well documented particularly in design literature, empirical research on the impact of design is quite scarce in the marketing field. More specifically, the importance of design is frequently taken as granted, and its impact on the formation of brand knowledge is studied to a very limited extent. Within this context, research on consumer responses that are elicited by product design is also in its infancy, although these responses constitute the antecedents of consumption behavior.

This paper aims to explore the extent to which perceived brand innovativeness is related with emo-

tional responses to the product design, which in turn are embodied into the brand perceptions. The rest of the paper is organized as follows: we offer a brief literature review on knowledge economy and the importance of innovativeness in such an environment. Following, a brief discussion on design and its relationship with brand related constructs is presented based on the existing literature. In the following sections, the methodology of the research and empirical findings are presented. Finally, the findings are discussed along with theoretical and practical applications, and recommendations for further research are provided.

### 1. Innovativeness as the key driver of the new economy

In today's business environment, innovativeness is regarded as one of the most valuable assets of organizations. The astonishing pace of new technologies, changes in consumer demands and preferences and fierce competition requires businesses to stay innovative to survive and grow in the market. Research reveals that innovativeness helps companies to stay on the field, while improving regional wealth at the same time. According to Mairresse and Mohnen (2002), innovations directly and positively influence the productivity and contribute to the profits of the companies and countries. In many industries, the majority of profits are earned from the products that were developed in the last five years, while this period is as short as 3 years in fast-paced industries. For instance, Goffien and Pfeifer (2002) report that approximately one-fourth of all revenues are earned from products less than 3 years old in engineering companies. Innovations also play a key role in

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development of great brands, and substantially help the marketers in their marketing and branding efforts.

Innovation has many different types and hence is defined in a number of different ways. One of the earliest definitions of innovation was offered by Schumpeter (1934), who noted that it is “some form of new combination” either in the *product* (e.g., a new product or an improvement on the existing product), *process* (e.g., a new production method), *market* (e.g., entering to a new market), *input* (e.g., a new source for supply) and *organization* (e.g., establishing a new organizational entity or new ways to manage business). While the conception has evolved through the years, it is still observable that innovation is usually defined on similar grounds. According to some authors, innovation is an interactive problem-solving process that involves relationships between different actors (Dosi, 1982; Kline and Rosenberg, 1986). For other researchers, innovation can be defined as an interactive and diversified learning process (e.g., Rosenberg, 1982; Dogson, 1991). According to the European Commission, innovation refers to “the renewal and enlargement of the range of products and services and the associated markets; the establishment of new methods of production, supply and distribution; the introduction of changes in management, work organization, and the working conditions and skills of the workforce” (EC, 1995, p. 668).

Increasing importance of innovations and innovativeness is directly linked to the development of knowledge-driven economies, in which individuals and organizations generate and exploit information to maximize their capability and competitiveness. A knowledge driven economy is mainly characterized with highly innovative firms, skilled labor-force and a vast knowledge base, all of which enhances competitiveness on the national, regional and local levels. Moreover, innovation is a key determinant of the knowledge economies as it helps the firms to cope with the new challenges of the 21<sup>st</sup> century. These challenges can be summarized as the changing characteristics of the market (i.e. globalization, competition and increased technological complexity and related effects on products), the paradigm shift in understanding innovation (i.e. not only technological innovation, but a variety of ways to reflect innovative capability of the firm in the market such as organizational, marketing, or design innovativeness), changing demands and preferences of the stakeholders (e.g., variety seeking behavior), and new approaches in innovation management (e.g., changes in managerial processes, assessment skills and management tools) (EC, 2004).

Given the importance of innovativeness for today’s economy, firms are continuously looking for ways

to utilize for effective management of innovations. To this purpose, there are some key areas that should be considered. These basically include efforts to establish and maintain an organizational structure that will foster innovativeness within the firm.

According to several authors, the organizational culture is one of the critical factors to enhance innovativeness. Jaworski and Kohli (1993) state that market-orientation is one of the key antecedents of innovativeness, as a market-oriented business essentially provides the target audience with innovative products. For other researchers, learning-orientation is also critical to an innovative organizational climate (Slater and Narver, 1995). In order to enhance such a culture within the organization, business decision-makers should take necessary actions to manage human resources in a strategic manner (James, 2002), integrate formal and informal relationships both inside and outside the company (Ahuja, 2000), and create an adaptive and flexible organizational structure (Schlegelmilch et al., 2003). Other cultural factors that directly influence innovativeness include participative decision making, level of collaboration, power sharing, openness of communication channels, attitude towards risk taking and tolerance for conflict (For a detailed review see, e.g., Brown and Eisenhardt, 1995). Apart from cultural characteristics, there obviously are other structural and process characteristics that may define the innovativeness of a firm. As reviewed by Hurley and Hult (1998), these include factors such as size and age of the firm, available or accessible resources, level of differentiation, formalization, use of and access to market intelligence, and hierarchical structures.

The extent to which internal and external stakeholders perceive the firm as being innovative is defined as “perceived innovativeness”. Unquestionably, this perception relies on the perception of the above-mentioned factors. For instance, if a stakeholder perceives a firm to be tolerant to risk taking, the perceived innovativeness will be higher. In this context, perception of innovativeness will also depend on some contextual factors, such as the degree of relationship and contact with organization’s members, the perceiver’s overall approach to innovation, and the amount of information that the perceiver is aware and knowledgeable (Johnson et al., 2001).

Obviously some information on which perceived innovativeness depends is not fully available to outside stakeholders such as consumers. In other words, while the above-mentioned cultural and structural factors appear to be essential antecedents of a firm’s innovative capability, consumers can only utilize a few of the above-mentioned factors in perceiving innovativeness. This is because most of the outside stakeholders (e.g., consumers) do not

have or only have limited access to inside information such as level of collaboration, communication structure, the extent of formalization and hierarchy, etc. Instead, consumers perceive a firm's innovativeness by considering the information that is already available to them, which is usually communicated through the product and accompanying marketing mix messages.

This paper approaches perceived innovativeness from the perspective of consumers and therefore conceptualizes perceived innovativeness from a general framework. In other words, the extent to which the consumers perceive a brand as being innovative is only measured through the information that is available to them, which is mainly based on the product itself. Notably, this approach was also utilized in a number of previous studies, where innovativeness was explained to apply in a general sense (e.g., Grupp and Maital, 2000; Paladino, 2007).

## 2. Design and emotional consumer responses

In the last two decades, the markets have witnessed remarkable advancements in several areas, which directly influence the dynamics of business, including technology, information, and changes in consumer preferences. Obviously, such changes have urged firms to find new ways of gaining and maintaining competitive advantage. Cost leadership approach of the pre-marketing era is now not an option for many businesses, particularly small ones, due to the limited resources of these firms. Alternatively, such firms are rather inclining to the differentiation strategy to gain sustainable competitive advantages. Differentiation strategy enables these businesses to focus on a few core competencies, while creating considerable benefits for customers. Moreover, this approach provides firms with better opportunities for developing strong brands, as differentiation is generally realized on perceptual levels. In other words, products are differentiated on several aspects that enhance positive consumer perceptions and these differences are strongly communicated to the target, through which the consumer pins the product with these differences on his mental map. These relative, but not necessarily absolute, differences play a major role in perception of the brand and formation of brand images.

Companies can differentiate their products on several aspects, such as features, technology, speed, or service. Within these, design may be regarded as the gleaming facet of the differentiation strategy. As Kotler and Rath (1984) point out, design is a powerful differentiator, which can be used as a strategic tool to achieve and sustain competitive advantages. This is particularly due to the capability of design to communicate product information quite effectively

and efficiently. Literature suggests that product design has a great potential to carry strategic messages (Karjalainen, 2004; Muller, 2001), as well as conveying information about the product's purpose, benefits, features, origin and the profile of its owner (Monö, 1997). Such information in turn contributes to development of brand awareness and brand image (Schmitt and Simonson, 1997), which reinforces the importance of design as a key differentiator.

Communicative power of design mostly arises from its capacity to influence and enhance visual perception, which extremely influences the way that humans understand and evaluate the material world. Research proposes that more than two-thirds of all the environmental stimuli reach the brain through the visual system (Zaltman, 1997). Although design cannot be conceptualized solely on the visual grounds (i.e. aesthetics), it is unquestionable that design is mostly perceived through visual senses, particularly during the initial stages of product-consumer relationship. Other components of design, namely functionality and ergonomics, mostly require more cognitive information processing, and therefore are likely to be assessed in the subsequent stages of the relationship. However, the impact of aesthetics on perception is immediate and direct, and obviously it is reflected in the first impression of the product. Notably, the impression that the product creates is then transformed into the image of the brand.

The importance of design is well documented, particularly in design literature. Built on the theory of semiotics, design literature has clearly recognized the power of design and systematically developed models to explain the communication mechanism. Especially in the recent years, several researchers with design backgrounds have made successful attempts to expand the investigation of design communication into marketing related fields, such as consumer research and brand management (e.g., Karjalainen, 2004; Warrell, 2001; Vihma, 1995). On the other hand, research on design in marketing literature is very scarce. Although design has been noted to have an impact on several marketing related concepts, brand awareness, perceived quality and choice, only limited empirical evidence was presented, while the majority has taken the relationship as granted.

Within this context, research in marketing domain only recently began to investigate the impact of design on a number of marketing processes. In a pioneering article, Bloch (1995) asserts that design (particularly product form) contributes to success of the product in four main ways: (1) differentiating the product from competition and enhancing instant recognition, (2) conveying information about the product, (3) contributing to the pleasure derived from a beautifully designed object, and hence satis-

fying aesthetic needs, and finally (4) creating long lasting effects as the product becomes part of the sensory environment. Other researchers noted similar effects, while they considered design, either as packaging or form or in general, as an important medium to communicate with consumers (Nussbaum, 1993) while increasing attention, recognition and willingness to buy (Kotler, 2003; Underwood and Klein, 2001; Garber, 1995).

Obviously, all these effects are ultimately reflected in the brand knowledge. Creusen and Schoormans (2005) state that the product communicates value most directly through its design, which is then embodied in the perception of the brand. Design serves a tool to transmit symbolism (Keller, 1993; Aaker, 1991) and through this mechanism it differentiates the brand from the competition. This is a very important effect to be studied, as a successful brand is considered to be the most valuable asset of a company.

For the last two decades, marketing science has evolved in a way to prioritize branding as one of the most critical activities of businesses. Such an attention is not beyond reason: Brands provide the companies with recognition and differentiation, which in turn generates value both for the customers and business itself (Keller, 2003). According to DeChenatony and McDonald (2003), a successful brand is “an identifiable product, service, person or place, augmented in such a way that the buyer or user perceives relevant, unique, sustainable added values, which match their needs most closely”. From such a holistic viewpoint, brand is the meaning that the consumers attach to a product (Kapferer, 1992), through which the consumers perceive all benefits pertaining to it. Upon this perception, consumers respond to the product cognitively, emotionally and behaviorally. For instance, they may find the product useful/useless, they may like/dislike it, they may approach/avoid buying it (Bloch, 1995, Monö, 1997).

Notably, research on cognitive and behavioral responses is older than research on emotional responses, particularly due to the fact that marketing has long relied on the “rational man” approach, assuming the consumer as an organism that calculates costs and benefits, hence utility, and makes a decision afterwards. It was only 80s when the hedonic aspects of consumption were brought into sunlight (e.g., Hirschman and Holbrook, 1982), which was followed by vast research on emotions, fantasies, aesthetic taste and similar constructs.

Literature suggests that cognitive responses on design involve perception of functionality and ergonomics, product categorization, dollar value and other similar inferences made by the consumers (Kaplan, 2007). As noted before, behavioral re-

sponses to design appear as approach to or avoidance from the product, which reflects itself in purchase or dismissal of the product. On the other hand, research on how design can elicit emotional responses is scarce (Desmet et al., 2000), although emotions are key to understanding consumer behavior. Demirbilek and Sener (2003) define emotional response to design as “the consumer’s affective reactions to the semiotic content of the product”. According to Bloch (1995), emotions elicited by product design may range from entirely positive to entirely negative. Emotional responses to product design are important because they add up to the pleasure of buying, owning and using these products (Hirschman and Holbrook, 1982), and they provide an opportunity to differentiate the product from competition (Kotler and Rath, 1984), enhancing brand-building process.

The relationship between perceived innovativeness and product design is important, as the design of the product appears to provide immediate information for consumers, which guides them in the perception of innovativeness. In other words, consumers are likely to make inferences about innovativeness by observing product design. Within this context, this paper proposes that design related aspects directly influence the consumers’ emotional responses to the product, which also directly relate to the perception of product innovativeness. These responses then are embodied into the brand perceptions and form several aspects of brand knowledge.

### 3. Methodology

The aim of this paper is to shed light into the relationship between the consumers’ perception of product innovativeness and emotional responses to the product, which are enhanced by product design as previously explained. In this context, the paper proposes that the more innovative a brand is perceived, the favorable the emotional responses to the product design will be. To this end, we conduct an exploratory research that replicates the methodology of a previous study by Desmet et al. (2000) to a certain extent, which explores the joint relationships of product appearance and several emotions. Desmet et al.’s (2000) study introduces a specific instrument named PrEmo (Product Emotion Measurement Tool), which is developed for measuring emotions elicited by product appearance. To note, this study utilizes this tool for a similar purpose as will be further explained below.

In this study, product design is operationalized only on the grounds of product appearance, as design is a more general concept that includes several aspects that are not readily visible (and hence easily comprehensible) to the consumer. The literature suggests that design can define three broad areas of the end prod-

uct, the creative activity, and the process in which the information is transformed into an outcome (Von Stamm, 2003). In this context, it is obvious that product design describes both the process and the product parts that are not visible to the consumers, such as internal design elements (Creusen and Schoormans, 2005). However, emotional responses to the product design are strongly and instantly influenced by their appearance, particularly due to the power of visual perception (Desmet et al., 1999). Therefore, it is appropriate to utilize product appearance as the facilitator of emotional product responses.

This study is carried out in two stages. At the first stage, the study unit and appropriate stimuli were selected. At the second stage, selected stimuli were utilized to elicit emotional product responses using the PrEmo scale. By the same time, a survey was carried out to assess perceived innovativeness of the brands that are utilized as the stimuli. Details of the study, including instruments and sample, are explained below.

#### 4. Selection and preparation of the stimuli

Following the previous study by Desmet et al. (2000), automobiles were chosen as the study unit, as research revealed that car models with different appearances can elicit strongly different emotions. In order to determine the car brands and models to be used in the main stage, a pilot study was conducted. In the pilot study, respondents were provided with 42 automobile brands that are available for sale in the Turkish market and were asked to rank the first five brands that they perceive to be the

*most innovative*, and another five brands that they perceive to be the *least innovative*. The perception of innovativeness was not limited to particular factors. The sample included 44 undergraduates studying business at Izmir University of Economics. Ranking by each respondent was scored on a scale that ranges from +5 (most innovative) to -5 (least innovative), and the brand's total score ( $\Sigma s$ ) was calculated by adding up the scores for that particular brand. The findings of the pilot study showed that the respondents perceive BMW ( $\Sigma s = 96$ ) and Honda ( $\Sigma s = 60$ ) to be the most innovative automobile brands in the market, while Lada ( $\Sigma s = -73$ ) and Tofas ( $\Sigma s = -99$ ) were perceived as the least innovative brands. Based on these findings, these four brands were included in the main study.

For the second stage, four models by each brand were selected. In order to select appropriate model, a keyword search was utilized to identify available models for each brand in the market. The model that was most frequently returned by the keyword search was selected as the stimulus for that particular brand. The rationale behind this procedure is that the most frequent returned model is more likely to carry the representational appearance characteristics of the product for the present day. Next, a photographic image for each model was selected based on the representative quality. In this context, all images showed the automobiles from right-front angle against a white background. To eliminate the effect of color on emotional response, all automobiles selected were white.



Fig. 1. Car models used as stimuli

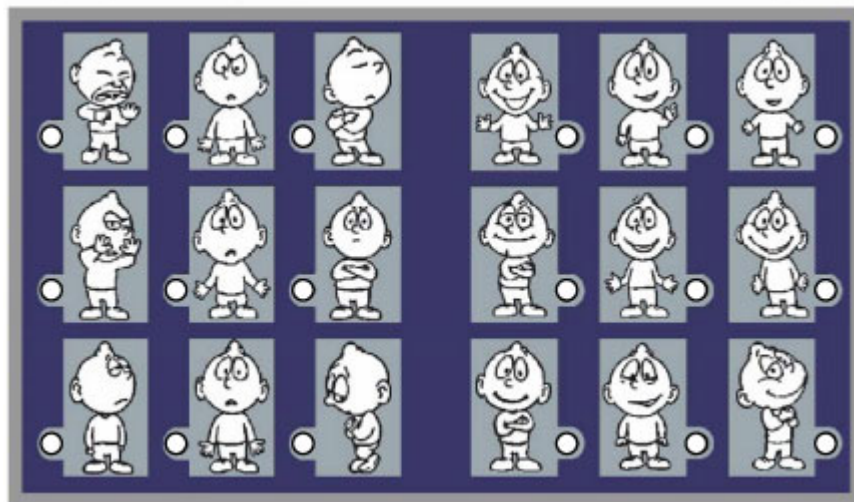
The images were further treated in Adobe® Photoshop® CS in order to eliminate the effect of brand related bias, as this stage of the study was only concerned with assessing emotional responses invoked by product appearance, and not the brand. For this purpose, any significant aspect of the design that may immediately recall the brand (e.g., logo) was removed from the image. Final output images were prepared as black and white. Car models used in the study are shown in Figure 1.

#### 5. Instrument

The instrument used in the main study is in the form of a booklet that contains four pages. In each page, a car model is shown next to a PrEmo scale, while brand names were unrevealed. The PrEmo Scale shows still images of 18 emotions, each illustrated as an animated character that expresses a different emotion. Nine of the emotions are negative and are located on the left-hand side of the scale, while the

remaining ones are positive and located on the right. The negative emotions are labeled as disgusted, indignant, contempt, aversive, disappointed, dissatisfied, bored, disillusioned, and vulnerable, while

the positive ones are enthusiastic, inspired, desiring, appreciative, pleasant-surprised, attracted, content, fascinated, and softened (Desmet et al., 2000). The PrEmo Scale is presented in Figure 2.



Source: Desmet et al. (2000).

Fig. 2. The PrEmo scale

In the first page of the booklet, respondents are instructed to view the each car model and asked to choose one or more emotions that correspond with their emotional reactions by ticking the checkbox next to the animated characters. In each booklet, car models were randomly distributed, i.e. the respondents viewed car models in a random order. The subjects were also instructed to avoid thinking for a long time, as initial emotional reactions were critical for the purpose of the study.

**6. Sample**

Sample size for the main study was 76. Subjects were selected from freshmen and sophomores studying business at Izmir University of Economics, who did not participate in the survey for the pilot study. The average age was 21.4, and 52.6

percent of the respondents were female. Due to the exploratory nature of the study, use of a student sample was found appropriate.

**7. Analysis and findings**

Based on the previous study by Desmet et al. (2000), we used correspondence analysis in order to display the relationship between the product appearance and elicited emotional responses. Correspondence analysis is a multivariate technique designed to analyze two-way and multi-way tables containing some measure of correspondence between the variables in the rows and the columns, and is suitable for descriptive and exploratory studies. Correspondence analysis is similar to factor analysis, but it allows to explore the structure of the categorical variables included in the table.

Table 1. Cross-table for car models and elicited emotions

Emotion \ Model	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
(A) Lada	34	10	16	23	9	16	13	9	17	4	2	4	5	1	6	3	4	3	179
(B) Tofas	23	7	18	18	6	18	11	4	11	4	2	4	7	0	3	9	5	1	151
(C) Honda	3	6	5	2	5	7	0	5	3	15	17	8	24	12	10	14	8	6	150
(D) BMW	0	6	8	3	2	3	4	2	2	36	16	1	14	15	25	12	5	23	177
Total	60	29	47	46	22	44	28	20	33	59	37	17	50	28	44	38	22	33	657

Prior to conducting further analysis, we established a cross table, where each cell shows the frequency of the particular emotion invoked by the corre-

sponding car model (Table 1). All emotions were numbered and entered to the SPSS 11.0 statistics package accordingly. Final numbering produced the

following list: (1) disgusted, (2) indignant, (3) contempt, (4) aversive, (5) disappointed, (6) dissatisfied, (7) bored, (8) disillusioned, (9) vulnerable, (10) enthusiastic, (11) inspired, (12) desiring, (13) appreciative, (14) pleasant-surprised, (15) attracted, (16) content, (17) fascinated, and (18) softened.

The cross-table is used to run a Pearson's Chi Square test in order to guarantee further inspection of the data. The chi-square of the 4x18 matrix is found to be 329.204 (Df = 51) and is statistically significant ( $p = .000$ ). Next, total inertia of the matrix is calculated by dividing chi-square by N, which equals .501. Both chi-square and total inertia indicate that the variation of the data is substantial and further analysis is sound. Although the decomposition of the inertia reveals three axes, the first two axes explain 97% of the variation and therefore these two dimensions are

included in the correspondence analysis (Table 2).

Table 2. Decomposition of inertia

Dimension	Inertia	Proportion of inertia	
		Accounted for	Cumulative
1	.415	.829	.829
2	.073	.145	.974
3	.013	.026	1.000
Total	.501	1.000	1.000

The two-dimensional map generated by the correspondence analysis is presented in Figure 3. This map visualizes the Euclidian distances that are used to interpret the measure of dissimilarity and is an appropriate way to demonstrate the emotions more elicited by a particular car model.

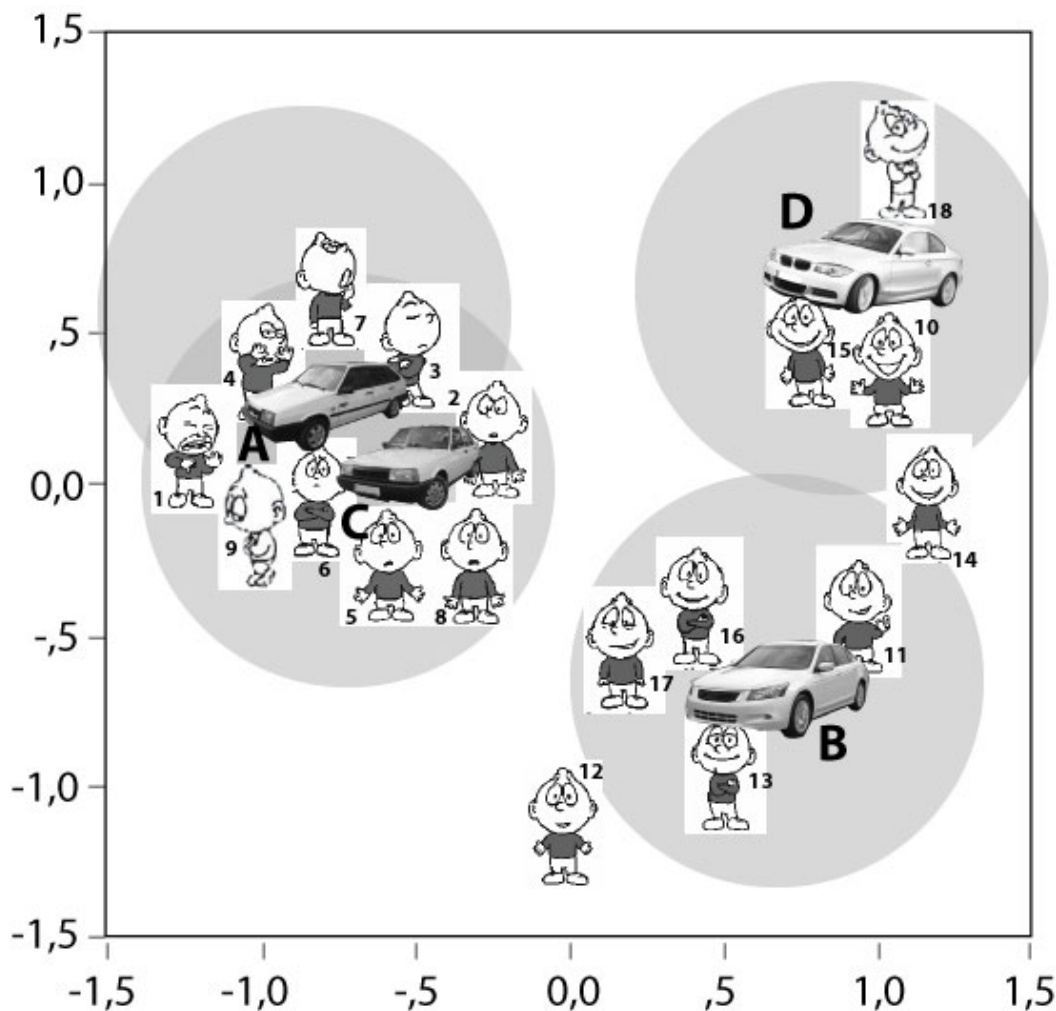


Fig. 3. Correspondence analysis map

As clearly depicted in the map, Model A (Lada) and Model C (Tofas) both elicit negative emotions, forming a cluster that is defined by the first nine expressions of the PrEmo Scale. On the other hand, Model D (BMW) facilitates more positive emotional

responses, namely enthusiasm (10), attraction (15), and softening (18). Finally, Model B (Honda) invokes some other favorable feelings such as inspiration (11), appreciation (13), contention (16), and fascination (17). With respect to the findings of the

pilot study, the results suggest that perceived innovativeness of the product is entirely parallel with the emotional responses that are elicited by the appearance of the product as proposed.

### Discussion and conclusion

The purpose of this paper is to investigate the extent to which perceived innovativeness of the brand is related with emotional responses invoked by the product design. For this purpose, an exploratory study is conducted to analyze the emotional responses elicited by different product appearances, where the perceived innovativeness of the respective brands is known. As anticipated, the findings clearly revealed that the more innovative a brand is perceived, the more positive the consumers respond to the product design. In other words, the findings reveal that there is a close relationship between the perceived innovativeness of a brand and the emotional responses to the product design of the firm bearing this brand name.

Obviously, the relationship between perceived innovativeness and product design is not always a one-way relationship. On one hand, it may be suggested that product design influences the perception of innovativeness. That is when a firm is engaged in developing new products with distinguishing features, the audience eventually perceives the brand as innovative. This is due to the fact that consumers are likely to make inferences about the brand by initially observing the visual qualities of the product. On the other hand, it is also likely that the firm may communicate the message of “innovativeness” via other means (e.g., marketing communications), which in turn influences the consumers to “feel” that a particu-

lar design by that brand is innovative. Whichever route is utilized, this study reveals that there is a strong relationship between the perceived innovativeness of the brand and the emotional responses elicited by the products of that brand. This indicates that firms should invest more in design in order to enhance consumers’ perception of innovativeness for their brand. Perception of innovativeness is important for firms, as it is ultimately reflected in the brand knowledge, particularly brand image. Given the tendency of consumers to value innovativeness very highly, the brand can extremely benefit from such a policy.

As a theoretical contribution, this study provides evidence for the relationship between perceived brand innovativeness and emotional responses to the product design. The study also validates the use of PrEmo Scale that was developed by Desmet et al. (2000) as a potential tool to measure the emotional responses invoked by the product design. Main limitation of this study is the use of a student sample. However, given the exploratory nature of the research, use of such a sample may be justified. Moreover, as noted by Calder et al. (1981), student samples are ideal for testing theoretical predictions about the relationships among variables, which is also the purpose of this study.

Further research should include the validation of the findings of this study, especially for other product classes. Second, research is needed to retest the scale used in this paper for other products and in other cultural settings. Finally, a validation of the relationship between perceived innovativeness and product design, and how these are cultivated in brand knowledge is strongly required.

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