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PRIDE AND DESIRE: EXPLORING EMOTIONS IN THE USERS' EVALUATION OF PRODUCTS USING AN ADAPTED VERSION OF THE PREMO RESEARCH TOOL

Art research paper

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Abstract

Design is a field of a dual nature, including both technical aspects of products and aesthetics. Nowadays, with the wide range of tasks undertaken by designers, it is more accurately to interpret product aesthetics as aesthetic experience, which is closely related to the emotions generated by artefacts as well as their images in advertising, marketing or culture. The ability to study the emotions aroused by products can be useful for representatives of many disciplines, including designers.

This article presents an empirical study of the emotions aroused by the appearance of products carried out with the use of an adapted version of the PrEmo tool, within the master's course for design students at the Eugeniusz Geppert Academy of Art and Design in Wrocław. It is divided into two parts: an introduction providing the literature review and a report on the empirical study.

Keywords

design, aesthetics, emotions, analysis of correspondence

Introduction

Aesthetics in design

Whoever has been interested in design is well aware of the “fundamental duality”¹ of this field, which, on the one hand, solves functional problems and, on the other, tries to improve the appearance of products and the overall impression they arouse. Both these aspects are important in design work and inextricably linked with each other.

In relation to design considered as a method of creating artefacts to populate the “artificial world” (in opposition to the natural world), there has always been a dichotomy between design seen as styling, changing fashion, and design understood as problem solving. The tension between aesthetic requirements and functional needs has been and still is a phenomenon analysed by the theoreticians and practitioners of design.

Andy Hamilton, professor at Durham University and director of the Aesthetics, Ethics and Politics Research Cluster, analyses the dual nature of design in his article on the aesthetics of design, noting, for example, that it is impossible to dismiss the aesthetic aspect when examining the classic pieces of design. On the other hand, the ways in which usability problems are solved, and thus the popularity of functional products among users, may well determine their place among the icons of design.

Hamilton takes the phone designed by Henry Dreyfuss as an example. This is actually a good case: the 302 phone is one of the first products that was designed in the modern sense of the word. Reportedly, the decision-makers at Bell Laboratories rejected the designer's proposal to carry out the design process in collaboration with engineers from the very beginning; they believed that this would limit the ‘artistry’ of creative design proposals. In the end, it turned out that the proposals submitted by other designers did not meet the phone manufacturer's expectations and Dreyfuss was allowed to design it ‘from the inside out’.

1 A. Hamilton, *The Aesthetics of Design: Problem-solving versus Fashion and Design*, https://www.academia.edu/11976004/Aesthetics_of_Design [accessed: 28/10/2021], p. 2.



Il. 1. H. Dreyfuss, 302 telephone, ca 1937,
<https://www.cooperhewitt.org/2014/11/06/model-302-telephone-henry-dreyfuss/> [accessed: 19/02/2022].

The product is durable, functional and equipped with innovations: a rotary dial for dialling, automatic connection and interruption of the call when picking up and hanging up the handset, a place to put the card with the phone number. It also has some unquestionable aesthetic advantages: the slightly concave pyramid-like form of the casing and the semi-circular shapes of the microphone and speaker which arouse positive emotions.² The design method chosen by Dreyfuss allowed functional and aesthetic effects to intertwine and reinforce each other: the concave walls of the telephone make it easier to read the numerals on the dial from any perspective, the thickest point of the handset's organic line prompts where to grip it, while the cable emerging from one end of the handset subtly indicates which end is to be placed against the ear. The two latter examples represent the phenomenon of affordance.³

But there are more contemporary examples, that can certainly be included in the canon of design icons, such as the G-Force vacuum cleaner by James Dyson. This device, using the functional innovation of cyclonic separation invented by the designer, was described in his memoirs as "the first impressionist vacuum cleaner".⁴ In contrast to standard colour schemes used for home appliances, Dyson chose for the first commercial model of his vacuum cleaner pink and purple: the "colours of Provence".⁵ As a result, a revolutionary functional innovation was underlined by a new aesthetic.

2 Sometimes associated with the ears of Mickey Mouse.

3 See W. Lidwell, G. Manacsa, *Deconstructing product design. Exploring the form, function, usability, sustainability and commercial success of 100 amazing products*, Beverly, MA 2011, p. 118.

4 J. Dyson, G. Coren, *Against the Odds. An autobiography*, London 1998, p. 164.

5 J. Dyson, G. Coren, *Against the Odds*.



Il. 2. Bagless vacuum cleaner, James Dyson, 1980s,
<https://www.ssplprints.com/image/97015/dyson-g-force-cyclonic-vacuum-cleaner-1990>
[accessed: 19/02/2022].

It is worth recalling at this point the MAYA principle formulated by the American designer and stylist Raymond Loewy. The name of the principle is an acronym of *Most Advanced Yet Acceptable* – which assumes that the most commercially successful designs are those in which advanced innovation is accompanied by an aesthetic that is cutting-edge yet recognisable enough to be accepted by the users. The *Variable Balans* kneeling chair designed by the Norwegian industrial designer Peter Opsvik in 1976 is a perfect illustration of the MAYA principle.



Il. 3. Variable Balans kneeling chair, 1979,
http://collectiononline.design-museum.de/#!/en/object/21103?_k=3a3jtf [accessed: 23/02/2022].

The project of this kneeling chair was the result of the designer's several-year research into the natural sitting position of humans, during which he came to the conclusion that even when sitting, people do not remain motionless, but are constantly moving. Opsvik thus created an ergonomic piece of seating that allows to change position and preserve the natural curves of the human spine. And although this construction offers a certain affordance – the seating person intuitively feels where to put their knees – from the aesthetic perspective it is a utilitarian product, devoid of references to emotion, and, above all, failing to meet the requirements of the MAYA principle: "it was perhaps too unusual for mainstream acceptance".⁶

The complex relationship between aesthetics and functionality includes the unexpected phenomena, and while one would hardly expect a design icon to be actually an object that represent functional deficiencies, the author of *Aesthetics of Design* reveals that the original Mini Morris rusted quickly and Wright's houses leaked.⁷

There is no doubt that aesthetic and the question of problem solving influence each other. "The best-designed objects seem to solve problems with a sense of style".⁸ Of course, there are borderline phenomena that cannot be easily classified as design or excluded from this category with equal certainty. Hamilton quotes the example of experimenting with the chemical composition of detergents: an activity that cannot be counted as design-related, even though it is, in principle, a problem-solving initiative. Problem solving in design should include some aesthetic component: even motors hidden inside machines are potentially seen by operators or engineers, so they can be counted as part of the world of design.⁹

Prasad Boradkar, professor emeritus at Arizona State University, in his book *Designing Things. A Critical Introduction to the Culture of Objects* emphasises that working on the aesthetics of artefacts is one of the fundamental tasks of design practice, although he also adds that, according to cultural studies scholars, it also takes the form of deceiving and seducing consumers, who are, by the way, co-creators of styles, tastes and fashions. Boradkar argues in his text that

As the profession of industrial design broadens the boundaries of its concerns, and as the assignments undertaken by the industrial design firms often include entire systems of interactions between people and the world, products are being considered in terms of experiences rather than objects. In relation to such a notion of products, the [...] definition of aesthetics as **aesthetic experience**¹⁰ or a state of mind might be the most suitable to explore in relation to design.¹¹

6 W. Lidwell, G. Manacsa, *Deconstructing product design*, p. 201.

7 A. Hamilton, *The Aesthetics of Design*, p. 3.

8 A. Hamilton, *The Aesthetics of Design*, p. 3.

9 A. Hamilton, *The Aesthetics of Design*, p. 4.

10 Highlights by the author.

11 P. Boradkar, *Designing Things. A Critical Introduction to the Culture of Objects*, London–New York 2014, p. 130.

According to Paul Hekkert, Professor of Form Theory at the Delft University of Technology, the typical experience of a designed product includes three components: cognitive, aesthetic and emotional. They are all interconnected and experienced together as a single entity (sensory delight, semantic interpretation and emotional engagement):

[...] a tentative definition of product experience would be: the entire set of effects that is elicited by the interaction between a user and a product, including the degree to which all our senses are gratified (aesthetic experience), the meanings we attach to the product (experience of meaning), and the feelings and emotions that are elicited (emotional experience).¹²

Aesthetics and functionality are not in opposition to each other, the relationship between them in a given product can be represented as a point on a straight line, with aesthetics at one end and functionality at the other. The decision where to place the emphasis on the axis between aesthetics and functionality was made by individual designers, according to their personal feeling, style and taste, but also in reference to current trends, to the spirit of a given era illustrated by the well-known modernist maxim “form follows function”¹³ in its several modifications.

Design and emotions

In 2006 Hartmut Esslinger, founder of the design agency Frogdesign, reformulated the traditional motto defining interests in function in relation to other aspects of design and proposed the following principle: “form follows emotion”.

This expression resulted from reflections on the state of design in the 1980s and the dynamic development of the high-tech industry. Faithful application of the functionalism theory and the Dieter Rams' principles of good design made the designers' activities began to be characterised by universal, essentialist aesthetics, and products intended for the mass market often looked like technical devices. Esslinger considered this a negative phenomenon and strove to introduce emotions into the relationship between humans and designed devices.¹⁴

This approach led the German designer to start working with Apple; this collaboration was crowned with the development and launch of the Apple IIc computer in 1984. This first computer of the company designed in the Snow White style became an icon of design and a model for the next generations of designers.¹⁵

12 P. Hekkert, *Design aesthetics: principles of pleasure in design*, “Psychology Science”, 48 (2006), issue 2, p. 160, https://www.academia.edu/4961005/Design_aesthetics_principles_of_pleasure_in_design [accessed: 15/03/2021].

13 After all, this modernist slogan resulted in the ‘essentialist’, ornament-free aesthetic of the projects designed by Dieter Rams and other designers from the Ulm School of Design.

14 The so-called Aesthetics-Usability Effect.

15 See <https://www.red-dot-design-museum.de/essen/ausstellungen/design-grundlagen/designprinzipien/form-follows-emotion> [accessed: 01/12/2021].

The design of the Apple IIc computer was driven primarily by the manufacturer's breakthrough concept to make the products stand out with contemporary styling. Esslinger and his co-workers took part in a competition announced by the Steve Jobs' company and proposed the use of an innovative design language, eventually used for an entire product line.¹⁶



Il. 4. MacIntosh IIfx computer, 1989, photo: Ben Boldt,
https://en.wikipedia.org/w/index.php?title=File:Macintosh_IIfx.png [accessed: 19/02/2022].

The case of MacIntosh IIfx, for example, features a series of parallel grooves that hide air vents and a disc drive drawer, which enables keeping the whole form clean. On the front of the unit, the grooves are arranged asymmetrically so that the balance of the composition is maintained. Even the fact that the edges are chamfered at the front, while at the back they are aligned sharply without chamfering, is supposed to soften the perspective accentuated by the series of parallel lines on the top wall of the case and make the object look smaller than it really is. Esslinger and his team also introduced a distinctive three-dimensional Apple logo, as well as a broken white colour called Fog, which made the computers easily recognisable around the world. The product was well thought-out in terms of functionality; one of its noteworthy features was the easy removal of the cover and the possibility to change the position of the 'feet' that slide into the grooves to use the computer in landscape or portrait orientation. This consistent design language was applied to all the peripheral appliances: parallel lines of grooves appear on the keyboard, the dedicated mouse and even the end of the power cable.¹⁷

The Snow White design language comprised about 10 elements, used in various configurations in a range of Apple products until the early 1990s, when the industrial design department of the company gradually began to withdraw them.¹⁸ A device designed in this way, with minimised visual noise, composed like a work of art and encouraging user interaction, embodied the design idea expressed in the slogan "form results from emotion" or "form follows emotion".

16 See <https://en.google-info.in/3608414/1/snow-white-design-language.html> [accessed: 16/12/2021]. The connection between the apple and Snow White could have been inspired by the fairy tale by Brothers Grimm.

17 Ruben de Rijcke, *The Snow White design language*, The Computer Archive, DEND Media Services, https://www.youtube.com/watch?v=h_6DKvyaP_I [accessed: 14/12/2021]. See also: <https://euiipo.europa.eu/ohimportal/pl/dea-2018-lifetime> [accessed: 14/12/2021].

18 The entire list of elements of the Snow White design language can be found, among others, at <https://en.google-info.in/3608414/1/snow-white-design-language.html> [accessed: 16/12/2021].

Emotional design initiated by the creative work of teams such as Frogdesign has been taken up by other designers and scientists; one of the most prominent representatives of them is Donald Norman,¹⁹ scientist, engineer, cognitive psychologist and designer. In his publications, Norman was very explicit about the role of emotion in design, writing, among other things, that products can be more than the sum of the functions they perform.²⁰

As Norman argued, this is due to the complexity of the functioning of the human brain and the functions of thinking, which can generally be divided into unconscious (fast and automatic, controlling the learned behaviour) and conscious (slow, controlled and activated in new, dangerous or non-standard situations).²¹ Norman pointed out that thought processes and emotions cannot be separated. Thoughts arouse emotions, emotions make you think.²²

The model of processing information in the brain proposed by Norman consists of three levels. The primary level concerns direct perception: sound, visual aspects, texture and smell.²³ The second level is behavioural, or, in other words: it relates to the efficiency of use. Efficiency of use can be understood as practicality and following the learned patterns, i.e. fulfilling expectations of functionality. The third level of processing information in the brain is called reflexive and it includes various types of reactions related to the object's history of use, intellectual reception, prestige in a broad sense or feelings of nostalgia. It is not a level that is triggered spontaneously and immediately, as "reflection is a cognitive, deep and time-consuming process".²⁴

The study conducted at the Chair of Design of the Academy of Art and Design in Wrocław in 2017 with the use of Norman's three levels of information processing in the brain, clearly proved that emotions emerge at each of these three levels: in response to impressions from direct perception, in experiencing the product during use, or in connection with intellectual reception at the reflective level.²⁵

19 M. van Hout, *Getting Emotional with... Hartmut Esslinger*, „Design @Emotion”, 2006, <https://www.design-emotion.com/2006/08/15/getting-emotional-with-hartmut-esslinger/> [accessed: 16/12/2021]: "I know, like and respect Don. However, as we introduced «emotional design» 40 years ago, it makes me very happy when other strategists, designers, and usability specialists like Don join our mission."

20 D.A. Norman, *Wzornictwo i emocje. Dlaczego kochamy i nienawidzimy rzeczy powszednie*, transl. D. Skalska-Stefańska, Warszawa 2015, p. 91.

21 D. Norman, *Dizajn na co dzień*, transl. D. Malina, Kraków 2018, p. 69.

22 D. Norman, *Dizajn na co dzień*, p. 67.

23 D. Norman, *Dizajn na co dzień*, p. 69.

24 D. Norman, *Dizajn na co dzień*, p. 73.

25 B. Ludwiczak, *Emocje i praktyczność w recepcji pojazdów przez projektantów*, "Systemy Wspomagania w Inżynierii Produkcji. Komunikacja w Obszarach Sztuki i Techniki", 9 (2020), issue 1.

How to study the emotions aroused by the aesthetic experience of products

So, if assuming the user's emotional response when designing artefacts is so important, a new issue arises: can these emotions be studied and measured?

This question has been asked by, among others, the consumer behaviour researchers who have found that emotions aroused by products increase the pleasure of buying, owning and using those products. In addition, it is often argued that the value of products associated with either experience or emotion has the potential to make them stand out in the market, as products are currently similar in terms of quality, price and technical features. In some purchasing decisions, emotional arguments can play decisive role.

One of the researchers working on the issue of design for emotion and user well-being, as well as the possibilities of measuring emotional experience is Pieter Desmet, professor of Design for Experience at the Delft University of Technology. His main research interests focus on understanding why and how designed products evoke emotions, as well as how design can improve the well-being of individual users and communities.²⁶

According to Desmet, the "enjoyment of use", i.e. the pleasure experienced when using a product, belongs to the realm of emotion, not reason. However, analysing the emotional aspects of the use of a given product is complicated by the fact that the experience itself is difficult to be captured. The difficulty is exacerbated by the fact that the above-mentioned "enjoyment of use" is not a single emotion, but probably the result of a wider number of positive emotions.²⁷

Desmet gives as an example the emotions that might be felt by someone watching a film. Of course, one of the emotions is the joy of having a good time, enjoying a modern form of entertainment. At the same time, this person "will experience all kinds of emotions, such as fear, amusement, anger, relief, disappointment, hope, etcetera".²⁸ Instead of one isolated emotion, we would have here a combination of emotions that contribute to the sensation of pleasure like 'joy'. As Desmet concludes, presumably the same applies to other instances of 'joy': whether laughing together with someone at a joke, using a mobile phone or interacting with a computer.

Aware that studying the process by which emotions arise or are aroused will enable a better understanding of the sources of pleasure derived from interacting with products, which can translate into

26 <https://www.tudelft.nl/io/over-io/personen/desmet-pma> [accessed: 17/02/2022].

27 P. Desmet, *Measuring Emotions: Development and Application of an Instrument to Measure Emotional Responses to Products*, Dordrecht 2013, p. 1, https://www.researchgate.net/publication/313757692_Measuring_emotion_Development_and_application_of_an_instrument_to_Measure_Emotional_Responses_to_Products?enrichId=rgreq-4e-9771061be7eef1692befb8e9f31b5a-XXX&enrichSource=Y292ZXJQYWdlOzMzMzc1NzY5MjUzBUzo2NjAyNzUwO-TAyODU1NzFAMTUzNDQzMjc4MDM0NQ%3D%3D&el=1_x_2&_esc=publicationCoverPdf [accessed: 09/07/2020].

28 P. Desmet, *Measuring Emotions*, p. 1.

more effective design, the Dutch researcher initiated research dedicated to developing a tool to measure emotional responses. Its assumptions included the possibility of measuring subtle (low intensity) emotions and mixed emotions, i.e. the simultaneous presence of more than one emotion.²⁹

When working on the new emotion measurement tool, Desmet took into account the state of emotion research, starting with a definition:

[...] at present the most favoured solution is to say that emotions are best treated as a multifaceted phenomenon consisting of the following components: behavioural reactions (e.g. approaching), expressive reactions (e.g. smiling), physiological reactions (e.g. heart pounding), and subjective feelings (e.g. feeling amused).³⁰

The problem is that most tools for measuring emotions only focus on one of the components mentioned.

Existing methods for measuring emotions can be divided into non-verbal and verbal. The non-verbal methods measure the expressive or physiological component of emotion. Expressive reactions are associated with facial expressions, sounds or body postures accompanying the occurrence of a given emotion (anger may be associated with a fixed gaze, drawn-down eyebrows and lips, short, vigorous movements, sometimes a sharp, high-pitched sound). Physiological reactions accompanying emotions may include heart rate, blood pressure and dilated pupils.

The non-verbal measurement of emotions has many advantages. First of all, by its very definition, it is independent of the language spoken by the people being measured and can therefore be used in different cultural backgrounds. They are also among the relatively discrete methods, the measurements performed are not burdensome for the research participants. Another advantage they represent is objectivity, as they do not depend on participants' conscious self-assessment.

However, the non-verbal emotions are also associated with certain limitations: they only allow the study of basic emotions (such as anger, fear or joy). They are also unsuitable for the study of mixed emotions and therefore not entirely applicable to the study of emotions aroused by products.³¹

The above-mentioned limitations of non-verbal methods are offset by verbal methods, which generally measure the subjective feeling of the emotional component. Subjective feelings, for example a sense of inspiration or happiness, reflect an awareness of the emotional state someone is in, that is, a subjective emotional experience. Such subjective feelings can only be measured with a self-questionnaire. In the most commonly used surveys respondents describe their emotions using either a scale or verbal descriptions.

29 P. Desmet, *Measuring Emotions*, p. 3.

30 P. Desmet, *Measuring Emotions*, p. 4.

31 P. Desmet, *Measuring Emotions*, pp. 4–5.

Verbal methods also have their advantages and disadvantages. Advantages include the fact that they enable the measurement of any set of emotions, even the mixed emotions. In contrast, verbal methods are limited by the fact that they are difficult to apply in different cultures.³²

Given the shortcomings of the methods developed so far, Pieter Desmet and his team created their own research tool with the intention of combining the advantages of verbal and non-verbal methods. The assumption was to enable the measurement of their own mixed emotions, but without the participants having to verbalise them.

PrEmo Emotions

For more information about the emotions, see: www.emotiontypology.com

Pride

The feeling when you possess (or have accomplished) something that exceeds your own expectations, or that others find praiseworthy.



Shame

The feeling when someone knows something bad about you. You believe this to be true, so you also feel bad about yourself.



Admiration

The feeling when you look up to someone who has excellent abilities or impressive accomplishments.



Contempt

The feeling when someone is inferior or unworthy in your eyes; they have done something blameworthy.



Joy

The feeling when something good happens to you. You fulfil a need, achieve something, or make progress towards achieving a goal.



Sadness

The feeling when you have lost something that was important to you, and believe it cannot be undone.



Hope

The feeling when you believe (but are not certain) that something good or desirable may happen in the future.



Fear

The feeling when something can harm you or someone you care about, and you are not sure whether you can do anything about it.



Satisfaction

The feeling when something meets or exceeds your expectations.



Anger

The feeling when someone does something bad that harms or offends you, and you blame that other person.



Desire

The feeling when you anticipate that something will be beneficial once acquired or consumed.



Disgust

The feeling when you find something repulsive and want to avoid having contact with it in any way.



Fascination

The feeling when you encounter something new and interesting that you do not immediately understand.



Boredom

The feeling when there is nothing interesting or engaging to do or experience.



II. 5. Representing different emotions with facial expressions and gestures in the PrEmo tool, <https://zenodo.org/record/3727497/files/PrEmo-card-manual.pdf> [accessed: 19/02/2022].

PrEmo, a non-verbal self-questionnaire measuring emotions evoked by products, was created on the basis of the innate human ability to interpret emotions based on facial expressions.³³ Participants in the study do not have to describe their emotions in words; they only mark the emotions they feel by selecting appropriate animated character drawings that clearly illustrate the relevant emotions using gestures, facial expressions and sounds.

The effectiveness of PrEmo was tested in repeated experiments and the tool was refined based on the results. As Desmet emphasises, the analysis of feelings aroused by designed products can allow designers to control the achievement of the effects desired as a result of the design process; moreover, it will allow them to communicate their intentions to other members of the team working on the project. Even the appearance of negative emotions does not necessarily disqualify the product: for

32 P. Desmet, *Measuring Emotions*, pp. 3–4.

33 <https://diopd.org/premo/> [accessed: 13/07/2020].

some people, feeling conflicting emotions can be as attractive as riding a rollercoaster. Skilful manipulation of the emotions aroused by a product can result in designs that are original, interesting and rich in opportunities for interaction. The awareness of these issues seems to be useful also for design students.

Empirical study of emotions aroused by the appearance of products with the use of adapted emotion measurement tool called PrEmo

As part of the course Semantics of the Form in the Chair of Design of the Eugeniusz Geppert Academy of Art and Design in Wrocław, a research experiment was carried out with the use of adapted emotion measurement tool called PrEmo, the aim of which was to investigate emotions aroused by the appearance of selected car models.

Aim of the experiment

The aim of the analysis is to group car brands according to the emotions of people looking at them on photographs.

Test sample and course of the experiment

After listening to a lecture on aesthetics in design, emotions in design, and experiments conducted by the Dutch designer and university lecturer Pieter Desmet, a group of students participating in the course Semantics of Form decided that the group of products to be analysed would consist of cars.³⁴

The students were also left free to choose the specific car models; as the course had five participants, the Mural board (the classes were conducted on-line) displayed a set of 15 car models.

They included: six vehicles belonging to the 'sport' category (Aston Martin DB5, Mustang Mach-E, Mazda MX-5, Subaru Impreza STI, Lamborghini Huracan, Mustang Shelby GT500), two vehicles belonging to the 'family' category (Volkswagen Passat, Fiat 125p), four cars belonging to the 'city' category (Nissan Cube III, Mini One, Fiat 126p, Smart Roadster), two vans (Volkswagen Transporter I, Opel Zafira Tourer) and one SUV: Dacia Duster.

The questionnaire scheme was prepared by the lecturer, after which one of the students placed the images of the cars in the questionnaire. The emotions that respondents had to choose from were taken from the PrEmo tool and included seven positive emotions: pride, admiration, joy, hope, satisfaction,

34 This came as a surprise to the lecturer, who had expected a different product category to be indicated. However, the students' decision seems to confirm the uniqueness of this group of means of transport in evoking emotional responses in users, consumers and observers.

desire, fascination, as well as seven negative emotions: shame, dislike, sadness, fear, anger, aversion and boredom.

The questionnaire was filled by the course participants, their friends and families, as well as by participants in some of the first- and second-year foreign language classes. In the end this represented the group of 45 people, of which $\frac{1}{4}$ were men and $\frac{3}{4}$ were women. The majority (91%) were young people, aged 20-30, with slightly over half being design related (students of design or designer by profession, 53.3%) and nearly half (46.7%) were non-design related.

Methodology of analysis (correspondence analysis)

Due to the type of variables (nominal variables), correspondence analysis was used. Correspondence analysis is a method of visualising in a two-dimensional coordinate system the co-occurrence of categories of two nominal variables.³⁵ The analysis was performed in the PS Imago software, following the procedure described in the manual *Analiza klienta* (Client analysis).³⁶

Results

The following section presents the results of the analysis carried out. First, a correspondence table is presented describing the joint distribution of the two studied characteristics, i.e. the car brand and the emotions of the person looking at the car.

³⁵ M. Rószkiewicz, *Analiza klienta*, Kraków, p. 142.

³⁶ M. Rószkiewicz, *Analiza klienta*.

Brand	Emotions								
	Pride	Admiration	Joy	Shame	Dislike	Sadness	Hope	Satisfaction	Desire
Aston Martin DB5	5	26	6	0	1	0	1	10	9
Mustang Mach-E	2	10	3	0	10	1	4	5	6
Fiat 125p	5	10	11	1	4	0	0	5	2
Mazda MX-5	0	2	9	5	13	1	0	1	1
Nissan Cube III	0	0	2	5	21	4	1	0	1
Smart Roadster	0	4	0	1	17	3	1	0	0
Volkswagen Trans- porter I	7	19	26	1	1	1	5	12	15
Mini One	1	7	11	2	2	0	5	11	9
Fiat 126p	12	9	16	3	4	1	4	8	7
Subaru Impreza STI	3	7	5	2	12	1	2	9	3
Volkswagen Passat	2	4	3	1	5	0	3	5	7
Dacia Duster	7	5	3	3	5	2	0	2	5
Lamborghini Hura- can	2	14	5	0	7	0	1	9	11
Mustang Shelby GT500	5	18	7	0	5	1	3	8	17
Opel Zafira Tourer	0	1	1	1	14	2	2	2	1
Marginal total of actives	51	136	108	25	121	17	32	87	94

Table 1. Correspondence table describing the joint distribution of the studied characteristics, source: own materials.

Brand	Emotions					
	Fascination	Fear	Anger	Aversion	Boredom	Marginal total of actives
Aston Martin DB5	21	0	0	0	5	84
Mustang Mach-E	11	3	1	8	9	73
Fiat 125p	9	0	0	1	8	56
Mazda MX-5	6	0	2	17	6	63
Nissan Cube III	4	4	10	27	11	90
Smart Roadster	4	3	2	14	10	59
Volkswagen Transporter I	22	2	0	0	2	113
Mini One	7	1	1	2	11	70
Fiat 126p	11	1	0	2	5	83
Subaru Impreza STI	11	4	4	6	9	78
Volkswagen Passat	5	0	2	4	23	64
Dacia Duster	6	1	5	4	13	61
Lamborghini Huracan	18	6	4	3	3	83
Mustang Shelby GT500	20	5	1	3	3	96
Opel Zafira Tourer	1	2	0	11	28	66
Marginal total of actives	156	32	32	102	146	1139

Table 1 (continued). Correspondence table describing the joint distribution of the studied characteristics, source: own materials.

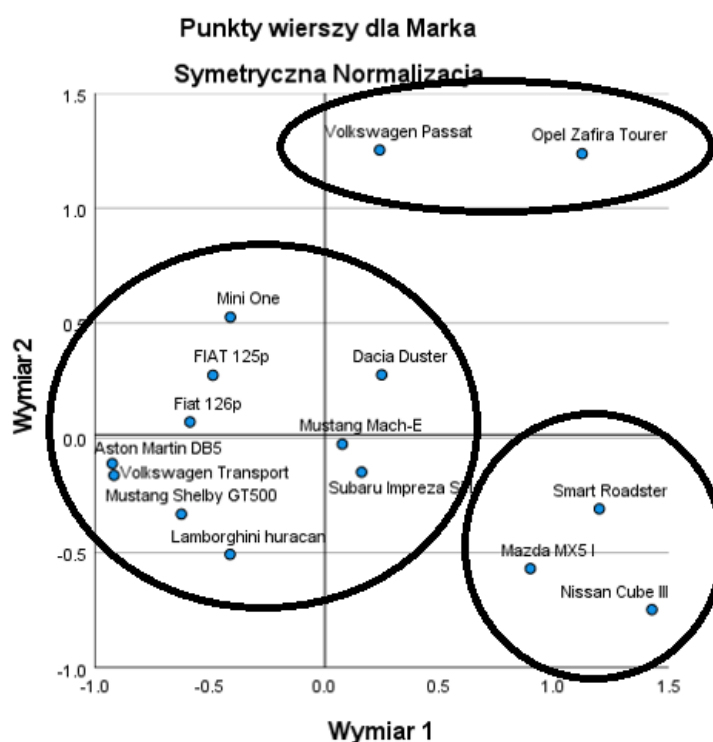
Table 2 shows all the possible dimensions, based on 15 car models and 14 emotions aroused while the participant looked at them. There are 13 dimensions in total and each of them is associated with a singular value, according to which the decomposition of the correspondence matrix was carried out.

Dimension	Distinctive value	Inertia	Chi-square	Relevance	Inertia ratio		Confidence – a distinctive value	
					Explained	Cumulated	Standard deviation	Correlation
								2
1	.600	.359			.579	.579	.021	.073
2	.302	.091			.147	.726	.035	
3	.256	.066			.106	.832		
4	.183	.033			.054	.886		
5	.170	.029			.046	.932		
6	.132	.017			.028	.960		
7	.107	.011			.018	.978		
8	.081	.006			.010	.989		
9	.065	.004			.007	.996		
10	.042	.002			.003	.998		
11	.024	.001			.001	.999		
12	.017	.000			.000	1.000		
13	.009	.000			.000	1.000		
Total		.621	706.897	.000a	1.000	1.000		
and 182 degrees of freedom								

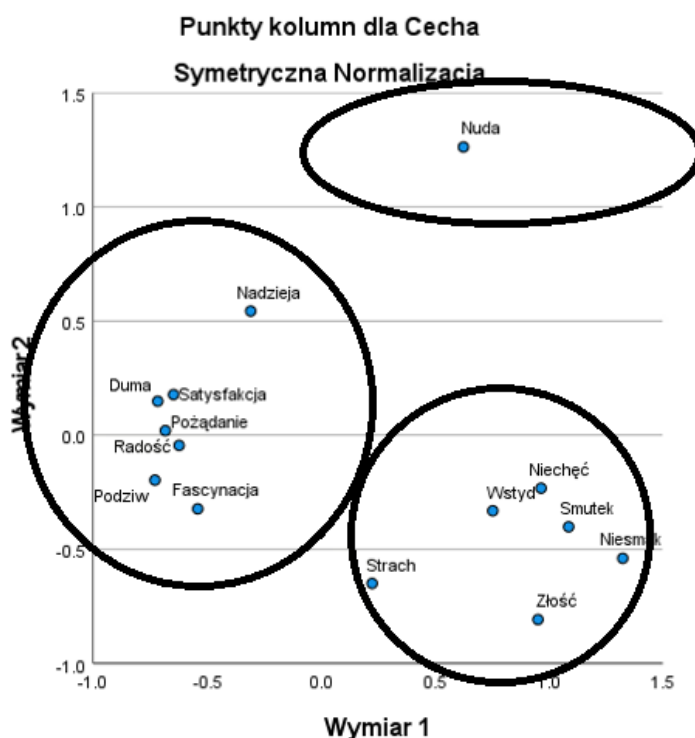
Table 2. All dimensions that can be determined, source: own materials.

Each dimension was characterised by a dispersion score, or inertia. The inertia coefficient enables the assessment of the degree of reproduction of the information contained in the correspondence table. The greater its value, the greater the degree of information restoration. The cumulative value of explained inertia for the two dimensions is 0.726, which means that the first two dimensions reproduce 72.6% of the information contained in the correspondence table, which is a good result.³⁷

The place of the brands and their attributes in the coordinate system explains the relationship of the car brand to the emotions of the person looking at the given car. For clarity, the distribution of scores for the variable 'car brand' and 'emotions' are shown in two separate graphs.



Graph 1. Distribution of scores for the variable 'car brand', source: own materials.



Graph 2. Distribution of scores for the variable 'emotions', source: own materials.

Based on the analysis, car brands can be divided into three groups. First group are boring cars; it includes Volkswagen Passat and Opel Zafira Tourer. Second group consists of brands that evoke negative emotions such as dislike, fear, anger or aversion. These include Smart Roadster, Mazda MX-5 and Nissan Cube III. The rest of the cars evoke positive emotions such as hope, satisfaction, fascination, joy or desire.

Discussion

Correspondence analysis is a data visualisation method used, among other things, in marketing to determine the characteristics that users associate with selected products.

One dominant negative emotion, namely boredom, appeared in relation to a group consisting of two family cars: Volkswagen Passat and Opel Zafira Tourer. These cars belong to the segment of brands considered as stable, functional but not particularly exciting in terms of form. The result of the survey confirms this reputation.

The second group of vehicles arousing the remaining negative emotions is varied in the nature of the form. Nissan Cube III, sometimes called 'a box on wheels', and Smart Roadster belong to utilitarian and practical designs, but the silhouette of Mazda MX-5 represents a completely different style.

However, in the group of people surveyed, this car evoked many negative emotions: for example dislike, anger, aversion or even sadness. At this point the findings are difficult to be interpreted.

The third group is most diverse in terms of design and character. It can be divided into three sub-groups: cars with a contemporary form expressing speed, power, luxury or technological advancement; a group of cars with a historical form (Fiat 125p, Fiat 126p, Volkswagen Transporter); or effectively referring to historical predecessors (Mini One) and the Dacia Duster: a contemporary, rather conservatively designed SUV. Although the 'success' of the latter model is difficult to explain, the positive emotions aroused by the cars of the 'historical' group probably prove that cars are among those products that are difficult to be evaluated solely on the basis of aesthetics; that in the evaluation of vehicles, using the Norman's terminology, the brain very quickly moves from the primary level to the reflexive level and so the emotions reported by the participants of the study are a reaction not only to the external appearance but also to the memories, knowledge and positive associations that arise when looking at the given object.

The respondents also mentioned a number of other emotions they felt when looking at the photos of the cars in the questionnaire. These included amusement, sentiment, interest or lack of affection. However, these were responses reported by individual respondents only.

The research experiment carried out with the use of an adapted version of the PrEmo research tool made it possible to group car brands according to the emotions accompanying people looking at them on photographs. The results of the experiment may partly confirm initial expectations, and partly turned out to be surprising, giving future designers material to think about and reflect on the form of the designed artefacts. This experience has already proved useful to students to plan research in the design process during their diploma assignments.

I would like to thank doctor Przemysław Tomczyk for his help in using correspondence analysis to develop the research results.

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