The Role of Emotions as Shaping Factors: Relations between Shapes used in the Vehicle Design and their Emotional Impact

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Abstract

In this paper, the relations between shapes used in the contemporary vehicle design and their emotional impact are investigated. Based on an analysis of the existing theories for shaping and a selection of five main shapes applied in the vehicle design, experimental studies are presented to establish the correlation between emotional experiences and a predominant use of the selected shapes. Statistical analysis is derived to determine the intensity of the experienced product-emotions. It is found that two of the selected main shapes evoked intensively pleasant emotions, while the predominant use of one of the shapes in the vehicle design provokes mainly unpleasant emotions. This study provides tools that can be applied by practical product engineers in their understanding on the emotional effect of the contemporary vehicle design industry, and can be also used in the education and training on design strategies of new designers.

Keywords: human-product interactions, emotional factors in shaping of vehicles, emotional design strategies, experimental design, vehicle design

1. Introduction

The topic of human-product interactions is an interdisciplinary problem that crosses traditional boundaries between the product design engineering and social sciences. The investigations on this field require knowledge on practical design concepts, as well as, on the nature of emotions. The emotions are ones of the most important factors in the creating of a successful human - products interactions. According to Jordan (2000), “Having become used to usable products, it seems inevitable that people...want something more: products that offer something extra; products that are not merely tools but 'living objects'...; products that bring not only functional benefits but also emotional ones. This is the new challenge for human factors.” The role of emotions in the human – product interaction has attracted the attention of many researchers, and the
study on the emotional design has undergone a rapid development in the last couple of decades (Boatwright & Cagan, 2010; Desmet, 2002; Desmet, Tax, & Overbeeke, 2000; Norman, 2004; Schifferstein, Mugge, & Hekkert, 2004).

Due to the numerous applications in the automotive industry, only relatively recently the investigations on the emotional impact of the vehicle design have started to receive an increasing interest. However, the analysis of emotional phenomena and design concepts requires an expert knowledge on different areas related to emotions, methods of measuring of emotions, and vehicle design. The first scientific experiment, conducted by Volvo Car Group (Volvo Cars) tested respondents to analyze how the brain reacts emotionally to car design and how design aesthetics actually make us feel (Tills, 2013, November 28). Also, there are few papers that deal with emotional power of car design in general, mainly developed by Desmet (2002, 2003), Desmet, Hekkert, & Jacobs (1999), Lewin & Borroff (2010). However, the work in this area is relatively scarce. All of the existing studies are only limited to emotions elicited by the total appearance of cars and they did not investigate the particular relations between the shapes of vehicles and emotions.

The results on the emotional impact of the vehicle design will offer new perspectives, if the research is directed on specific design features (shape, color, ergonomics, etc.). The creation of a methodology for analysis of different design hypotheses about the emotional impact and their efficient realizations will be highly benefited by a determination of a design characteristic, which has a crucial role for the total appearance of a vehicle and which can clearly express the involved in the design ideas. The application of such a “determined design characteristic” concept may lead to different results depending of the nature of the problems considered during the creation of the methodology. By means of a determined design feature, the designers can manipulate the appearance of their products, and thus, the emotions elicited by these products.

Form-formation or morphology of products is the basis of creativity in the work of a designer. Therefore, shapes of products play a crucial role in the process of evoking emotions, and the problem related to the emotional influence of shapes is very important in theories and applications and also is a very challenging problem.

The relations between shapes and emotions are considered in several contexts in the existing literature. Indeed, there exists a direct link between the emotional influence of the total appearance of a product and the domination of a particular shape in the product design. For example, Bloch (1995) introduced a conceptual model and several propositions that describe how the form of a product relates to consumers' psychological and behavioral responses. Lu et al. (2012) investigated the computability of emotion
through shape modeling by extracting contours from complex images, and then representing contours using lines and curves extracted from images. Plass et al. (2013) studied the effects of colors and shapes of a multimedia learning material. The recent study of Zaw (2013) on the relations between emotions and shapes features found within BMW car design, as part of a research on computer tools capable of identifying brand-specific shape features, is strongly brand oriented. However, none of the existent studies provides an exploratory treatment for shapes of vehicles or put a specific spotlight towards the emotion power of shaping of contemporary vehicles regardless of a specific brand and this paper's aim is mainly to fill the gap.

In the present paper, the shape of contemporary vehicles is investigated as a basic design characteristic which can provide the most comprehensive and accurate information to the designer about the ability of human perception to understand and evaluate the complete involved in the design idea. An analysis of the existing theories of shaping is conducted to justify a selection of five main shapes applied in the contemporary vehicle design. Experimental studies are presented to establish the correlation between emotional experiences and contemporary vehicles whose design in based on several basic selected shapes. The method of “product-emotion” developed by Desmet (2002) is applied and extended with new concepts related to the emotional impact of contemporary vehicles with a defined design feature which is the main source of emotional responses. The goal of the work is to develop tools that designers, constructors and companies can use to determine the connections between the shapes applied in contemporary vehicles design and their emotional influence, to determine how designers can communicate in an emotional level to process information.

2. Preliminaries

This section introduces the necessary tools to accomplish the main aim of this research related to the emotional aspects of shaping in the vehicle design. Firstly, the section presents the background to the subject of shaping of products and classification of shapes. Through the discussion of the existing theories, a clear understanding of the process of shaping in the real world is presented that will allow us to apply it to the vehicles’ shaping. A classification of five main shapes applied in the vehicle design is introduced. In addition, methods for measuring of emotions are discussed, and the most appropriate for our study method for measuring of product-emotions is proposed and justified.
2.1. Main Forms and their Form-formation. A Review of Existing Theories

A variety of literature exists that presents theoretical foundations of the process of shaping in the material world, as well as basic principles of the form-formation. Since ancient times, researchers have tried to prove that the natural diversity in the world is based on a limited number of basic forms. Pythagoreans considered the form-formation limited to the use of four basic elements: point, line, triangle and tetrahedron. Plato considered five main elements (Platonic solids, regular solids) (Cornelli, McKirahan, & Macris, 2013; Wenninger, 1974). According to Wenninger (1974), models of the regular and semi-regular polyhedral solids have fascinated people for centuries. Those include not only the five figures found by Plato, but also the solids, which were discovered by Archimedes and are contained by equilateral and equiangular, but not similar, polygons (Thomas, 1941; Wenninger, 1974). After Plato and Archimedes, many authors used polyhedron models (Field, 1988). The German astronomer Johannes Kepler in his “Mysterium cosmographicum”, published in 1596, (Field 1988) attempted to explain the structure of the Universe as a whole by means of Platonic solids.

In crystallography, the figures are classified by their elements of symmetry (Kahr & Shtukenberg, 2012; Shafranovskii, 1978, 1980). But, crystallographers also realized that the "intrinsic symmetry" of the body is not sufficient for an exact description of all figures. Therefore, crystallographers introduced classifications according to walls, ribs and tips.

Russian orthodox theologian, philosopher, priest, mathematician, physicist, electrical engineer, and inventor Pavel A. Florensky makes one of the most interesting attempts to draw up a common classification of visual images and universal symbolic forms, in his scientific work "Dictionary of Symbols" or "Symbolarium" (Misler, 1999). The "Symbolarium" is conceived as a large collective research, but unfortunately it remains incomplete and consists of a number of draft documents in his first part, written in 1920. According to it “ideographic symbols exist on their own and make a difference, regardless of the verbal language, so in some ways the ideographic script can be called a universal language of mankind” (Nekrasova 1984). To operate with the infinite variety of graphical symbols a graphical scheme (or a kind of graphical alphabet) has been introduced which classifies most of the visual images, symbols or graphical signs. The development of such a universal set of symbolic forms is a unique idea in design. But, this vocabulary does not explain the internal mechanism of transformation of one form into another.

The questions related to the shape grammars have also attracted considerable interest during the years. Significant contributions to the classifications of forms in architecture and design have researchers as Burrell (2013), Itten (1964), Klee (1922),
Stiny (1975), Zitsman, & Schultz (1990), etc. In addition, the book of Ching (2007) is a classic introduction to the basic elements of architecture design. In it the author considered a point as a main generator of all shapes. Each element is presented in order of its appearance from the point, first as a conceptual element off and then - a visual element in the vocabulary of architectural design.

In general, the idea of a structural organization of shapes has been constantly developed, and each new step strengthens the belief that there exists a limited vocabulary of basic shape categories. But, how these shapes are formed? How we can differ a form category from another in order to use them in the process of evoking emotions? The book written by Zitzmann & Schulz (1990) played an outstanding role in this direction. It is entirely devoted to a systematic presentation of the form categories and their form-formation. Zitzmann & Schulz (1990) classified all basic forms in the five main classes of determined categories: “Without directions”, “Direction”, “Opposite directions”, “Distinguished directions”, “Movement directions”. The main plain and volumetric entities used in each form category, the differences and the movement from one form category to another have been considered. In addition, a sixth “undetermined” or “Ambiguity” form category has been also discussed as a differentiation of the “movement direction” category. Unlike the determined form categories, "ambiguity“ of the form is a purely visual quality because any form from this category may be decomposed into ambiguous parts.

Attempts to scientific systematization of forms categories known since ancient times create conditions and absolute prerequisites for generating a specific set of basic shapes applicable to the study of the emotional impact of vehicles’ shapes.

2.2. A Selection of Main Shapes Applicable in Vehicle’s Design

This section offers a selection of main shapes applicable in the contemporary vehicle design (Stamov, 2014, 2015). The main objective is to use selected forms as an instrument for measuring of the emotional impact of the vehicle design.

First Main Shape

This research, from Pythagoras to the present, leads to the conclusion that the shape from which all others arise is the so called “Without Direction”. On the plane the main element used in this shape is represented as a dot or as a circle spot (Burrell, 2013; Ching, 2007; Klee, 1922; Itten, 1964; Zitzmann & Schulz, 1990). In the space the sphere is used as a main basic symbolic form. There are two understandings in the literature. The first one emphasizes on the center of the composition and on the
composition’s integrity. As a results, such a design is related and subordinated to the center of the composition. According to the second direction, all composition’s elements must have a strongly expressed independence. If we follow such a direction, the perfect relation of subordination between the elements is very important in order to achieve the desired appearance. There are, also, numerous opportunities in between the two basic and opposite ones. A three-dimensional structure with “without direction” forms is either with strongly dominant separate elements (basic forms) or all separate forms are subordinated to the entire shape. Examples of the use of the First Main Shape in the design of vehicles are given in Fig. 1.

Second Main Shape

As a Second Main Shape which is a suitable prerequisite for studying emotional reactions from the design of contemporary vehicles, we will determine the “Direction” shape. Many researchers have studied the form-formation of this shape and its spatial analogues (Burrell, 2013; Ching, 2007; Klee, 1922; Itten, 1964; Zitzmann & Schulz, 1990).

One of the main criterions in the study of shapes of objects is related to the determination of proportions or a surface structure of uniformly oriented items. Peculiarities in the proportions in targeted forms are expressed primarily in terms of ratios of their length to their width. In case of a disorder of the determined relationship between the length and the width, the test form is allocated to another form category. In this context, the Second Main Shape is mainly used in the design of vehicles having a length significantly greater than their width (see Fig. 2).

Fig. 1. Using of the First Main Shape in the vehicle design

Fig. 2. Using of the Second Main Shape in the vehicle design

Third Main Shape

The investigations on the form-formation of the Third Main Shape mark their beginning with the studies on the Platonic solids. On a plane the main form-part used in shaping is a square, and on the space a cube and a parallelepiped are used. A number of results on the form-formation of shapes from this shape category were published (Itten,
This is one of the main shapes used in the geometrical representations by the regular nets (Alliez et al., 2008). It is called “Opposite Directions” by Zitzmann & Schulz (1990).

Note that, in the vehicle design process, ordering in one or several axes is not mandatory, but it helps in the determination of the shape category. The building of plastic models with opposite directions is more efficient if all model’s parts are arranged at right angles.

Fig. 3. Vehicles with a predominant use of the Third Main Shape in their design

This contributes to the differentiation of different parts spatially because all intermediate spaces between them are also under the right angles. Examples of a dominant use of this shape in the design of vehicles are given in Fig. 3.

Fourth Main Shape

The main form-element in the plane representation of the Fourth Main Shape is the triangle. In the space, the shape is displayed mainly by pyramids (Itten, 1964; Shafranovskii, 1978, 1980; Zitzmann & Schulz, 1990). Researchers have been aware of the fact that many form-formation problems of this shape are pointless unless the dependence on previous shape category is being taken into account. But until the work written by Zitzmann & Schulz (1990), where the shape is named as “Distinguished Directions”, a bigger part of the obtained results refers to several specific properties of a narrow type of shape’s elements.

The new property in this category that differs it from the previous one is that the quality of the shape is substantially determined by the relations between the angles and their parts. If we use forms from the third class of shapes in a plastic design composition (such as vehicles design), the relation between the angles is not a particular problem, because only right angles are used. In contrast, in the work with forms from the fourth main class, the relation between the angles is of a crucial importance. The designer can manipulate the angles to achieve the effect of a tension, or to remove such an effect, as well as, to obtain clarity in the forms (see Fig. 4)
**Fifth Main Shape**

Finally, the Fifth Main Shape, that is included in our selection is discussed in the works of Thompson (1945), but from a design point of view it is justified by Zitzmann & Schulz (1990) as “Direction Movement”. The main characteristics of this shape are in many curved and rounded building blocks, which are used on the plane as well as in the space representation.

Among the all discussed categories, the “Direction Movement” or “Direction Motion” provides a perfect opportunity to merge more building parts in a whole unity by infinitely infusion of the parts into each other, in which the separate parts lose their autonomy and it is often very difficult to be recognized as separate components. This new shape can be analyzed using ordered one after another concave and convex distortions, which are expressed more or less. In the Fig. 5 some example of using this shape in the automotive design are given.

![Fig. 4. Using of the Fourth Main Shape in the vehicle design](image1)
![Fig. 5. Using of the Fifth Main Shape in the vehicle design](image2)

### 2.3. Product-Emotions

To study the relations between shapes of vehicles and emotions, we need an adequate instrument to measure the emotional impact of the selected shapes. The study of methods for measuring the emotional impact of products has gained an increasing research interest in recent years (Desmet, 2002, 2003; Ekman, 1992, 1994; Kim et al. 2011). It is known that emotions (Desmet, 2003) can not be measured by a single characteristic (magnitude dimension). They have a multi-component nature consisting of expressive effects (e.g., smile), physiological responses (e.g., increased heart rate), behavioral effects (e.g., approaching) and personal feelings (e.g., a feeling of happiness). All instruments for measuring emotions actually measure these components. For example, the instruments that measure expressive reactions fall into two main categories: those that measure facial expressions (Ekman, 1992, 1994) and those that measure vocal expressions (Johnstone & Scherer, 2001). The achievements in the analysis of digital signals in recent years, are a prerequisite for new developments in the instruments for measuring expressive effects (Cavicchio & Poesio, 2012). However, the main
disadvantage of such instruments is that they tend to deal with a limited number of basic emotions collected in the works of Ekman and Friesen (1975), Frijda (1986), Picard (1997). Another problem is that people can control their expressive reactions (Cacioppo, Bush, & Tassinary, 1992). Similar problems are reported for the instruments that measured physiological responses (Desmet, 2003). The subjective feeling component of emotions is measured by verbal and non-verbal instruments. The basic limitation for verbal instruments is that they are difficult to be applied between cultures (Desmet, 2003).

![Fig. 6. Emotions measured by PrEmo-6 and their pictograms (Desmet, 2002).](image)

To overcome the disadvantages and limitations of different instruments for measuring emotions, and to turn the attention to measuring emotions elicited by products the model of “product-emotions” was proposed and the PrEmo instrument,
was elaborated by Desmet (2002, 2003). The set of emotions, measured by PrEmo-6 contains 7 pleasant and 7 unpleasant “product-emotions”. For each of these emotions a corresponding pictogram (a face that portrays an emotional expression) is elaborated (Fig. 6).

The set of “product-emotions” was established to be a representative and a manageable (Desmet 2002). It is an intersection of emotions that are often caused by the appearance of the products. The PrEmo-6 instrument has the main advantages of verbal and non-verbal techniques for measurement of emotions. The instrument is made so as to measure different emotions (even mixed), but its use does not require verbalization of experienced emotions. For these reasons, it is the most appropriate instrument for the purposes of this study.

3. Experimental Studies

This section offers experimental design studies on the emotional power of vehicle’s shapes. The strategy of “product-emotions” is applied in order to evaluate the relations between the main shapes used in the vehicle design and their emotional impact.

Participants. Since the model of “product-emotions” is extended using the new concepts, related to the emotional influence of shapes, then decisive in the selection of participants is the requirement they to have the necessary knowledge on the form-formation and compositions of forms. Based on this consideration, graduate students in “Engineering Design” from the Technical University of Sofia, Bulgaria were selected as respondents. 44 participants took part in the experiment. The participants comprised of 16 male and 28 female students, and have completed all core courses in engineering design. Eligibility for participation is motivated also by the considerations of elimination of emotions caused by the possession and use of vehicles. All participants are over 18 years old (M=25.65, SD=3.75).

Stimuli. The stimuli were images of contemporary vehicles, which best represent the selected five main shape categories. For each of the main shapes four images have been created. To isolate additional emotional responses caused by the impact of colors and brands, all vehicles included in the images are represented in identical uniform graphic-color interpretation in monochrome range. Also, to avoid getting emotional responses associated with a specific type of vehicles (cars, trains, tracks, etc.) or with the specific part of vehicles (front, back, sides) contemporary vehicles or different parts of vehicles are used, covering different types of transport. Figures 7-11 show the images used in the studies shown as they were presented to participants.
**Procedure.** The “product-emotion” model was explained to all participants. It was stressed that the experiment serves to estimate the emotions caused by the shapes used in the vehicle design. The experiment was conducted on a paper questionnaire of 6 pages received by each of the participants. On the first page an introduction providing information for the type of study and how to identify and measure the emotions was...
given. On each of the next five pages the representative vehicles for each of the five main shapes (on the left side of each page) and the pictograms and emotional expressions (on the right side of each page) have been displayed. The pictograms and emotional expressions were divided into two columns. On the left side – the unpleasant emotions were presented, and on the right site – the pleasant emotions.

Each participant determined the emotions evoked by the main shape of a representative group of vehicles. All experienced by participants emotions caused by the relevant shapes have been evaluated, i.e. there was an opportunity to estimate more than one emotion. The power of each elicited emotion was estimated using a scale from 0 to 2, respectively, 0 – “I do not feel the emotion expressed by this pictogram”; 1 – “I poorly feel this emotion; 2 – “I strongly feel this emotion”. Each participant carried out the assessment individually. They have had time of 1 hour to complete their answers.

4. Results
4.1. Emotional Responses for Different Forms
To obtain graphical interpretations of the results received, the main scores for each evaluated emotion for different shapes were calculated. Five diagrams were elaborated for each of the evaluated shapes (Fig. 12-16). In each diagram the product-emotions are placed on the x-axis, while the power is scaled on the y-axis. The intensity of each emotion for each shape was analyzed.

![First main shape](image1.png)  ![Second main shape](image2.png)

*Fig. 12. Emotional responses for the First Main Shape*  
*Fig. 13. Emotional responses for the Second Main Shape*
The results about the intensity of the experienced emotions for each of the five main shapes are the following:

*First Main Shape:* The most intensively experienced emotion from this shape is *inspiration* (main score 1.32), following by *fascination* (main score 0.93) and *desire* (main score 0.8). No one of the participants experienced *indignation* and *disgusts*.

*Second Main Shape:* The emotions with the highest rates are: *inspiration* (1.09); *desire* (0.86) and *amusement* (0.84). Not experienced emotions: *indignation*, *contempt* and *disgust*.

*Third Main Shape:* The highest rates have: (the most intensively experienced emotions of this shape) *boredom* (0.8); *disappointment* (0.77); *dissatisfaction* (0.73); *inspiration* (0.66). Not experienced emotions: *pleasant surprise*. Obviously, this shape causes the strongest unpleasant emotional reactions.

*Fourth Main Shape:* The highest rates have: *inspiration* (1.27); *amusement* (1.25); *admiration* (1.23); *pleasant surprise* (1.11). Not experienced emotions: *contempt* and *disgust*.

*Fifth Main Shape:* The highest rates: *inspiration* (1.5) (the highest score for all emotions and all shapes); *amusement* (1.45); *admiration* (1.41); *fascination* (1.39). The emotion *indignation* was not experienced for this shape by no one of the participants.

![Third main shape](image1)

![Fourth main shape](image2)

*Fig. 14.* Emotional responses for the Third Main Shape  
*Fig. 15.* Emotional responses for the Fourth Main Shape

Also, the emotional reactions for the Third Main Shape are different from the emotional
responses received by all other shapes. Using these diagrams, we cannot, however, compare the magnitudes of differences in the emotional expressions elicited by each of the main shapes, and to specify the emotional power of the corresponding shape. For this reason a new analysis has been conducted, which is discussed in the next section.

The summary of the obtained results shows that there was no emotion which is not caused by any of the five shapes. The least experienced emotions (elicited by only two shapes) are indignation and disgust. The emotional expression contempt is elicited only by three of the main shapes. The highest score received inspiration (1.5) elicited by the Fifth Main Shape.

The obtained results confirmed the expectation for differences in emotional reactions of the five main shapes. Moreover, the conducted analysis shows that some differences in the intensity of emotional responses for some shapes are smaller than others.

4.2. Differences between the Emotional Responses for Different Shapes

In order to estimate the ranges of differences in the emotional responses for different shapes, the main scores for pleasant and unpleasant emotions are evaluated. The obtained results are shown on Fig. 17 and Fig. 18.
The results demonstrated in the above figures have imposed the expected view that differences in emotional responses received for the Fourth and Fifth shape are smaller than the differences between the emotions evoked by each of these two shapes compared with others.

4.3. Emotional Profiles
Based on the results in the evaluation of ranges of differences in the intensity of emotional responses for each pair shapes, three sets of shapes are formed: *First set of shapes* (includes Fourth and Fifth main shapes); *Second set of shapes* (includes First and Second main shapes) and *Third set of shapes* (includes the Third Main Shape). The main scores of the intensity of each emotion caused by the shapes included in the first two sets are calculated, and corresponding diagrams are elaborated. Fig. 19 and Fig. 20 are graphical representations of the “emotional profiles” of the first two sets of shapes.

The emotional profile of the third set of shapes, which includes just the Third Main Shape is demonstrated by the responses received for this shape and is shown in Fig. 14.

![First set of shapes](image1)
![Second set of shapes](image2)

Fig. 19. Emotional responses for the First set of shapes.
Fig. 20. Emotional responses for the Second set of shapes.

4.4. Estimation of Mixed Emotions
Obviously, each of the five main shapes, which is applicable in the design of contemporary vehicles has caused mixed emotions. This phenomenon can be observed
in each of the three emotional profiles. Figures 12-16, 19, 20 again show the abilities of
the used instrument to measure mixed emotions. First, Second, Fourth and Fifth main
shapes elicited mainly pleasant emotions, while the Third Main Shape elicited mainly
unpleasant emotions.

Most powerful and most pleasant emotions are elicited by the shapes included in
the First set of shapes. The emotional reactions elicited by the shapes included in the
Second main set are also mainly pleasant than unpleasant. But, compare with the first
set, the intensity of these reactions is lower. The higher score for unpleasant emotions
are received from vehicles whose design is based mainly on the Third Main Shape.
However, the scores for the emotional responses received for the Third Main Shape are
not high for all unpleasant emotions, and not significantly low for all pleasant emotions.
Although to a lesser extent this is also seen in the responses received for the design of
vehicles related to the Second set of shapes.

The shapes from the First set elicited mainly inspiration, amusement and
admiration. These shapes received the lowest scores for unpleasant emotions, i.e. these
shapes barely elicited unpleasant emotions. The shapes from the Second set elicited
mainly inspiration and fascination. At the same time and almost with the same intensity
they caused the unpleasant emotion boredom and the pleasant emotion pleasant surprise.
Although to a lesser extent than forms from the First set, those from the Second caused
desire and amusement. The Third set of shapes elicited with the highest intensity the
emotions boredom, disappointment and dissatisfaction. Moreover, these shapes caused
also the pleasant emotion inspiration. The shapes from the Third set of shapes are both
irritable and amazing.

5. Conclusions
In this study, firstly, shapes used in the contemporary vehicle design are investigated. A
selection of five main shapes is justified based on the existing theories. The proposed
selection of main shapes provides the necessary tools for real creative design process
and opportunities not only in design and traditional design culture, but also in new areas
of knowledge where solving problems of the emotional impact of the appearance of
products becomes a real prospect. Secondly, experimental studies are presented for the
relations between the main shapes applied in the contemporary automotive design and
emotions. The PrEmo instrument, elaborated by Desmet (2002) is used to measure the
emotional responses. It was concluded that the Fourth and Fifth Main shapes evoked
highly intensively pleasant emotions, while the predominant use of the Third Main
Shape in the vehicle design provokes mainly unpleasant emotions. The model of
product-emotions is extended and some new concepts are added related to the emotional
impact of vehicles’ shapes. This study provides empirical evidence on the correlation between emotional experiences and shapes of contemporary vehicles and shows that the emotional impact can be a major shaping factor. The results obtained can be useful for designers in manipulating the emotional impact of the contemporary vehicles, and can also support the education of new designers.

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