

**MEASURING EMOTIONS IN PRODUCT DESIGN: A  
STUDY ON EMOTIONAL RESPONSES TO  
CONCEPTUAL CAR DESIGNS**

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**ÜRÜN TASARIMINDA HEYECAN ÖLÇÜMÜ:  
KONSEPT OTOMOBİLLERE KARŞI DUYULAN  
HEYECANLAR ÜZERİNE BİR ÇALIŞMA**

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## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS</b>	<b>iii</b>
<b>TABLE OF CONTENTS</b>	<b>iv</b>
<b>ABBREVIATIONS</b>	<b>vi</b>
<b>LIST OF TABLES</b>	<b>vii</b>
<b>LIST OF FIGURES</b>	<b>viii</b>
<b>SUMMARY</b>	<b>xi</b>
<b>ÖZET</b>	<b>xiii</b>
<b>1. INTRODUCTION</b>	<b>1</b>
<b>2. LITERATURE REVIEW</b>	<b>3</b>
2.1. What is an Emotion?	3
2.1.1. Definition of Emotion	3
2.1.2. Emotion Types	5
2.1.3. Theory of Emotion	9
2.1.4. Emotion, Expression and Culture	15
2.2. Emotional Design	20
2.2.1. Identifying Consumer Needs	20
2.2.2. Defining Emotions Towards Products	24
2.2.2.1. Defining Pleasure and Pleasurable Design	24
2.2.2.2. Classifying Product Emotions	28
2.2.2.3. Products Properties That Elicit Emotions	33
2.3. Designing Emotionally Effective Products	37
2.3.1. Emotional Products	37
2.3.2. Consumer Taste, Product Attachment and Product Personalization	39
2.3.3. Product Experience and Experience Design	41
2.3.4. Hedonic Experience and Empathic Design	43
2.3.5. Methods of Designing Emotional Products	44
2.3.6. Studies on Designing Emotional Products	62
2.4. Product Evaluation and Product Emotion Measurement	65
2.4.1. Product Evaluation Techniques	65
2.4.1.1. Visual Product Evaluation	65
2.4.1.2. Product Handling	67
2.4.1.3. Mood Boards	70
2.4.1.4. Product Personality Profiling	71
2.4.2. Emotion Measurement Techniques	73
2.4.2.1. Instruments that Measure Emotional Expressions	74
2.4.2.2. Instruments that Measure Physiological Reactions	77
2.4.2.3. Instruments that Measure Subjective Feelings	77
2.4.2.4. Evaluative Tools and Methods	78
2.4.2.5. Product Emotion Measurement Instrument (PrEmo)	92

<b>3. METHODOLOGY</b>	<b>102</b>
3.1. Aim	102
3.2. Pilot Study	103
3.2.1. Participants	103
3.2.2. The Stimuli	104
3.2.3. The Instrument	104
3.2.4. Descriptive Statistics of Users' Responses to the Questionnaire	105
3.3. Research	105
3.3.1. Participants	106
3.3.2. The Instrument	108
3.3.3. The Stimuli	111
3.3.4. Data Analysis	112
<b>4. RESULTS</b>	<b>113</b>
4.1. Descriptive Statistics of Participants' Responses	113
4.2. Descriptive Statistics of Responses According to the Gender Difference	134
4.2.1. Emotional Responses to Car A	134
4.2.2. Emotional Responses to Car B	135
4.2.3. Emotional Responses to Car C	136
4.2.4. Emotional Responses to Car D	137
4.2.5. Emotional Responses to Car E	138
4.2.6. Emotional Responses to Car F	139
4.2.7. Emotional Responses to Car G	140
4.3. Comparison across Genders	142
<b>5. CONCLUSION AND DISCUSSION</b>	<b>148</b>
<b>REFERENCES</b>	<b>152</b>
<b>APPENDIX</b>	<b>162</b>
<b>CURRICULUM VITAE</b>	<b>186</b>

## ABBREVIATIONS

<b>CMTS</b>	: Context Mapping Tool Suite
<b>IA Cards</b>	: Inspiration & Assessment Cards
<b>RGT</b>	: Repertory Grid Technique
<b>[p&amp;e] Navigator</b>	: [product & emotion] Navigator
<b>KESo</b>	: Kansei Engineering Software
<b>SQ</b>	: Subjective Questionnaire
<b>PrEmo</b>	: Product Emotion Measurement Instrument
<b>LED</b>	: Locally Experienced Discomfort Questionnaire
<b>FACS</b>	: Facial Action Coding System
<b>FEAT</b>	: Facial Expression Analysis Tool
<b>ANS</b>	: Autonomic Nervous System
<b>SAM</b>	: Self-Assessment Manikin
<b>UCC</b>	: User Compass Chart
<b>PSA</b>	: Product Semantic Analysis
<b>2DES</b>	: Two Dimensional Emotion Space
<b>DES</b>	: Differential Emotions Scale
<b>GEW</b>	: Geneva Emotion Wheel
<b>RVS</b>	: Rokeach Value Survey
<b>ANOVA</b>	: Analysis of Variance
<b>MANOVA</b>	: Multivariate Analysis of Variance

## LIST OF TABLES

	<b><u>Page No</u></b>
<b>Table 2.2.1</b> Needs, Features, Benefits.....	21
<b>Table 2.4.1</b> Emotion Categories.....	94
<b>Table 2.4.2</b> Distribution of age and gender over the two value groups.....	99
<b>Table 2.4.3</b> The relationship between value-group membership and emotional responses.....	101
<b>Table 3.1</b> The number of the participants from different occupations.....	103
<b>Table 3.2</b> The number of participants from different age groups.....	104
<b>Table 3.3</b> The results of the questionnaire.....	105
<b>Table 3.4</b> Distribution of ages of the participants.....	107
<b>Table 4.1</b> The emotional responses of all respondents to Car A.....	114
<b>Table 4.2</b> The emotional responses of all respondents to Car B.....	117
<b>Table 4.3</b> The emotional responses of all respondents to Car C.....	120
<b>Table 4.4</b> The emotional responses of all respondents to Car D.....	123
<b>Table 4.5</b> The emotional responses of all respondents to Car E.....	126
<b>Table 4.6</b> The emotional responses of all respondents to Car F.....	129
<b>Table 4.7</b> The emotional responses of all respondents to Car G.....	132
<b>Table 4.8</b> Negative emotional responses to Car A.....	135
<b>Table 4.9</b> Positive emotional responses to Car A.....	135
<b>Table 4.10</b> Negative emotional responses to Car B.....	136
<b>Table 4.11</b> Positive emotional responses to Car B.....	136
<b>Table 4.12</b> Negative emotional responses to Car C.....	137
<b>Table 4.13</b> Positive emotional responses to Car C.....	137
<b>Table 4.14</b> Negative emotional responses to Car D.....	138
<b>Table 4.15</b> Positive emotional responses to Car D.....	138
<b>Table 4.16</b> Negative emotional responses to Car E.....	139
<b>Table 4.17</b> Positive emotional responses to Car E.....	139
<b>Table 4.18</b> Negative emotional responses to Car F.....	140
<b>Table 4.19</b> Positive emotional responses to Car F.....	140
<b>Table 4.20</b> Negative emotional responses to Car G.....	141
<b>Table 4.21</b> Positive emotional responses to Car G.....	141
<b>Table E.1</b> Car A.....	179
<b>Table E.2</b> Car B.....	180
<b>Table E.3</b> Car C.....	181
<b>Table E.4</b> Car D.....	182
<b>Table E.5</b> Car E.....	183
<b>Table E.6</b> Car F.....	184
<b>Table E.7</b> Car G.....	185

## LIST OF FIGURES

	<u>Page No</u>
<b>Figure 2.1.1</b>	Typical Distribution of Experienced Moods..... 6
<b>Figure 2.1.2</b>	Differences between emotional statement and emotional experience..... 13
<b>Figure 2.1.3</b>	Model of product emotions..... 14
<b>Figure 2.2.1</b>	Maslow's "Hierarchy of Needs"..... 22
<b>Figure 2.2.2</b>	Jordan's Hierarchy of Consumer Needs..... 22
<b>Figure 2.2.3</b>	The four pleasures..... 25
<b>Figure 2.2.4</b>	Basic model of Product Emotions..... 26
<b>Figure 2.2.5</b>	Model of Product Emotions..... 28
<b>Figure 2.2.6</b>	The Circumplex of Emotions..... 31
<b>Figure 2.2.7</b>	The Circumplex of 41 Product Relevant Emotions..... 32
<b>Figure 2.2.8</b>	Desmet's classification of product emotions..... 32
<b>Figure 2.3.1</b>	Three-step approach..... 39
<b>Figure 2.3.2</b>	Conceptual model for the relationship between product attachment and the personalization of a product's appearance..... 41
<b>Figure 2.3.3</b>	The Emotional Chart..... 42
<b>Figure 2.3.4</b>	User – Artifact – Activity within context forms experience..... 42
<b>Figure 2.3.5</b>	A diagram showing the converging roles..... 44
<b>Figure 2.3.6</b>	An example of context mapping communication infographic..... 46
<b>Figure 2.3.7</b>	Emofaces..... 47
<b>Figure 2.3.8</b>	Set with 100 abstract images..... 48
<b>Figure 2.3.9</b>	Designer using Cabinet to capture physical digital material..... 50
<b>Figure 2.3.10</b>	Extreme Characters..... 51
<b>Figure 2.3.11</b>	Interaction scenario..... 52
<b>Figure 2.3.12</b>	The interface of Real People tool..... 53
<b>Figure 2.3.13</b>	Designers using Skin..... 54
<b>Figure 2.3.14</b>	The [product & emotion] Navigator Interface..... 55
<b>Figure 2.3.15</b>	Interaction Relabelling: Inspirational products..... 56
<b>Figure 2.3.16</b>	Top left: Phidget Interfacekit. Top right: We supply designers with a large set of sensors and actuators..... 57
<b>Figure 2.3.17</b>	Top: interactive tangible sketches were produced within 3 hours, which were 'fully' working..... 58
<b>Figure 2.3.18</b>	The picture on the right shows the graphical user interface of KESo..... 59
<b>Figure 2.3.19</b>	Database of products in Kn6 IBV..... 60
<b>Figure 2.3.20</b>	Sound Library of the Product Sound Modelling Tool..... 61
<b>Figure 2.3.21</b>	Description of the images: 1 – 3: views of one SENSOTACT® descriptor box/ 4 – 6: examples of tactile movements characterization samples..... 62
<b>Figure 2.3.22</b>	The chair changes to different positions according to the sitter's state and task at hand..... 63
<b>Figure 2.3.23</b>	The final design of the new wheelchair..... 64



<b>Figure 2.4.1</b>	Evaluating concepts visually based on renderings.....	66
<b>Figure 2.4.2</b>	Visual Product Evaluation Questionnaire.....	67
<b>Figure 2.4.3</b>	Product Handling and Form Filling.....	68
<b>Figure 2.4.4</b>	Product Handling Questionnaire.....	69
<b>Figure 2.4.5</b>	Visual questionnaire for retrieving aesthetic preferences.....	69
<b>Figure 2.4.6</b>	An example for a mood board.....	70
<b>Figure 2.4.7</b>	The selection of mood board images for ironing, ironing products and environment.....	71
<b>Figure 2.4.8</b>	Product personality profiling questionnaire with user responds.....	72
<b>Figure 2.4.9</b>	An example for a product personality profiling form.....	73
<b>Figure 2.4.10</b>	FEAT (Facial Expression Analysis Tool).....	75
<b>Figure 2.4.11</b>	The examples for prototypical expressions.....	75
<b>Figure 2.4.12</b>	White spots showing the facial movements by Hägglund.....	76
<b>Figure 2.4.13</b>	Self Assessment Manikin.....	78
<b>Figure 2.4.14</b>	Areas of interest that is registered by Eye Tracking Analysis.....	80
<b>Figure 2.4.15</b>	The HADRIAN database.....	81
<b>Figure 2.4.16</b>	The I.D. Tool – the result viewer.....	82
<b>Figure 2.4.17</b>	Human model seated on the vehicle in the virtual reality software Jack..	83
<b>Figure 2.4.18</b>	Image of the tablet with the samples from an evaluation of systematic disturbances in prints.....	84
<b>Figure 2.4.19</b>	User Compass Chart with material samples positioned by a truck driver	85
<b>Figure 2.4.20</b>	Visual Scanning and assessment method.....	86
<b>Figure 2.4.21</b>	Questionnaire format for a public transportation service survey.....	87
<b>Figure 2.4.22</b>	Java Applet windows for data collection and an example of results obtained with the proposed method.....	88
<b>Figure 2.4.23</b>	Questionnaire for the emotional assessment of footwear.....	89
<b>Figure 2.4.24</b>	The expression of an electric cooker; the assessment of customers and designers respectively.....	90
<b>Figure 2.4.25</b>	The interface of PrEmo.....	93
<b>Figure 2.4.26</b>	Animation series of <i>disgust</i> and <i>inspiration</i> emotions.....	95
<b>Figure 2.4.27</b>	The stimuli used in the application study.....	96
<b>Figure 2.4.28</b>	Product & emotion space’ of Dutch and Japanese participants for six car models.....	96
<b>Figure 2.4.29</b>	Car models used in the study .....	97
<b>Figure 2.4.30</b>	PrEmo measure map.....	98
<b>Figure 2.4.31</b>	Six car models used in the study.....	99
<b>Figure 2.4.32</b>	‘Product & emotion’ space of the six stimuli used in the study.....	100
<b>Figure 3.1</b>	The graphical translation of the results.....	105
<b>Figure 3.2</b>	Number of participants in each department.....	106
<b>Figure 3.3</b>	Distribution of ages of the participants.....	107
<b>Figure 3.4</b>	14 product related emotions measured by PrEmo.....	108
<b>Figure 3.5</b>	Some examples of expressive cartoons.....	108
<b>Figure 3.6</b>	The Design Module of PrEmo.....	109
<b>Figure 3.7</b>	The Experiment Module of PrEmo.....	110
<b>Figure 3.8</b>	The stimuli used in the pilot study.....	111
<b>Figure 4.1</b>	Car A.....	114
<b>Figure 4.2</b>	Means of 14 emotional responds to Car A.....	116
<b>Figure 4.3</b>	Car B.....	117
<b>Figure 4.4</b>	Means of 14 emotional responds to Car B.....	119
<b>Figure 4.5</b>	Car C.....	120

<b>Figure 4.6</b>	Means of 14 emotional responds to Car C.....	122
<b>Figure 4.7</b>	Car D.....	123
<b>Figure 4.8</b>	Means of 14 emotional responds to Car D.....	125
<b>Figure 4.9</b>	Car E.....	126
<b>Figure 4.10</b>	Means of 14 emotional responds to Car E.....	128
<b>Figure 4.11</b>	Car F.....	129
<b>Figure 4.12</b>	Means of 14 emotional responds to Car F.....	131
<b>Figure 4.13</b>	Car G.....	132
<b>Figure 4.14</b>	Means of 14 emotional responds to Car G.....	134
<b>Figure 4.15</b>	Plot of means of the gender groups on emotions to Car A.....	142
<b>Figure 4.16</b>	Plot of means of the gender groups on emotions to Car B.....	143
<b>Figure 4.17</b>	Plot of means of the gender groups on emotions to Car C and Car D.....	144
<b>Figure 4.18</b>	Plot of means of the gender groups on emotions to Car E.....	145
<b>Figure 4.19</b>	Plot of means of the gender groups on emotions to Car F.....	146
<b>Figure 4.20</b>	Plot of means of the gender groups on emotions to Car G.....	147
<b>Figure A.1</b>	VW Polo.....	162
<b>Figure A.2</b>	Citroen C3.....	162
<b>Figure A.3</b>	Fiat Punto.....	163
<b>Figure A.4</b>	Ford Fiesta.....	163
<b>Figure A.5</b>	Honda Jazz.....	164
<b>Figure A.6</b>	Hyundai Getz.....	164
<b>Figure A.7</b>	Toyota Yaris.....	165
<b>Figure C.1</b>	The introduction given to the participants.....	172
<b>Figure C.2</b>	The explanation that guides how to use the software.....	173
<b>Figure C.3</b>	The guide that shows how to rate each emotion.....	173
<b>Figure C.4</b>	The exercise part before starting the experiment to guide the respondents how to use the software.....	174
<b>Figure C.5</b>	The measurement interface that shows each emotion grouped in negative and positive for the exercise product.....	174
<b>Figure D.1</b>	Bugatti Veyron (Car A).....	175
<b>Figure D.2</b>	Hummer H3 (Car B).....	175
<b>Figure D.3</b>	Kia Ceed (Car C).....	176
<b>Figure D.4</b>	Peugeot 908 RC (Car D).....	176
<b>Figure D.5</b>	Pininfarina Nido (Car E).....	177
<b>Figure D.6</b>	Renault Koleos (Car F).....	177
<b>Figure D.7</b>	VW Iroc (Car G).....	178

## **MEASURING EMOTIONS IN PRODUCT DESIGN: A STUDY ON EMOTIONAL RESPONSES TO CONCEPTUAL CAR DESIGNS**

### **SUMMARY**

Emotions have become one of the most progressive topics of product design discipline in recent years. Especially the studies on human factors raise the need for explaining the area of emotions in product design. Today, the conditions of market have started to value the emotional qualities of products rather than their physical qualities. So, the designers started to be expected to design emotionally effective products. Nowadays, most of the products become similar with their technological functions, quality and price. As differentiation in market is important, producers want designers to work on the emotional effect of their designs. On the other hand, it seems impossible to control the emotions elicited by products as they seem indefinable. For that reason, this thesis is concerned with the relationship between product design and evoked emotions. The research focus is on emotions elicited specifically by product *appearance*.

The thesis is structured in five chapters. The first chapter of the thesis is an introduction that explains the aim of the study. The second chapter is literature review explaining the emotions, emotion types, the connection between emotion and culture were discussed through theories in the first section. In the second section of the literature review chapter, the terms “emotional design”, “pleasure”, “product emotions” and “emotional products” were defined and explained. The third section of the literature review chapter examines the methods of designing emotionally effective products, and the fourth section is on product evaluation and emotion measurement methods. Following the literature review chapter, the third chapter is methodology chapter that explains the steps of the research and its components. Similarities and differences of emotional responses among genders are explored using multiple analysis of variance (MANOVA) procedures. In results chapter, the descriptive statistics of participants’ emotional responses to seven conceptual car designs measured by PrEmo (Product Emotion Measurement Instrument) and the

comparison of gender differences are presented. Finally, the findings and the limitations of the study are presented in discussion and conclusion chapter.

# **ÜRÜN TASARIMINDA HEYECAN ÖLÇÜMÜ: KONSEPT OTOMOBİLLERE KARŞI DUYULAN HEYECANLAR ÜZERİNE BİR ÇALIŞMA**

## **ÖZET**

Ürün tasarımındaki heyecan konusu son yılların en hızlı gelişim gösteren konularından biri haline gelmiştir. Özellikle insan faktörleri alanında yapılan çalışmalar, heyecan konusunu derinden inceleme gerekliliği yaratmıştır. Günümüzde pazar koşulları da ürünlerde fiziksel özelliklerin üstünlüğünden ziyade heyecansal özelliklere değer vermeye başlamıştır. Bu sebepten, ürün tasarımcılarından heyecansal değeri yüksek ürünler tasarlamaları talep edilmeye başlanmıştır. Günümüzde birçok ürünün teknolojik fonksiyonları, kaliteleri ve fiyatları açısından birbirine benzediği düşünülürse, ürünlerin kullanıcılar üzerinde bıraktığı heyecansal etkiler pazarda bir farklılaştırma oluşturacaktır. Bu yüzden ki, üreticiler de tasarımcılarını bu konuya yönlendirmeye başlamışlardır. Fakat diğer yandan, ürünlerin ortaya çıkardığı heyecanları kontrol edebilmek ve onlara müdahale edebilmek çok da mümkün görünmeyebilir. Bu sebepten dolayı bu araştırma projesinde ürün tasarımı ve oluşan heyecanların ilişkisi incelenecektir. Bu araştırmanın odağı ürünlerin dış görünümünün bıraktığı etkiyi incelemek olacaktır.

Bu tez çalışması beş ana bölümden oluşmaktadır. İlk bölüm yapılan çalışmanın amacını anlatan giriş bölümüdür. İkinci bölüm literatür taraması bölümü olup, dört alt bölümden oluşmaktadır. Birinci alt bölümde, heyecan, heyecan çeşitleri, heyecan-kültür ilişkisi teorilerle açıklanmaktadır. İkinci alt bölümde, heyecana dayalı tasarım, tasarımda zevk, ürün heyecanları ve heyecan veren ürünler konuları açıklanmaktadır. Üçüncü alt bölümde, heyecan veren ürün tasarlama yöntemleri konusunda bilgi vermektedir ve dördüncü alt bölümde ise ürün değerlendirme yöntemleri ve ürün heyecanı ölçme yöntemleri anlatılmaktadır. Tezin üçüncü ana bölümünde ise yapılmış araştırmanın yöntemi ve aşamaları açıklanmaktadır. Tezin amacı, katılımcıların verilen ürünlere karşı gösterdiği heyecansal tepkilerin ölçülmesi ve

farklılıkların belirlenmesidir. Bu farklılıkları belirlemek için MANOVA (Multiple Analysis of Variance) yöntemi kullanılmıştır. Araştırmanın sayısal sonuçları, dördüncü ana bölüm olan Sonuçlar kısmında sunulmuştur. Son bölüm olan Tartışma ve Son kısmında ise araştırmanın sınırlamalarıyla birlikte bulgular tartışılmıştır.

## 1. INTRODUCTION

Emotions have become one of the most progressive topics of product design discipline in recent years. Especially studies on human factors raise the need for explaining the area of emotions in product design. Today, the conditions of market have started to value the emotional qualities of products rather than their physical qualities. So, the designers were expected to design emotionally effective products.

As the products in the market started to share similar technological features and prices, people started to demand more than usability and a need for understanding emotions and their connection with design became an interesting topic for the new product development process. In spite of the increasing demand in the market for pleasurable products, designers are still uninformed about how to adapt the emotional data to the design process. Although the issue of emotional design became popular in recent years, it is not a new subject of design. As the discipline of design has always been related to humans and the environment, it has also been connected to people's emotional expressions. However, recently design has been focused on the topic of emotion with new arguments withstanding the existing theories.

The aim of this research is to understand and apply a methodology, measuring and translating emotions that customers have about a certain product. More specifically, the study aims to answer the following research questions:

1. What are the emotional responses of the participants towards given products?
2. Do participants from different genders differ in terms of their emotional responses to each product given in the questionnaire / instrument?

This chapter guides the reader towards an introduction to the research area. In the first section of literature review chapter, a definition and types of emotion are briefly explained and supported by theories (James, 1884; Solomon, 1980; Elster, 1999; Fellous and Arbib, 2005; Cowie, Randolph and Cornelius, 2003; Frijda, 2003, 1994; Mendençova, 2004; Forlizzi, Disalvo and Hannington, 2003; Desmet and Hekkert, 2002; Ekman, 1980; Russell, 1991). In the second section, emotionally effective

products and product emotions are defined and explained to comprehend the terms of the area (Jordan, 2000, 1999, 1998; Evans, Jamal and Foxall, 2006; Green, 2002; Norman, 2004; Desmet and Hekkert, 2002, 2000; Desmet, 2002; Hauge-Nilsen and Flyte, 2002). Following definitions, methods of designing emotionally effective products are discussed with examples of studies (Overbeeke, Vink, and Cheung, 2001; Desmet and Dijkhuis, 2003). The last section of the literature review chapter mentions emotion measurement methods and techniques (Bruseberg and McDonagh-Philip, 2001; Desmet, 2003, 2002; Kaiser and Wehrle, 1992, 2004; Hägglund, 2004; Ekman and Friesen, 1978; Desmet, Hekkert and Jacobs, 2000; Desmet, Hekkert and Hillen, 2003). The methodology chapter examines the aim of the study, participants, research setting, procedures taken throughout the research, and data analysis. The results chapter presents the descriptive statistics of participants' emotional responses to seven conceptual car designs measured by PrEmo (Product Emotion Measurement Instrument) and the comparison of gender differences. The findings and the limitations of the study are presented in discussion and conclusion chapter.



## **2. LITERATURE REVIEW**

In this chapter, emotional design will be discussed in detail from principal theories to practical studies. In “What is an Emotion?” section, after defining the term “emotion” and the types of emotions that are expressed in daily life, the area will be illuminated with emotion theories of philosophers such as Aristoteles and Descartes and contemporary researchers such as Solomon (1980, 2003), Desmet and Hekkert (2002) and Frijda (2003). Then, the effect of culture on emotions and ways of expression will be discussed with studies of Ekman (1980), Russell (1991) and Elster (1999). In “Emotional Design” section, the terms “emotional design” and “pleasurable design” will be explained with theories of Jordan (2000, 1999,1998), Evans, Jamal and Foxall (2006), Norman (2004) and Desmet (2002). Then the product properties that evoke emotions will be defined and product emotions will be classified. In “Designing Emotional Products” section, the areas that are directly connected to emotional design will be introduced, such as *consumer taste, product attachment, product personalization, product experience & experience design, hedonic experience* and *empathic design*. The section will be concluded with two examples of studies on designing emotional products (Desmet, Hekkert and Jacobs, 2000; Desmet, Hekkert and Hillen, 2003). In “Product Evaluation and Product Emotion Measurement” section, methods of evaluating products (Bruseberg and McDonagh, 2002; McDonagh, Bruseberg and Halsam, 2002; Bruseberg and McDonagh-Philip, 2001) and measuring emotions (Ekman and Friesen, 1978; Kaiser and Wehrle, 1992, 2004; Hägglund, 2004; Desmet, 2002) will be explained.

### **2.1. What is an Emotion?**

#### **2.1.1. Definition of Emotion**

First of all a definition of emotion should be given to generate an outline of the topic. According to the Cambridge Advanced Learning Dictionary (2005), emotion is defined as “a strong feeling such as love or anger, or strong feelings in general”. For a more comprehensive definition, in the Random House Dictionary of the English

Language (1987) it is defined as “any strong agitation of the feelings actuated by experiencing love, hate, fear, etc., and usually accompanied by certain physiological changes, as increased heartbeat, respiration, or the like, and often overt manifestations, as crying, shaking, etc.; any vehement or excited state”.

Averil (1980) states the origin of the word “emotion” comes from Latin, *e + movere* that means relocating. It was also a word used for explaining annoyance in the meanings of both corporeal and cerebral. Then, after being used in its symbolic meaning, especially in psychological states it changed into today’s contemporary meaning. The term “passion” comes from the Latin, *pati* and the Greek version, *pathos* that means to suffer. Also such expressions as *passive* and *patient* comes from the origin *pati*. Under the light of these descriptions, it can be stated that emotions are not the actions that we do, they are the ones happening to us.

To start with one of the theorists’ definition; James (1884, p.190) giving the starting point of the discussions on emotion defines the term as “*the bodily changes follow directly the perception of the exciting fact and that our feeling of the same changes as they occur is the emotion*”. James opposes to the previous theories of emotion and argues that the emotional perception forms body expressions and describes that the formation of emotion starts by a stimulant falling to a sense organ and it is perceived by the concerned cortical center. After the stimulus has been evaluated in the sense organ, a reflex is evaluated as a conscious emotion related to the stimulant object (James, 1884). Jamesian theory of emotion will be discussed in detail in the following sections.

In daily speech emotions are mostly used for the meaning of feelings or sensations and the term “emotion” can hardly be separated from the term “feeling”. In some resources emotions are described as feelings, and also in some resources body expressions are considered in the definition of emotion. In Frijda’s (2002, p. 11) definition emotions are called “primarily *strivings* or *passions*”. Passion is defined as a model for emotions to change objects’ connection to one’s perception, although they can not be emotions themselves. It is obvious that all emotions do not have strivings or desire, just as despair, dejection, distress, and sadness. So, according to Frijda it will be more appropriate to define emotion in general terms as “states of action readiness” (Ibid, p. 13).

According to Solomon (1980, p.252), emotions are not just sudden happenings; they are deliberate and concern something. In the sentence of “I’m angry at John for stealing my car”, the emotion is felt towards somebody for some reason. So, it is clear that emotions are rational and conscious. Emotions are rational as they are formed through one’s behavior and can be explained through this model. It is not the same for moods or feelings. For instance being angry at someone for something is an emotion, but melancholy and depression can not be emotions, just because they do not have an object. So they are called moods. Similarly feelings can not be emotions, as they do not have directions. Emotion can be identified as a feeling that is directed to an object or a person. Being angry is a feeling, but being angry about something is an emotion.

According to Elster’s (1999, p.26) definition of emotion, emotion has some characteristic properties. An emotion gives a unique qualitative feeling. It happens suddenly and naturally. It is formed in short periods. It has a direction to a deliberate object. It makes psychological changes and has its own psychological and physical statements even action inclinations.

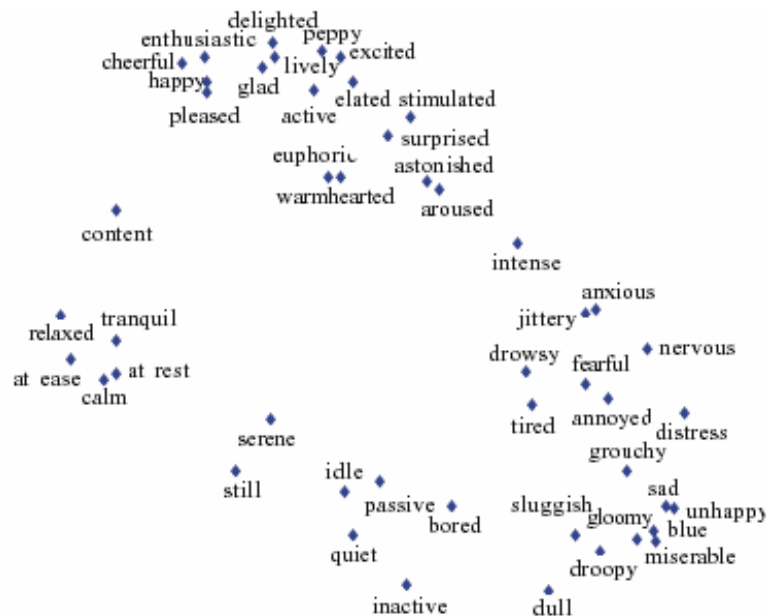
Emotion is a word that is used in daily life by everybody in spite of its distinct degrees. The use of emotion in speech is a comprehensive research topic. The distinction occurs by arousals that characterizes the emotion. At this point it is indispensable to mention the types of emotions and its variations.

### **2.1.2. Emotion Types**

There are various emotions that we are used to express in daily life with their combinations and intensity. According to James (1884), our psychological life is directly related to our physical state. Some feelings such as rapture, love, ambition, indignation, and pride are the expressions of pleasure and pain that are corporeal reactions of the body. The feelings without having bodily reactions are considered to be out of the circle of the definition of emotion. So, the emotions that come from the cerebral forms of pleasure or displeasure can be called “standard emotions”.

In daily conversation, the terms “emotion” and “feeling” are confused and sometimes they are used interchangeably. Actually, they have different meanings. Solomon (1980) describes the difference. He affirms that emotions have directions and an object, but feelings do not. Emotions have a purpose and they are tended to a specific

item. Emotions not being coincidental happenings, they can not be called irrational. The emotions can be controlled because the actions are in purpose. But, feelings not having directions, for example just being angry, they are not related with a specific object. Also, moods that are similar with emotions also do not have a direction. For example euphoria, melancholy, and depression are moods that expose states but not specific conditions. Moods continue for hours and sometimes days although emotions are sudden actions that happen in seconds. To be in a mood, one can not just be sad, but blue and not just angry, but irritable or hostile. In Rusting and Larsen's (1995, as cited in Marcus, MacKuen, Wolak, Keele, 2003) study a structure showing different moods is formed (Figure 2.1.1).



**Figure 2.1.1:** Typical Distribution of Experienced Moods  
(Marcus, MacKuen, Wolak, Keele, 2003)

Feelings are within the emotions. Fellous and Arbib (2005) state that without feelings we can not have emotions but when we feel emotions we feel more than feelings. Because emotions connect actions and perceptions.

There is another discussion topic about what types of emotion there are. In general, researchers use the terms of particular emotions such as *happiness*, *surprise*, *fear*, *anger*, *disgust*, and *sadness*. These emotions are called as “basic emotions” (Fellous and Arbib, 2005). There are also different theories about the classification of emotions. One of these is Roll's (1999, as cited in Fellous and Arbib, 2005) study

mapping emotions in two dimensions in the means of presentation of reward (pleasure, ecstasy), presentation of punishment (fear), withholding of reward (anger, frustration, sadness), or withholding of punishment (relief). Another study about the categorization is Panksepp's (1998, as cited in Fellous and Arbib, 2005) that is conducted to classify emotions according to the reason that form them in a neuroethological manner and the reactions that are shaped as a result of them. Although these two studies give explanation to how emotions can be classified in a neurobiological approach, they are incapable to map all the social emotions that we experience in daily life (Fellous and Arbib, 2005).

For a more comprehensive categorization, Elster's (1999) study differentiates emotions according to their relation with behavior or character and categorizes emotions in two basic categories: positive and negative emotions according to how they are experienced: pleasurable or painful. The main group of emotions that we use in daily life can be considered as *social emotions*. But, daily language is not a capable and reliable source to make a differentiation among all the types of emotions. So, Elster makes a classification of emotions into two groups according to their happenings by one's own or someone else's behavior or character and the thought that someone else deservedly or undeservedly possesses some good or bad.

The first category is:

- *Shame*: a negative emotion triggered by a belief about one's own character
- *Contempt* and *hatred*: negative emotions triggered by beliefs about another's character.  
(Contempt is induced by the thought that another is inferior; hatred by the thought that he is evil.)
- *Guilt*: a negative emotion triggered by a belief about one's own action
- *Anger*: a negative emotion triggered by a belief about another's action
- *Pridefulness*: a positive emotion triggered by a belief about one's own character
- *Liking*: a positive emotion triggered by a belief about another's own character
- *Pride*: a positive emotion triggered by a belief about one's own action
- *Admiration*: a positive emotion triggered by a belief about another's action

(p. 21)

The second category is:

- *Envy*: a negative emotion caused by the deserved good of someone else
- *Indignation*: a negative emotion caused by the undeserved good of someone else
- *Sympathy*: a positive emotion caused by the deserved good of someone else
- *Pity*: a negative emotion caused by the undeserved misfortune of someone else

- *Malice*: a positive emotion caused by the undeserved misfortune of someone else
- *Gloating*: a positive emotion caused by the deserved misfortune of someone else

(p. 22)

Elster (1999) adds that there is a third category including positive and negative emotions formed by people's concerns about themselves and their future, for example joy and grief with various degrees. Also, some other emotions that are formed by the thoughts of probabilities or possibilities are another group of emotions, for example hope, fear, love and jealousy. Moreover, it is stated by Elster (1999) that some emotions formed by *counterfactual* thoughts about what might have happened or what might have been done, for example regret and disappointment.

According to Cowie, Randolph and Cornelius (2003) one of the widespread theories on the classification of emotions is, categorizing emotions in basic and second-order emotions. This view arising from Descartes' theory has two different parts. The first one states that the basic emotions are pure and primitive though the others not. The second one states the other emotions are the mix of the basic emotions. This is called "a palette theory of emotion" as the mix of basic emotions is described as the mix of basic colors to create other colors. The list of basic emotions has not been completed yet, but the majority of researches agree on the six basic emotion categories called "big six": *fear*, *anger*, *happiness*, *sadness*, *surprise*, and *disgust*. The emotions of contempt and love are discussed to be added to the categories and the emotion of anger to be separated into two groups: hot and cold anger.

According to a research that was conducted in 1997 by Picard and her colleagues at MIT, a series of measurements were conducted to classify emotions. Firstly, they could identify anger and calm emotions with about 90% accuracy and low arousal states with about 80% accuracy. But, the difference between positive and negative emotions could not be identified. After further studies they could differentiate the eight type of emotion with 80% rate (as cited in Cowie, Randolph and Cornelius, 2003).

The relationship between the person and the object determines the type of the product. Lazarus (1994) explains the determinants that form an emotion are the environment conditions, the goals of the person. If the object is perceived as harmful, a negative emotion is formed, such as anger, anxiety, guilt, shame, sadness, envy or

jealousy. But, if the object is perceived as advantageous, a positive emotion is formed, such as happiness, pride, relief, or love.

### **2.1.3. Theory of Emotion**

The topic of emotion is as old as the discussion about the nature of human. Plato and Aristoteles are the philosophers who have arguments about emotion and the expression of emotion. Aristoteles (384-322 B.C.) discusses the nature of emotion in the *Rhetoric*, in *de Anima*, and his *Nicomachean Ethics*. After his description of “soul” known as “life principle” in *de Anima*, Aristoteles separates the human into two parts: the cognitive part and the physical part. In *Rhetoric* Aristoteles defines emotion as the affection of decision by perception associated with pleasure and pain. The examples of emotions are: anger, pity, fear, and the like and their opposites. He states to understand an emotion it is necessary to understand more than one of these three factors: the disposition of the person, the direction of the emotion to an object or to another person. In *Rhetoric* he defines the emotion of “anger” with its reasons and analyzed the character of angry people. In *On the Soul* Aristoteles suggests that emotions are not only bodily reactions but also reflection of spirit. Emotions like anger, gentleness, fear, pity, courage can not be detached from neither the soul nor the body. Solomon (2003) states that Aristoteles claims the emotions are formed from a cognitive part built from judgments and hopes besides the physical part. In the *Nicomachean Ethics*, Aristoteles states that one can reconstruct his emotions with education and habit. And, in the *Rhetoric*, he underlines that many emotions are shaped by social environment. Aristoteles has theories as complex as today’s philosophers had about emotion.

René Descartes (1596-1650) had theories about mind and body. He made a distinction between mental (mind) and physical (body). Descartes said emotions are physical happenings shaped in our body. His theory had been followed by philosophers such as Hume and James declaring emotions are sensations of excitement (Solomon, 2003). In *The Passions of the Soul, Article XVII*, Descartes says that the thinking is the one that refers the soul and there are two types of thoughts: one is the “action” and the other is the “passion” both concerning the soul. He distinguishes the action and passion as; the action is the “desire” of the soul for perceiving a situation and the passion, existing in the soul, is the perception of the

objects that symbolized by the passions. In the *Article XVIII*, it is stated that the desires can be separated into two parts: first one is the desire directed to an abstract thing known as the soul's actions and the other is the desire directed to a concrete thing known as the bodily actions. In the *Article XIX*, Descartes distinguishes the passions into two groups: first one aroused from soul and the other from body. The first group of passions is the ones related to our cognition and cognitive decisions such as hopes, thoughts and dreams. Passions related to the spirit give rise to psychological expressions such as excitement. To classify passions, their formation process or their variations or their directions that formed them should be examined. Descartes makes this classification into six main groups: *wonder, love, hatred, desire, joy* and *sadness*. He adds the other passions are the combinations and variations of these six basic ones.

David Hume, having theories about human nature, defined emotion as mostly a physical happening but gave possibility of having mental effects. Being a follower of Descartes' doctrine, he classified emotions into two groups: calm and violent. He stated both calm and violent emotions had less mental excitement. Again Hume made two categories of emotions: direct emotions and indirect emotions. Emotions that had a simple cause such as pleasure and pain were called direct emotions like joy, grief, and hope. But, indirect emotions besides having a simple cause of pleasure and pains had certain beliefs about the object and the association with some person. Hume's theory is disapproved because of being too simplified. But, Hume's moral theories and his cognitive point of view are still agreed by contemporary philosophers (Solomon, 2003). Hume separates the perceptions into two groups: "impressions" and "ideas" and impressions are divided into two according to their composition: "sensations" and "reflective impressions". Sensations are basically physical reactions, and reflective impressions are "passions". Passions' source is mind which also gives rise to bodily reactions. Hume gives examples of passions such as; grief, hope, and fear. Also, reflective impressions are examined in two groups: the "calm" and the "violent". Emotions are considered to be calmer than passions.

Charles Robert Darwin, in his books *The Expression of Emotion in Man and Animals*, published in 1872, states that emotions and expressions are similar in both human and animals. This theory is directly related with his *Theory of Evolution*. He



outlines that the reason of some emotions' happening is directly related to survival instincts. Darwin calls them 'useful emotion behaviors'. He adds that the reason of other emotions is simple physical changes like trembling. Darwin says that emotions have adaptive functions and they are universal (Person, 2002). Some researchers such as James and Dewey, Ekman, and Frijda followed Darwin's theory on the purposive emotional behavior (Solomon, 2003). Although Frijda approves Darwinian Theory on emotions being purposive and useful, she adds that not all emotions have purpose and the usefulness of an emotion as a psychological function (Frijda, 2003). Darwin states in *The Expression of Emotion in Man and Animals* expressions become "habitual" and then "inheritance". Then they become unconscious reactions. For example coughing might have been done consciously before, and it might have been a "habit" to continue breathing. The beneficial ones of these habitual actions are saved and inherited from the primitives related to the *Theory of Evolution*. The inherited expressions that are called "reflex actions" are directly related to the expression of an emotion. For example, gestures are mostly unconscious actions that became permanent through habit. The inherited expressions are no longer under the control of the person and they are useful for the well-being of human.

William James, as a psychologist having a philosophical insight, wrote an essay named "What is an Emotion?" (1884) that is assumed as a classical starting point of the field. James worked on his theory with a Danish psychologist, C.G. Lange, that is why the theory is known as "James-Lange Theory". In *What is an Emotion?* James wrote about emotions that are expressed in an explicit action like a physical movement; and some emotions like pleasure or displeasure without an exact expression are examined by James as they are also reflections of psychological statements. The physical conditions of the environment such as sounds, appearance of objects like form and colour are the cause of corporeal feelings and they are evaluated in nervous system. For example, *surprise, curiosity, rapture, fear, anger, lust or greed* are emotions that affect people. The reflections of these emotions in the body are called "emotional manifestations" or "expressions". Emotions having more clear expressions are called "standard emotions". James states that bodily manifestations follow the psychological status, namely the reason we cry is that we feel sorry; not we feel sorry because we cry. As emotions have various determinants like physical changes and neural and muscular effects, it specifically concerns about

the moment it arises, that means any emotional state can not be repeated or imitated in any other condition. Another considerable feature of emotion is that it can be thought separately from our “consciousness”. If it could, all we have experience will be only a “cold and neutral state of perception”. For example, an emotion of fear can not be experienced as a fear without high blood pressure or tight muscles. It is very difficult to control our consciousness, for example giving a speech to an unfamiliar group of people without feeling nervous is very difficult.

To give a more extensive explanation, in the James-Lange Theory, it was stated that when we respond to objects and events happening in our environment, as a result we perceive psychological disorders and an emotion is formed. The James-Lange Theory belongs to the Cartesian tradition that states emotion is a physical consciousness (Solomon, 2003). James opposed the previous theories that stated an emotion is formed after the psychological perception formed a bodily reaction. In James’ theory he did not mention Darwin’s theory of “useful emotional behavior”, so it is seen as incompetence.

Another important name about the topic of emotion is John Dewey who was a philosopher and a member of pragmatist movement in philosophy like William James. The well-known books of Dewey were *Experience and Nature* (1925) and *Art as Experience* (1934). *Art as Experience* can be named as a powerful text expressing a theory on experiencing meaningful objects in our environment. The text states how an emotion is formed by expressing expressive objects and discusses the emotional features of the objects. Dewey describes an emotion as an extensive characteristic that builds an experience; he continues that giving name to emotions by using experiences is impossible as an experience is composed of many emotions (Forlizzi, Disalvo and Hannington, 2003). Dewey states in his emotion theory that emotions consist of three parts: a feel, a conscious behavior, and an object that have an emotional characteristic and an emotion is a purposive behavior that is formed as a feeling. Dewey criticizes James’ theory for the reason that he did not explain exactly the reason of significance of emotions in our lives. Dewey thought James’ chances in traditional emotional theories were problematic in some cases. In James’ theory there is no exact connection between bodily reactions with emotional expressions (Mendençova, 2004). Dewey says emotions are important for our lives, because they are directly related with the objects of our environment. Dewey also supports the

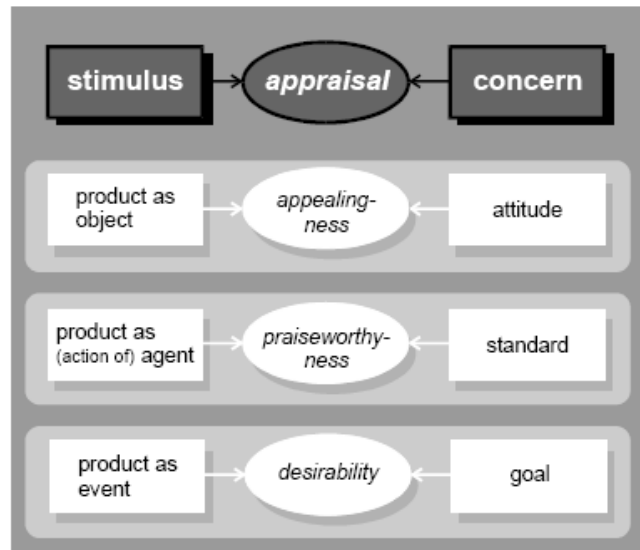
theory of Darwin and James on Darwin's explanation for need of "useful emotion behaviors" to survive and James' statement on the role of emotions on problem solving (Solomon, 2003). Dewey declares an argument that states an object should have a characteristic of physical quality to be expressive to evoke an emotion. Forlizzi, Disalvo, and Hannington (2003) explains this statement as an opposition for the emotion topic, as it refuses the possibility to determine any feature or occurrence being the reason of an emotional response. Dewey classifies emotional responses into two groups: *emotional statements* and *emotional expressions*. An emotional statement is described as a short characteristic response that is not accepted as a real form of expression. An emotional statement is formed for a reason of physiological need or a similar cause that can not be the characteristic emotional experience. An emotional expression is described as an action formed by past emotional experiences. Dewey states that an emotional statement can not be defined as an experience but emotional expression does (Forlizzi, Disalvo and Hannington, 2003).

Richard A. Carlson, in his book *Experienced Cognition* (1997), makes a definition of *emotion* and *mood*. Emotion is defined as a short, unconscious feeling formed by autonomous nervous system that makes physical changes in the body. Mood is defined as a long but less powerful emotional response (Forlizzi, Disalvo and Hannington, 2003). Both Dewey and Carlson defined an emotion and an emotional statement in the same meaning and a mood and an emotional expression in the same meaning. An emotional statement and emotion are both short and reflexive feelings. An emotional expression and a mood are both long sustaining and reflective (Figure 2.1.2).

	Characteristics	Information about self	Information about environment
Emotional Statement	Momentary Autonomous	Strong	Weak
Emotional Experience	Sustaining Ordered Controllable May reference prior experience	Weak	Strong

**Figure 2.1.2:** Differences between emotional statement and emotional experience  
(Forlizzi, Disalvo and Hannington, 2003)

From the cognitive – functionalist perspective, it is stated that emotions serve an adaptive purpose. Our emotions point out the useful or harmful things. This means, a concern is formed with each emotion to a specific expressive object. Respect, safety, and self-esteem are examples of human concerns in life. The reason of all we have concerns is we all want to be behaved well. As all emotions are deliberate, concerns are a part of emotions (Figure 2.1.3) (Desmet and Hekkert, 2002).



**Figure 2.1.3:** Model of product emotions (Desmet and Hekkert, 2002)

Frijda wrote about the functions of emotions in his study *The Nature of Emotion: Fundamental Questions* (1994). The emotions are formed for particular events. Emotions arouse positive or negative responses according to the object’s perception and character. Emotional sensitivity gives evidence to the individual’s concerns of well-being. Emotions’ function is to give signals to the individual by feeling pleasant or unpleasant with the concerns to the psychological and physical systems. Frijda (1994) described this process as: “*Emotions can be considered as the mechanism whereby the organism signals to its cognitive and action systems that events are favorable or harmful to its ends. It is the relevance signaling mechanism*”. The terminology in the literature for “end” is known as motives, major goals, well-being or concerns. Positive emotions are expressed with positive concerns like success, respect, survival or satisfaction. For example the emotion “enjoyment” is formed by a concern “achievement”. Also, negative emotions are expressed with concerns

formed because of pain, threat or harm. These emotions prevent unpleasant results (Ibid, 1994).

A second feature of emotion is emotional responses. There are three types of responses: experiential, behavioral, and physiological reaction. Experiential reaction occurs when a pleasure or pain is experienced or when a pleasant or unpleasant event is experienced. Emotions may be considered as “motivators” as an emotion motivates a reaction. Briefly, they motivate behaviors that relate to the environment (Frijda 1994).

In the Theory of Emotion sub-section, the theories of important theorists and philosophers on emotion were summarized. The definitions that were made or the theories that were developed were given in details. The topic of emotion is mentioned as one of the oldest discussion points on the human nature.

#### **2.1.4. Emotion, Expression and Culture**

In the sub-section of Emotion, Expression and Culture, the relation between culture and expression and reasons of the differences/similarities will be mentioned. As emotions are physical occurrences, they are expressed physically, such as facial or vocal ways. After describing the types of emotional expressions, the different points of views on the effect of culture on emotions will be explained.

Emotional expression is a way to express ourselves without using a word. Ekman (1980) describes the ways of expressing emotions: the emblems and the body manipulator actions and illustrators. The emblems are described as the figurative actions used instead of a verbal expression. Emblems are used in daily conversations frequently. For example nodding head to both sides is an emblem meaning “no”. Emblems are used in cases of not preferring to speak or having no chance to speak for example because of loud noise. The body manipulator actions are movements that are not in purpose and interpretable as they are directly related to psychological circumstances such as nervousness, anxiety or deference. For example, scratching the head, picking the nose, wringing the hands or licking the lips are body manipulators. Ekman states that body manipulators are done unconsciously and they do not have an exact message. Although some body manipulators have clear meanings, they do not have specific meanings as emblems. Finally, gestures which used to give meaning to the speech are called illustrators (Ekman, 1980).

There are discussions about facial expressions rather than body manipulators. There are two opinions; one states facial expressions are universal (universalists) and the other states facial expressions change from culture to culture (relativists). Many researches were conducted about the terminology of emotions, facial expressions of emotions, and their variations to determine the differences of emotional expressions between various cultures and languages. Russell (1991) states that five hypotheses are given about emotion and culture: (1) Basic emotions are universal, but second-order emotions are culture specific. (2) Center points of emotions are universal, but edge points are culture specific. (3) A basic distinct physiological activation is the starting point of all emotion categories. (4) Emotion categories can be described by semantics although they are mostly culture specific. (5) Emotion categories have both universal and culture specific constituents. According to Russell, there are undeniable similarities between categories of emotion that are used in different cultures and languages. But also it is assumed that if emotion words are labeled differently in different cultures, they might be perceived in different ways. About the emotion-language connection, Hoffman, Lau, and Johnson (1986) conducted a research with Chinese-English bilinguals to analyze whether the language has an affect on cognition or not. As a result, it is found that the language that the subjects used during the experiment changed their perception on the same object. So it is stated that language is closely related to the emotion categories (Russell, 1991).

Ekman and Friesen (1978) developed the Facial Action Coding System (FACS) that defines basic facial movements and determines the distinctions by empirical results. FACS measures both the movement and the timing of the expression to distinguish different expressions that are made by the same muscle groups but different timing to appear or to disappear.

Ekman (1980) states that various research conducted in the world with different nationalities to support the idea of facial expressions are universal. According to one of these studies conducted by Ekman, Friesen, and Ellsworth (1972), more than half dozen researchers from both universalist and relativist opinions applied the research method in thirteen countries and in nine different languages. As a result, it is stated that basic emotions such as happiness, surprise, fear, anger, disgust, and sadness have universal facial expressions. According to another study conducted among South Fore people, Ekman, Friesen, and Ellsworth (1972) mention the participants showed

universal expressions. They were requested to show a facial expression for the emotion they were asked to. The expressions on their faces were examined and as a result it was stated they showed universal expressions except fear and surprise emotions. Ekman (1980) mentions about an important study that was conducted at Waseda University in Tokyo and the University of California in Berkeley. In a laboratory physical measurements were made on subjects while they are watching both a travelogue and a stress-inducing film. Subjects were watched by a hidden camera and physical measurements were evaluated by researchers not knowing about which film was watched. As a result, between Japanese and American people a correlation higher than 0.90 was found (Ekman, 1980).

Wierzbicka (1986, p.584), a linguist, wrote about the words of emotions' relation to different cultures and languages.

One of the most interesting and provocative ideas that have been put forward in the relevant literature is the possibility of identifying a set of fundamental human emotions, universal, discrete, and presumably innate; and that in fact a set of this kind has already been identified. According to Izard and Buechler (1980, p. 168), the fundamental emotions are (1) interest, (2) joy, (3) surprise, (4) sadness, (5) anger, (6) disgust, (7) contempt, (8) fear, (9) shame/shyness, and (10) guilt. If the researchers happened to be native speakers of Gidjingali rather than English, would it still have occurred to them to claim that fear and shame are both fundamental human emotions, discrete and clearly separated from each other?

Russell (1991) states a number of emotion words being used among different cultures and every language has different number of words that express emotions. For example, 2000 words are found that express different emotions in English language in 1973 by Wallace and Carlson; 1501 words are found in Dutch that express different emotions in 1986 by Hoekstra; 750 words are found in Taiwanese Chinese and 230 words in Malay in 1979 by Boucher (as cited in Russell, 1991). Also, Russell (1991) adds that some English words related to emotion do not have equivalent in some other languages, for example the English language has the words of *terror*, *horror*, *dread*, *apprehension*, and *timidity* that express different levels and degrees of fear; but in Australian Aboriginal language called Gidjingali there is only one word, *gurakadj*, that express fear.

According to the studies examining the culture-emotion relation, subjects were asked to categorize some facial expressions to find out the origin of emotional expressions

being universal or culture-specific. As a result, with a high average, categorization of facial expressions was found to be similar. So, it was stated that some categories of emotions are universal. But, Russell adds that this method is called forced-choice method and in between culture studies this method can not show an exact outcome because of being insensitive to the correct meanings of the terminology (Russell 1991). Although all these considerable work on culture and emotion, these data do not show that emotions are different among different cultures for the reason that emotions are also physiological conditions beside cognitive states. How we perceive emotions and how we express them are directly related to the social context and culture (Fellous and Arbib, 2005).

The formation of emotions is a three-step process which is occurred in a neurological structure. Fellous and Arbib (2005, p.17) describes these steps as:

- (1) an initial perceptual representation of the stimuli (or a perceptual representation recollected from memory)
- (2) a subsequent association of this perceptual representation with emotional response and motivation
- (3) a final sensorimotor representation of this response and our regulation of it.

According to Elster (1999), there are three main points clarifying the relation of emotion and culture. Firstly, social norms shape the characteristic of emotion. So, different cultures perceive emotions differently. Secondly, even if for the universal emotions, they are not perceived the same in cross-cultural context. Thirdly, an emotion can be culture-specific and has a meaning in its own cultural context that other cultures can hardly experience and express.

In facial expressions, the movements of face muscles especially in the forehead, eyelid, and mouth areas sometimes move separately but sometimes they move all together when expressing a mixed emotion. For example, pleasant surprise is an emotion which embodies both surprise and pleasantness. Ekman (1980) describes these kinds of mixed emotions “blend emotions”. Ekman (1980, p.96) describes a blend like “*a blend is a compound facial expression in which the muscular actions for two or more emotions combine in a single facial expression*”. Cultural variations make recognizable differences in the blends. Even if more than one culture has the same blends, they have a different word to describe the emotion.



The reasons of the variation of emotion among different cultures are written by Ekman (1980, p.99) as:

- variations in the specifics of the elicitors, display rules and coping;
- variations in partial or blend expressions;
- additional non-universal expressions for emotions for which there is also a universal expression;
- some emotions having no universal expression but only culture specific, if any, consistent facial expression;
- variations in timing (onset, apex, and offset, as well as sequencing), of facial actions.

In the sub-section of Emotion, Expression and Culture, the relation between culture and expression and the variety of emotions among cultures were mentioned. Also the reasons of the differences/similarities were explained by theories. The researches that were conducted to examine the universality of emotions were referred.

In conclusion, in the first section of the literature review chapter, firstly the term emotion was defined, secondly the types of emotions were explained, then the topic of emotion was illuminated with emotion theories, and lastly the variety of emotions through culture was mentioned. After becoming familiar with the topic, in the next section, an introduction will be made to the area of “emotional design” in terms of “user-centered design”, “consumer needs” and “pleasure”.

## **2.2. Emotional Design**

User-centered design got more importance in design in recent years. An ergonomic or user-friendly design starts to attract more attention than a high-tech design. So, manufacturers invest in human-factors and emphasize a user-centered design policy to advertise their products. Jordan (2000) states that human factors' aim is to add value to products to make them usable, however he adds that usability is no more enough for a "satisfying" product. It is necessary to understand customer needs for a user-centered design process.

Identifying the needs of customers should be considered not only in technological meaning, but also in aesthetical, and emotional sense. The designer's mission should be to balance the objective (functional) and subjective (emotional) features of the product (Lee, Harada and Stappers, 2002). Gathering data about user profile, for example culture, lifestyle, environment, and analyzing the data needs research knowledge and skills. If designers can reach the data about consumer needs, it is being considered as "evidence-based design" (Bruseberg and McDonagh-Philip, 2001). But, identifying user needs can be difficult, as it is intangible data. Once the data is gathered and analyzed, the results are set as the objectives of the design process. There are many methods for identifying consumer needs and they will be explained in detail in the forthcoming chapter.

### **2.2.1. Identifying Consumer Needs**

User-centered design has been the topic of marketing. In marketing research, many methods are used to gather user data, such as focus groups or questionnaires; and also there are also contemporary methods. Evans, Jamal and Foxall (2006) propose a method called "benefits approach" to identify consumer needs. In this method, the needs of the user profile are determined and then the needs are met with the products or services that have expected properties (Table 2.2.1).

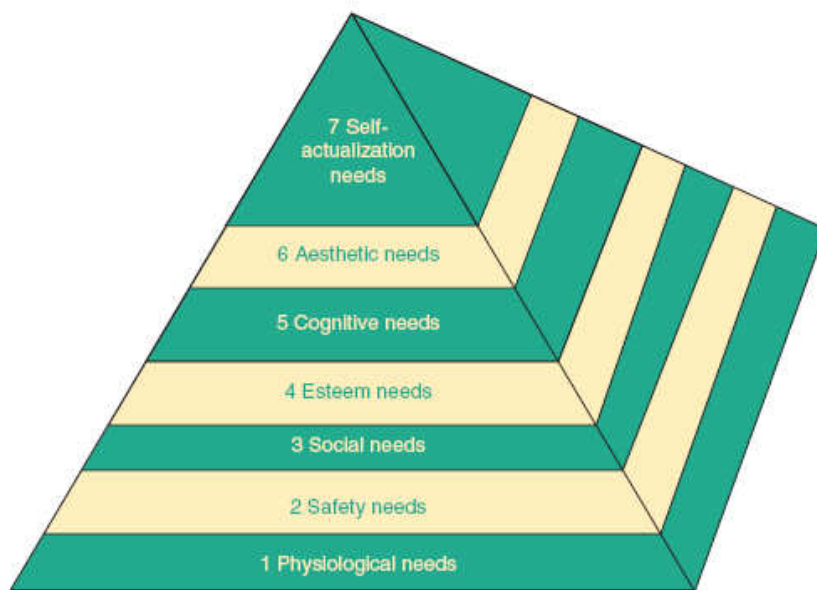
**Table 2.2.1:** Needs, Features, Benefits (Evans, Jamal and Foxall, 2006, p.3)

Needs	Features	Benefits
<i>Identify needs</i>	<i>Select relevant features</i>	<i>Convert features into benefits that satisfy needs</i>
Newly married couple who have just moved into a newly built house	This drill-bit set includes a set of masonry and wood/metal bits	This drill-set can help you turn your house into a home by allowing you to personalize it by hanging shelves, pictures, etc.
Shy and retiring 18-year-old who has just started university and wants to make some new friends	Designer-label jacket	This jacket will help you fit in and become part of the in-crowd
A young woman who wants to experience life to the fullest and wishes to make a statement about her individuality	A navel-piercing service	Piercing your navel makes a statement. It says something about who you are and you've never before experienced anything like the feeling it gives you.

Evans, Jamal and Foxall (2006) examine the terms of “motivation” and “value” to understand consumer needs. Motivation is described as “*the driving force within individuals that moves them to take a particular action (p.4)*”. Motivated behavior is triggered by deficiency of needs and dissatisfaction and it aims to balance the “*deprivation*” and “*need of satisfaction*”. Motivations have a direct purpose. Motives are aroused by two reasons, called: *biogenic (physiological) drives* and *psychogenic drives*. Biogenic derives are basically physiological needs that are mostly necessary to survive; for example needing to eat or drink, keeping warm. Psychogenic drives are the consequences of the social environment and culture; for example, being respected in a community, and having a status. Also, there are positive and negative motivations. For example, people feel pleasure and comfort when facing attractive goods or services, or attractive situations. On the contrary, people feel pain and discomfort when they face unattractive goods or services, or unattractive situations. As an instinct of survival, people always search for the pleasurable one and escape from the displeasurable one. For example, in purchase decisions people choose a product that seems attractive and also beneficial for themselves, in sum people tend to choose pleasurable products.

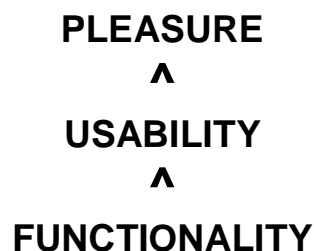
According to Jordan (2000), people are “wanting animals” who always search for satisfaction. Maslow’s (1970) “hierarchy of needs” theory explains the priority of

needs that people want to satisfy (Figure 2.2.1). According to the theory, once people have the satisfaction of a lower-level, they start to desire to satisfy the next level. After satisfying the physiological needs, people try to satisfy their psychological needs. Also people need to satisfy their cognitive needs that are the needs of understanding and knowing things. Aesthetic needs mean the needs of creativity and artistic motives. In Maslow's theory the self-actualization needs are not described clearly, but Evans, Jamal and Foxall (2006) explains this level as *self-realization*. Self-realization is described as the actions that people do to develop their personality or the actions that are found meaningful by people who want to contribute their capabilities and talents.



**Figure 2.2.1:** Maslow's "Hierarchy of Needs" (1970)

Jordan (2000) taking the main principle of Maslow's "hierarchy of needs" model, builds a new model called "hierarchy of consumer needs". Basically, the model has three steps, *functionality*, *usability* and *pleasure* (Figure 2.2.2).



**Figure 2.2.2:** Jordan's Hierarchy of Consumer Needs (2000)

Having the same principle of Maslow's model, in Jordan's model firstly people demand a functional product, then they want to have a usable product, and then after satisfying the need of usability they expect to have a pleasurable product. According to Jordan (2000), a product is useless if it does not have the necessary functions for serving the user appropriately. In other words, people can not be satisfied with a product that does not have necessary functions. So, designers should determine the product's specifications according to its scenario of use. In the second step, when people become satisfied with the product's functionality, they search for the usable products that are easy to use. In third step, after having functional and usable products, users demand product with added-value such as emotional properties. As a result, human factors start to research on how to satisfy the emotional needs. Jordan (2000) states that usability is no more enough for products and designers should tend to design pleasure-based products. According to Marzano (1998), products have relationship with users and objects can make people feel various emotions, such as anger, surprise, disgust or happiness. He adds that products have also personality as people, and they interact with people. So, the new path of product design should be to design pleasure-based products to satisfy the users who demand products not only functional or usable, but also emotional.

Bonapace (2002) states there are a three-step process to design pleasurable products. Firstly, the needs of consumers should be understood. Secondly, to meet the user requirements, especially pleasure needs, the emotional responses should be linked to the properties of products. Thirdly, using methods to measure pleasure in product design and search to establish pleasure. Measuring emotions elicited by products has been essential for pleasurable products, as it makes possible to comprehend user responses to the products and understand the user requirements. Creusen and Snelders (2002) conducted a research to find out that consumers use an analytical or emotional evaluation method during the purchase decision of the product. Two methods were used to meet the information. A scale of four *holistic items* and five *analytical items* were used in the first method. An interview was conducted with participants about their choice on products in the second method. Participants were asked to choose a product alternative from a limited number group and mention the reasons of their choices both in scales and in interview. According to the results, it was found that half of the participants gave decisions in a holistic view, in other

words aesthetics of the product was found more important by half of the participants. So, it can be stated that holistic view plays an important role in product decisions.

## **2.2.2. Defining Emotions Towards Products**

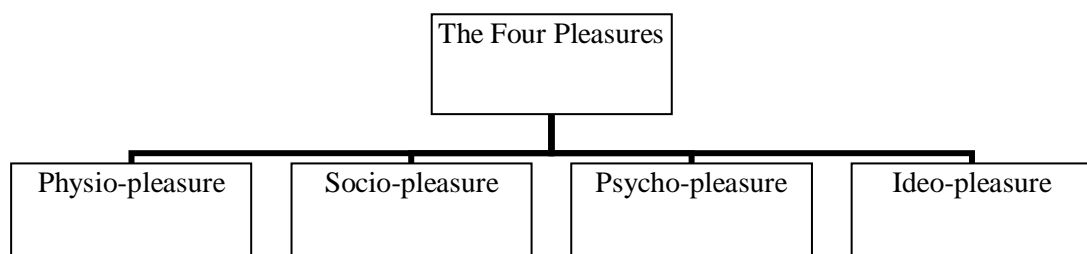
### **2.2.2.1. Defining Pleasure and Pleasurable Design**

To design pleasure-based products the term firstly pleasure should be defined. In the Oxford English dictionary (2002), pleasure is defined as: “*The condition of consciousness or sensation induced by the enjoyment or anticipation of what is felt or viewed as good or desirable, enjoyment, delight, gratification. The opposite of pain.*” To establish a pleasurable connection between the product and the user, it should be examined how the products elicit pleasure and how the pleasure is connected with products. But, what if the products have the same technical properties or price? Then what will give the product added value? Green (2002) states the human factors and industrial design have developed together in recent years. But, he adds that the integration process of human factors and industrial design needs to be examined carefully. Jordan (1999) explains the integration process of human factors and industrial design in three steps: (1) *Being ignored (Self-explanatory)*, (2) *‘Bolt on’ human factors (Post-facto clean-up of the interface)*, (3) *Integrated human factors (H. F. specialists in the design team)*.

Products are the piece of our social environment. Everyday we use, interact and experience products. To clarify how products elicit emotions, firstly the formation of emotional experience in our brains should be examined. Norman (2004) describes three-level elements of emotional design: *visceral*, *behavioral* and *reflective* levels (p. 21). Visceral level is about the automatic senses of the brain. In other words, visceral design is about the appearance and how users evaluate it through their senses. Behavioral level is the brain’s control on daily behaviors. So, the behavioral level is about the pleasure and effectiveness relating to use of a product. Reflective level is the brain’s thought and decision actions. In other words, reflective level is about the rationalization and intellectualization of a product. The visceral level makes the fast judgments of beneficial or unbeneficial things and this level is accepted as the *start of affective processing*. Most of the animals behave at this level. Secondly, the behavioral level is described as the place of human behavior that can be improved or prevented by reflective layer. The human beings behave at this level

especially at well-learned, habitual behaviors that are not consciously done. Lastly, reflective level, that does not directly control the behavior, considers the behavioral level. Norman (2004) gives the example of roller coaster and asks why people pay money to get scared. He explains the situation with the competition of *visceral anxiety* and *reflective pleasure* which is about doing an action that others say ‘no’, in other words a show of bravery. The three-level elements that are proposed by Norman are related to emotional aspects of the products and explain how people behave and respond to a product emotionally.

Pleasure with products is the result of the relation of the product and the user. So, pleasurable is the interaction of the product and the user. The question is which qualities of products elicit pleasure or which products evoke pleasure for the user. Jordan (1999) states pleasurable products have three elements: *emotional*, *hedonic* and *practical benefits*. Practical benefits depend on how efficient the product works or serves. For example, a printer’s printing fast and high quality is the practical benefit. Emotional benefits are the pleasurable feelings elicited during the use of product. For example, it is emotional benefit when a product makes the user feel happy, confident, or fun. Lastly, hedonic benefits are related to aesthetic pleasure aroused by the product. For example, a dress may be hedonically beneficial because it gives a soft, sensitive touch. In other words, a product should give user at least one of the emotional, hedonic or practical benefits to be perceived as pleasurable. Products give different emotional benefits. Tiger (1992, as cited in Jordan 2000, p. 13) classified different types of pleasure and drew a framework of four groups: Physio-pleasure, Socio-pleasure, Psycho-pleasure, and Ideo-pleasure (Figure 2.2.3). This is a structured method for the ‘pleasure’ topic.

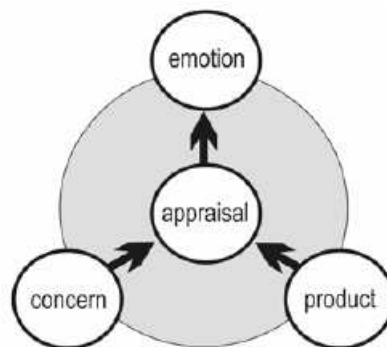


**Figure 2.2.3:** The four pleasures (Jordan, 2000)

Physio-pleasure is bodily sensations that are the pleasures related with sensory organs such as touch, taste, taste and smell. For example, the touch of a sofa or the

smell of a new cloth may give physio-pleasure to the user. Socio-pleasure is about the relation with other people such as friends, colleagues or members of a society. For example, an expensive automobile may attract the others' attention or a special piece of furniture may be an image of good taste for its user. Sometimes specific groups may be identified by specific products that give their users identity, such as Harley Davidson motorcycle riders' boots and jackets. Psycho-pleasure is about how people perceive products and how they emotionally react to them. For example, if a computer works fast with no problems, the user feels psycho-pleasure. Ideo-pleasure is about people's values. For example, a product made of recycled materials gives ideo-pleasure to a user who is concerned with environment. Classifying pleasures into four groups makes easier to comprehend the whole topic and shows way to designers which group of pleasures they should consider during the design process. However, emotions are related to characteristics and environment of people and they differ from person to person.

According to Desmet, Overbeeke and Tax (2001) emotions are specific for each person, that means a product which is loved by a person, might also be hated by another. For this reason, it may seem difficult to build a connection between product appearance and emotions. To comprehend with this connection, Desmet and Hekkert (2002) defines the relation of pleasure and emotion. They state that pleasure is an emotional benefit that includes all positive emotion reactions. Desmet (2002), and Desmet and Hekkert (2002) generate a model of product emotions to clarify the product appearance and emotions. This model has four elements that describe the process of an emotion: (1) *appraisal*, (2), *concern*, (3) *product*, and (4) *emotion*. (Figure 2.2.4).

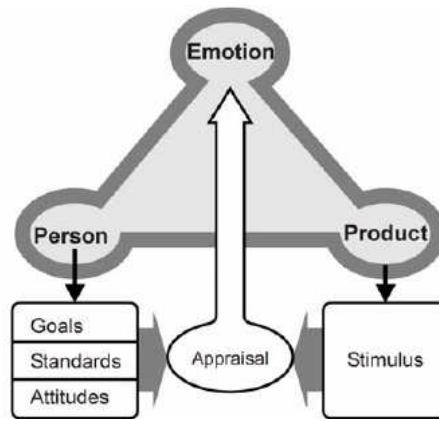


**Figure 2.2.4:** Basic model of Product Emotions (Desmet, 2002)



Appraisal can be described as not the event itself, but the way how the event is perceived by people. In the context of product emotions, an appraisal is how the user perceives the product. There are three possible outcomes: the product is beneficial, the product is harmful or the product does not concern the user. When the product is perceived as beneficial, a pleasant emotion is aroused or if the product is perceived as harmful, an unpleasant emotion is evoked. If a product is appraised as beneficial, this means it matches our concerns or if a product is appraised as harmful, this means it mismatches our concerns. Some examples for our concerns are; concern for safety or concern for love. Products elicit different emotions. But, in this model moods are not considered because a mood can be aroused independently from the properties of products. For example, a person in an unhappy mood may perceive products more negatively. For this reason, the model of product emotions is based on emotions.

Desmet and Hekkert (2002) propose a model of product emotions that describe the process of how products elicit emotions. (Figure 2.2.5) Desmet and Hekkert's view is cognitive –functionalist- view that says emotions serve an adaptive purpose. This model describes that people have three types of concerns: (1) *Goals*, (2) *Standards*, and (3) *Attitudes* based on the theory of Ortony, Clore, and Collins (1988). Goals are the things that we want to make real. There are types of goals: *utilitarian goals* (e.g., using a pair of scissors to open a package), *social goals* (e.g., buying an expensive car to gain status by impressing others) and *hedonistic goals* (e.g., eating ice-cream because it is delicious). Products that seem to make our goals real, elicit positive emotions for us. Standards are our beliefs, and norms. Products that match our standards are perceived as beneficial. Attitudes are our characteristic taste such as liking and disliking. For example, some people like classical furniture, and some like modern design.



**Figure 2.2.5:** Model of Product Emotions (Desmet and Hekkert, 2002)

To define pleasure and pleasurable design, an explanatory path is followed. Starting with the statement of the relation of human-factors with industrial design, firstly Norman’s (2004) elements of emotional design are described and the formation of emotion in brain is examined. Secondly, benefits of pleasurable products are explained with Jordan’s (1999) theory to clarify which products evoke pleasure for the user. Then, types of pleasure are described with Tiger’s (1992) “*Four Pleasures*” theory that gives a structured model for the topic. Finally, with Desmet and Hekkert’s (2000) basic model of emotions, the relation of products and emotion and how products elicit emotions are explained.

#### 2.2.2.2. Classifying Product Emotions

There are various types of emotions that people experience during their life-time. Also these emotions are classified in different ways by researchers. As a topic of emotional design, the types of product emotions are examined to find out which types of emotion the products evoke. The most well-known studies about classification of product emotions are Jordan’s (1998) and Desmet’s (2002). They both conducted a series of studies to come out their differentiation.

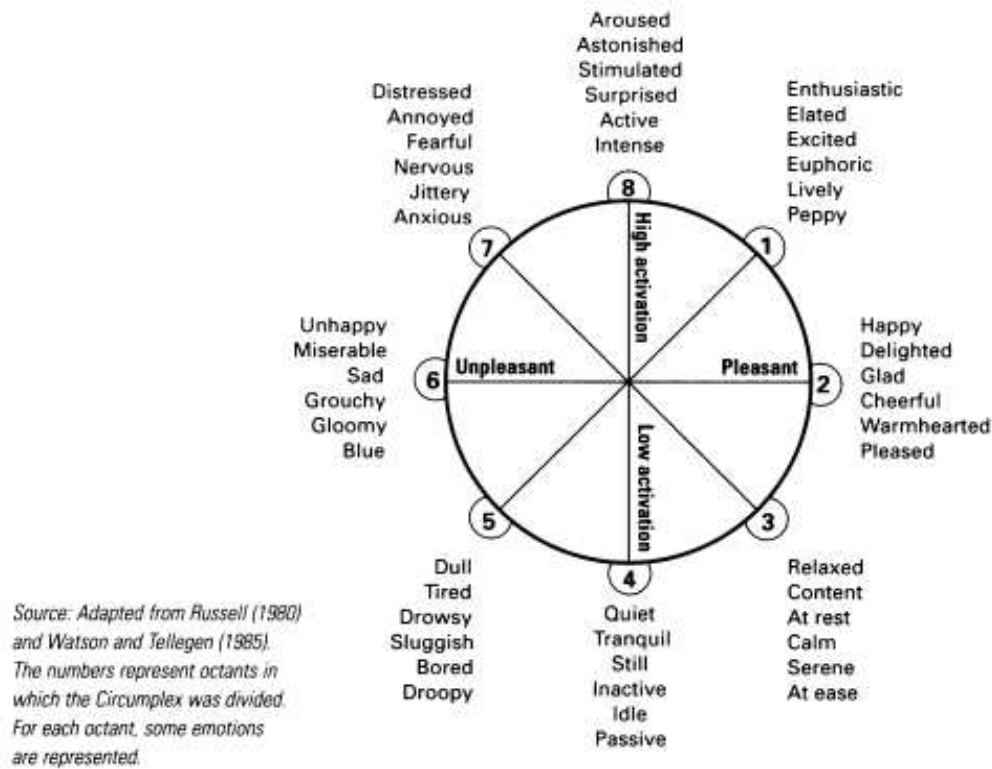
Jordan described pleasurable products in *Human factors for pleasure in product use* (1998). He states that a usable product does not always mean a pleasurable product. Usability can be only one condition of pleasurable products. Jordan (1999) states that pleasurable products are the ones that are emotionally and hedonically beneficial in use and displeasurable products are emotionally and hedonically disadvantageous in use. Jordan (1998) conducted a research to determine the pleasurable and displeasurable feelings to products and the connection of product properties with feelings. The main

aims of the study were to find the emotions related to products, to define the properties of product that elicit emotions, and to identify the connection of behaviors with pleasurable features of products. In the study, each participant was wanted to think one pleasurable and one displeasurable product that they owned or used. Then an interview was held with each participant and they were asked about their pleasurable and displeasurable feelings about the two products they thought. The interview questions were grouped in three sections: questions about the pleasurable products and their properties, questions about the displeasurable products and their properties, and general questions. As a result of this study Jordan states pleasurable and displeasurable feelings that are evoked by products. Pleasurable feelings towards products are *security*, *confidence*, *pride*, *excitement*, *entertainment*, *freedom*, and *nostalgia*. Displeasurable feelings towards products are *aggression*, *feeling cheated*, *resignation*, *frustration*, *contempt*, *anxiety*, and *annoyance*.

The feeling of *security* is desire to know that the product is ready to serve when the user needs it. For example, knowing that your hair drier has the required features and power whenever you need to use it and it makes you feel sure about its reliability. Feeling *confidence* about a product is to feel that you have all the control while using it and to feel self-assured even after the use. For example, TV set should feel you self-confident when using it with its sound and image quality, and also its appearance in your living room. When the user feels *pride* about the product, he feels pride about the purchase decision, and thinks the products he bought is more valuable from the other similar ones. For example, the personal stereo may be special for the user and he is proud of having it. Also, some people feel *excitement* about their own products such as a guitar player feels excited when he plays his guitar or when he thinks to play it. The feel of *satisfaction* about a product, being related to usability, is described as feeling pleasure when the product serves the user's needs completely and causes no problem during/after use. Also, when the user feels *entertainment* about the product, it means finding the product fun to use. When a product elicits the feeling of *freedom*, it means the product makes its user feel independent while using it. For example, an Mp3 player elicits the feeling of freedom for the majority of the users. Also, the feeling of *nostalgia* arises when a product makes its user feel a connection to a memory or history (Jordan, 1998).

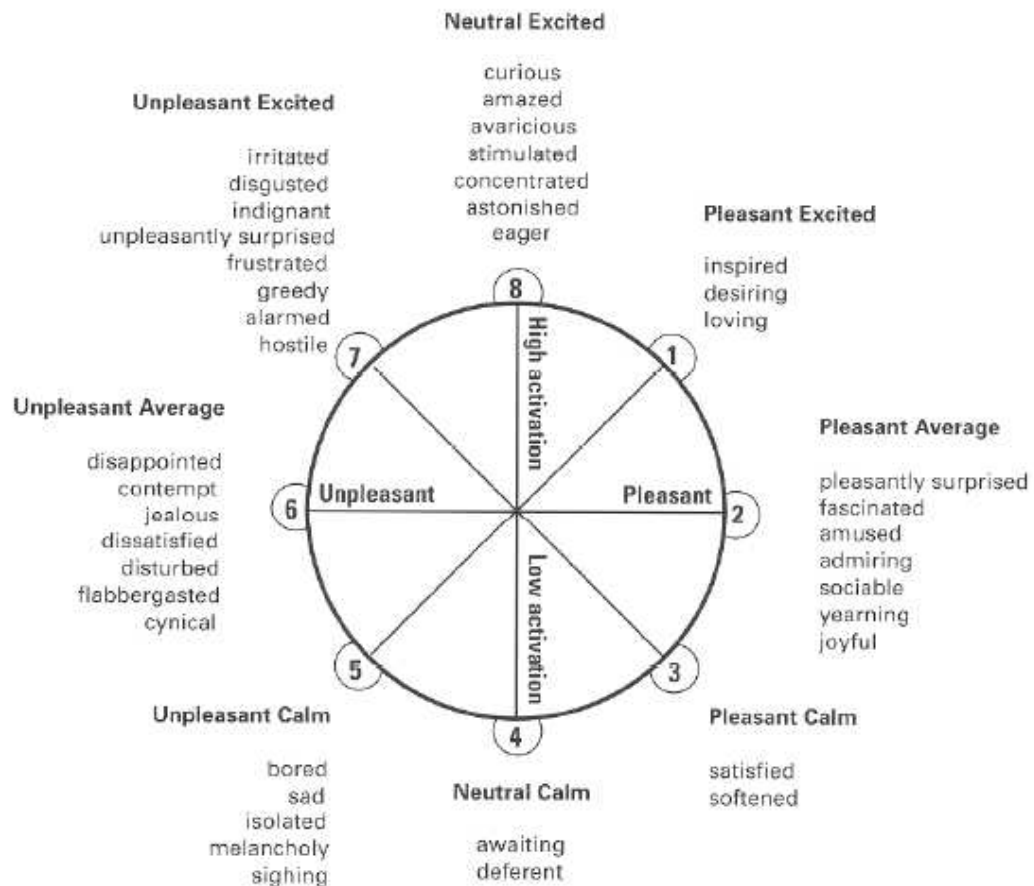
On the other hand, the feeling of *aggression* may be about the product's working disorder and elicit displeasurable feelings. For example, a computer being broken down while working on an important file makes the user feel aggression. The users sometimes *feel cheated* when the product does not work properly as promised by the salesman or the manufacturer. Also, people feel of *resignation*, mostly after feel of *frustration* by the product, when they finally accept the product's being inefficient. People feel frustrated when the product is not usable enough. The feeling of *contempt*, both towards to the product or the manufacturer, arises when there is unsolved or annoying problem with the product. For example, it happens when the user could not get help from the product's service. When people feel *anxiety* towards a product, they think the product is problematic in use. For example, someone feels anxious when he can not manage the functions of his video recorder. *Annoyance* is the feel of irritation about the product's incapability or inappropriateness. For example, the sound of the refrigerator may irritate the user; he wants to have a more silent refrigerator (Jordan, 1998).

Desmet (2002) states that there are three approaches to differentiate emotions: (1) Differentiating emotions on the basis of their manifestations, (2) Differentiating emotions on the basis of their proceeding appraisals, (3) Differentiating emotions on the basis of their underlying dimensions. Desmet uses the third approach to classify product emotions. This method uses a two-dimensional diagram with x dimension of pleasantness and y dimension of activation level to describe the variations of emotions. This diagram was created by Russell (1980, cited in Desmet 2002) and called "The Circumplex of Emotions" (Figure 2.2.6).



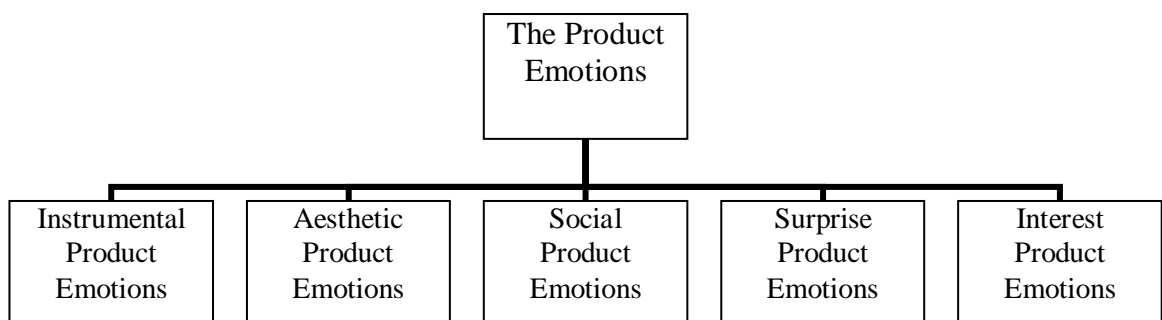
**Figure 2.2.6:** The Circumplex of Emotions (Desmet, 2002)

To find out which emotions are generated by product appearance, Desmet (2002, p.20) conducted a series of studies. These emotions are called *product relevant emotions*. In study 1, 347 emotions were placed on the “Circumplex of Emotions” diagram and 65 of them were excluded because of being unclear. Finally, 282 emotions were classified by twenty participants who were wanted to scale each emotion by its degree of pleasantness and activation level. In study 2, emotions that are found less relevant to products were omitted by twenty two participants. Participants were asked to select top five emotions of each part of the Circumplex diagram according to their frequency of use in daily life. Finally, the number of product relevant emotions was reduced to 69. In study 3, 69 categorized product relevant emotions were eliminated according to their similarity in meaning. Similar emotions like cheerful and joyful or sad and gloomy were omitted. Finally, a set of 41 product relevant emotions was formed (Figure 2.2.7).



**Figure 2.2.7:** The Circumplex of 41 Product Relevant Emotions (Desmet, 2002)

Based on the appraisal model of Desmet (2002), and Desmet and Hekkert (2002), Desmet (2004) classified product emotions into five groups according to different appraisal and relating concern types. These groups are: instrumental, aesthetic, social, surprise, and interest product emotions (Figure 2.2.8).



**Figure 2.2.8:** Desmet's (2002) classification of product emotions

*Instrumental product emotions:*

When people use or own products to achieve a goal, this type of products is called instrumental products. Instrumental products elicit positive or negative emotions

according to its performance. Examples for instrumental product emotions are: satisfaction / dissatisfaction, fulfillment / disappointment.

*Aesthetic product emotions:*

Beside goals, people have attitudes towards product appearance. People like or dislike products according to their taste that match or mismatch their attitudes. Feeling attracted, desiring or disgusting to a product are aesthetic product emotions.

*Social product emotions:*

People have standards according to their social group and environment. Products that match the social norms of people are called legitimate and elicit emotions like admiration or contentment. But, people feel indignation or contempt toward products that mismatch their social standards.

*Surprise product emotions:*

Novelty is the term that product eliciting surprise product emotions should match. Pleasantly or unpleasantly surprise emotions are evoked by products that match or mismatch people's concerns.

*Interest product emotions:*

People search for different products and product that have something to explore. If the product does not match the concern of challenge and promise, people feel negative interest emotions. Examples for interest product emotions are fascination, boredom, and inspiration.

Emotions are categorized into two main groups: pleasurable (positive) and displeasurable (negative) emotions. Emotions that are mostly elicited by products are named as "*product emotions*". Product emotions are designated by some research that are mentioned above and also classified into groups according to their types of appraisals and concerns. To label and classify product emotions is required for measuring and designing more pleasurable products.

### **2.2.2.3. Products Properties That Elicit Emotions**

The source of pleasure in product use has become an interesting topic of human factors as being only user-friendly or usable is not enough for the market. Products that give pleasure in use have become more preferable. But, the main question is to

find out what characteristics of products evoke pleasure or displeasure. We are all surrounded with products in our social life. So, we are affected mostly by the products around us.

The first question is to determine if products form considerable experience by evoking emotions of users. Forlizzi, Mutlu and DiSalvo (2004) conducted a study to find out which properties of products affect emotional responses of people. The participants were between 21-57 aged females who were interested in sport products. Forlizzi, Mutlu and DiSalvo state that they have three main goals in this study: (1) to identify the emotional responses of the users, (2) to identify which properties of the products evoke emotional responses, (3) to build a framework to understand experience and emotion. A self-report method was used to collect emotional experience data of the users. As a result, 80% of the 119 recorded emotional experiences were found to be similar. Finally, Forlizzi, Mutlu and DiSalvo (2004) state that most of the emotional experiences are formed by products directly, however the relation of the product and the experience sometimes is indirect. In other words, it can be stated that products surrounding us evoke emotions while interacting with user and the reason of emotional experience of the user is based on products.

To determine which properties of products evoke emotions, firstly the types of products that we interact should be classified. Ontony, Clore and Collins (1998) state that we perceive the world through three different ways: through *events*, *agents* and *objects*. Based on this theory, Desmet and Hekkert (2002) focus on product emotions and divide products in three groups in a structure of emotion. These are *products as objects*, *products as agents* and *products as events*.

*Products as objects (Product – attitude relation):*

Products are objects that are appraised by their appealingness. People firstly make decisions about products in terms of their appearance and perceived as good or bad. People like or dislike products for several reasons; such as aesthetic taste, personal experience or social attitude.

*Products as agents (Product – standard relation):*

Agents being reasons of events affect decisions of people with its standards. Products as agents are perceived as good or bad according to the standard of people, for



example social standards on the rules of society or design standard on the designer or the manufacturer of the product.

*Products as events (Product – goal relation):*

Although products are not events, Desmet and Hekkert (2002) state most of the product emotions belong to this group. For example, to have a goal of owning a product for a reason is desire, such as desire to own a TV stereo system to have a social statue in a society. People may have the goal of desire for several reasons, like to have fun, to seem wealthy, to feel confidence.

In other words, it can be stated that products evoke emotions by three main ways: as objects, as agents and as events. The next point that should be clarified is which properties of products evoke what type of emotion. Products' properties affect the products' being pleasurable or displeasurable. According to Jordan (1998, p.29), there are eight properties influence the product giving rise to various feelings. They are: *features, usability, aesthetics, performance, reliability, convenience, size, cost, and being gimmick or practical*. Products should have necessary features that it should serve to the user's demand. For example, a telephone machine without a redial button is not a complete design and it does not satisfy the users who want to use this function or a remote control with many unnecessary buttons that do nothing but confuse the user is also a dissatisfying product. Secondly, usability is a necessary component for pleasurable products. In spite of having emotional benefits, if a product is not usable, it can not satisfy the user. Also, aesthetics is an important component of pleasurable products as appearance affects the perception. For example, a consumer may buy a TV set because it fits his living room or a consumer may refuse to buy a product because it is not aesthetic although it has all necessary functions. The fourth element of pleasurable products is performance that means a product's serving the purpose appropriately and having an acceptable level of productivity. Reliability is a product's continuity of its performance in long-term. For example, if a consumer invests his money to an electric oven, he wants it to be reliable and he wants to use it for many years. Another feature of pleasurable product is convenience. Products should be suitable for its environment of use. For example, an Mp3 player should have a part for fastening to body as it should be convenience for outdoor activities. In addition, the size of the product should be appropriate to its function. For example, a mobile phone should not be very big to be able to carry in

pocket or not too small to be able to press buttons. Also, the cost of the product affects the perception of the consumer. If a product is more expensive than its estimated value, the consumer rejects to buy it as he feels displeasure. Lastly, a product may be totally unreasonable or have a wrong concept. Jordan (1998) described this situation as being “gimmick”. According to Jordan, these are the properties of products that elicit positive or negative emotions. A supporting research that has mostly the same findings with Jordan’s is Hauge-Nilsen and Flyte’s (2002).

Hauge-Nilsen and Flyte (2002) presents the studies of the Ergonomics and Design Group at Loughborough University on the methods that are used to define the pleasure in product use. The Ergonomics and Design Group conducted a three-step research that the aim of the first study was to find out the emotion words about the products, the aim of the second study was to find out the relation of emotion words with pleasure and displeasure, and the aim of the third study was to find out which of the emotion words were evoked by other products. As a result of the study, nine pleasure and nine displeasure attributes of products were found out: *good performance, good feel/touch, pleasing aesthetics, control of the product, safety, good quality, good construction, usability, good feedback entertainment and opposites of all*. They formed a figure, *the Pleasure Cake*, which shows the properties that evoke pleasure in short-time use with total frequency of each.

There are different views and studies on the product properties that elicit positive emotions. However, it is possible to come up with generic principles to use in the design of pleasurable products.

### 2.3. Designing Emotionally Effective Products

As emotional design has become a part of consumer needs, ways of building emotions in design should be explained. Although understanding the emotions and experiences of consumers is not a new topic in design, designers try to explore different ways to create products and services with added emotional value. Areas that should be understood for emotional design are consumers' values, experiences, social environment, concerns; shortly how people live and feel.

#### 2.3.1. Emotional Products

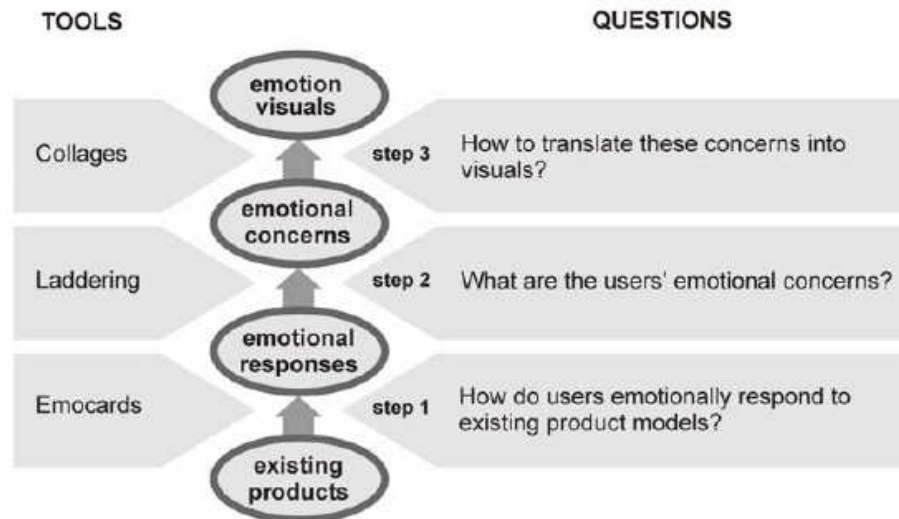
People feel different emotions towards different products and designers can manage these product emotions (Desmet, 2002). The first step of designing emotional products is to build an insight of consumer values. Understanding consumer background is for comprehending the user needs, values and taste. Overbeeke, Djajadiningrat, Hummels and Wensveen (2000) state that people interact with products through a three-step process: *cognitive skills (knowing)*, *perceptual-motor skills (doing)* and *emotional skills (feeling)*. In recent years adding emotional value to products is a developing issue of design. However, the main question is how to design emotional products. The topic is mentioned in various titles, for example Jordan (2000) deals with this topic in the context of pleasurable design and proposes "pleasure-based approaches" to design emotional products; Kälviäinen (2002) mentions about "consumer taste" and develops a framework to manage the issue; and Overbeeke, Djajadiningrat, Hummels and Wensveen (2000) suggests methods to design emotionally rich products. It is important to keep in mind that products are not just tools. Marzano (1998) states that products are *living objects* that have *personality* and connected with people and products make people feel various emotions such as happiness, anger, admiration or disgust.

Jordan (2000, p.8) states that it is necessary firstly "*understanding people holistically*", secondly "*linking product benefits to product properties*", and thirdly "*developing methods and metrics for assessing product pleurability*" to design pleasurable products. To analyze people and product interaction, not only functional interaction, but also hedonic and emotional interaction should be considered. After determining emotional benefits, the connection with them and product properties

should be established. For example, the concern for security results with the search of safe products and people feel more pleasure towards a safer car. To be sure that the product is pleasurable, various methods and research should be applied. For example, the concept of the product can be evaluated by users with these methods such as interviews or questionnaires.

Designing pleasurable products is a complicated process that has many factors. All of these factors should be considered to make people experience positive emotions. Overbeeke, Djajadiningrat, Hummels and Wensveen (2000) express that the designer should design a context of experience, not just a product. The interaction of a user and a product should be designed as pleasurable. To design pleasurable products, Overbeeke, Djajadiningrat, Hummels and Wensveen (2000, p.3) suggest new principles. These are: (1) *Don't think affordances, think temptation*, (2) *Don't think beauty in appearance, think beauty in interaction*, and (3) *Don't think ease of use, think enjoyment of the experience*. In these principles, it is clearly seen that they oppose the traditional aspects of design methods. For example, they advise that designers should give priority to attractiveness of the product, so people will be tempted to features other than physical ones; or designers should pay attention to build an effective and user-friendly interaction between the user and the product, rather than just designing charming products in appearance; or as Jordan (2000) states "usability is not enough", designers should also think about creating pleasurable experience with products.

Designing products with the emotional value has been the new research area in human factors in product design. However, the challenge of the topic is to design the product that matches user's emotions. To find a way to connect the product properties and emotional responses, Desmet, Overbeeke and Tax (2001) developed a three-step approach (Figure 2.3.1). Firstly they explore the emotional responses, and secondly match these responses with concerns, and then thirdly they visualize the concerns.



**Figure 2.3.1:** Three-step approach (Desmet, Overbeeke and Tax, 2001)

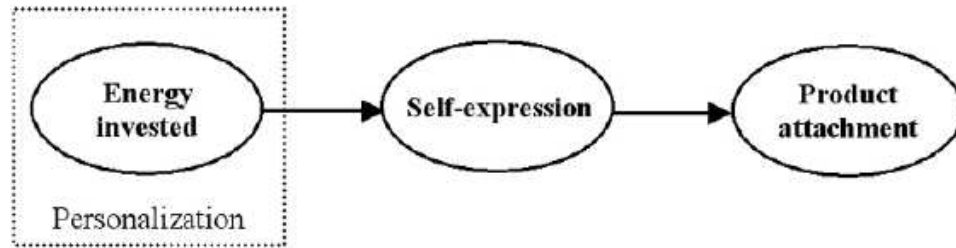
Our emotional responses depend on how products connect with our concerns in term of goals, standards and attitudes (Ortony, Clore, and Collins, 1988). As the concerns of people differ, emotional responses to products also differ from person to person. In the first step, they use “Emocards” (will be introduced in the next section) to capture emotional responses to the existing products. In the second step, with laddering method the emotional concerns of the users are found. Laddering method that has its origin in marketing research is a method to comprehend the relations between product properties, product benefits and the characteristics of the user; and the principle of the method is the investigator’s questions of “why” one after another until the participant can not think another reason (Jordan, 2000). Finally, in the third step of the approach, the emotional concerns are visualized by collages that express the emotions (Desmet, Overbeeke and Tax, 2001). All of these studies and developed principles are to suggest new methods and to show a way for emotional products.

### 2.3.2. Consumer Taste, Product Attachment and Product Personalization

Another branch of emotional design is “the design for consumer taste” which is proposed by Kälviäinen (2002). She states that background of the consumer taste should be understood to manage a pleasurable design process. She defines the term “taste” as: “*a preference arising from the consumer’s value-based capacity to make distinctions between physical objects and to get pleasure from them.* (p. 77)”. She develops a framework to determine all the factors that affect the consumer taste. These factors are in three main titles: *contextual*, *aspirational* and *social* areas of the

use. The examples for the contextual factors are the components such as the environment, the location; place and region of the use that affect the taste and the experience of the product. Also, time of the year and also time of the day influence consumer taste. Additionally, gender is an effective factor of taste, for example the selection of color and the style of the design are more or less determined by gender. Kälviäinen (2002) states that the match of *self-image* and the *product-image* develops a pleasurable user-product interaction. A method called “identity building” is used to create a product-image that fits self-image of the user (Signs of the Times, 1992, as cited in Kälviäinen, 2002). In identity building method, the aim is that products reflect the personal characteristics of the user such as gender effects, status aspirations, and metaphors of self. For example, if a product is unique, owning this product presents the desire of individuality of its user; or owning a powerful car makes its user feel strong.

The properties of the product and the type of emotion they evoke on customers determine people’s choices of purchase and use. People may love a product for personal reasons, or on the contrary they may hate them. Schifferstein and Pelgrim (2003) define the positive relation of the product and the user as “*product attachment*” and make a definition of product attachment as “*the emotional bond a consumer experiences with a product*”. Desmet (2002) states that people feel attached to product because they have specific concerns about them. For example, “*Why am I attached to my umbrella? Because I have a concern for staying dry.*” (p.195). People think the products that they are attached to are very special for them. Mugge, Schifferstein, and Schoormans (2004) state that a lifetime of a product gets longer by means of product attachment. They conduct a research to find out if product personalization increases product attachment. Users may change the appearance, even the functions of the product they own to individualize them, and it is called product personalization. Mugge, Schifferstein, and Schoormans (2004) add that people change their products according to their tastes and values and they invest energy. The relation of product personalization and product attachment is shown in the Figure 2.3.2.



**Figure 2.3.2:** Conceptual model for the relationship between product attachment and the personalization of a product's appearance (Mugge, Schifferstein, and Schoormans, 2004)

In the study of product personalization, a group of students who own bicycles were grouped into two: the group of students who personalized their bicycles and the group of students who did not personalize them. As the result of the study that was conducted according to the students' demographic variables, it is found that the students who have personalized products are more interested in unique products than the other group. So, Mugge, Schifferstein, and Schoormans (2004) state that if a product answers to all self-expression needs, the consumer feels attached to it. In other words, people find personalized products more pleasurable, because they want to express themselves.

### 2.3.3. Product Experience and Experience Design

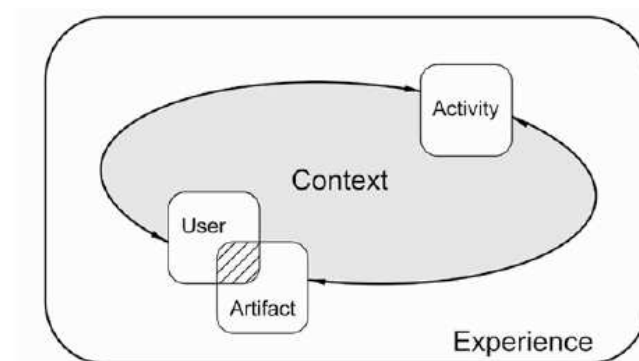
Another branch of emotional design is "Product Experience" and "Experience Design". People experience and interact with products in daily life. Hekkert (2006) makes a definition of product experience as: *"the entire set of effects that is elicited by the interaction between a user and a product, including 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). (p. 3)"*. In other words Hekkert (2006) states that the experience has three levels: the *aesthetic*, *understanding*, and *emotional* level. This means we do not just experience products in emotional level, but also in aesthetic and understanding level. A new approach is developed with product experience theory that is called "experience design". The aim of experience design approach design is creating pleasurable experiences with product properties. Gomez, Popovic, and Bucolo (2004) conducted a study to find out the product experience of the users during the product interaction. The study was focused on automobiles, and a series of

interviews and observations were carried out to communicate the negative or positive experience of users. According to Russell's (2003) theory, a moment of negative or positive experience affects the emotions arising as pleasurable or displeasurable. Gomez, Popovic, and Bucolo (2004) reformed Russell's (2003) "Emotional Chart" having the horizontal axis of happy-unhappy and the vertical axis of excited and calm to establish the questions of the study (Figure 2.3.3).



**Figure 2.3.3:** The Emotional Chart (Gomez, Popovic, and Bucolo, 2004)

Gomez, Popovic, and Bucolo (2004) mention that the product – user interaction should be examined in the context of the related activity. Figure 2.3.4 shows the relation of human – artifact – activity in the context of use. As a result of the study, it is stated that emotions that are related to activities in the context of use affects the product experience.



**Figure 2.3.4:** User – Artifact – Activity within context forms experience  
(Gomez, Popovic, and Bucolo, 2004)



Experience design is a method for designing pleasurable products. With the theory of product experience, the interaction of the user and the product is examined during the activity in the definite context of use. By using this method, the emotions of the user that are elicited during the use of product can be found and the necessities for more pleasurable design can be determined.

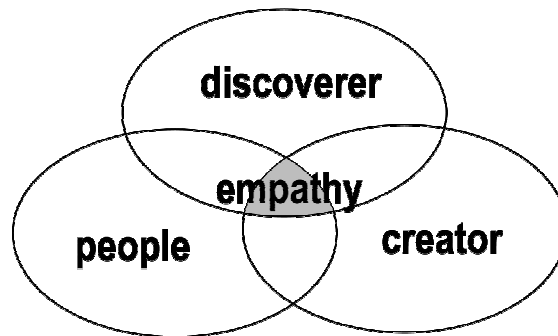
Emotional experience is just a level of the experience that have other levels such as aesthetic experience and experience of meaning. Also Battarbee, Mattelmäki, and Mäkelä (2000) and Mattelmäki and Battarbee (2000) define the design for experience as “*emphatic design*”. They conducted a series of studies to find out the values of people to communicate the pleasurable experience of use. Their aim is to build empathy between designers and users to create more pleasurable products. They conduct a research by using various research methods such as a focus group, diaries, open questions, self-photographing, interviews and collage making to capture the user data to create feelings of empathy within the design team and users.

#### **2.3.4. Hedonic Experience and Empathic Design**

Another approach to experience design is defined as “*hedonic experience*” by Stelmaszewska, Fields, and Blandford (2004). A study that aims to find out how people perceive hedonic experience and what factors affect hedonic experience was conducted to make a certain definition of hedonic experience. The participants were asked questions to define hedonic experience. As a result of the study, it is mentioned that hedonic experience has five types: *pleasure, enjoyment, excitement, fun, and happiness*. Moreover, from the discussions of the participants, four main sets of determinants identified were: *usability/functionality, interactivity-social element, appealingness, and novelty*. Usability and functionality of a product gives satisfaction to user. The social elements of a product mean the interaction that is given to the user and the user’s interactivity with others. Appealingness of a product is the aesthetic characteristics of the product that makes the user feel good. Finally, novelty is about the product’s having sense of surprise and it makes the user feel enjoy and excited.

Another term explaining design with added emotional value is “*empathic design*” that defines a new relation between user/consumer, researcher and the designer (Crossley, 2003). In traditional methods, the researcher gets the user data from the

customer, and transfers the data to the designer, and designer designs the product according to the relevant information. Crossley (2003) states that to get empathic data from consumers and to design emotional products, the distinct roles should not be so clarified. Figure 2.3.5 shows the relation of the discoverer, creator and people that have an intersection point called *empathy*. With Crossley's (2003) words: "*partial adoption of these three core areas builds empathy*".



**Figure 2.3.5:** A diagram showing the converging roles (Crossley, 2003)

In order to understand people's experiences, behaviors, and thoughts; designers should build a *personal insight*. Crossley (2003, p.37) states the requirements of a personal insight as:

- *building a shared vision*
- *building empathy and understanding of people's past experiences*
- *making sensitive observations of behavior*
- *defining the essence of the problem and the exploration of relevant ideas*
- *the ability to effectively communicate key insights and visions.*

In other words, designers should communicate with researchers from different areas and consumers in order to build an empathic experience between the product that they designed and the people whom they designed for.

### **2.3.5. Methods of Designing Emotional Products**

According to Design and Emotion Society's ([www.designandemotion.org](http://www.designandemotion.org)) classification, product evaluation and emotion measurement tools and methods are grouped in two main titles:

- (1) *Generative tools and methods,*
- (2) *Evaluative tools and methods.*

Generative tools and methods will be explained in the section of methods of designing emotional products. Evaluative tools and methods will be discussed in the emotion measurement techniques section.

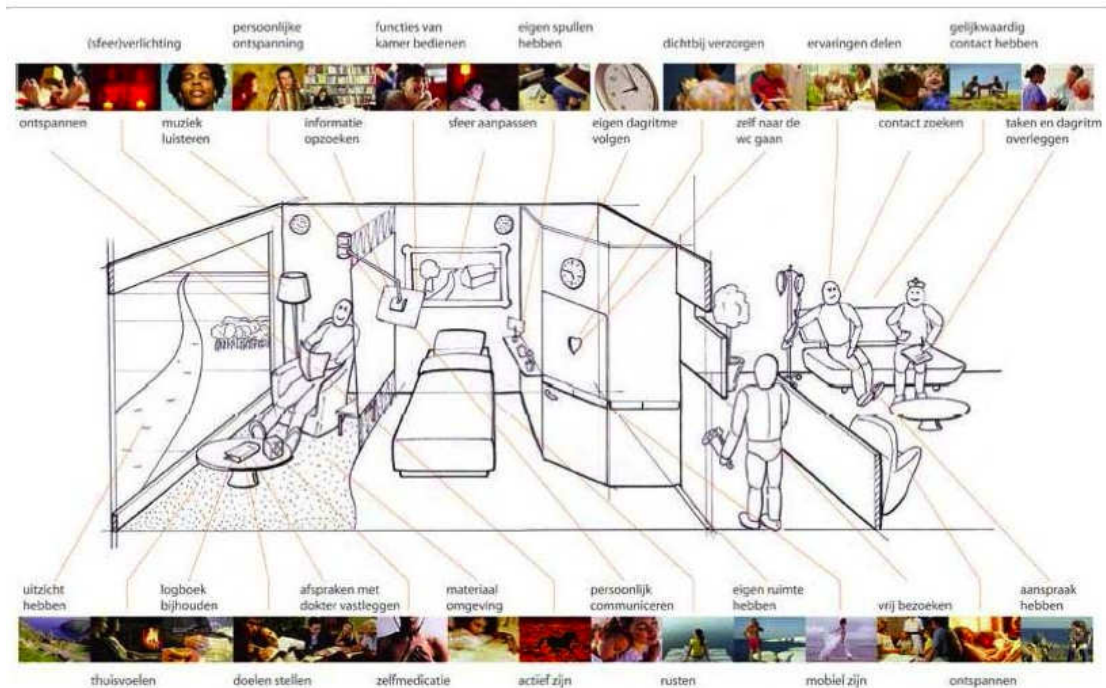
Stappers and Sanders (2004) state that generative methods try to develop an insight in three perspectives: *marketing research* (“*what people say*”), *applied anthropology* (“*what people do*”), and *participatory design* (“*what people make*”). Generative tools and methods are also categorized in three sections: (1) *Tools to collect information*, (2) *Tools to represent/explore information*, and (3) *Tools and methods to define product characteristics*.

To introduce existing tools and methods registered by Design and Emotion Society, all of them will be identified in this section shortly with their characteristic properties. First of all, tools to collect information are:

- (a) Context Mapping Tool Suite,
- (b) Emofaces,
- (c) Inspiration & Assessment Cards, and
- (d) Product Attachment Scale.

*(a) Context Mapping Tool Suite*

Developed by P.J. Stappers, R. v.d. Lugt, F. Sleeswijk Visser from Delft University of Technology, Context Mapping Tool Suite (CMTS) tool aims to connect designers with users and their experiences. The main problem that was tried to be solved by CMTS is the lack of empathic understanding of the experiential environment of users. With CMTS; users, researchers, and designers share visual-creative tools to express user needs, and present the findings in ways that support idea generation (Figure 2.3.6). Stappers (<http://studiolab.io.tudelft.nl/contextmapping/>) states that CMTS has been applied, developed, and studied in graduation projects in Delft University of Technology.



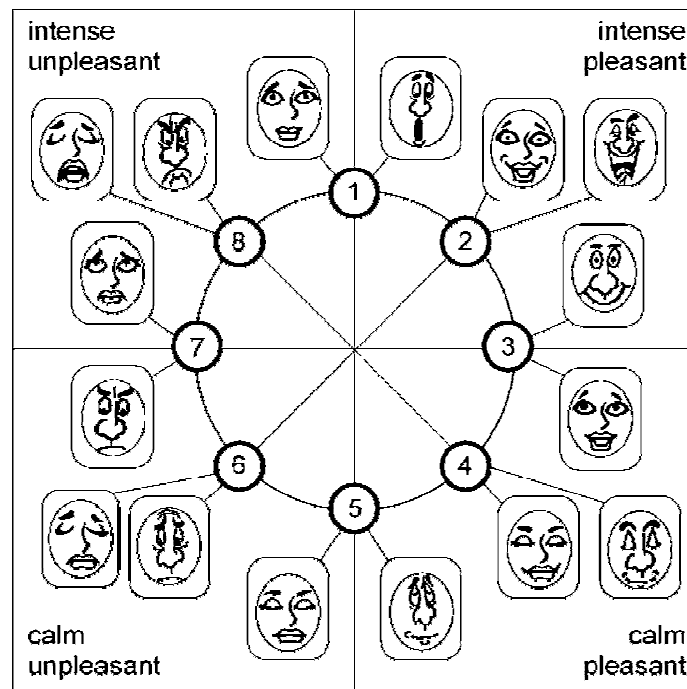
**Figure 2.3.6:** An example of context mapping communication infographic

*(b) Emofaces*

Developed and owned by Pieter Desmet, Emofaces tool aims to express emotions in a non-verbal method, as verbalizing emotions can be both difficult for the participant and misleading for the researcher. The tool Emofaces is named as “Emocards” by Desmet, Overbeeke and Tax (2001) before. Desmet, Overbeeke and Tax (2001) state that objects have difficulty in expressing their emotions when they are asked to, because of the reasons that it is difficult to verbalize emotions, and objects’ responses can be influenced with verbal communication. The main principle of Emofaces chart is based on Russell’s (1980) “the Circumplex of Emotions” with one axis of “pleasantness” and the other “intensity”.

With Emofaces tool, respondents can choose the related cartoon drawings of facial expressions to report their emotions. There are 16 Emofaces showed in male and female versions in 8 emotion categories: *excited neutral*, *excited pleasant*, *average pleasant*, *calm pleasant*, *calm neutral*, *calm unpleasant*, *average unpleasant*, and *excited unpleasant*. The aim of the Emofaces tool is to help objects to express their emotional responses by selecting an Emoface (an emotional category) (Figure 2.3.7). The Emofaces can be used to measure responses to existing products, adverts, or

services, to new (verbal) concepts, and to new products or prototypes. As it is a non-verbal tool, it can be applied to any culture.



**Figure 2.3.7:** Emofaces

*(c) Inspiration & Assessment Cards*

Developed by Caroline Hummels and owned by ID-dock, Inspiration & Assessment Cards (IA Cards) method tries to encourage people to talk, think and feel about subjects by using a large set of images. The image cards not having definite meaning give people courage to tell their stories and give meanings to the cards. Hundreds of cards are used in this method that are categorized in respect of their themes, such as people, animals, products, consumables, environments, abstract images and textures. Then they are grouped based on three factors: ambiguity, variety and aesthetics. Then some questions are asked to respondents like: “Who are you?” or “How do you experience the interaction with a product X?” or “What kind of experience should the new product evoke?” The IA Cards don’t have a fixed meaning, thus giving the user more freedom for expression. Nevertheless, they are more structured and guiding compared to traditional collages and mood boards. Figure 2.3.8 shows some examples of IA Cards tool.



**Figure 2.3.8:** *Top left:* Set with 100 abstract images; *Top right:* a designer’s selection of cards expressing the experience the product should evoke; *Bottom left:* a graphical overview of the answers (keywords & images) of 100 subjects, clustered by 7 main topics. The size of the circles represents the number of similar answers. *Bottom right:*

IA Cards exist of different sets with different themes, such as people, products, environments and abstract images.

#### *(d) Product Attachment Scale*

Developed by Ruth Mugge and owned by Ruth Mugge and Hendrik N. J. Schifferstein, Product Attachment Scale tool provides a quantitative measure of the strength of the emotional connection of a person with a product during ownership. The scale can be used in questionnaires. People’s scores on the scale represent how attached they are to their product. The Product Attachment scale uses a seven point Likert scales (1 = strongly disagree, 7 = strongly agree). The items of the questionnaire are such as: “*This product is very dear to me*”, “*I am very attached to this product*”, “*I have a bond with this product*”, and “*This product has no special meaning to me*”. It is stated that the product attachment scale can provide designers with insights in the relationships that people develop with their products and more

knowledge can help designers who are interested in stimulating the emotional bonding to a product.

Secondly, tools to represent / explore information are:

- (a) Cabinet
- (b) Extreme Characters
- (c) MDS-Interactive
- (d) RealPeople
- (e) Repertory Grid Technique (RGT)
- (f) Skin 2.0
- (g) [product & emotion] navigator

*(a) Cabinet*

Developed and owned by Ianus Keller, Cabinet tool helps designers collect and organize the images they have on their computers together with the physical visual artefact they have collected in the context of their design work. The problem is defined as designers have difficulty in bridging the physical and digital collections. Cabinet is a table-sized interaction device that allows designers to collect and organize collections of both physical and digital visual material. Cabinet captures material by taking a picture from above or digital images can be added with a USB flash drive. Images can be organized spatially in stacks and compositions using the whole length of the arm. Cabinet blends the physical world and digital world very smoothly through its interaction and smooth transitions from the physical to the digital realm (Figure 2.3.9).



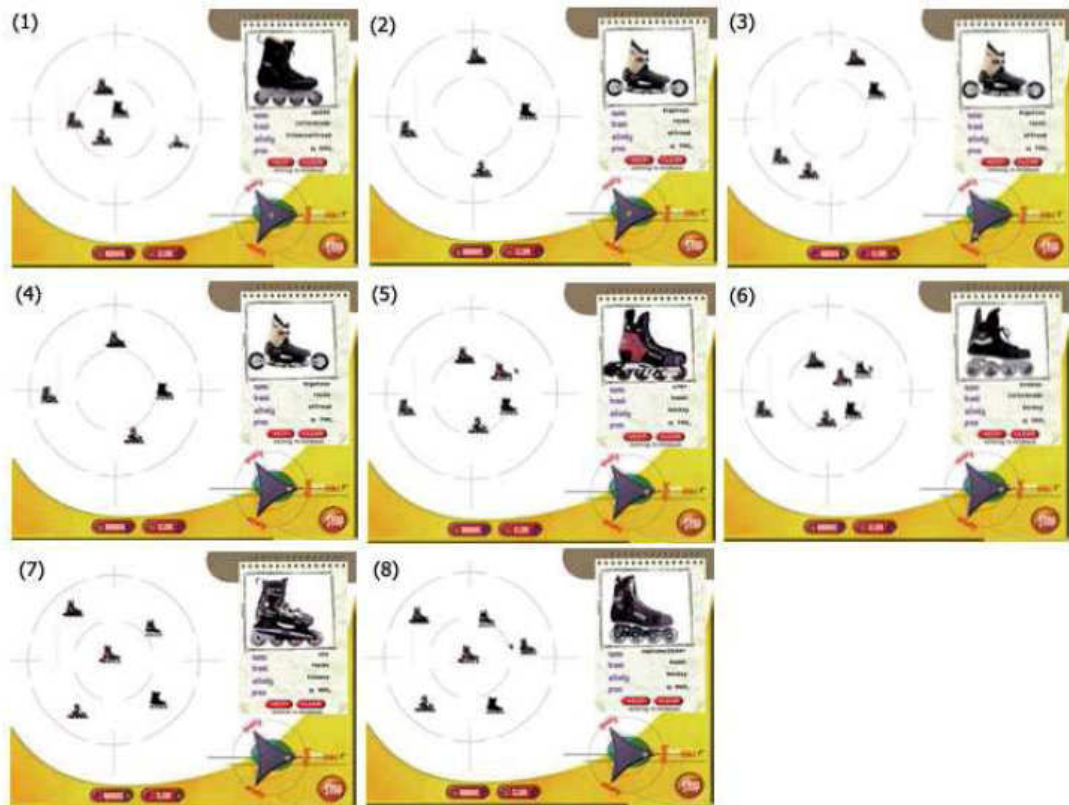
**Figure 2.3.9:** Designer using Cabinet to capture physical digital material

*(b) Extreme Characters*

Developed and owned by Frens, J.W., Djajadiningrat, J.P., and Gaver, W.W., Extreme Characters tool tries to steer away from the usual designing for a prototypical character from a target group. The aim of the method is to design for characters that have exaggerated emotional attitudes instead of designing for characters that are emotionally shallow (Djajadiningrat, Gaver, and Frens, 2000). In this tool, first of all several (three to five) extreme character pictures are prepared with short descriptive texts and in groups that four or five people participate the design problem is explored by designing a product for an Extreme Character (Figure 2.3.10). It is stated that this method will force a designer to look beyond the obvious and consider alternatives and the findings can be used to enrich the new to be designed product.







**Figure 2.3.11:** Interaction scenario.

- (1) When the search begins, a small set of samples is shown
- (2) Grouped by similarity; the two-wheel offroad skate stands apart from the other skates. If the user clicks on the offroad skates, details are shown in the inset
- (3) , (4) The triangle weighting dial allows users to shift the weight of criteria groups without knowing details about these groups; shifts result in a different grouping, as a different similarity criterium is adopted
- (5) By clicking on a position in the screen, a query is given, which results in the best fit for that position to be returned
- (6) To accommodate the new skate, the pattern is again adjusted automatically; the user can navigate through the database, switching between visual judgement, detail inspection, criteria adjustment, and by querying (click in the whitespace) and removing (drag offscreen) items.

(d) Real People

Developed by Samantha Porter, Mark Porter, Shayal Chhibber and owned by Loughborough University, Real People tool that is based on Jordan's (2000) "Four

Pleasures” principle aims to inspire and inform designers in the very early stages of the design process; highlighting the key pleasure needs of a target market and promoting empathy with the user. Real People tool is software that focuses on users (Figure 2.3.12). With this tool, designers can specify a user group by selecting certain variables e.g. age, gender and product type. Also, richer and more in-depth information about favorite products and lifestyle, including video clips about the target user profile can be found in the software. Then designer can view statistical information about the user group’s attitudes towards products and the types of pleasure they express. It is also stated that this is the only tool that focuses on pleasure and contains statistically valid data concerning age and gender differences.



**Figure 2.3.12:** The interface of Real People tool

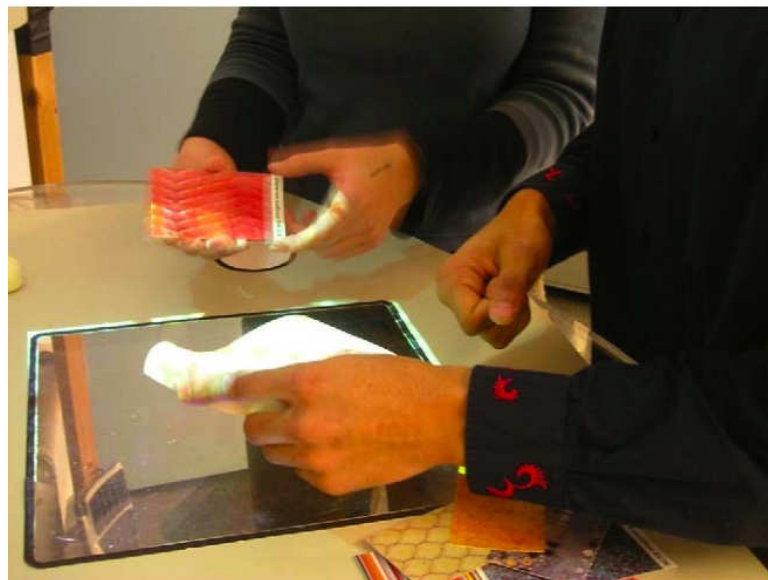
#### (e) Repertory Grid Technique (RGT)

Originally developed by George Kelly, this version by Brian Gaines and Mildred Shaw, adapted/applied by D. Fällman and owned by Interactive Institute, Sweden, Repertory Grid Technique (RGT) is a technique for eliciting and evaluating people’s subjective experiences of interacting with technology. It aims to communicate expressions of both *emotionally- based constructs (warm-cold)* and more “*rational*”

*ones (professional-popular)* and it tries to capture the data of how people experience things, what the experience means for them. The method can be applied to compare new prototypes, or just design sketches, and also to compare these with existing products.

*(f) Skin 2.0*

Developed by Daniel Saakes and owned by Daniel Saakes, and Delft University of Technology, Skin aims to give designers more control on designing the appearance of products, as the appearance of products become more important in emotional design. Skin is a small interaction device that can be attached to a table to visualize materials on products (Figure 2.3.13). With this tool, new materials can be mixed on the models. Skin is very appropriate for packaging design as it can mix materials with prints such as logos and prints.

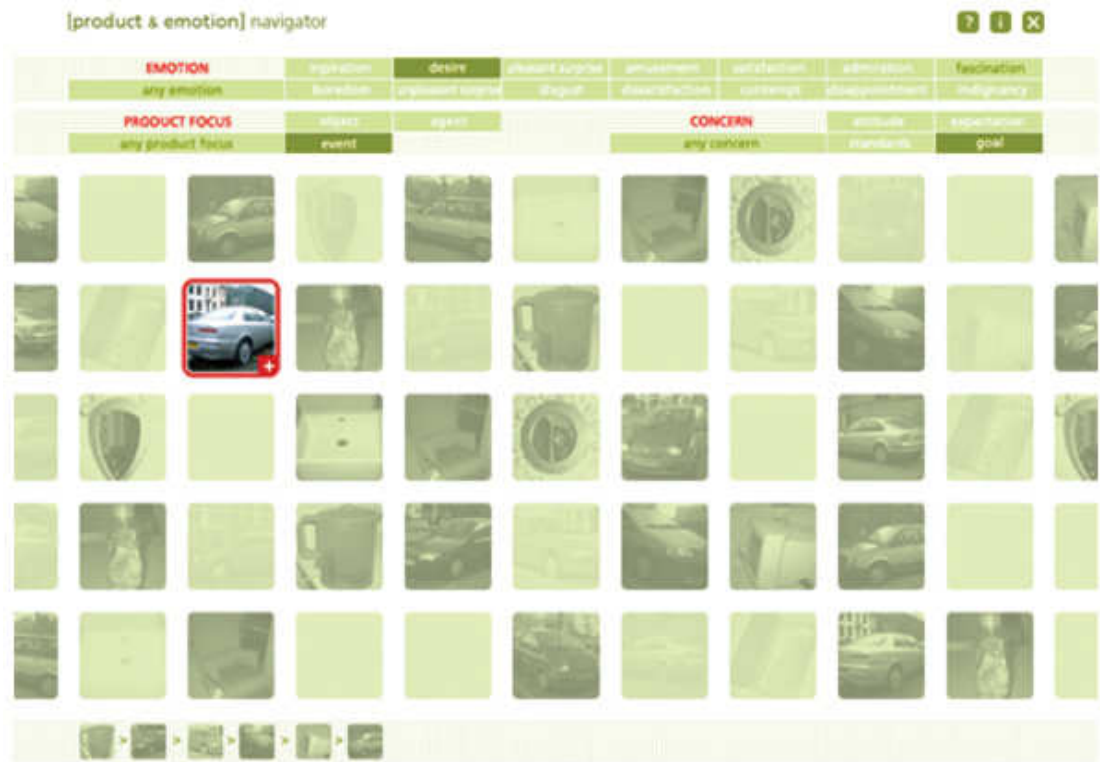


**Figure 2.3.13:** Designers using Skin

*(g) [product & emotion] Navigator*

Developed by Pieter Desmet and owned by Delft University of Technology, department of IDE, [product & emotion] Navigator is one of the methods that helps to design emotional products. The [product & emotion] Navigator is an inspiring computer program developed by Desmet (2002) for understanding variables such as concerns, appraisals that form emotion related to products and for introducing the product emotions to designers. As a result of two workshops that had designers as participants, the [p & e] Navigator is developed. The [p & e] Navigator is interactive

software that was developed to help designers to comprehend the product emotions model. The tool has an open-ended navigation; it is not dependent to a particular emotion or a product. Its aim is to give designers opinion about the emotions elicited by existing products and help to design emotional products (Figure 2.3.14).



**Figure 2.3.14:** The [product & emotion] Navigator Interface

Desmet held another workshop to apply the [product & emotion] Navigator in December 2001 (Desmet, 2002). Participants were asked to design products with their insights they got from the navigator; and secondly they were requested to evaluate the program. Some participants reported that the [p & e] Navigator had the advantages of viewing different determinants (concern types, emotion types) together and understanding how products elicited emotions. However, some participants reported that the [p & e] Navigator had the disadvantages of not evaluating mixed emotions rather than one specific emotion and having difficulty in understanding and interpreting the information given by the navigator. This study aimed to clarify if designers had influence on the emotional impacts of the products they designed and if it was possible to design products with added emotional value. It is found that the [p & e] Navigator can be an appropriate tool to guide designers to design emotional products. The [p&e] Navigator differs from other picture databases in the sense that



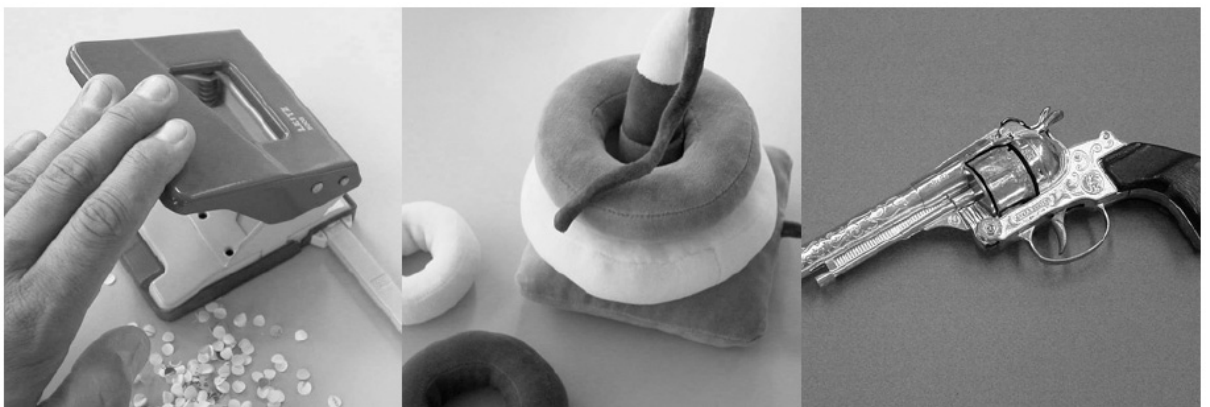
it was built on, and aims to demonstrate, underlying universal principles in the nature of human emotions.

Thirdly, tools & method to define product characteristics are:

- (a) Interaction Relabelling
- (b) Interactive tangible sketching
- (c) Kansei Engineering Software (KESo)
- (d) Kn6 IBV
- (e) Pictograms for product sound
- (f) SENSOTACT® (version V3)

*(a) Interaction Relabelling*

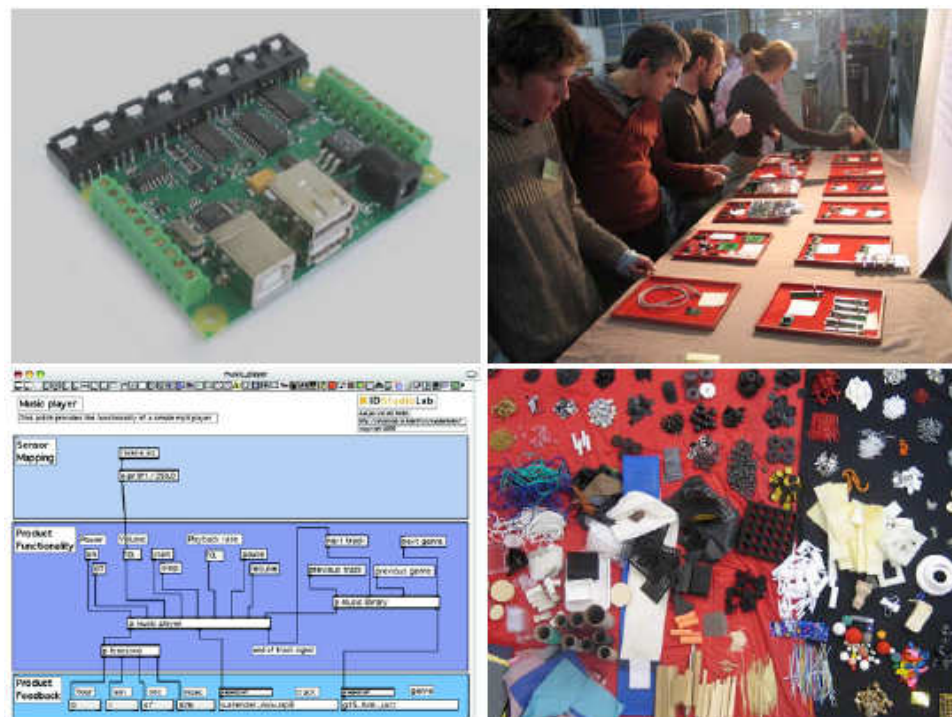
Developed and owned by Frens, J.W., Djajadiningrat, J.P., and Gaver, W.W., Interaction Relabelling is a method that works in group exercises. An Interaction Relabelling session is prepared with several different inspirational products (Figure 2.3.15). Djajadiningrat, Gaver, and Frens (2000) state that each group starts with a different inspirational product with the leading questions of ‘*what if this product was a “the product to be designed”*’. After 10 to 15 minutes the inspirational products are rotated. The advantages of Interaction Relabelling” are that it makes participants acutely aware of the relations between form, interaction, and function; and it is a creativity method to be used in the early phase of the design process (Djajadiningrat, Gaver, and Frens, 2000).



**Figure 2.3.15:** Interaction Relabelling: Inspirational products  
(hole-puncher, fluffy toy, toy gun)

*(b) Interactive tangible sketching*

Developed by Caroline Hummels and Aadjan van der Helm and owned by ID-StudioLab (TU Delft) and Design Movement, Interactive tangible sketching is a tool that integrates physical modelling with play-acting, sensor technology and dataflow modelling program MAX/MSP (Figure 2.3.16). This method gives designers the chance of moving ahead quickly from idea to prototype (Figure 2.3.17). Then, these 3D sketches can be tested on an experiential level with users and the design can be developed further (both conceptual as well as physical). The advantage of the approach is that it focuses on movement-based interaction and it integrates high-tech equipment and low-tech materials, resulting in interactive tangible sketches within a few hours.



**Figure 2.3.16:** Top left: Phidget Interfacekit. Top right: We supply designers with a large set of sensors and actuators. Second row left: the dataflow modelling program MAX/MSP is used control the product's behaviour in combination with the used sensors and actuators. Second row right: tinkering materials were offered throughout the process.

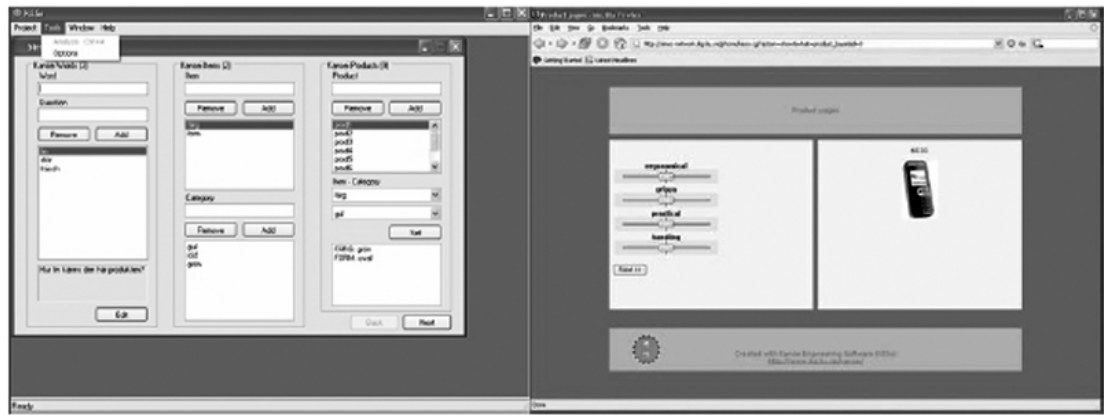


**Figure 2.3.17:** Top: interactive tangible sketches were produced within 3 hours, which were ‘fully’ working. Bottom: during several design cycles (including multiple 3D sketches) the sketches were transformed into interactive tangible prototypes, e.g. Cycles (left) and CreMu (right).

*(c) Kansei Engineering Software*

Developed and owned by Schütte, R., Kansei Engineering Software (KESo) is a tool for automatic data collection and evaluation of the data according to Kansei Engineering rules. As Kansei Engineering evaluation usually takes much time and requires expert knowledge in the areas of psychology, statistics and engineering; KESo shortens the process and reduces time and effort. It is stated that KESo generates web pages using predefined Kansei Engineering words and product properties as basic data and respondents rate the products (Figure 2.3.18). KESo is currently used by development staff of several companies for quick affective evaluation of products.





**Figure 2.3.18:** The picture on the right shows the graphical user interface of KESo.  
The picture on the left shows a typical webpage generated by KESo.

(d) *Kn6 IBV*

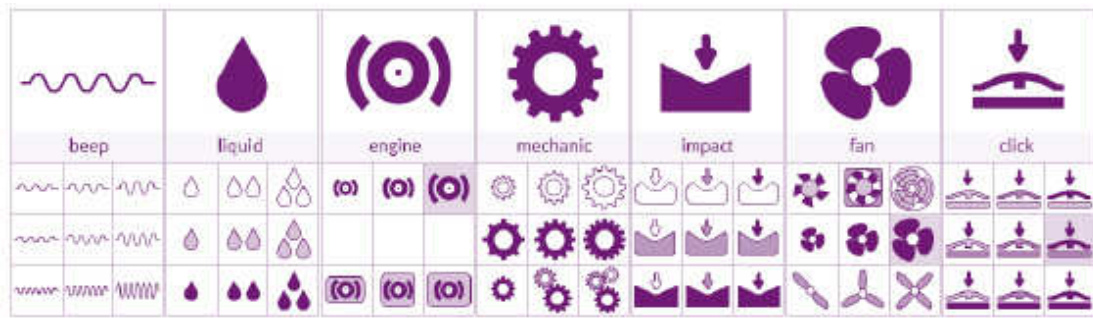
Developed and owned by Instituto de Biomecánica de Valencia (IBV), Spain, Kn6 IBV is a tool that provide support for the development of user oriented products, providing storage and management of data and information (Kansei words, design elements, products, users) and helping in gathering users' information. The tool is made up of three modules: *Management of the databases*, *Profiles generator* and *Design*. The first module manages the databases that feed the system (Figure 2.3.19); the second module generates graphs that represent products; and the third module connects the product properties with perceptions. The advantage of the tool is that it is a new tool designed for the management of the results obtained from the application of Kansei Engineering, for non-experts and easy to use.

Código	Nombre	Fabricante	Fecha de Alta	Valoraciones	Suministrado
DDK010	KENSYS 010	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK011	KENSYS 011	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK012	KENSYS 012	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK013	KENSYS 013	ANÓNIMO	16/03/2005	24	<input type="checkbox"/>
DDK014	KENSYS 014	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK015	KENSYS 015	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK016	KENSYS 016	ANÓNIMO	16/03/2005	23	<input type="checkbox"/>
DDK017	KENSYS 017	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK018	KENSYS 018	ANÓNIMO	16/03/2005	23	<input type="checkbox"/>
DDK019	KENSYS 019	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK020	KENSYS 020	ANÓNIMO	16/03/2005	24	<input type="checkbox"/>
DDK021	KENSYS 021	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK022	KENSYS 022	ANÓNIMO	16/03/2005	24	<input type="checkbox"/>
DDK023	KENSYS 023	ANÓNIMO	16/03/2005	24	<input type="checkbox"/>
DDK024	KENSYS 024	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK025	KENSYS 025	ANÓNIMO	16/03/2005	24	<input type="checkbox"/>
DDK026	KENSYS 026	ANÓNIMO	16/03/2005	24	<input type="checkbox"/>
DDK027	KENSYS 027	ANÓNIMO	16/03/2005	24	<input type="checkbox"/>
DDK028	KENSYS 028	ANÓNIMO	16/03/2005	23	<input type="checkbox"/>
DDK029	KENSYS 029	ANÓNIMO	16/03/2005	24	<input type="checkbox"/>
DDK030	KENSYS 030	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK031	KENSYS 031	ANÓNIMO	16/03/2005	23	<input type="checkbox"/>
DDK032	KENSYS 032	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK033	KENSYS 033	ANÓNIMO	16/03/2005	25	<input type="checkbox"/>
DDK034	KENSYS 034	ANÓNIMO	16/03/2005	24	<input type="checkbox"/>

**Figure 2.3.19:** Database of products in Kn6 IBV

*(e) Pictograms for product sound*

Developed and owned by Elif Özcan Vieira, Pictograms for product sound is a tool that enables sound visualization that represents the sounds of product parts (e.g., fans, engines, etc.). The tool has a sound library that has pictograms that represent various sounding parts of the products. Pictograms are hierarchically organized to make it easy for designers to navigate, choose, and build the right sound. In this hierarchical structure, they also vary in their shape, colour, pattern, and size to appropriately visualize the properties of the sounding parts (e.g., shape, materials, size) Özcan and Van Egmond (2004). Pictograms are used to explore the sound design of a product on a conceptual design phase (Figure 2.3.20).



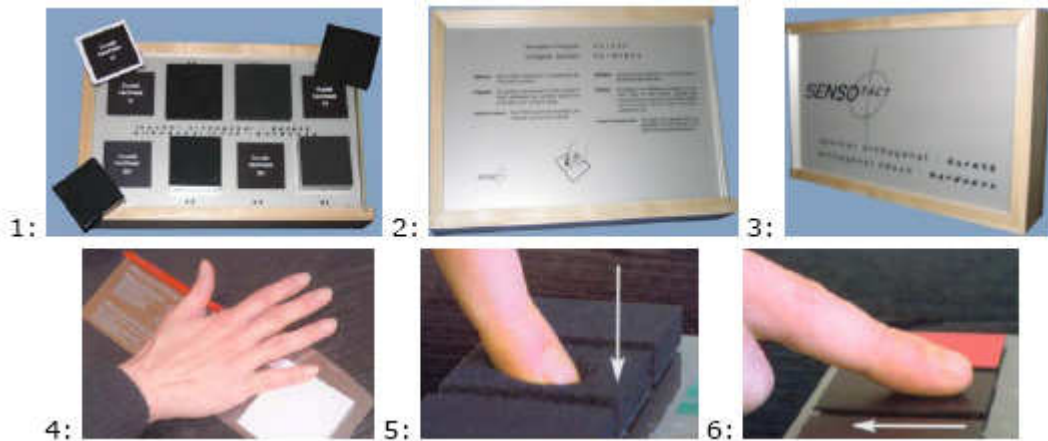
**Figure 2.3.20:** Sound Library of the Product Sound Modelling Tool

(f) *SENSOTACT® (version V3)*

Developed and owned by Ecole Nationale Supérieure de Mécanique et des Microtechniques (ENSM) / Renault, SENSOTACT® is a tool that helps designers to define the sense of touch of a product (Figure 2.3.21). The SENSOTACT® reference frame proposes an overall breakdown of the sense of touch into 10 descriptors that are made accessible through 3 distinct movements ([http://www.sensotact.com/pages/outil\\_englpag.html](http://www.sensotact.com/pages/outil_englpag.html)):

- Static Movement: 1 descriptor (thermal)
- Orthogonal Movements: 4 descriptors (stickiness, hardness, nervousness, memory of shape)
- Tangential Movements: 5 descriptors (braking, depth, slippery, fibrous, roughness)

Even if it has been initially developed by the automotive industry this tool can be used in different areas of application like cosmetics, sports equipment, toy manufacturing, textile industry, pens, hygiene and beauty products, etc. It also can be used in every parts of the industry like marketing, communication, design or research departments. This tool enables to precisely define every product and improve the communication skills.



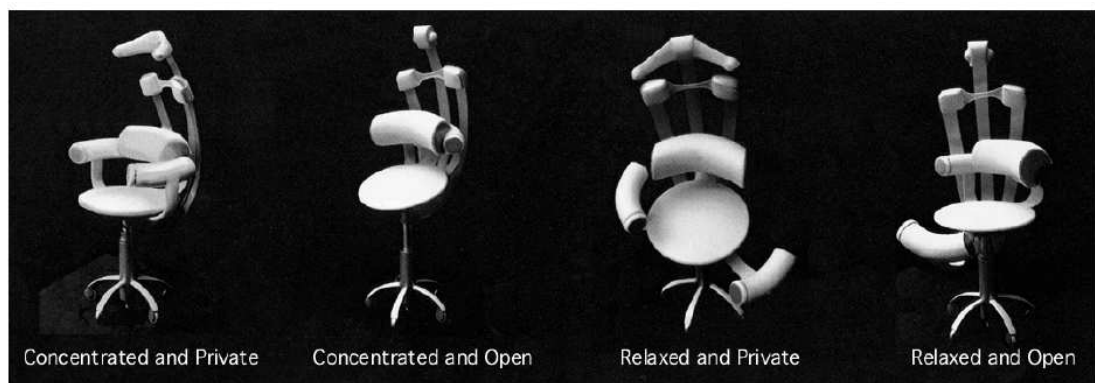
**Figure 2.3.21:** Description of the images: 1 – 3: views of one SENSOTACT® descriptor box/ 4 – 6: examples of tactile movements characterization samples

In this sub-section, the methods of designing emotional products were introduced. To make the classification, the web site of Design and Emotion Society was used. To sum up, three groups of tools and methods were introduced. These are: (1) *Tools to collect information*, (2) *Tools to represent/explore information*, and (3) *Tools and methods to define product characteristics*. These methods have different application areas, but all of them propose a way to build emotions in product design. In the next sub-section, the studies that were conducted to design pleasurable products will be mentioned.

### 2.3.6. Studies on Designing Emotional Products

Several studies were conducted on designing emotional products. Some recent studies will be explained in this section. The first one is the study of Overbeeke, Vink and Cheung (2001) that was focused on designing an emotionally effective office chair. They state that the operation system (handles) of the office chairs is too complicated and difficult to use. Firstly, they set an experiment that tests how people react physically and emotionally when interacting with an office chair by using a hidden camera. Then, they measured users' emotional states through three questionnaires: a subjective questionnaire (SQ), Product Emotion Measurement Instrument (PrEmo) and Locally Experienced Discomfort questionnaire (LED). SQ is a five-point scale (from bad to excellent) questionnaire about the features of the chair: *the seat, the back, the support in the lower back, and how the chair felt overall*. PrEmo that will be explained in details in the section 4.3 is a non-verbal self-

report instrument measuring emotional responses to products. LED is a questionnaire that users can rate the comfort of the product by selecting relevant parts shown in the questionnaire. 4 respondents (2 male, 2 female) participated the study by doing the given task on the chair: *45 minutes typing a given text, 15 minutes relaxed reading, 45 minutes Auto-Cad drawing, 15 minutes relaxed reading, 45 minutes typing a given text, 15 minutes relaxed reading*. Then, they were wanted to vote the three types of office chairs. As a result of the study, it was found that users did not like the office chairs that had independently moving seats and backs, as it was found difficult to operate all of them. Moreover, four main positions were determined by using the camera records: *concentrated and closed, concentrated and open, relaxed and closed, relaxed and open*. Then, a new office chair was designed to answer all the needs in four different positions (Figure 2.3.22).



**Figure 2.3.22:** The chair changes to different positions according to the sitter's state and task at hand (Design: Kin Fai Cheung, TU Delft) (Overbeeke, Vink and Cheung, 2001, p. 266)

The new chair changes its current position to the desired position when a user pushes it backwards for a while. Also, the armrest can be retreated or turned down to serve as a leg-rest. Overbeeke, Vink and Cheung (2001) state that the new chair reflects the user's state of well-being.

Another study on designing emotional products is the study of Desmet and Dijkhuis (2003) on a children's wheelchair design case. It is clear that wheelchairs are known by their negative emotional impact. However, they are designed as based on the rules of ergonomics, functionality and usability. Especially, a wheelchair for children should be designed as a *playful outdoor transportation facilitator* that encourages

children to go out and explore. Desmet and Dijkhuis (2003) firstly, investigated the emotional impact of existing wheelchair models by Product Emotion Measurement Instrument (PrEmo) with 8 children (5 boys and 3 girls) and their parents; then they searched the reasons of the emotions that are evoked by existing models. In the second part, they continued with the design step that used the data from the first study to design a new wheelchair (Figure 2.3.23). Finally, the emotional impact of the new model was evaluated compared with the existing models.



**Figure 2.3.23:** The final design of the new wheelchair (Desmet and Dijkhuis, 2003)

## **2.4. Product Evaluation and Product Emotion Measurement**

Meeting consumer data is a challenge for designers. Various techniques are developed to communicate the user data. The most considerable methods different from traditional ones are about product evaluation and emotion measurement. Product evaluation techniques are focused on capturing user data by testing functionality and appearance of products. In addition, product emotion measurement methods are focused on evaluating emotional expressions, physiological reactions and subjective feelings regarding to products.

### **2.4.1. Product Evaluation Techniques**

Product evaluation techniques are used in order to gather user data. Owing to the several studies of Bruseberg and McDonagh, a new title of “product evaluation techniques” was started to be discussed different from other traditional methods to get user data.

Both functionality and appearance can be evaluated with product evaluation techniques. However, the first visual impression of a product has the biggest share in purchasing decisions of consumers (Bruseberg and McDonagh, 2002). Thus, designers should consider user needs and hopes to increase consumer satisfaction. There are some product evaluation techniques that are used to capture user data such as: *Visual Product Evaluation* and *Product Handling Method* (McDonagh, Bruseberg and Halsam, 2002), *Mood Boards* and *Product Personality Profiling* (Bruseberg and McDonagh-Philip, 2001).

#### **2.4.1.1. Visual Product Evaluation**

Visual product evaluation method is a *visual questionnaire* based upon the related product’s appearance (shape, form, the use of materials, colour etc.). In a short period of time participants are asked to fill out the questionnaire form regarding the picture of the product as stimulus (Figure 2.4.1).



**Figure 2.4.1:** Evaluating concepts visually based on renderings  
(Bruseberg and McDonagh, 2002)

This method emphasizes that the purchase decisions are made up in a short period of time according to the product's usable/functional/emotional appearance. Therefore, the visual data of a product is very important. The time given for evaluation of each product is 5 minutes, as the initial impact is important for the researchers. The stimulus of the product may be a photograph, a rendering or a slide projection. Figure 2.4.2 shows a typical visual product evaluation questionnaire (McDonagh, Bruseberg and Halsam, 2002).



Product D	Toaster	very poor	poor	OK	good	very good	un-sure
		1	2	3	4	5	6
1 Regarding the visual appeal of this product, what do you think							
a) of its <b>shape and styling</b> ? (e.g. form, proportion, character)							
b) of its <b>colour</b> ? (e.g. sympathy, suitability)							
c) of the <b>materials</b> used? (e.g. texture, strength, surface)							
d) of its <b>size and weight</b> ? (e.g. mass, dimensions, lightness)							

2 What do you **like** about the **appearance** of the product?

3 What do you **dislike** about the **appearance** of the product?

*(you can also make comments by attaching notes to the picture)*

4 We need to find out whether you have got any previous knowledge of this model.

Please tick in case you


currently own it	use it	used it in the past	have seen it before	have not seen it before
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*(please tick)*

5 Would this product suit your kitchen?      yes ☐ no ☐

6 Would you want to buy this product?      yes ☐ no ☐

7 Please estimate the retail cost of this product:      £



**Figure 2.4.2:** Visual Product Evaluation Questionnaire  
(McDonagh, Bruseberg and Halsam, 2002)

McDonagh, Bruseberg and Halsam (2002, p. 239) state the benefits and limitations of this method. The benefits of the visual product evaluation method are that the method is very helpful to understand visual quality of developing or existing products, also the questionnaire gives reliable results as short comments and scales are used, and this method supports focus group discussions. However, the limitations of the method are that the types of questions may be insufficient to understand user response, the picture may not be a descriptive stimulus to perceive the product, and the evaluation and preparation process of the method may be long and tiring.

#### 2.4.1.2. Product Handling

The main idea of product handling method is to collect user data on product samples to find out requirements for new products (Bruseberg and McDonagh, 2002). The participants are firstly asked to examine the sample products like in a retail showroom to get as similar data as the participants are giving purchase decisions. Then the participants are asked to fill out the given questionnaire with their thoughts on the sample products' visual appearance, perception of quality and durability.



**Figure 2.4.3:** Product Handling and Form Filling

(Bruseberg and McDonagh-Philip, 2001)

Bruseberg and McDonagh-Philip (2001) state that there are two types of product handling questionnaires: The first one involves questions about the product's perceived properties (Figure 2.4.3), and the second one is a visual questionnaire about the aesthetic preferences of the participants (Figure 2.4.4). In the Figure 2.4.5, the visual questionnaire is arranged for evaluation of 20 variations of kettle.

**Product handling questionnaire**

Please explore the products as if you were in a retail showroom and assess the products for their ease of use. Please feel free to pick up each product. Use the questionnaires to fill in your responses for each product. Please do not spend longer than 5 minutes per product. Please feel free to ask any questions throughout this exercise. Please do not share your opinion with other participants during the exercise (to avoid influencing others).

		Product A Toaster						Product B Toaster									
		very poor	poor	OK	good	very good	un-sure			very poor	poor	OK	good	very good	un-sure		
		1	2	3	4	5	0			1	2	3	4	5	0		
1 What do you think of its visual appearance? (e.g. style, shape, colour, texture, size)								Any comments?								Any comments?	
2 What is your perception of the quality (texture, solidity) of the product elements?																	
3 What is your opinion about the durability of the product?																	
4 What is your opinion about its ease of cleaning?																	
5 What do you think about the suitability of this product for the following tasks:																	
a) placing slices in toaster																	
b) choosing required function																	
c) pressing down lever																	
d) monitoring progress of toasting																	
e) cancelling toasting early if required																	
f) lifting out toasted slices																	
6 Would you purchase this product (if you needed this type of product)?		(please tick) yes <input type="checkbox"/> no <input type="checkbox"/>						Why?		(please tick) yes <input type="checkbox"/> no <input type="checkbox"/>						Why?	
7 Please estimate the retail cost of this product:		£								£							

**Figure 2.4.4** Product Handling Questionnaire (Bruseberg and McDonagh, 2002)

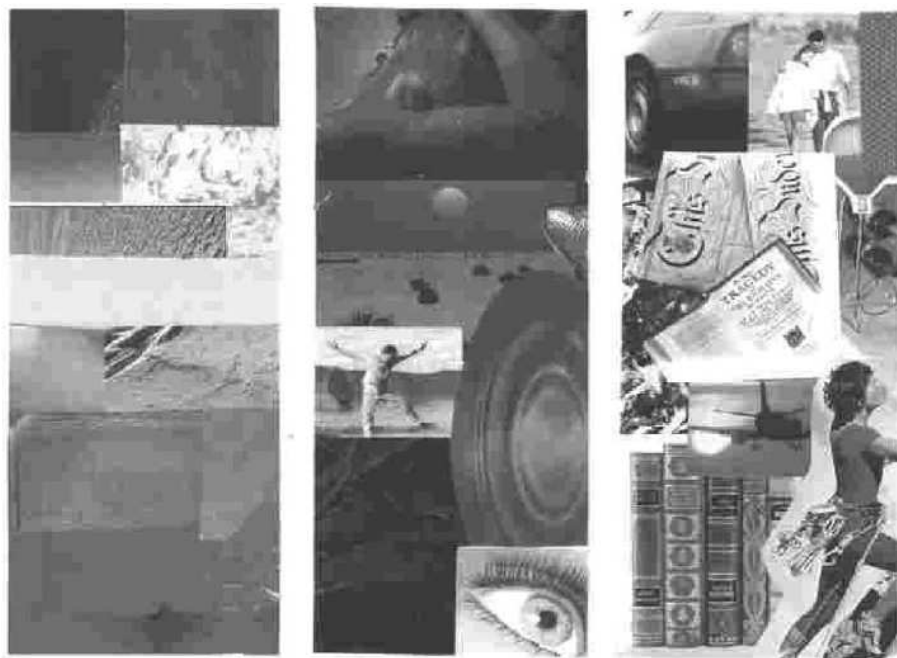
Please rate these products according to your initial opinion about their visual appearance

Product	Ugly	OK	Attractive	Product	Ugly	OK	Attractive	Product	Ugly	OK	Attractive	Product	Ugly	OK	Attractive
	(1)	(2)	(3)		(1)	(2)	(3)		(1)	(2)	(3)		(1)	(2)	(3)
1				5				9				13			
2				6				10				14			
3				7				11				15			
4				8				12				16			
What is your preferred colour material?				What do you appreciate most regarding the styling/shape of a kettle? (e.g. novelty, solid controls)				Which 2 products do you like best and why?				Which 2 products do you like least and why?			

**Figure 2.4.5:** Visual questionnaire for retrieving aesthetic preferences (Bruseberg and McDonagh-Philip, 2001)



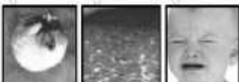





### 2.4.1.3. Mood Boards

The mood boards technique is based on a collection of visual images combined to represent a specific emotion. The main aim of the method is to meet the emotional data of the participants that can not be expressed by speech. Bruseberg and McDonagh-Philip (2001) state that abstract images that represent emotions are more effective in expressing emotions than images that show emotions directly. They add that both the users and the designers can express themselves with this method without using a word (McDonagh, Bruseberg and Halsam, 2002). As there are no rules for preparing a mood board, every suitable image from magazines or online sources can be used. Figure 2.4.6 shows an example for a mood board prepared by a designer.



**Figure 2.4.6:** An example for a mood board (McDonagh, Bruseberg and Halsam, 2002)

Mood boards are used to evaluate products or concepts through a test. Participants are asked to select one of the mood boards that represent what they feel about the product or concept. Figure 2.4.7 shows an example of a mood board test.

Questions	Mood Board Used	Questions	Mood Board Used
Which image resembles your mood whilst ironing?		Which image best resembles the environment that you iron in?	
Which image would you like to resemble your mood whilst ironing?		Which image best represents the environment that you want to iron in?	
Which image represents your current iron?		Which image represents the future of ironing?	
Which image would you like to represent your current iron?			

**Figure 2.4.7:** The selection of mood board images for ironing, ironing products and environment (McDonagh, Bruseberg and Halsam, 2002)

McDonagh, Bruseberg and Halsam (2002) state the benefits and limitations of mood board technique. The benefits of the method are that; it is cheap to apply, it enables a non-verbal communication, it provides a visual connection between the user and the designer, it gives valuable data to designers about designing emotional products, and it can be combined with other methods such as focus groups. The limitations of the method are that; if the images are not selected carefully, they may affect participants' decisions; the selection of images requires effort and carefulness, the designer should not be able to guide the non-verbal communication during the evaluation, and the participants may be unfamiliar to the method and may not express themselves briefly.

#### **2.4.1.4. Product Personality Profiling**

The aim of the product personality profiling technique is to find out the target user group through participants' perception through a questionnaire. Participants are asked to imagine that given products are people and have personalities; and they are wanted to imagine that products have some characteristics such as gender, age, and occupation etc. in a short period of time. McDonagh, Bruseberg and Halsam (2002) state the product personality profiling method is used by manufacturers (e.g. Kenwood and Morphy Richards) to identify their target consumer profile. The technique can be used in a focus group discussion for 2-3 minutes per product. McDonagh, Bruseberg and Halsam (2002) explain the limitation and the benefits of the method. The benefits of the method are; it is a successful method to communicate

abstract consumer data which is difficult to express, and it gives clues about the target consumer profile, the terms and points that are important for consumers. The limitations of the method are; the participants may not reflect their purchase decisions during the test, and the evaluation process of the results may be complex. Figure 2.4.8 and Figure 2.4.9 show some examples of product personality profiling questionnaires.

Please imagine that these products were persons and envisage the following features for them:

Product	A	B	C	D	E
1 Age	30	70	45	40	25
2 Gender	Female	female	Male	female	Male
3 Occupation	office worker	retired	Stockbroker	working mother - Sales rep.	city Banker
4 Accommodation	flat	Bungalow	4 bed detached	3 bed semi right end of row	Docklands flat
5 Car	Small - fiat type	None works	4 door family range	4 door but good design	Fast, sporty 2 seater
6 Personality	outward going party animal	staid old fashioned	secure focused stable	efficient, hard working, hard	Arrogant
7 Holidays	Tunisia	with family members	Europe	Town & Country	Caribbean
8 Home Environment	untidy	Spacious	Neat but not ultra tidy	very tidy everything in its place	Minimalist

**Figure 2.4.8:** Product personality profiling questionnaire with user responses  
(Bruseberg and McDonagh-Philip, 2001)

Please imagine that this product was a person and envisage the following features for him/her:



Toaster

1 Gender	(female or male)	Male
2 Age	(please be specific, e.g. 25)	28
3 Occupation	(e.g. secretary, engineer, house wife, teacher, accountant, GP, sales rep, gardener, architect, taxi driver, retired, model, factory worker, factory owner, musician, student, lawyer, soldier, computer programmer)	Computer sales, software
4 Accommodation	(e.g. large detached house, council house, penthouse flat, terraced house, rented room)	Batchelor pad - posh Apartment
5 Car	(e.g. MG Midget, Ka, Jaguar, Micra, new Golf, motor bike, Mini, old Fiesta, BMW, Focus, Beetle, Puma, Landrover, Maestro Van, Cavalier, Panda, Porsche, Volvo Estate)	Sporty BMW
6 Personality	(e.g. outgoing, bubbly, reserved, calm, sincere, traditional, mature, dull, fun loving, strict, warm, charming, trendy, snooty, confident, formal, ordinary, cheerful, natural, perfectionist, pretentious, caring, loyal, witty)	Confident, Sporty, trendy
7 Holidays	(e.g. Ibiza, Disneyland, skiing, Alps, Lake District, Caribbean, caravan, Cruise, Far East, backpacking, USA, Italy, Skagness, coach tour: Greece, drive to South France, safari, Sweden, cottage, Devon, New York shopping)	Slings
8 Home Environment	(e.g. modern, traditional, tidy, minimal, stylist, cosy, cluttered, wealthy, lived-in, 70's, homely, established, Scandinavian, carefree, country style, extravagant, yuppie, floral, bright, pretty, casual)	Minimal
9 Shop for food	(e.g. ASDA, Sainsbury's, Marks and Spencer, Tesco, Aldi, Harrods)	Sainsbury's
10 Shop for clothes	(e.g. Marks and Spencer, Top Shop, Next, Gap, charity shop, internet, market, New York)	Primoy's, Timberland
11 Drinks	(e.g. tea, coffee, white wine, sherry, water, whiskey, beer, banana juice)	Bud.
12 Newspaper	(e.g. Guardian, Times, Radio Times, OK magazine, Leicester Mercury, ADMAG, National Geographic)	Times
13 Pets	(e.g. cat, rabbit, gold fish, reptiles, chickens, tropical bird, pig, goat, poodle, collie, Saint Bernard)	None
14 Music	(e.g. classical, ABBA, rap, pop, Dixieland, folk, heavy metal, swing, be-bop, country, latin jazz, opera)	Too trendy for us to know
15 Food	(e.g. vegetarian, vegan, spicy, English traditional, fast food, Mexican, Italian, Indian)	Healthily
16 Name	(e.g. Rosemary, Anita, Claire, Jeremy, Nigel, John, Ted, Naomi, Charles, Vicki, Jackie, Sharon, Clive, Simon)	Harvey

Figure 2.4.9: An example for a product personality profiling form

(McDonagh, Bruseberg and Halsam, 2002)

## 2.4.2. Emotion Measurement Techniques

To manage product emotions successfully, the measurement techniques of emotion should be examined that are used for collecting emotional data. Emotion measuring has been used as a method of psychology and sociology. After the role of emotion in product design gained importance, marketing researchers started to use different emotion measurement methods to capture consumer emotional data, by mostly computer-based techniques. Desmet (2003) states that none of the existing emotion measurement methods are capable of measuring product emotions and responses toward products. Because he believes that it is required to characterize emotions and classify them before building a measurement method.

Desmet (2002, p. 38) categorizes existing emotion measurement instruments into three groups according to what component of emotion they measure; as:

- (1) Instruments that measure emotional expressions,
- (2) Instruments that measure physiological reactions,
- (3) Instruments that measure subjective feelings.

Also, Desmet (2003, p. 113) categorizes emotion measurement instruments two groups according to their dependence on speech; as:

- (1) *Non-verbal measurement instruments, and*
- (2) *Verbal measurement instruments.*

#### **2.4.2.1. Instruments that measure emotional expressions**

Instruments that measure emotional expressions are divided into two categories by Desmet (2002, p. 39):

- (a) *Instruments that measure facial expressions, and*
- (b) *Instruments that measure vocal expressions.*

Facial expressions are very important component of emotions and gives considerable clues about the type of emotions. Facial expression measurement instruments are non-verbal measurement instruments. An example for facial expression measurement instruments is the *Facial Action Coding System* (FACS; Ekman and Friesen, 1987). FACS is a description where all the muscles of the face have been identified. Each performance of the muscle is named an action unit. FACS codes even the tiny movements of facial muscles and defines them by numeric codes. The advantage of FACS is that it gives chance to link emotions with facial expressions. The *Facial Expression Analysis Tool* (FEAT; Kaiser and Wehrle, 1992) is another example for facial expression measurement instruments that has been linked to FACS (Figure 2.4.10). Shortly, it can be stated that FEAT categorizes facial expressions in terms of FACS.





Figure 1: Game situation: The unexpected and sudden appearance of a unknown enemy that roars like a lion.



Figure 2: Game situation: Start of a new game level that is much faster than those before.

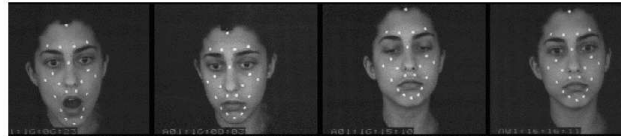


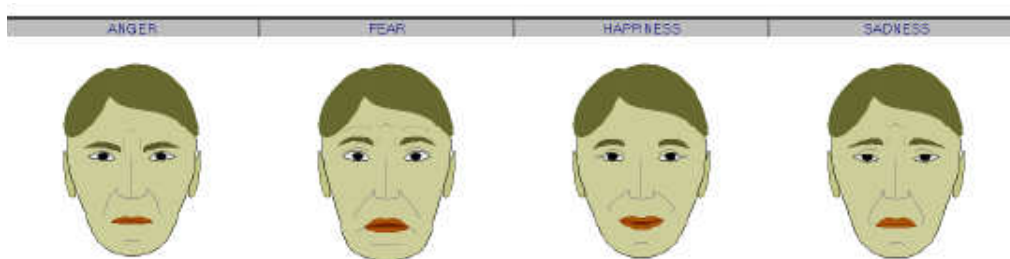
Figure 3: Game situation: At the end of level 9, message from AMIGO that he will disappear



Figure 4: Game situation: At the end of level 6, AMIGO gives thanks for having collected all magic potions

**Figure 2.4.10: FEAT (Facial Expression Analysis Tool)**  
(Kaiser, Wehrle, and Schmidt, 1998)

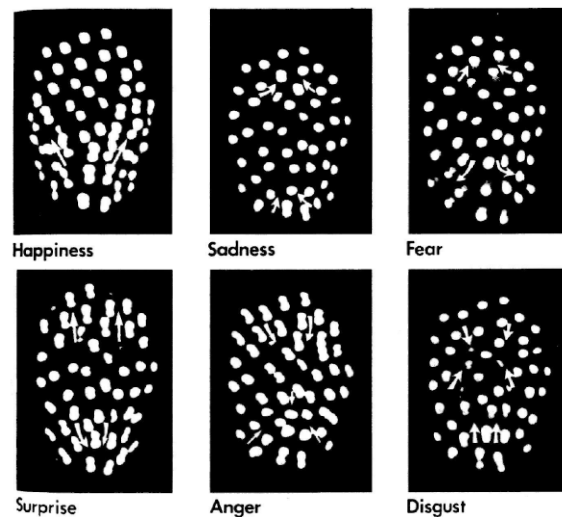
As mentioned in the “What is an Emotion?” section, universal opinion on the relation of culture and emotion state that some emotions which are called basic emotions have common facial expressions among various cultures. Universal expressions have *prototypical expressions* that are significantly recognizable in such emotions like: happiness, sadness, surprise, disgust, anger, and fear. Kaiser and Wehrle (2004) show the prototypical expressions that are synthesized with FACE in the Figure 2.4.11.



**Figure 2.4.11: The examples for prototypical expressions (Kaiser and Wehrle, 2004)**

Kaiser, Wehrle, and Schmidt (1998) conducted a study to analyze the participants’ facial expressions during specified emotion types. 14 emotional episodes, including different types of positive (happiness, pride, relief) and negative emotions (anger/irritation, anxiety/fear, sadness/disappointment, embarrassment/shame) were shown to participants. They found that some specific face actions were special for

some emotional reactions; for example *lip stretcher* is found more often only in fear., *brow lowerer* is less often seen in anxiety and fear than in anger and sadness. Hägglund (2004) conducted a study to determine the specific facial expressions of the emotions. He used a video camera, a computer and a tactile device; the camera for recording the participants' faces, the computer for analyzing the content, the tactile device for interpreting the emotional expressions of a blind person. He used templates to track the facial figures; and the colour, shape, and motion was then analyzed to get an estimation of the facial expressions. Six participants each of them having 100 white spots on their faces were used. For example, when a smile occurred it was observed that some white spots were moving to the left and to the right. So, Hägglund (2004) concluded that with over 85% accuracy, emotions obviously can be detected just by the movement of the facial features (Figure 2.4.12).



**Figure 2.4.12:** White spots showing the facial movements by Hägglund (2004)

After mentioning the facial expression measurement instruments, the next group that is included in the instruments that measure emotional expressions is “vocal expression measurement instruments”. Desmet (2003) states that vocal expression measurement instruments measure the various components of voice while expressing an emotion. The components that give the voice specific properties are: *average pitch, pitch changes, intensity colour, speaking rate, voice quality, and articulation*.

Finally, Desmet (2002, p. 39) states the advantages of the instruments that measure emotional expressions are; they can be used in multi-cultural context as they are non-verbal instruments; and the participants do not feel bothered during the measurement.

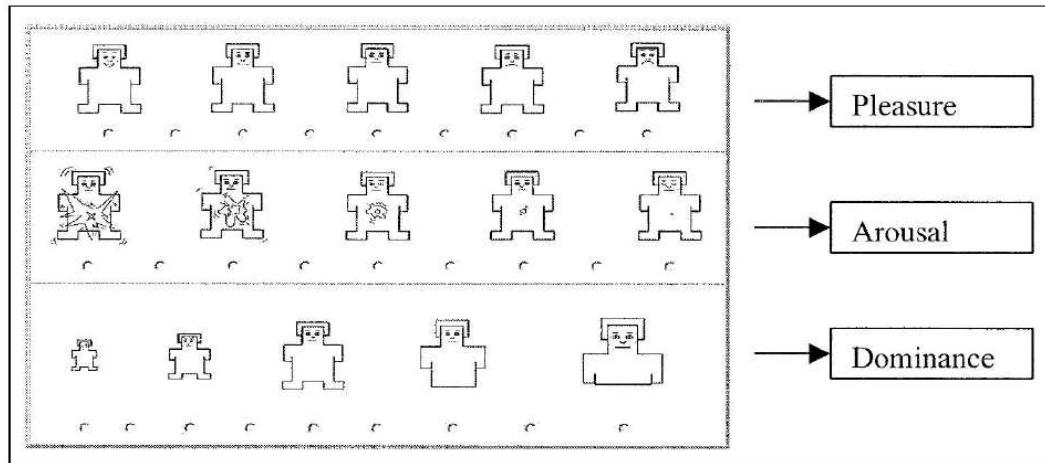
Nevertheless, the instruments that measure emotional expressions have disadvantages such as they can only measure basic emotions and the expertise and technical equipment is needed for the experiments of the instruments that measure emotional expressions.

#### **2.4.2.2. Instruments that measure physiological reactions**

The second group of emotion measurement instruments is “the instruments that measure physiological reactions” (Desmet, 2002). These instruments are non-verbal measurement instruments. They measure the changes in the autonomic nervous system (ANS), such as blood pressure responses, skin responses, pupillary responses, brain waves, and heart responses. The physical reactions of people while experiencing an emotion can be detected with these instruments. Desmet (2002) states the advantages of the instruments that measure physiological reactions are that they make objective measurement as the output can not be changed by participants; and similar to the instruments that measure emotional expressions, the instruments that measure physiological reactions also do not disturb participants during the experiments. However, these instruments have some disadvantages such as the existence of specific physiological reactions for each emotion can not be proved, although some basic emotions have recognizable physiological reactions; so the physiological reactions can not be used as an evidence for an emotion.

#### **2.4.2.3. Instruments that measure subjective feelings**

The third group of emotion measurement instruments is “the instruments that measure subjective feelings”. These instruments are verbal measurement instruments that are also called “self-report” instruments. The participants report their emotions by using these instruments; for example with a reporting scale. Desmet (2002) also mentions about an instrument that measure subjective feelings by a non-verbal way: *Self-Assessment Manikin* (SAM; Lang, 1980 as cited in Desmet, 2002). In SAM method, participants select a manikin from each row representing their pleasure, arousal and dominance degree (Figure 2.4.13).



**Figure 2.4.13: Self Assessment Manikin**

(from Morris J.D., Woo C., Geason J.A. and Kim J., 2002)

The verbal instruments that measure subjective feelings have some limitations such as they are not appropriate to be used between cultures; and many people can not verbalize their momentary emotions easily or truly. However, the main advantage of both verbal and non-verbal instruments that measure subjective feelings is to measure mixed emotions by giving rates to distinct emotion types.

#### **2.4.2.4. Evaluative tools and methods**

As mentioned in the section of Methods of Designing Emotional Products, according to Design and Emotion Society's ([www.designandemotion.org](http://www.designandemotion.org)) classification, product evaluation and emotion measurement tools and methods are grouped in two main titles:

- (1) *Generative tools and methods,*
- (2) *Evaluative tools and methods.*

Generative tools and methods were explained in the section of methods of designing emotional products and evaluative tools and methods will be discussed in the emotion measurement techniques section. Evaluative tools and methods are categorized in three sub-titles:

- (1) Tools to measure sensory characteristics
- (2) Tools to measure expression and meaning of products
- (3) Tools to measure the emotional reaction to products

First of all tools to measure sensory characteristics are:

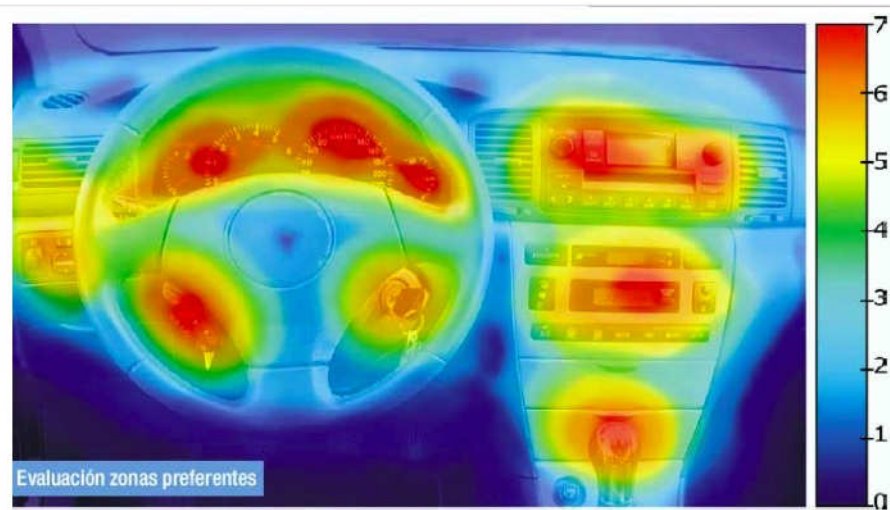
- (a) Colour Emotion models
- (b) Eye Tracking Analysis
- (c) HADRIAN v1
- (d) I.D. Tool: IMPRINT DeSIGN TOOL
- (e) Perceived Comfort Assessment
- (f) Quality Engineering approach for comfort assessment in virtual reality
- (g) Tabscale
- (h) User Compass Chart (UCC)
- (i) Visual Scanning and assessment

*(a) Colour Emotion models*

Developed by Li-Chen Ou and owned by Colour & Imaging Group, Department of Colour, Colour Emotion models tool aims to meet the need for designers to understand the relationships between colours/colour combinations and semantic terms, e.g. warm-cool, heavy-light and active-passive. Colour Emotion models (<http://colour-emotion.co.uk/>) aims to connect a relationship between colours and viewers' emotional responses to the colours. For example, when seeing a red colour, we may have impressions like: "that's a very warm colour", "how exciting the colour feels", "the colour feels heavy" or "the colour makes me feel nervous". Colour Emotion models can accurately predict the relationships between colours and semantic terms and hence are valuable for designers when they evaluate their design work.

*(b) Eye Tracking Analysis*

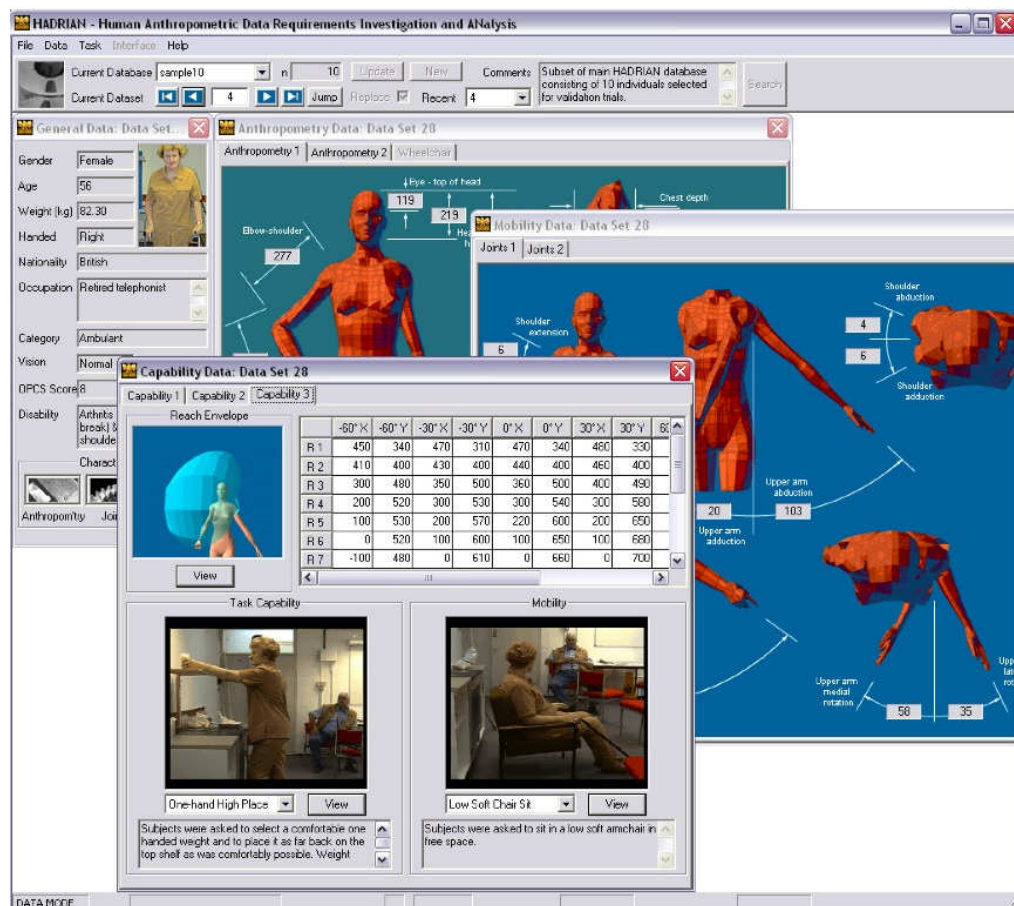
Developed and owned by Instituto de Biomecánica de Valencia, Spain, Eye Tracking Analysis is a tool that registers the eye movements and directions of users. A camera focuses on one eye and records its movements as the viewer looks at some kind of stimulus (Figure 2.4.14). The method gives relevant data about: *Scan path*, *location of areas of interest*, and *time in each area of interest*. A technical limitation is that eye tracker does not provide absolute gaze direction, but rather can only measure changes in gaze direction. However, the main benefit of the tool is that it measures user's visual interaction with product, so it is necessary to have an existing product or a prototype.



**Figure 2.4.14:** Areas of interest that is registered by Eye Tracking Analysis

(c) *HADRIAN v1*

Developed by Russell Marshal, and owned by Mark Porter, Russell Marshall, Keith Case, and Diane Gyi, HADRIAN is a 3D human modelling inclusive design tool that includes people of all shapes and sizes and ability levels, together with information on their basic cognitive and emotional characteristics. The video clips of the tool allows the designer to have empathy with the people in database (Figure 2.4.15). HADRIAN can be used throughout the development stages of design to explore concepts, specify, and evaluate designs with respect to their physical ergonomics. HADRIAN's demands for physical CAD geometry are low so given a basic 3D cad model the ergonomics of fit, reach and posture can be investigated / evaluated at any stage.



**Figure 2.4.15: The HADRIAN database**

*(d) I.D. Tool: IMPRINT DeSIGN TOOL*

Developed and owned by Anders Oppenud from Volvo Technology Corporation, Sweden, I.D. is a tool that identifies the physical design attributes that a product have (or should have) in order to evoke the desired experience from the target customers. According to the information in Design and Emotion Society website ([www.designandemotion.org](http://www.designandemotion.org)) I.D. Tool consists of three parts:

- 1) The collection of product impressions with the use in-depth interviews or focus group sessions.
- 2) The analysis of interview input by categorization according to a predetermined structure.
- 3) The visual result presentation with diagrams that shows the connection between product attributes, impressions and customer opinions.

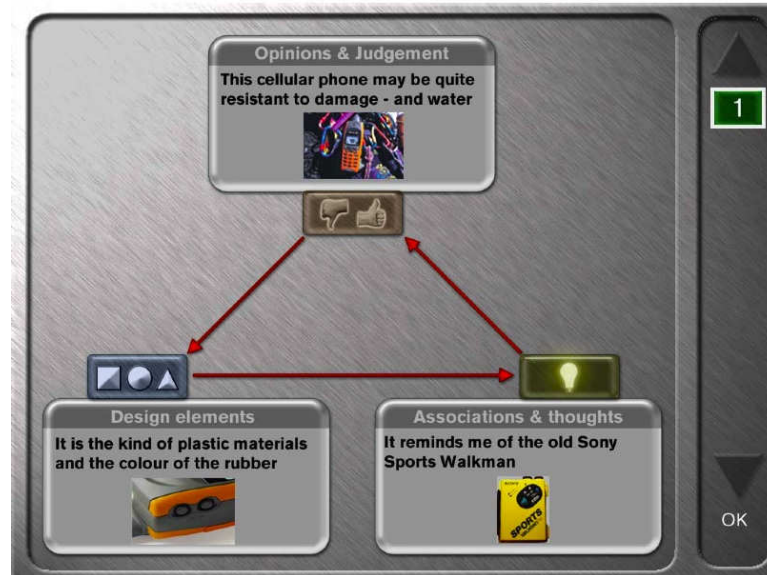
Each stage is carried out with the use of a software program that significantly speeds up the efficiency and reliability. This software includes:

- a) An electronic questionnaire which supports the interviewer and capture the customer statements.

- b) A built in tool for real time categorization of the collected information.
- c) A result viewer which presents the results directly on-site.

([http://www.designandemotion.org/society/knowledge\\_base/template.html?item=140](http://www.designandemotion.org/society/knowledge_base/template.html?item=140))

I.D. Tool helps to understand user and market, explore ideas and concepts, test and evaluate products, and evaluate market communication materials (Figure 2.4.16).



**Figure 2.4.16:** The I.D. Tool – the result viewer

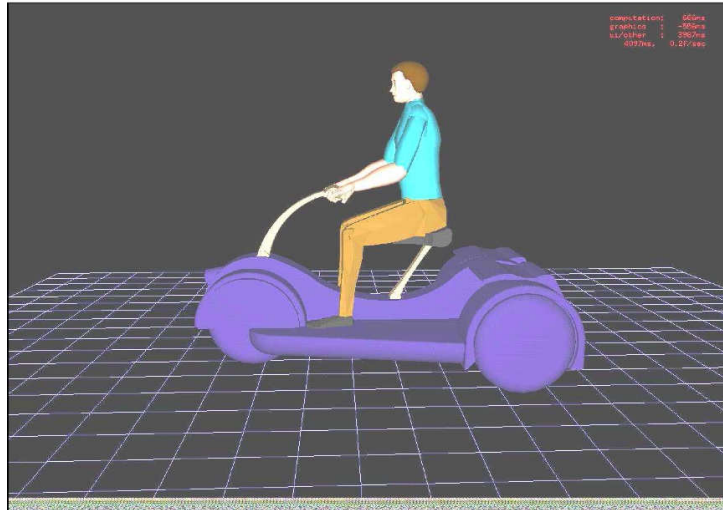
*(e) Perceived Comfort Assessment*

Developed and owned by Hanna Staaf and Henrik Sohlman, dept. of Mechanical engineering, Division of Industrial ergonomics, Linköping University, Sweden, Perceived Comfort Assessment is a tool that aims to improve comfort of products. Especially, seats in the automotive industry are the focus point of the studies with Perceived Comfort Assessment tool. However, the tool does not replace research and evaluations for improved ergonomic/biomechanical features of seats.

*(f) Quality Engineering approach for comfort assessment in virtual reality*

Developed by Stefano Barone, from University of Palermo, and Antonio Lanzotti from University of Naples, the tool aims to assess and improve the comfort characteristics of a new product since the early phases of design, when a physical prototype is not available yet. By using virtual reality tools, comfort properties of a new product can be optimized with this method (Figure 2.4.17).

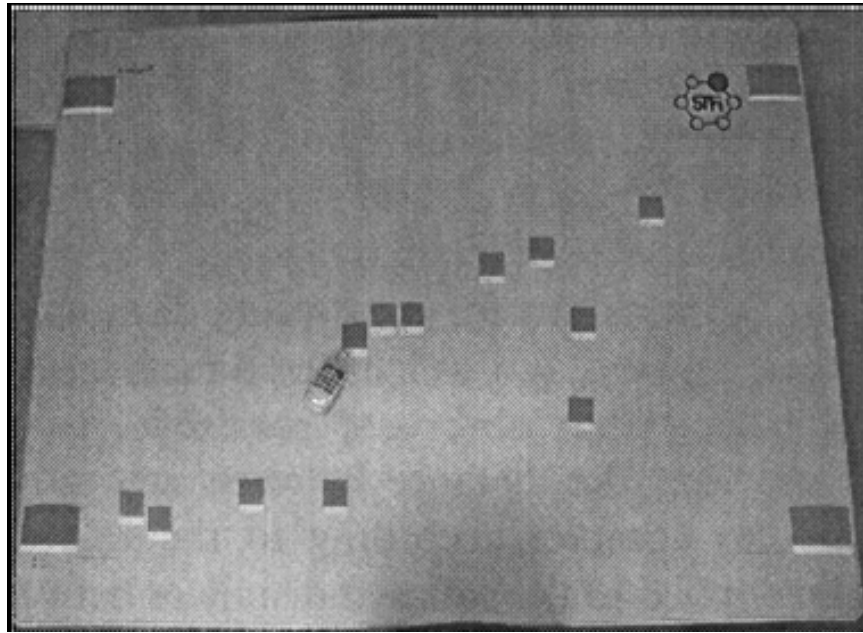




**Figure 2.4.17:** Human model seated on the vehicle in the virtual reality software Jack. Schematic drawing of the new vehicle indicates chosen design parameters.

*(g) Tabscale*

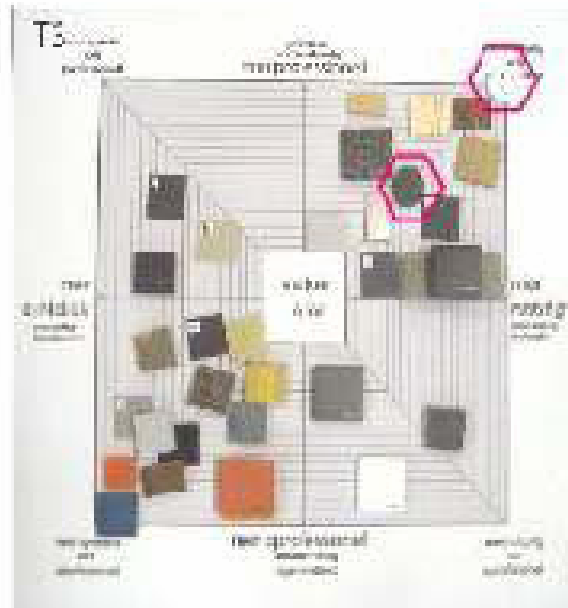
Developed and owned by STFI-Packforsk AB, Tabscale is a tablet tool that is a two-dimensional scaling technique. The observer's task is to position the samples in the two-dimensional plane of the tablet. The tablet's horizontal (long) axis is considered a scale for assessing the magnitude of quality attribute A, and its vertical (short) axis is considered a scale for assessing quality attribute B. According to the information in Design and Emotion Society website, the observer is asked to place the samples with the print containing the least magnitude of attribute A closest to the origin at the left edge of the tablet and the sample print containing the highest magnitude of attribute A farthest from the origin in the horizontal direction. Samples with the least magnitude of attribute B are to be placed closest to the origin in the vertical direction (lower edge of the tablet), and samples with higher magnitude of attribute B towards the top edge of the tablet. When the observer is satisfied with the ratings of all samples, their positions on the tablet are conveniently recorded in a computer with a point-and click device (Figure 2.4.18).



**Figure 2.4.18:** Image of the tablet with the samples from an evaluation of systematic disturbances in prints.

*(h) User Compass Chart (UCC)*

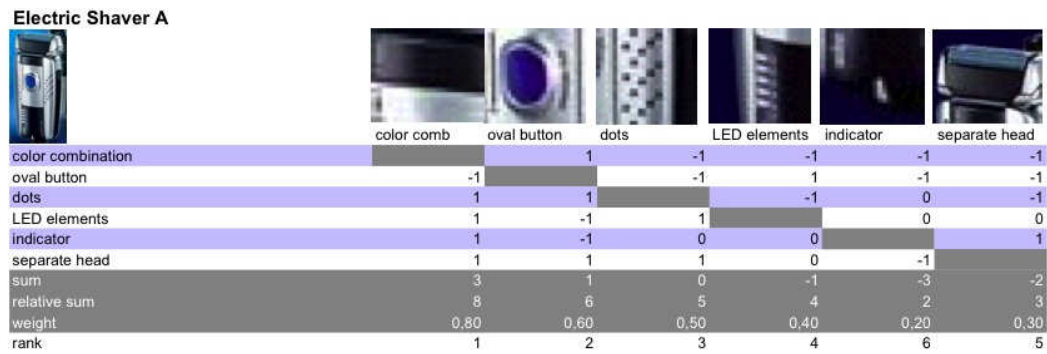
Developed by Lena Sperling, Lund University and Per Eriksson, from Chalmers University of Technology, Sweden, User Compass Chart (UCC) is a game-board with two crossing vectors and four resulting sectors and the chart points have labels with adjectives and their associations. The subject is asked to position a number of different samples in the four sectors according to his/hers experiences and to reflect verbally. When the UCC is completed, it is possible for the subject to adjust samples of each sector in order to give a more exact ranking of qualities (Figure 2.4.19).



**Figure 2.4.19:** User Compass Chart with material samples positioned by a truck driver. The vectors are labeled more professional/more unprofessional and more natural/more synthetic respectively. In the middle is a neutral zone (neither-nor) In addition, markers representing the present truck (black) and the “dream truck” were positioned.

*(i) Visual Scanning and assessment*

Developed by Anders Warell, Visual Scanning and assessment is a method that determines which visual elements of a product are considered to be the most visually characteristic, as perceived by a selected respondent group. The method also provides a way to determine the ‘visual importance’ or ‘weight’ through the process of pair wise assessment of visual elements in relation to each other (Figure 2.4.20).





**Figure 2.4.20:** Visual Scanning and assessment method

Secondly, tools to measure the expression /meanings of products are:

- (a) A new adaptive Conjoint Analysis
- (b) Attribute rating using choice time
- (c) Portal for Product Assessment
- (d) Product Semantic Analysis (PSA)

*(a) A new adaptive Conjoint Analysis*

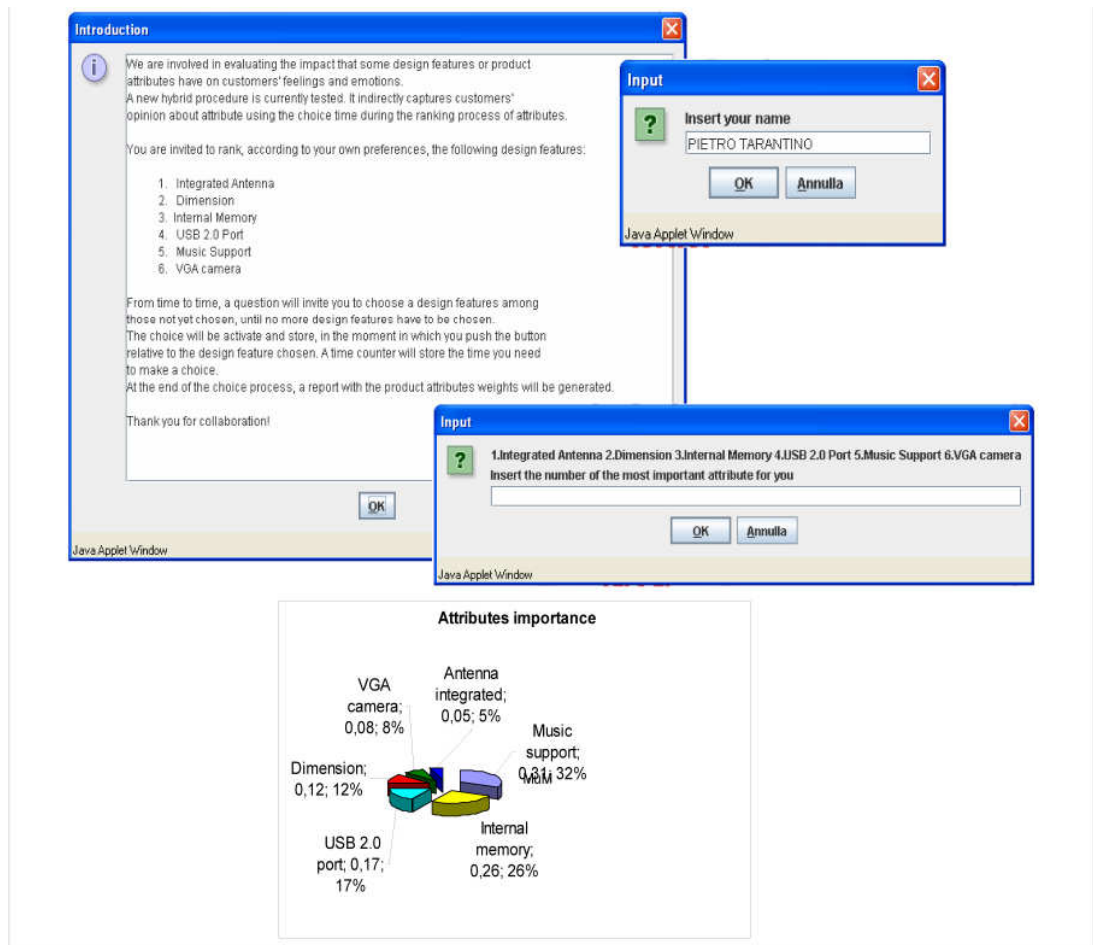
Developed by Stefano Barone and Alberto Lombardo, owned by University of Palermo, Italy, the new adaptive conjoint analysis tool aims to solve the problem of getting emotions from the customer and translating them in product properties. The tool is based on a questionnaire design and survey (Figure 2.4.21). The purpose of the method is the evaluation of the effect of the product features upon the user satisfaction of the customer.

 University of Palermo					<b>AMAT</b> Azienda Speciale per la mobilità, Palermo				
<b>Advanced information systems</b>									
1	2	3	4	5	6	7	Excluded optional	Score (0:100)	
Internet web site	Cellular phone services	Call center	Multimedia information stands	Telematic schedule off-board	Displays/notices on-board	Multimedia route map on-board			
Internet web site	Cellular phone services	Call center	Multimedia information stands	Telematic schedule off-board	Displays/notices on-board	Multimedia route map on-board			
Internet web site	Cellular phone services	Call center	Multimedia information stands	Telematic schedule off-board	Displays/notices on-board	Multimedia route map on-board			
Internet web site	Cellular phone services	Call center	Multimedia information stands	Telematic schedule off-board	Displays/notices on-board	Multimedia route map on-board			
Internet web site	Cellular phone services	Call center	Multimedia information stands	Telematic schedule off-board	Displays/notices on-board	Multimedia route map on-board			
Internet web site	Cellular phone services	Call center	Multimedia information stands	Telematic schedule off-board	Displays/notices on-board	Multimedia route map on-board			
Internet web site	Cellular phone services	Call center	Multimedia information stands	Telematic schedule off-board	Displays/notices on-board	Multimedia route map on-board			
Score of current service (without optionals)									
<b>Gender</b>	<b>Education</b>			<b>Age</b>					
M	Primary school    Middle school			<18    18-25    25-40    40-60    >60					
F	High school I    Laurea degree								

**Figure 2.4.21:** Questionnaire format for a public transportation service survey

*(b) Attribute rating using choice time*

Developed by Stefano Barone, Alberto Lombardo, and Pietro Tarantino, and owned by University of Palermo, Italy, attribute rating using choice time is a method that is proposed as a new procedure for attribute rating method (Figure 2.4.22). It aims to identify which product properties are important for customers by controlled and unbiased interviews. It is stated that the proposed method indirectly captures customers' opinion, avoiding all possible drawbacks of traditional attribute rating methods.



**Figure 2.4.22:** Java Applet windows for data collection and an example of results obtained with the proposed method

*(c) Portal for Product Assessment*

Developed and owned by Instituto de Biomecánica de Valencia, Spain, Portal for Product Assessment is a portal-like online website that allows test persons to remotely evaluate a collection of visual stimuli through semantic differential scales (Figure 2.4.23). The tool not only analyzes consumers' opinion, but also evaluates the emotional perception of products.

**VALORACIÓN DE PRODUCTOS**

HOME LOGIN CONTACTO MAPA AYUDA ACCESIBILIDAD

Home > Mis Encuestas

**MIS ENCUESTAS**

PIKOLINOS UNITED KINGDOM WOMEN

PRODUCTO 2. PROD 9

**1. EMOTIONAL ASSESSMENT**

Mark 5 when the product represents totally the idea and 1 otherwise.

1. THIS PRODUCT IS...

A. TOTALLY ELEGANT 5 4 3 2 1 B. NOT ELEGANT AT ALL

2. THIS PRODUCT IS...

A. TOTALLY YOUNG 5 4 3 2 1 B. NOT YOUNG AT ALL

3. THIS PRODUCT IS...

A. TOTALLY WELL-DRESSED 5 4 3 2 1 B. NOT WELL-DRESSED AT ALL

4. THIS PRODUCT IS...

A. TOTALLY BASIC-EVERYDAY 5 4 3 2 1 B. NOT BASIC-EVERYDAY AT ALL

GALERÍA MULTIMEDIA

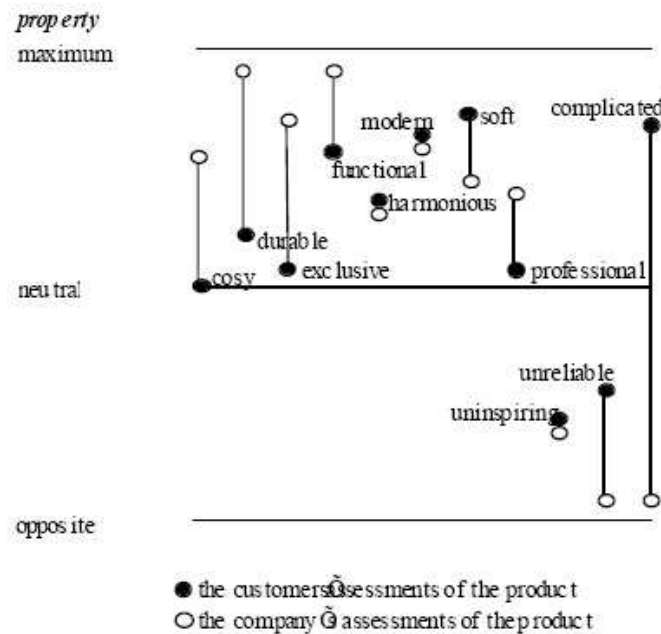
Prod 9

1 de 1

**Figure 2.4.23:** Questionnaire for the emotional assessment of footwear

*(d) Product Semantic Analysis (PSA)*

Developed by Li Wikström, from Chalmers University of Technology, Sweden, Product Semantic Analysis (PSA) is a method that aims to support product developers to design products with specific, desired semantic qualities. The PSA method provides a structured process in which the desired qualities can be identified and described in terms of a desired product semantic profile, and the design solution evaluated and compared against the desired profile (Figure 2.4.24). The PSA method contains several steps; interviews with customers, construction of semantic scale, consumer/user ratings by means of scale etc. The distinctive feature is the way these steps are combined. The PSA method has a thorough theoretical basis. The PSA does not rely so heavily on statistics as do, e.g., the Kansei methodology.



**Figure 2.4.24:** The expression of an electric cooker; the assessment of customers and designers respectively

Thirdly, tools to measure the emotional reaction to products are:

- (a) Two Dimensional Emotion Space (2DES)
- (b) Differential Emotions Scale (DES)
- (c) Emo2
- (d) FaceReader
- (e) Geneva Emotion Wheel (GEW)
- (f) PrEmo

*(a) Two Dimensional Emotion Space (2DES)*

Developed and owned by Emery Schubert, from School of Music and Music Education, The University of New South Wales, Australia, 2DES is a self-report measurement of the emotion expressed by a stimulus. Participants in tests or experiments have to continuously rate the emotion expressed by a stimulus using this computer program. 2DES lets the participants report the emotion perceived by moving the mouse in a space defined by the two bipolar dimensions valence and arousal. Both dimensions are labeled by little pictograms representing a human face (smiling or frowning for valence, with eyes and mouth wide open or closed for arousal).



*(b) Differential Emotions Scale (DES)*

Developed by Carroll E. Izard, from University of Delaware, USA, DES is a standardized instrument that reliably divides the individual's description of emotion experience into validated, discrete categories of emotion. The DES can be used to obtain self-report of felt emotions elicited by events or objects. The DES instructions ask the respondents to consider the experience they described and to rate how often s/he experienced each emotion item during the experience. However, The DES was not developed with product design in mind and may not include all emotions relevant for product experience.

*(c) Emo2*

Developed by Gaël Laurans and owned by Delft University of Technology, The Netherlands, Emo2 is an instrument for the measurement of emotion during product use. Test participants are filmed while interacting with a product. Immediately afterwards they watch this video and can report about their feelings during the interaction. Ratings can be collected at predefined points in time (fixed interval, after completion of a task, etc.), when the participants want to report their feelings or when psycho-physiological data (skin conductance, cardiac function and possibly facial EMG) indicate a change in arousal or an emotional response.

*(d) FaceReader*

Developed and owned by VicarVision, The Netherlands, FaceReader is a tool to track the user affective state while using products or software without resorting to self-report. FaceReader constructs a model of the face from the video and automatically evaluates several elementary facial movements (action units). Based on these movements it calculates the likeliness that each of six basic emotions (joy, anger, sadness, surprise, fear and disgust) is felt at any given time.

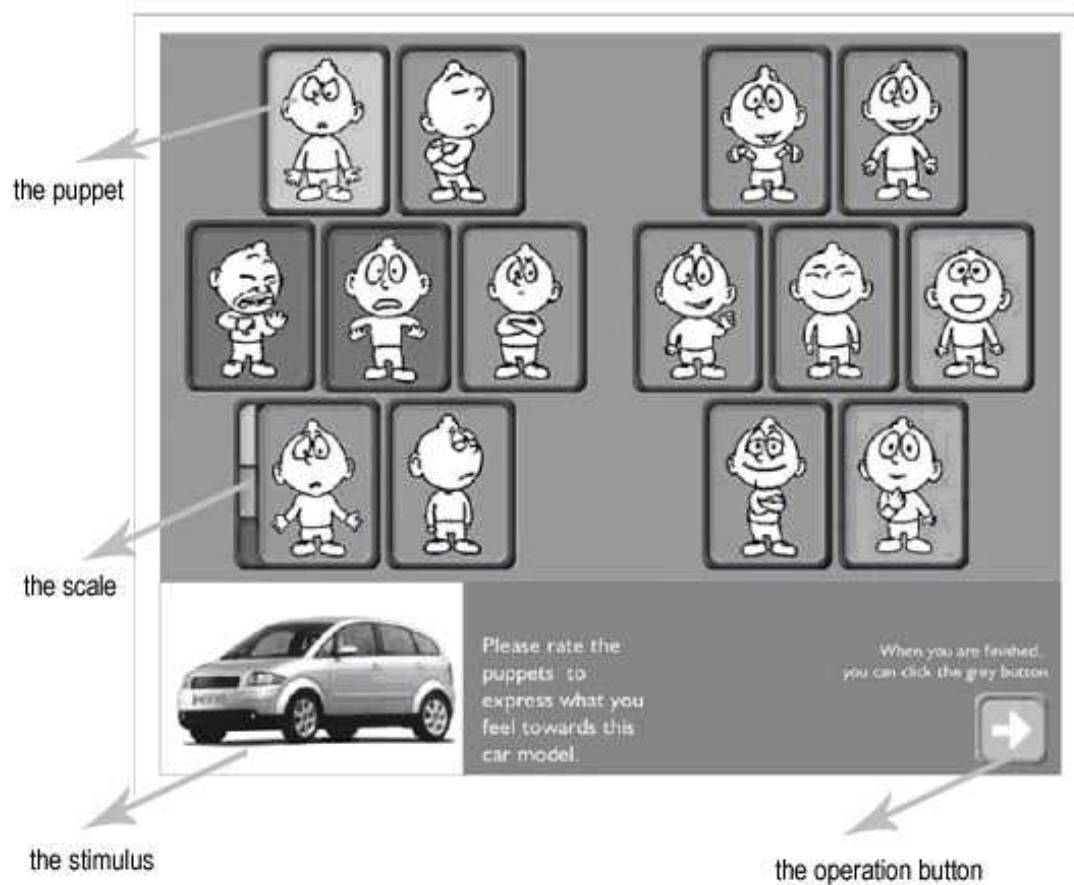
*(e) Geneva Emotion Wheel (GEW)*

Developed and owned by Geneva Emotion Research Group, Switzerland, Geneva Emotion Wheel (GEW) is tool that includes a structured set of emotions that is presented in a graphical form. The Geneva Emotion Wheel (GEW) is an instrument to measure emotional reactions to objects, events, and situations. The respondent is asked to indicate the emotion he/she experienced by choosing intensities for a single emotion or a blend of several emotions out of 20 distinct emotion families. The

emotion families are arranged in a wheel shape with the axes being defined by two major appraisal dimensions. However, the emotion wheel was not developed with product design in mind and may not include all emotions relevant for product experience.

#### **2.4.2.5. Product Emotion Measurement Instrument (PrEmo)**

Desmet (2002) developed an emotion measurement instrument, specifically designed for measuring product emotions: Product Emotion Measurement Instrument (PrEmo). PrEmo is a non-verbal self-report instrument. The aim of developing a new instrument was to attach the advantages of non-verbal and verbal measurement instruments (Desmet 2002). Norman (2003) finds Desmet's instrument practical and clever than the existing ones. The main idea of PrEmo is the universality of emotional expressions (facial and bodily) across cultures. PrEmo uses cartoon animations to describe distinct emotions. 14 emotion types are animated; seven pleasant emotions (i.e. desire, pleasant surprise, inspiration, amusement, admiration, satisfaction, fascination) and seven unpleasant emotions (i.e. indignation, contempt, disgust, unpleasant surprise, dissatisfaction, disappointment, and boredom). Desmet (2002, p. 44) explains the development process of the instrument step by step. In the early stages of the process the main idea of measuring emotions in two dimensions (pleasantness and activity dimensions) was decided, and 41 emotions that were determined as product relevant emotions in the earlier studies were reduced to 18 with the reports of participants. Then, the interface of the instrument and the cartoon characters were designed. Three-point scale placed near of each emotion types was decided to represent the following ratings: *"I do feel the emotion," "to some extent I feel the emotion,"* and *"I do not feel the emotion expressed by this animation"*. Next step was reducing the number of emotions measured by PrEmo to 14 from 18 to make the evaluation process shorter for participants. Then, the bodily, facial and vocal expressions of the cartoon characters were decided, with the help of the protocol of the Facial Action Coding System (FACS; Ekman and Friesen, 1978). Finally, the interface of the instrument was formed as in the Figure 2.4.25.



**Figure 2.4.25:** The interface of PrEmo (Desmet, 2002)

Desmet validated the tool by studies in the Netherlands, Finland, Japan, and the United states, and also did a more detailed study of automobiles in both the Netherlands and Japan (2003). Norman (2003) states that the instrument requires too much effort and time, because the participants should vote each 14 emotion for each product. However, he adds that Desmet's study will inspire future studies of design research.

The advantages of PrEmo are that it can be used in different cultures as it is a non-verbal measurement instrument; and it can measure mixed emotions rather than basic ones, as the participant gives a scale for each emotion one by one. However, a limitation of the instrument is that it can not be reliable in interactive human-product relation, as it is designed for the emotions evoked by the product appearance. Moreover, Norman (2003) states that none of the measuring instruments can solve the problems of meeting behavioral and emotional needs that come from demographic variations.

- *Development of Product Emotion Measurement Instrument (PrEmo)*

The 14 emotions (seven pleasant emotions: desire, pleasant surprise, inspiration, amusement, admiration, satisfaction, fascination; and seven unpleasant emotions: indignation, contempt, disgust, unpleasant surprise, dissatisfaction, disappointment, and boredom) measured by PrEmo are selected through a series of studies (Desmet, 2003). Firstly, an extensive set of emotions were formed. 347 emotions in the first set were eliminated according to rates given by participants. The rates were given on the principle of Russell's (1980) Circumplex Theory on the dimensions 'pleasantness' and 'arousal. Furthermore, participants were wanted to eliminate emotions that were not familiar. Table 2.4.1 shows the number of emotions that were assigned in each group on the Circumplex of Emotions.

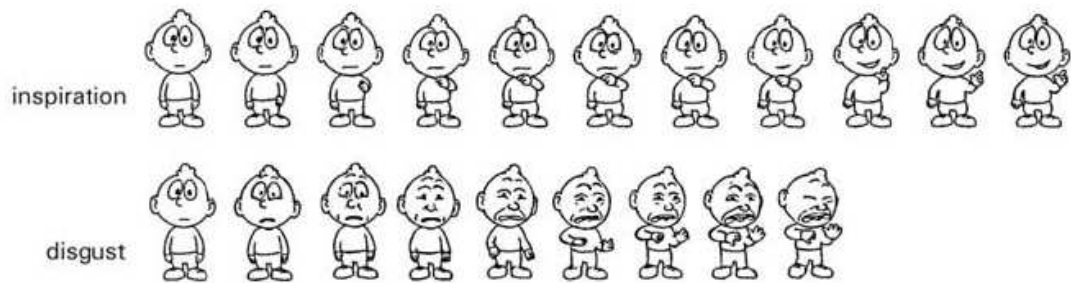
**Table 2.4.1:** Emotion Categories (Desmet, 2003)

<i>Category</i>	<i>Amount of included emotions</i>	<i>Category</i>	<i>Amount of included emotions</i>
Excited pleasant	30	Calm unpleasant	34
Average pleasant	53	Average unpleasant	61
Calm pleasant	24	Excited unpleasant	46
Calm neutral	14	Excited neutral	20

Then a second study was conducted to eliminate emotions that were not related to products and the number of emotions was reduced to 69. In the third study, the emotions that were found similar by participants were eliminated and the number of emotions reduced to 41. Finally, in the last study the 41 emotions were rated by participants on a five-point scale (from 'very relevant to product experience' to 'not relevant to product experience'). 14 emotions were selected from the results of the final study. Desmet (2003) states that however products can evoke more than 14 emotions, these 14 emotions are the most frequent ones that are evoked by products.

After determining the product relevant emotions that would be measured, the next step was how to express the emotions to the participants. Desmet (2002) decided to express emotions not only with a facial expression, but also a bodily, and vocal expression. Then, it is decided to use cartoon animated characters to express emotions in a total body expression. Desmet (2003, p.7) states the reasons of using cartoon animated characters are that it is efficient to portray an emotion, and it is possible to "*amplify (or exaggerate) the expressive cues that differ between*

*emotional expressions*". Professionally animated and vocally synchronized cartoon characters were finalized after several studies. Figure 2.4.26 shows examples of *disgust* and *inspiration* animation series.



**Figure 2.4.26:** Animation series of *disgust* and *inspiration* emotions (Desmet, 2003)

Desmet (2003, p.8) assessed the validity of PrEmo in two steps: the validity of animations and the validity and reliability of the instrument. To validate that PrEmo is a cross-cultural instrument, a study that has participants from four countries (N=120, Japan, United States, Finland, and The Netherlands) was conducted. In this study, participants were asked to identify each animation that expressed a specific emotion. As a result, the animations portraying *desire* and *disappointment* emotions were found to be invalid for Japan and they are decided to be developed more. To validate the reliability of the instrument, another study was conducted with 30 participants. In this study, it was decided to measure emotion with both PrEmo and a verbal scale. As a result, it is found that the participants did not respond differently as a result of the measurement instrument applied. Moreover, it is reported that participants found PrEmo more enjoyable and intuitive than the verbal scale. So, Desmet (2003) concludes that PrEmo is a reliable instrument.

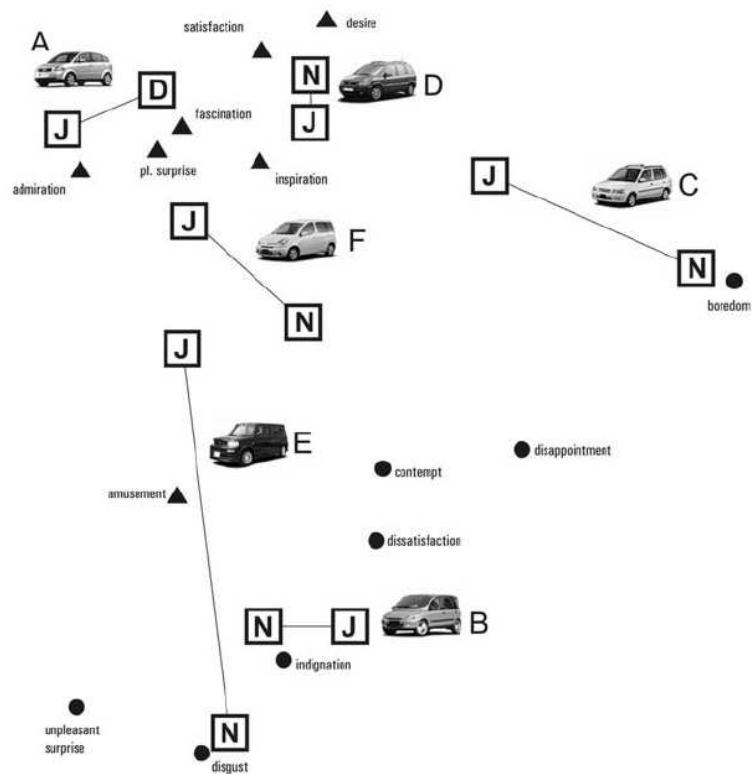
#### - Studies with PrEmo

Desmet (2003) applied PrEmo in a multi-cultural context with 68 participants: 36 from the Netherlands and 32 from Japan. He used car models as stimuli, because car models evoke strong emotions in appearance (Desmet, Hekkert and Jacobs, 2000). The participants aged from 20 to 60 were shown 6 car models in random order (Figure 2.4.27) with PrEmo.



**Figure 2.4.27:** The stimuli used in the application study (Desmet, 2003)

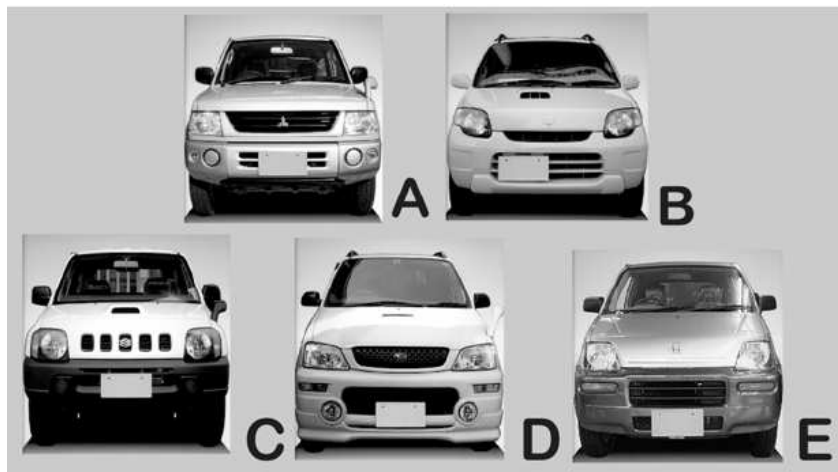
By applying a correspondence analysis, the ‘*product & emotion space*’ was formed representing a graphical interpretation of the results. In product & emotion space “N” represents Dutch participants, and “J” represents Japanese ones (Figure 2.4.28). “N” and “J” points for each car represent the emotional states reported by each nation. For example, Japanese people express more positive emotions to “C” car than Dutch people.



**Figure 2.4.28:** ‘Product & emotion space’ of Dutch and Japanese participants for six car models (Desmet, 2003)

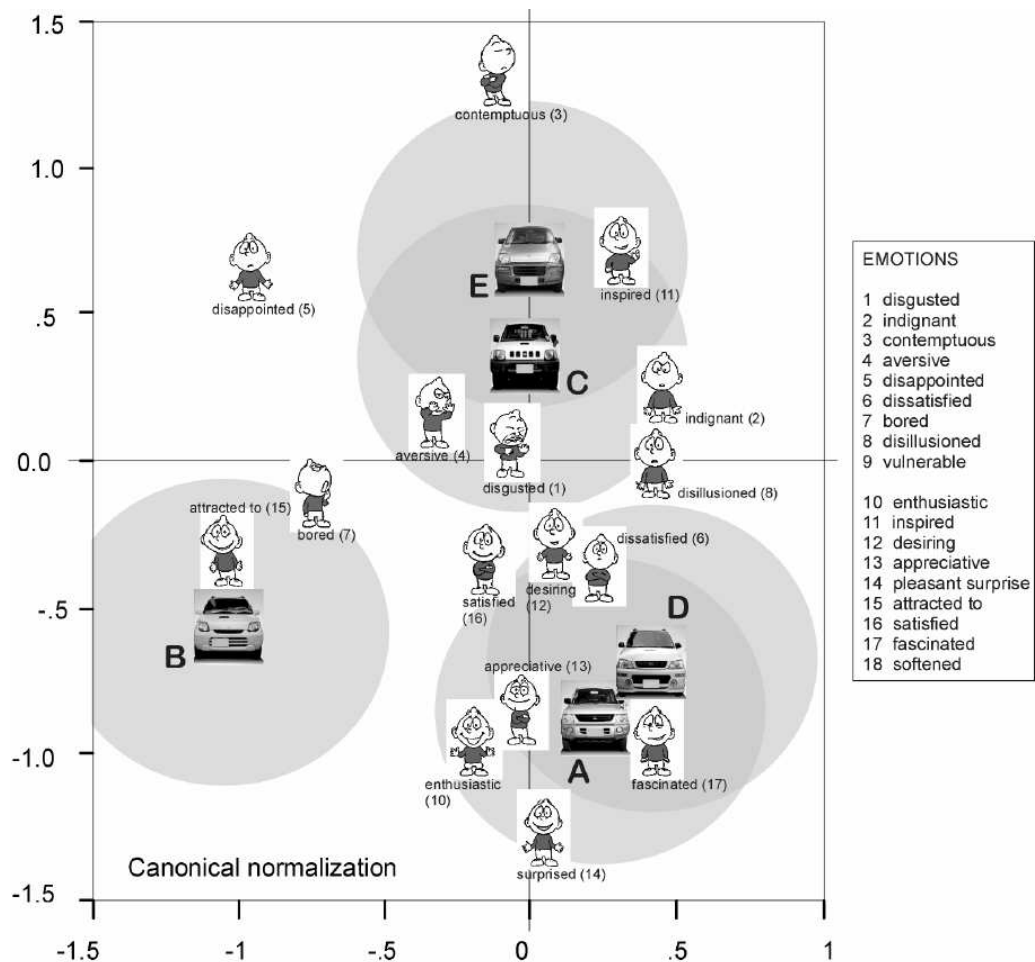
To find between culture differences, Desmet applied a two-way repeated measures MANOVA for each emotion. The car models (six levels) were determined as *within-participant factor*, and culture (two levels) were *between-participant factor*. Moreover, emotions were *dependent variables*. Desmet (2003) reports the results as: in three emotions (admiration, satisfaction and fascination) Japanese people show higher mean scores, that means Japanese people are more *admired of*, *satisfied* and *fascinated* by car models than Dutch people.

In another study conducted by Desmet, Hekkert and Jacobs (2000), the PrEmo was tested with 15 participants (8 female, 7 male) given 5 car models as stimuli (Figure 2.4.29).



**Figure 2.4.29:** Car models used in the study (Desmet, Hekkert, Jacobs, 2000)

Participants report their responds through PrEmo about 5 car models. Then, correspondence analysis was applied to visualize the relationships between the cars and the emotions. Figure 2.4.30 shows the graphical display of the corresponding analysis. In the measure map, it is shown that each car elicits mixed emotion rather than one exact emotion. For example, Model B elicits attraction and boredom.



**Figure 2.4.30:** PrEmo measure map (Desmet, Hekkert, Jacobs, 2000)

Desmet, Hekkert and Hillen (2003) conducted a study that examines values and emotions. They state that it is required to define concerns of the group to communicate their emotional responds. To define concerns, they use Rokeach Value Survey (RVS) developed by Rokeach (1968, as cited in Desmet, Hekkert and Hillen, 2003). RVS is a kind of questionnaire that measures 18 terminal (e.g. *a comfortable life, social recognition, and freedom*) and 18 instrumental (e.g. *ambitious, clean, and loving*) values. As RVS was developed especially for the United States of America, Desmet, Hekkert and Hillen (2003) used the study of Oppenhuizen (2001, as cited in Desmet, Hekkert and Hillen, 2003) that adapted RVS to the Dutch culture. The 12 basic values were determined by Oppenhuizen (2001, as cited in Desmet, Hekkert and Hillen, 2003): *to have a social life, have a career, show empathy, be carefree, prove yourself, be relaxed, seek security, seek challenge, have a family life, be independent, adjust, and to be unique* (as cited in Desmet, Hekkert and Hillen, 2003). Then, Desmet, Hekkert and Hillen (2003) applied a value test that measures these 12



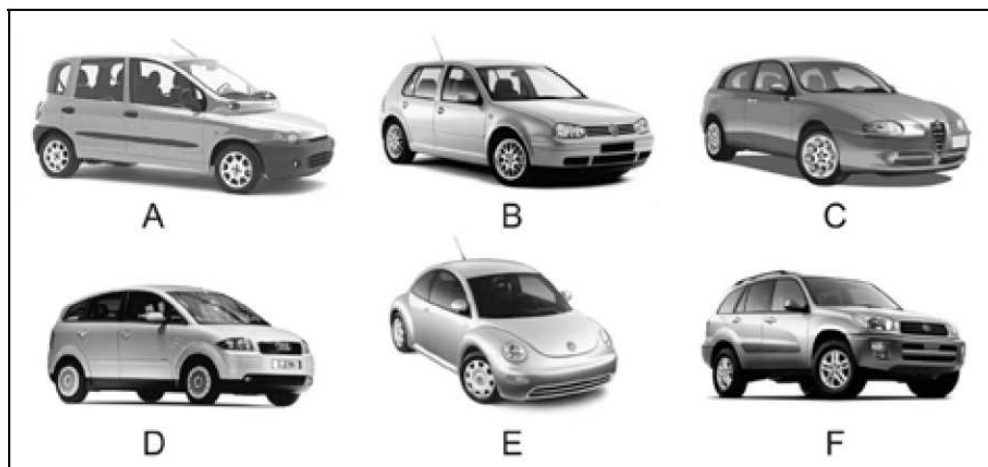
values to Dutch people. The value test was applied in a group of 40 participants; 10 male between 18-27 years old, 10 female between 18-27 years old, 10 male between 40-60 years old, 10 female between 40-60 years old. A one-way ANOVA was applied to analyze each value, and the analysis is reported to show that there is significant difference between value groups for all values. According to the results of the values test, two value groups were formed: value group 1 (named *ambitious*) and value group 2 (named *lighthearted*) (Table 2.4.2).

**Table 2.4.2:** Distribution of age and gender over the two value groups

(Desmet, Hekkert and Hillen, 2003)

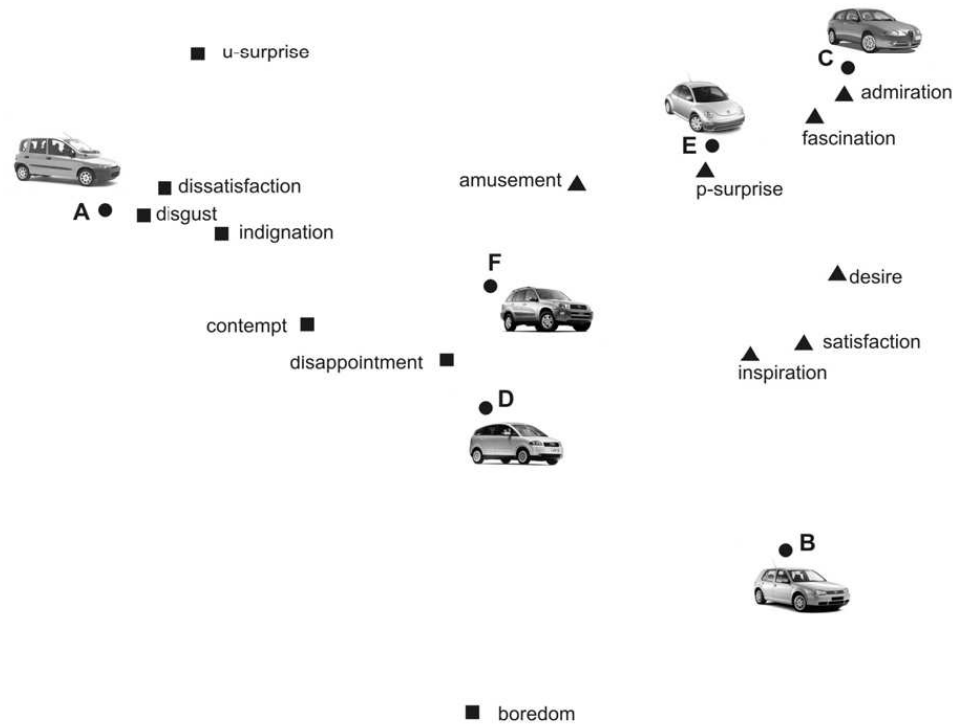
Value-group 1				Value-group 2			
male		female		male		female	
Aged 18-27	Aged 40-60	Aged 18-27	Aged 40-60	Aged 18-27	Aged 40-60	Aged 18-27	Aged 40-60
3	7	7	3	7	3	3	7

Secondly, 6 cars were used as stimuli and the emotional respondents of the participants were measured by PrEmo (Figure 2.4.31).



**Figure 2.4.31:** Six car models used in the study (Desmet, Hekkert and Hillen, 2003)

Correspondence analysis with two factors (Emotion: 14 levels, Cars: 6 levels) is applied to get a graphical representation of the results. Figure 2.4.32 shows the ‘product & emotion’ space of the six stimuli. In the figure “▲” represents the pleasant emotions, and “■” represents unpleasant emotions. For example, Model E and Model C evoke similar emotions, but Model C and Model D evoke different emotions.



**Figure 2.4.32:** 'Product & emotion' space of the six stimuli used in the study  
(Desmet, Hekkert and Hillen, 2003)

To analyze the effect of value-group membership on the emotional responses, two-way repeated measures MANOVA was applied with Car (six levels) as within-participant factor, Value-group (two levels) as between-participant factor, and the emotion as dependent variable. Table 2.4.3 shows the relationship between value-group membership and emotional responses.

**Table 2.4.3:** The relationship between value-group membership and emotional responses (Desmet, Hekkert and Hillen, 2003)

Emotion	Main effect	Interaction	Value-group effect on each car model F (1,38)					
	F(1,39) Value-group	F(5,15) Car x value-group	Pairwise comparison (value-group 1 – value-group 2)					
			A	B	C	D	E	F
Disgust	.41	.41	-.20	.10	.10	.00	.15	.20
Indignation	1.40	.39	-.10	.05	.05	.15	.20	.30
Contempt	<b>6.54</b>	(1.84)	-.30	.25	<b>.40</b>	<b>.45</b>	.15	.30
Unpl. surprise	.90	1.48	-.05	-.05	.20	.25	.05	<b>.45</b>
Dissatisfaction	2.77	1.50	-.20	.05	<b>.45</b>	<b>.50</b>	.05	.05
Disappointment	.15	.19	-.20	.05	-.05	-.05	.00	.05
Boredom	.13	<b>3.12</b>	<b>-.75</b>	.05	<b>.40</b>	.25	-.10	-.05
Desire	.14	.69	.25	-.20	-.20	.05	-.15	.05
Pl. surprise	.49	(1.87)	(.45)	(-.45)	-.35	.00	.00	-.05
Amusement	.07	.93	.15	(-.40)	.00	.25	.10	.05
Admiration	.71	1.75	<b>.35</b>	<b>-.50</b>	-.25	-.10	.05	.00
Inspiration	.12	(2.11)	(.40)	(-.50)	-.25	.05	-.20	.30
Satisfaction	1.05	1.71	.25	<b>-.45</b>	(-.45)	-.20	.20	.05
Fascination	.29	(1.83)	.30	<b>-.50</b>	-.30	-.05	.00	.25

*Value-group is between-participant effect ( $n$ -group 1 = 20;  $n$ -group 2 = 20). Two-tailed  $t$ -test. Adjustment for multiple comparisons: Bonferroni. Significant  $F$  values and mean differences ( $p < .05$ ) are shown in bold type.  $F$  values and Mean differences that reach significance ( $p < .1$ ) are placed between brackets.*

To sum up, in the chapter of Product Evaluation and Product Emotion Measurement, several methods and tools were introduced with their benefits and limitations. In this study, Product Emotion Measurement Instrument will be used, because it is a non-verbal self report tool that enables multi-cultural application and a recent technique that was validated in multi-cultural context. Briefly, PrEmo measures 14 distinct emotions (seven pleasant emotions: desire, pleasant surprise, inspiration, amusement, admiration, satisfaction, fascination; and seven unpleasant emotions: indignation, contempt, disgust, unpleasant surprise, dissatisfaction, disappointment, and boredom) by cartoon animations that express each emotion with facial, bodily and vocal expressions. Thus, PrEmo was chosen in this study, because of its reliability and ease of use. In the next chapter, the methodology of the study will be explained in detail.

### **3. METHODOLOGY**

#### **3.1. Aim**

The present study aims at identifying consumer emotions towards products and defining the differences between males and females. The study has a piloting process prior to the main research. The questionnaire based on the principle of “Product Emotions” by Desmet (2002) was conducted with 30 participants in the pilot study. Then, Istanbul Technical University approved the purchase of Product Emotion Measurement Instrument (PrEmo) from Pieter M.A. Desmet, Delft University of Technology, the Netherlands. Thus, the final research was conducted using PrEmo following the pilot study.

More specifically, the study aims to answer the following research questions:

1. What are the emotional responses of the participants towards the given products?
2. Do the participants from different gender differ in terms of their emotional responses to each product given in the questionnaire / instrument?

#### **3.2. Pilot Study**

In order to elicit emotional responses of users, a questionnaire was prepared. The questionnaire was designed to measure 14 emotions (7 positive, 7 negative) that were defined as “Product Emotions” by Desmet (2002). These emotions were named according to their place on the Circumplex of Emotions (Russell, 1980). Desmet (2002) defined product emotions as: “emotions likely to be elicited (or often elicited) by product appearance”. They are:

- *Unpleasant-excited*: indignation, unpleasant surprise
- *Unpleasant-average*: contempt, dissatisfaction
- *Unpleasant-calm*: boredom
- *Pleasant-excited*: inspiration
- *Pleasant-average*: pleasant surprise, fascination, admiration
- *Pleasant-calm*: satisfaction

### 3.2.1. Participants

30 participants between 25-45 years old were selected as respondents of the study. The questionnaire was given to the participants with A4 printed colorful images of each stimulus. The beginning section of the questionnaire was deducted to obtain demographical data from the respondents. According to the results of this part, 10 of the participants were lecturers, 7 of them were architectures, 4 of the participants were secretaries, 2 of them were interior designers, 2 of them was security guards/cleaners, and 5 of the participants have other occupations (Table 3.1).

**Table 3.1:** The number of the participants from different occupations

Occupation	Number
Lecturer	10
Architecture	7
Secretary	4
Interior Designer	2
Security Guard / Cleaning	2
Industrial Designer	1
Physics Engineer	1
Director of P.R.	1
Technician	1
I.T. Specialist	1

26 of the participants had driving license and 4 of them did not have driving license. 16 of the participants had a car, and 14 of them did not have a car. In terms of their educational background, 20 of the participants had a university degree, 6 of them were high school graduates, and 4 of them held a Master's or a higher degree. In addition, 40% of the participants were aged between 26-30 years old, 30% of the participants were aged between 31-35 years old, 16,6% of the participants were aged between 20-25 years old, 10% of the participants were older than 40 years old, and just 3,3% of the participants were aged between 36-39 years old (Table 3.2).

**Table 3.2:** The number of participants from different age groups

Age Group	Number
Between 20-25	5
Between 26-30	12
Between 31-35	9
Between 36-39	1
40 and older	3

### **3.2.2. The Stimuli**

Seven different models of cars were used in the pilot study. Variables such as price (20.000 YTL-30.000 YTL), target user group, technical properties of the cars were held constant. The stimulus was given to the participants in printed A4 colorful images with the questionnaire sheet. The models of the cars were:

- VW Polo (coded as Car 1)
- Citroen C3 (coded as Car 2)
- Fiat Punto (coded as Car 3)
- Ford Fiesta (coded as Car 4)
- Honda Jazz (coded as Car 5)
- Hyundai Getz (coded as Car 6)
- Toyota Yaris (coded as Car 7)

The brand of each car was erased by using Adobe Photoshop software in order not to affect participants' perceptions, and also each car was in light gray or white color. (See Appendix B for the images of the cars)

### **3.2.3. The Instrument**

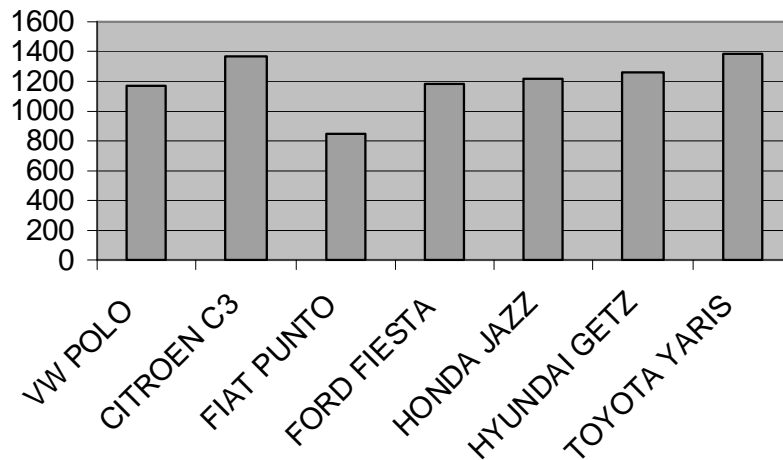
A questionnaire was prepared to elicit the product emotions that were defined by Desmet (2002). The Likert scale was used in the construction of the instrument, as it provides the interval level of measurement and is believed to be more reliable than interview. The participants were asked to fill seven questionnaire forms for seven car models. The questionnaire was prepared in five-point scale that represents "1- I strongly disagree", "2- I disagree", "3- I feel neutral", "4- I agree", "5- I strongly agree". See Appendix B for the questionnaire.

### 3.2.4. Descriptive Statistics of Users' Responses to the Questionnaire

Each of the rates given by participants were calculated and summed up. Reverse coding was applied to “Negative Emotions” and all the ratings were summed up (Table 3.3). According to the results, it is shown that *Toyota Yaris* is the product that evoked more pleasant emotions (M= 46). *Citroen C3* got the second highest mark (M= 45,8), and *Hyundai Getz* the third highest mark (M= 41,9) (Figure 3.1).

**Table 3.3:** The results of the questionnaire

	CAR MODELS	POSITIVE EMOTIONS	NEGATIVE EMOTIONS	TOTAL
CAR 1	VW POLO	478	695	<b>1173</b>
CAR 2	CITROEN C3	618	757	<b>1375</b>
CAR 3	FIAT PUNTO	321	529	<b>850</b>
CAR 4	FORD FIESTA	515	663	<b>1178</b>
CAR 5	HONDAJAZZ	503	716	<b>1219</b>
CAR 6	HYUNDAI GETZ	549	710	<b>1259</b>
CAR 7	TOYOTA YARIS	628	753	<b>1381</b>



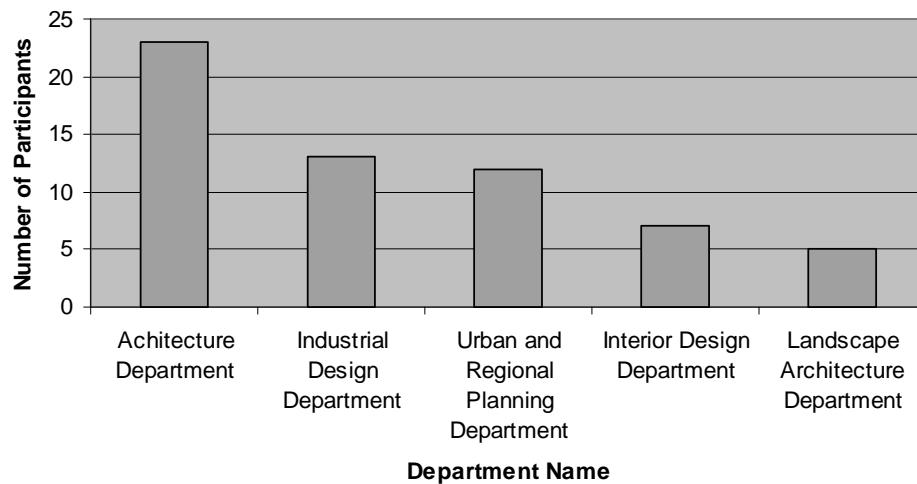
**Figure 3.1:** The graphical translation of the results

### 3.3. Research

Following the pilot study, it was decided to carry on with the main research with a larger group of participants using the instrument developed by Pieter Desmet from ID-Studiolab, in Department of Industrial Design Engineering, Delft University of Technology.

### 3.3.1. Participants

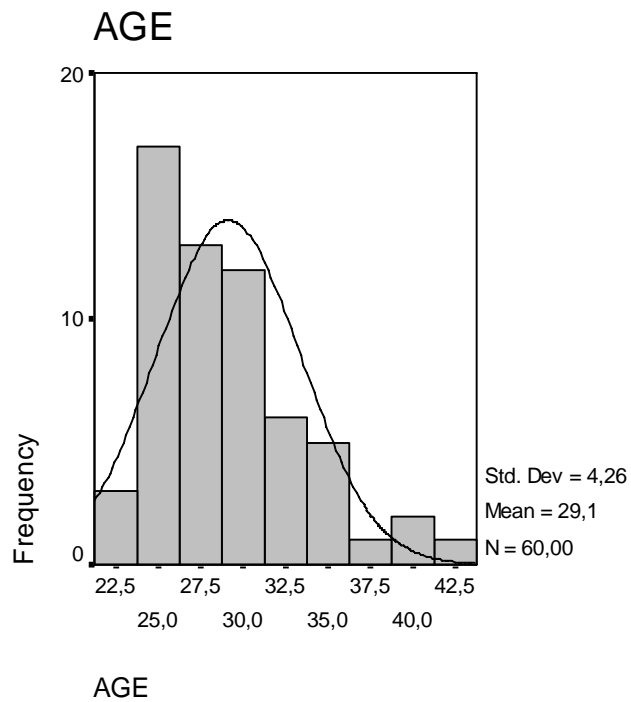
The research assistants (N= 60) at the Faculty of Architecture, Istanbul Technical University participated in this study during the academic year of 2006-2007. The study was applied to 30 male and 30 female research assistants aged between 23 and 42. The research assistants were selected in order to apply the study to a homogenous group in terms of their educational background and monthly income. The research assistants were selected in different departments of the Faculty of Architecture. 23 of them in the Department of Architecture, 13 of them were in the Department of Industrial Design, 12 of them were in the Department of Urban and Regional Planning, 7 of them in the Department of Interior Design, and 5 of them in the Department of Landscape Architecture (Figure 3.2).



**Figure 3.2:** Number of participants in each department

Figure 3.3 and Table 3.4 shows the distribution of participants' ages. It is seen that the majority of the participants are between 25-32 years old ( $M= 29.1$ ). 5 % of the respondents were 23 years old, 1.7 % of them were 24 years old, 10 % of them were 25 years old, 16.7 % of them were 26 years old, 6.7 % of them were 27 years old, 15 % of them were 28 years old, 10 % of them were 29 years old, 3.3 % of them were 30 years old, 6.7 % of them were 31 years old, 8.3 % of them were 32 years old, and 16,7% of them were between 33 and 42 years old.





**Figure 3.3:** Distribution of ages of the participants

**Table 3.4:** Distribution of ages of the participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	23,00	3	5,0	5,0	5,0
	24,00	1	1,7	1,7	6,7
	25,00	6	10,0	10,0	16,7
	26,00	10	16,7	16,7	33,3
	27,00	4	6,7	6,7	40,0
	28,00	9	15,0	15,0	55,0
	29,00	6	10,0	10,0	65,0
	30,00	2	3,3	3,3	68,3
	31,00	4	6,7	6,7	75,0
	32,00	5	8,3	8,3	83,3
	33,00	1	1,7	1,7	85,0
	34,00	2	3,3	3,3	88,3
	35,00	3	5,0	5,0	93,3
	38,00	1	1,7	1,7	95,0
	40,00	2	3,3	3,3	98,3
	42,00	1	1,7	1,7	100,0
	Total	60	100,0	100,0	

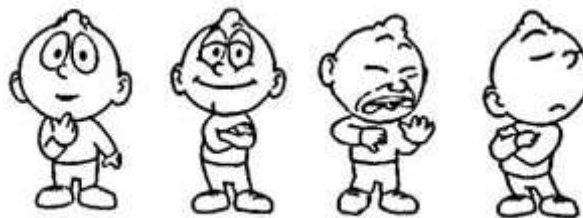
### 3.3.2. The Instrument

The latest version of Product Emotion Measurement Instrument (PrEmo 7.0) was used for the research to elicit emotional responses of the users. PrEmo is a non-verbal self-report instrument that measures 14 emotions that are often elicited by product design. These emotions are grouped in two: 7 negative and 7 positive product emotions (Figure 3.4).

Pleasant Emotions	Unpleasant Emotions
Desire	Indignation
Pleasant Surprise	Contempt
Inspiration	Disgust
Amusement	Unpleasant Surprise
Admiration	Dissatisfaction
Satisfaction	Disappointment
Fascination	Boredom

**Figure 3.4:** 14 product related emotions measured by PrEmo (Desmet, 2002)

In the instrument, each emotion is portrayed by an animation of dynamic facial, bodily, and vocal expressions (Figure 3.5).

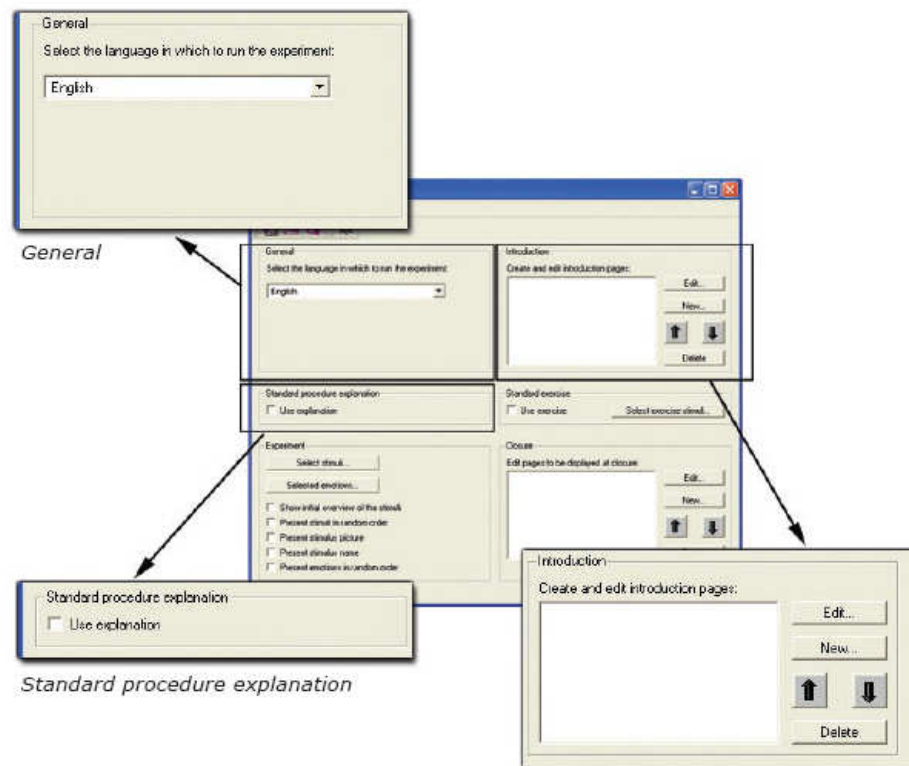


**Figure 3.5:** Some examples of expressive cartoons (Desmet, 2002)

The unique strength of PrEmo is that it combines two qualities: it measures distinct emotions and it can be used cross-culturally, because it does not ask respondents to verbalize their emotions. In addition, it can be used to measure mixed emotions. That is, more than one emotion is experienced simultaneously. The operation requires neither expensive equipment nor technical expertise. Also, respondents reported that the measurement task with PrEmo is pleasant or even enjoyable. In addition, a PrEmo test is self-running. Each participant is guided through the procedure with a step-by-step explanation on the computer interface.

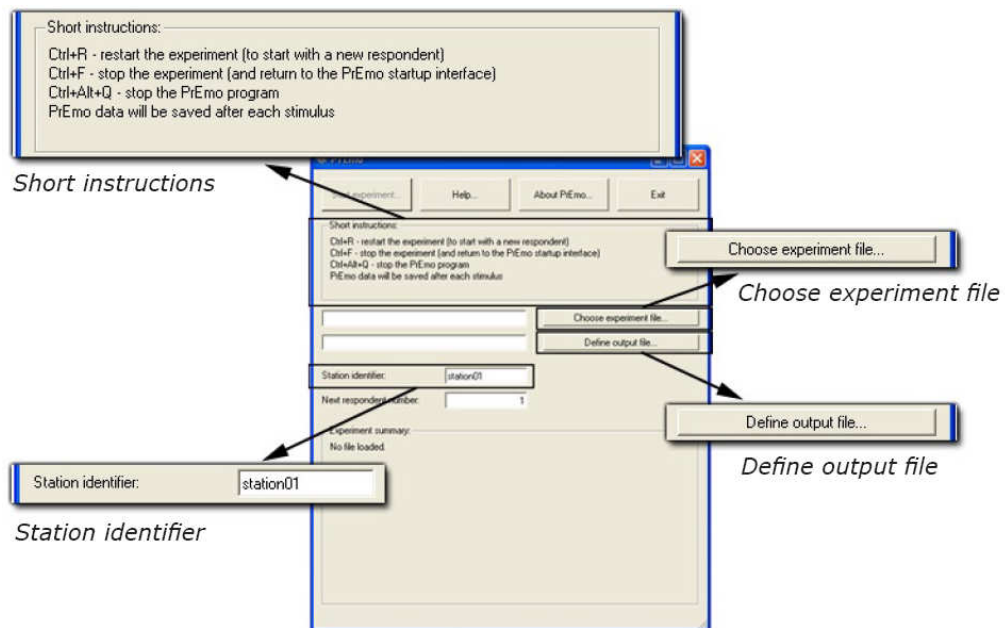
## - The Structure of the Software

PrEmo 7.0 is a software program that operates under Windows, and consists of two modules: (1) a design module, (2) an experiment module (Figure 3.6). The design module is used by the researcher to design the experiment (e.g. select stimuli, formulate introduction texts, etc.). The experiment module is used to run the experiment that was designed with the design module.



**Figure 3.6:** The Design Module of PrEmo

The experiment module is used by the respondent to perform the research task. An experiment, that has already been designed and saved with the design module, can be opened in the experiment module (Figure 3.7).



**Figure 3.7:** The Experiment Module of PrEmo

### - The Methodology of the Software

The procedure of a PrEmo experiment is self-running. Firstly, the introduction that guides respondents through the procedure is displayed on the computer screen. Then an explanation and exercise part is displayed to guide the respondents how to use the software. (See Appendix C for the screen shots of the software)

The core of the program is the measurement interface, which was designed to be simple and intuitive in use. The top section of the interface depicts stills of the 14 animations. Each still is accompanied by a three-point scale. These scales represent the following ratings: “I do feel the emotion”, “to some extent I feel the emotion” and “I do not feel the emotion expressed by this animation”. The rating scales are hidden behind the animation frames. A scale appears on the side of the animation frame only after the animation is activated by clicking on the particular still. (See Appendix C for the interface of the software)

The lower section of the interface displays a picture of the stimulus and an operation button. During an experiment, the respondents are first shown a (picture of a) product and subsequently instructed to use the animations to report their emotion(s) evoked by the product. While they are viewing an animation, they must ask themselves the following question: “Does this animation express what I feel?” Subsequently, they

use the three-point scale to answer this question. Visual feedback of the scorings is provided by the background colour of the animation frame.

Istanbul Technical University purchased the academic license of PrEmo from Delft University of Technology for this research. The software was installed to a laptop. The researcher visited all the respondents and took permission from them. The data is written in an excel sheet automatically, coding “0” for “I do not feel this emotion”, “1” for “neutral”, and “2” for “I feel this emotion”.

### 3.3.3. The Stimuli

During the pilot study, the stimulus that was used was decided to be used in PrEmo. They were VW Polo, Citroen C3, Fiat Punto, Ford Fiesta, Honda Jazz, Hyundai Getz, and Toyota Yaris. As mentioned in the 3.2.2. The Stimuli sub-section of the pilot study, variables such as price (20.000 YTL-30.000 YTL), target user group, technical properties of the cars were held constant (Figure 3.8).



**Figure 3.8:** The stimuli used in the pilot study

However, respondents reported that the car models looked too similar when they were viewed in the PrEmo. Thus, the participants got confused and found it difficult to rate the cars. When analyzing the data, it was found that responses to each car

model did not differentiate. Especially, it was reported that the cars that the respondents used in daily life could not be evaluated objectively; most of the participants identified the brands of the cars. Therefore, this identification of the car models affected their evaluation, and their experience influenced their choices.

Then, it was decided to use different models of cars from different categories. Also, it is thought that the new stimuli should not be the products that were used by the participants. Thus, the concept cars of different brands were selected as stimuli. (See Appendix D for the images of cars used in the research). They are:

- Bugatti Veyron (coded as Car A)
- Hummer H3 (coded as Car B)
- Kia Ceed (coded as Car C)
- Peugeot 908 RC (coded as Car D)
- Pininfarina Nido (coded as Car E)
- Renault Koleos (coded as Car F)
- VW Iroc (coded as Car G)

#### **3.3.4. Data Analysis**

Data were analyzed using SPSS 11.5 version. First, data were coded and computerized by the researcher. The computerized data were checked and any mistakes made during the coding or entering the data were corrected. Then, the descriptive analysis was conducted. Following the descriptive analysis, to explore the effect of gender on the emotional responses, the data were analyzed for each of the 14 measured emotions with MANOVA. MANOVA was run seven times for each car model with gender (two levels) as between-participant factor, and the emotions (14 levels) as dependent variable.

## 4. RESULTS

In this section, the findings of the study will be reported. First, descriptive statistics for each variable is provided. Then, the participants are compared based on their gender and whether they show differences on each component investigated.

### 4.1. Descriptive Statistics of Participants' Responses

Participants were asked to evaluate 7 car models by using PrEmo. First of all, the votes of the participants for each car will be examined to comprehend which emotion was felt to which product.

Figure 4.1 shows the stimulus of Car A. In the Table 4.1, it is shown that, to the A Car, 71.7 % of the participants did not feel *disgust*, 13.3% of the participants were neutral on *disgust*, and 15 % of the participants feel *disgust* (M= 1.43). 80 % of the participants did not feel *indignation*, 10 % of the participants were neutral on *indignation*, and 10 % of the participants feel *indignation* (M= 1.3). 55 % of the participants did not feel *contempt*, 30 % of the participants were neutral on *contempt*, and 15 % of the participants feel *contempt* (M= 1.6). 78.3 % of the participants did not feel *boredom*, 16.7 % of the participants were neutral on *boredom*, and 5 % of the participants feel *boredom* (M= 1.26). 65 % of the participants did not feel *unpleasant surprise*, 18.3 % of the participants were neutral on *unpleasant surprise*, and 16.7 % of the participants feel *unpleasant surprise* (M= 1.51). 58.3 % of the participants did not feel *dissatisfaction*, 15 % of the participants were neutral on *dissatisfaction*, and 26.7 % of the participants feel *dissatisfaction* (M= 1.68). 63.3 % of the participants did not feel *disappointment*, 21.7 % of the participants were neutral on *disappointment*, and 15 % of the participants feel *disappointment* (M= 1.51).

38.3 % of the participants did not feel *inspiration*, 36.7 % of the participants were neutral on *inspiration*, and 25 % of the participants feel *inspiration* (M= 1.86). 41.7 % of the participants did not feel *desire*, 23.3 % of the participants were neutral on *desire*, and 35 % of the participants feel *desire* (M= 1.93). 33.3 % of the participants

did not feel *pleasant surprise*, 33.3 % of the participants were neutral on *pleasant surprise*, and 33.3 % of the participants feel *pleasant surprise* ( $M= 2.00$ ). 31.7 % of the participants did not feel *fascination*, 38.3 % of the participants were neutral on *fascination*, and 30 % of the participants feel *fascination* ( $M= 1.98$ ). 68.3 % of the participants did not feel *amusement*, 20 % of the participants were neutral on *amusement*, and 11.7 % of the participants feel *amusement* ( $M= 1.43$ ). 28.3 % of the participants did not feel *admiration*, 31.7 % of the participants were neutral on *admiration*, and 40 % of the participants feel *admiration* ( $M= 2.11$ ). 40 % of the participants did not feel *satisfaction*, 35 % of the participants were neutral on *satisfaction*, and 25 % of the participants feel *satisfaction* ( $M= 1.85$ ).



**Figure 4.1:** Car A

**Table 4.1:** The emotional responses of all respondents to Car A

<b>A - Disgust</b>	
	Marginal Frequency
I do not feel it	43
I am neutral	8
I feel it	9

<b>A - Inspiration</b>	
	Marginal Frequency
I do not feel it	23
I am neutral	22
I feel it	15

<b>A - Indignation</b>	
	Marginal Frequency
I do not feel it	48
I am neutral	6
I feel it	6

<b>A - Desire</b>	
	Marginal Frequency
I do not feel it	25
I am neutral	14
I feel it	21

<b>A - Contempt</b>	
	Marginal Frequency
I do not feel it	33
I am neutral	18
I feel it	9

<b>A - Pleasant Surprise</b>	
	Marginal Frequency
I do not feel it	20
I am neutral	20
I feel it	20



<b>A - Boredom</b>	
	Marginal Frequency
I do not feel it	47
I am neutral	10
I feel it	3

<b>A - Fascination</b>	
	Marginal Frequency
I do not feel it	19
I am neutral	23
I feel it	18

<b>A - Unpleasant Surprise</b>	
	Marginal Frequency
I do not feel it	39
I am neutral	11
I feel it	10

<b>A - Amusement</b>	
	Marginal Frequency
I do not feel it	41
I am neutral	12
I feel it	7

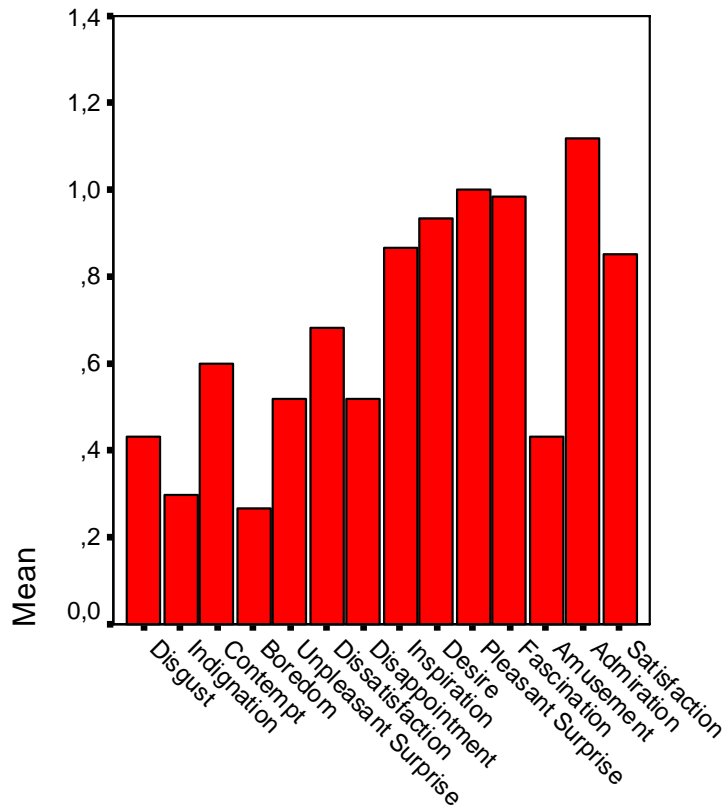
<b>A - Dissatisfaction</b>	
	Marginal Frequency
I do not feel it	35
I am neutral	9
I feel it	16

<b>A - Admiration</b>	
	Marginal Frequency
I do not feel it	17
I am neutral	19
I feel it	24

<b>A - Disappointment</b>	
	Marginal Frequency
I do not feel it	38
I am neutral	13
I feel it	9

<b>A - Satisfaction</b>	
	Marginal Frequency
I do not feel it	24
I am neutral	21
I feel it	15

Figure 4.2 shows the means of 14 emotional responds to Car A. In the figure, it is seen that Car A evoked positive emotions among participants. The most elicited emotion was *admiration* and the least elicited emotion was *boredom*.



**Figure 4.2:** Means of 14 emotional responds to Car A

Figure 4.3 shows the stimulus of Car B. To the B Car, 56.7 % of the participants did not feel *disgust*, 25 % of the participants were neutral on *disgust*, and 18.3 % of the participants feel *disgust* (M= 1.61). 55 % of the participants did not feel *indignation*, 25 % of the participants were neutral on *indignation*, and 20 % of the participants feel *indignation* (M= 1.65). 40 % of the participants did not feel *contempt*, 30 % of the participants were neutral on *contempt*, and 30 % of the participants feel *contempt* (M= 1.9). 43.3 % of the participants did not feel *boredom*, 35 % of the participants were neutral on *boredom*, and 21.7 % of the participants feel *boredom* (M= 1.78). 60 % of the participants did not feel *unpleasant surprise*, 25 % of the participants were neutral on *unpleasant surprise*, and 15 % of the participants feel *unpleasant surprise* (M= 1.55). 28.3 % of the participants did not feel *dissatisfaction*, 26.7 % of the participants were neutral on *dissatisfaction*, and 45 % of the participants feel *dissatisfaction* (M= 2.16). 46.7 % of the participants did not feel *disappointment*, 25 % of the participants were neutral on *disappointment*, and 28.3 % of the participants feel *disappointment* (M= 1.81).

61.7 % of the participants did not feel *inspiration*, 25 % of the participants were neutral on *inspiration*, and 13.3 % of the participants feel *inspiration* (M= 1.51). 68.3 % of the participants did not feel *desire*, 18.3 % of the participants were neutral on *desire*, and 13.3 % of the participants feel *desire* (M= 1.45). 63.3 % of the participants did not feel *pleasant surprise*, 21.7 % of the participants were neutral on *pleasant surprise*, and 15 % of the participants feel *pleasant surprise* (M= 1.51). 48.3 % of the participants did not feel *fascination*, 36.7 % of the participants were neutral on *fascination*, and 15 % of the participants feel *fascination* (M= 1.66). 73.3 % of the participants did not feel *amusement*, 15 % of the participants were neutral on *amusement*, and 11.7 % of the participants feel *amusement* (M= 1.38). 60 % of the participants did not feel *admiration*, 23.3 % of the participants were neutral on *admiration*, and 16.7 % of the participants feel *admiration* (M= 1.56). 61.7 % of the participants did not feel *satisfaction*, 23.3 % of the participants were neutral on *satisfaction*, and 15 % of the participants feel *satisfaction* (M= 1.53) (Table 4.2).



**Figure 4.3:** Car B

**Table 4.2:** The emotional responses of all respondents to Car B

<b>B - Disgust</b>	
	Marginal Frequency
I do not feel it	34
I am neutral	15
I feel it	11

<b>B - Inspiration</b>	
	Marginal Frequency
I do not feel it	37
I am neutral	15
I feel it	8

<b>B - Indignation</b>	
	Marginal Frequency
I do not feel it	33
I am neutral	15
I feel it	12

<b>B - Desire</b>	
	Marginal Frequency
I do not feel it	41
I am neutral	11
I feel it	8

<b>B - Contempt</b>	
	Marginal Frequency
I do not feel it	24
I am neutral	18
I feel it	18

<b>B - Pleasant Surprise</b>	
	Marginal Frequency
I do not feel it	38
I am neutral	13
I feel it	9

<b>B - Boredom</b>	
	Marginal Frequency
I do not feel it	26
I am neutral	21
I feel it	13

<b>B - Fascination</b>	
	Marginal Frequency
I do not feel it	29
I am neutral	22
I feel it	9

<b>B - Unpleasant Surprise</b>	
	Marginal Frequency
I do not feel it	36
I am neutral	15
I feel it	9

<b>B - Amusement</b>	
	Marginal Frequency
I do not feel it	44
I am neutral	9
I feel it	7

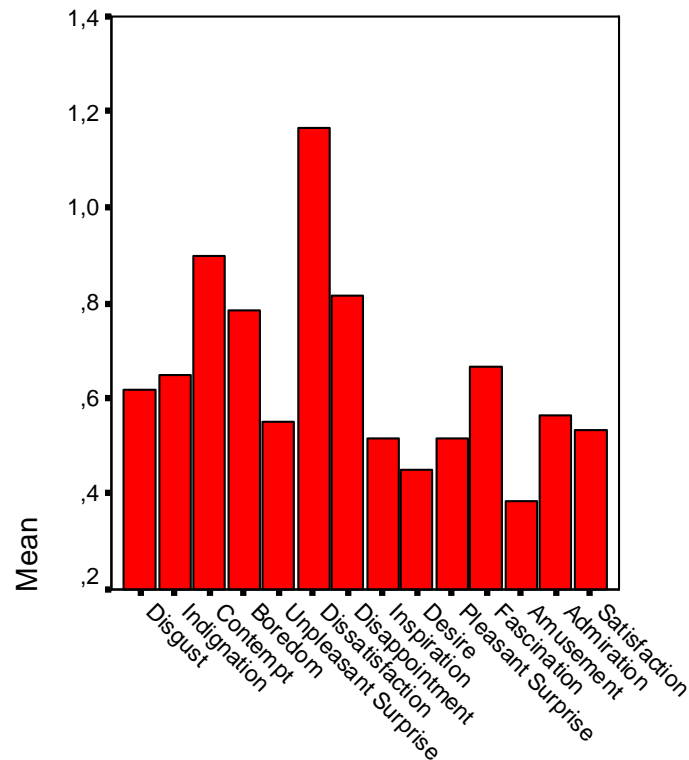
<b>B - Dissatisfaction</b>	
	Marginal Frequency
I do not feel it	17
I am neutral	16
I feel it	27

<b>B - Admiration</b>	
	Marginal Frequency
I do not feel it	36
I am neutral	14
I feel it	10

<b>B - Disappointment</b>	
	Marginal Frequency
I do not feel it	28
I am neutral	15
I feel it	17

<b>B - Satisfaction</b>	
	Marginal Frequency
I do not feel it	37
I am neutral	14
I feel it	9

Figure 4.4 shows the means of 14 emotional responds to Car B. In the figure, it is seen that Car B evoked more negative emotions among participants. The most elicited emotion was *dissatisfaction* and the least elicited emotion was *amusement*.



**Figure 4.4:** Means of 14 emotional responds to Car B

Figure 4.5 shows the stimulus of Car C. To the C Car, 88.3 % of the participants did not feel *disgust*, 10 % of the participants were neutral on *disgust*, and 1.7 % of the participants feel *disgust* ( $M = 1.13$ ). 88.3 % of the participants did not feel *indignation*, 11.7 % of the participants were neutral on *indignation*, and none of the participants feel *indignation* ( $M = 1.11$ ). 76.7 % of the participants did not feel *contempt*, 20 % of the participants were neutral on *contempt*, and 3.3 % of the participants feel *contempt* ( $M = 1.26$ ). 70 % of the participants did not feel *boredom*, 20 % of the participants were neutral on *boredom*, and 10 % of the participants feel *boredom* ( $M = 1.40$ ). 81.7 % of the participants did not feel *unpleasant surprise*, 11.7 % of the participants were neutral on *unpleasant surprise*, and 6.7 % of the participants feel *unpleasant surprise* ( $M = 1.25$ ). 71.7 % of the participants did not feel *dissatisfaction*, 16.7 % of the participants were neutral on *dissatisfaction*, and 11.7 % of the participants feel *dissatisfaction* ( $M = 1.40$ ). 70 % of the participants did not feel *disappointment*, 23.3 % of the participants were neutral on *disappointment*, and 6.7 % of the participants feel *disappointment* ( $M = 1.36$ ).

33.3 % of the participants did not feel *inspiration*, 45 % of the participants were neutral on *inspiration*, and 21.7 % of the participants feel *inspiration* ( $M = 1.88$ ). 40

% of the participants did not feel *desire*, 36.7 % of the participants were neutral on *desire*, and 23.3 % of the participants feel *desire* (M= 1.83). 36.7 % of the participants did not feel *pleasant surprise*, 35 % of the participants were neutral on *pleasant surprise*, and 28.3 % of the participants feel *pleasant surprise* (M= 1.91). 16.7 % of the participants did not feel *fascination*, 55 % of the participants were neutral on *fascination*, and 28.3 % of the participants feel *fascination* (M= 2.11). 80 % of the participants did not feel *amusement*, 16.7 % of the participants were neutral on *amusement*, and 28.3 % of the participants feel *amusement* (M= 1.23). 36.7 % of the participants did not feel *admiration*, 35 % of the participants were neutral on *admiration*, and 28.3 % of the participants feel *admiration* (M= 1.91). 26.7 % of the participants did not feel *satisfaction*, 36.7 % of the participants were neutral on *satisfaction*, and 36.7 % of the participants feel *satisfaction* (M= 2.1) (Table 4.3).



**Figure 4.5:** Car C

**Table 4.3:** The emotional responses of all respondents to Car C

<b>C - Disgust</b>  <div> <div></div> <div>Marginal Frequency</div> </div> <div> <div>I do not feel it</div> <div>53</div> </div> <div> <div>I am neutral</div> <div>6</div> </div> <div> <div>I feel it</div> <div>1</div> </div>	<b>C -Inspiration</b>  <div> <div></div> <div>Marginal Frequency</div> </div> <div> <div>I do not feel it</div> <div>20</div> </div> <div> <div>I am neutral</div> <div>27</div> </div> <div> <div>I feel it</div> <div>13</div> </div>
<b>C - Indignation</b>  <div> <div></div> <div>Marginal Frequency</div> </div> <div> <div>I do not feel it</div> <div>53</div> </div> <div> <div>I am neutral</div> <div>7</div> </div> <div> <div>I feel it</div> <div>0</div> </div>	<b>C - Desire</b>  <div> <div></div> <div>Marginal Frequency</div> </div> <div> <div>I do not feel it</div> <div>24</div> </div> <div> <div>I am neutral</div> <div>22</div> </div> <div> <div>I feel it</div> <div>14</div> </div>
<b>C - Contempt</b>  <div> <div></div> <div>Marginal Frequency</div> </div> <div> <div>I do not feel it</div> <div>46</div> </div> <div> <div>I am neutral</div> <div>12</div> </div> <div> <div>I feel it</div> <div>2</div> </div>	<b>C - Pleasant Surprise</b>  <div> <div></div> <div>Marginal Frequency</div> </div> <div> <div>I do not feel it</div> <div>22</div> </div> <div> <div>I am neutral</div> <div>21</div> </div> <div> <div>I feel it</div> <div>17</div> </div>

<b>C - Boredom</b>	
	Marginal Frequency
I do not feel it	42
I am neutral	12
I feel it	6

<b>C - Fascination</b>	
	Marginal Frequency
I do not feel it	10
I am neutral	33
I feel it	17

<b>C - Unpleasant Surprise</b>	
	Marginal Frequency
I do not feel it	49
I am neutral	7
I feel it	4

<b>C - Amusement</b>	
	Marginal Frequency
I do not feel it	48
I am neutral	10
I feel it	2

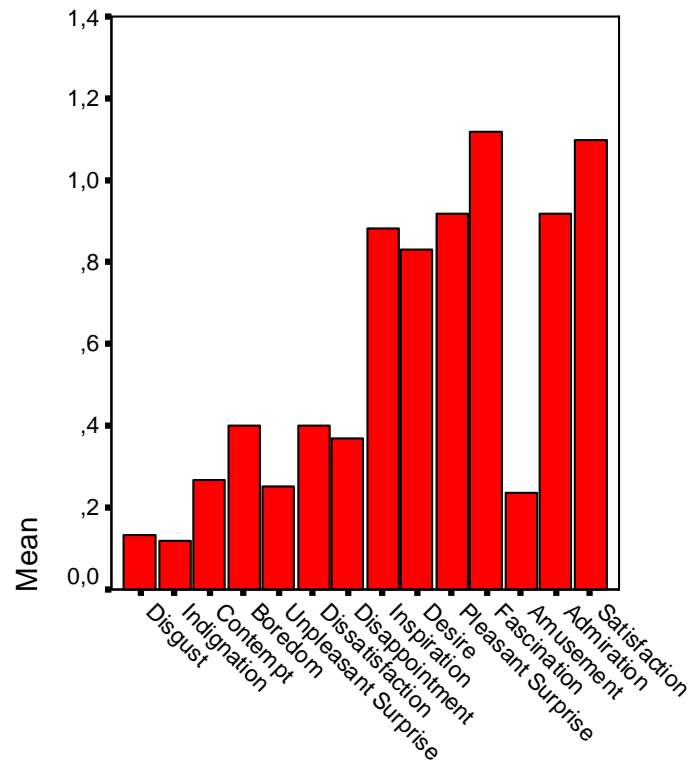
<b>C - Dissatisfaction</b>	
	Marginal Frequency
I do not feel it	43
I am neutral	10
I feel it	7

<b>C - Admiration</b>	
	Marginal Frequency
I do not feel it	22
I am neutral	21
I feel it	17

<b>C - Disappointment</b>	
	Marginal Frequency
I do not feel it	42
I am neutral	14
I feel it	4

<b>C - Satisfaction</b>	
	Marginal Frequency
I do not feel it	16
I am neutral	22
I feel it	22

Figure 4.6 shows the means of 14 emotional responds to Car C. In the figure, it is seen that Car C evoked more positive emotions among participants. The most elicited emotions were *fascination* and *satisfaction*, and the least elicited emotions were *indignation* and *disgust*.



**Figure 4.6:** Means of 14 emotional responds to Car C

Figure 4.7 shows the stimulus of Car D. To the D Car, 78.3 % of the participants did not feel *disgust*, 15 % of the participants were neutral on *disgust*, and 6.7 % of the participants feel *disgust* (M= 1.28). 80 % of the participants did not feel *indignation*, 11.7 % of the participants were neutral on *indignation*, and 8.3 % of the participants feel *indignation* (M= 1.28). 60 % of the participants did not feel *contempt*, 23.3 % of the participants were neutral on *contempt*, and 16.7 % of the participants feel *contempt* (M= 1.56). 68.3 % of the participants did not feel *boredom*, 21.7 % of the participants were neutral on *boredom*, and 10 % of the participants feel *boredom* (M= 1.41). 71.7 % of the participants did not feel *unpleasant surprise*, 16.7 % of the participants were neutral on *unpleasant surprise*, and 11.7 % of the participants feel *unpleasant surprise* (M= 1.40). 60 % of the participants did not feel *dissatisfaction*, 21.7 % of the participants were neutral on *dissatisfaction*, and 18.3 % of the participants feel *dissatisfaction* (M= 1.58). 63.3 % of the participants did not feel *disappointment*, 25 % of the participants were neutral on *disappointment*, and 11.7 % of the participants feel *disappointment* (M= 1.48).

33.3 % of the participants did not feel *inspiration*, 33.3 % of the participants were neutral on *inspiration*, and 33.3 % of the participants feel *inspiration* (M= 2.00). 41.7



% of the participants did not feel *desire*, 20 % of the participants were neutral on *desire*, and 38.3 % of the participants feel *desire* (M= 1.96). 33.3 % of the participants did not feel *pleasant surprise*, 36.7 % of the participants were neutral on *pleasant surprise*, and 30 % of the participants feel *pleasant surprise* (M= 1.96). 20 % of the participants did not feel *fascination*, 50 % of the participants were neutral on *fascination*, and 30 % of the participants feel *fascination* (M= 2.10). 71.7 % of the participants did not feel *amusement*, 18.3 % of the participants were neutral on *amusement*, and 10 % of the participants feel *amusement* (M= 1.38). 33.3 % of the participants did not feel *admiration*, 21.7 % of the participants were neutral on *admiration*, and 45 % of the participants feel *admiration* (M= 2.11). 45 % of the participants did not feel *satisfaction*, 20 % of the participants were neutral on *satisfaction*, and 35 % of the participants feel *satisfaction* (M= 1.9) (Table 4.4).



**Figure 4.7:** Car D

**Table 4.4:** The emotional responses of all respondents to Car D

<b>D - Disgust</b>	
	Marginal Frequency
I do not feel it	47
I am neutral	9
I feel it	4

<b>D - Inspiration</b>	
	Marginal Frequency
I do not feel it	20
I am neutral	20
I feel it	20

<b>D - Indignation</b>	
	Marginal Frequency
I do not feel it	48
I am neutral	7
I feel it	5

<b>D - Desire</b>	
	Marginal Frequency
I do not feel it	25
I am neutral	12
I feel it	23

<b>D - Contempt</b>	
	Marginal Frequency
I do not feel it	36
I am neutral	14
I feel it	10

<b>D - Pleasant Surprise</b>	
	Marginal Frequency
I do not feel it	20
I am neutral	22
I feel it	18

<b>D - Boredom</b>	
	Marginal Frequency
I do not feel it	41
I am neutral	13
I feel it	6

<b>D - Fascination</b>	
	Marginal Frequency
I do not feel it	12
I am neutral	30
I feel it	18

<b>D - Unpleasant Surprise</b>	
	Marginal Frequency
I do not feel it	43
I am neutral	10
I feel it	7

<b>D - Amusement</b>	
	Marginal Frequency
I do not feel it	43
I am neutral	11
I feel it	6

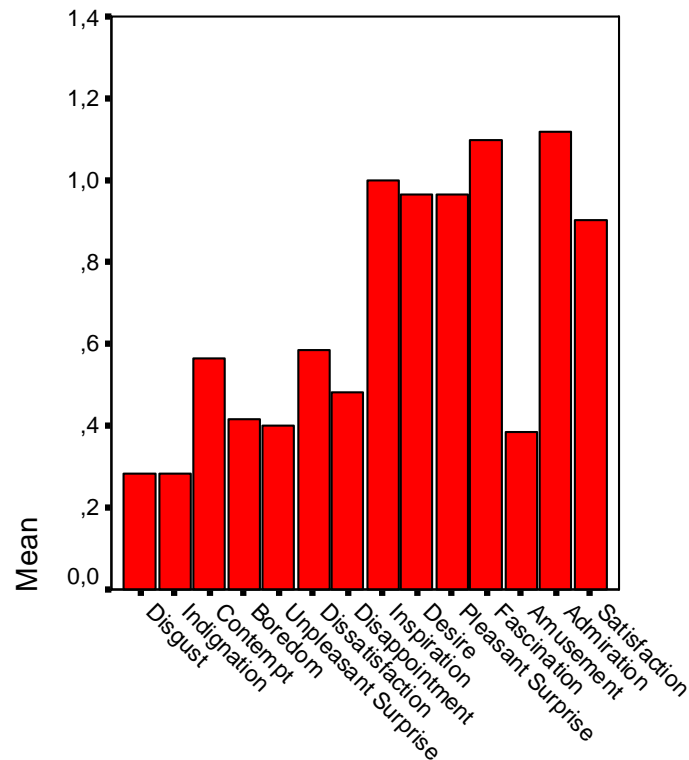
<b>D - Dissatisfaction</b>	
	Marginal Frequency
I do not feel it	36
I am neutral	13
I feel it	11

<b>D - Admiration</b>	
	Marginal Frequency
I do not feel it	20
I am neutral	13
I feel it	27

<b>D - Disappointment</b>	
	Marginal Frequency
I do not feel it	38
I am neutral	15
I feel it	7

<b>D - Satisfaction</b>	
	Marginal Frequency
I do not feel it	27
I am neutral	12
I feel it	21

Figure 4.8 shows the means of 14 emotional responds to Car D. In the figure, it is seen that Car D evoked more positive emotions among participants. The most elicited emotions were *admiration* and *fascination*, and the least elicited emotions were *indignation* and *disgust*.



**Figure 4.8:** Means of 14 emotional responds to Car D

Figure 4.9 shows the stimulus of Car E. To the E Car, 80 % of the participants did not feel *disgust*, 15 % of the participants were neutral on *disgust*, and 5 % of the participants feel *disgust* (M= 1.25). 78.3 % of the participants did not feel *indignation*, 15 % of the participants were neutral on *indignation*, and 6.7 % of the participants feel *indignation* (M= 1.28). 66.7 % of the participants did not feel *contempt*, 23.3 % of the participants were neutral on *contempt*, and 10 % of the participants feel *contempt* (M= 1.43). 61.7 % of the participants did not feel *boredom*, 25 % of the participants were neutral on *boredom*, and 13.3 % of the participants feel *boredom* (M= 1.51). 88.3 % of the participants did not feel *unpleasant surprise*, 11.7 % of the participants were neutral on *unpleasant surprise*, and none of the participants feel *unpleasant surprise* (M= 1.11). 66.7 % of the participants did not feel *dissatisfaction*, 15 % of the participants were neutral on *dissatisfaction*, and 18.3 % of the participants feel *dissatisfaction* (M= 1.51). 71.7 % of the participants did not feel *disappointment*, 20 % of the participants were neutral on *disappointment*, and 8.3 % of the participants feel *disappointment* (M= 1.36). 33.3 % of the participants did not feel *inspiration*, 41.7 % of the participants were neutral on *inspiration*, and 25 % of the participants feel *inspiration* (M= 1.91). 53.3

% of the participants did not feel *desire*, 28.3 % of the participants were neutral on *desire*, and 18.3 % of the participants feel *desire* ( $M= 1.65$ ). 36.7 % of the participants did not feel *pleasant surprise*, 33.3 % of the participants were neutral on *pleasant surprise*, and 30 % of the participants feel *pleasant surprise* ( $M= 1.93$ ). 20 % of the participants did not feel *fascination*, 35 % of the participants were neutral on *fascination*, and 45 % of the participants feel *fascination* ( $M= 2.25$ ). 50 % of the participants did not feel *amusement*, 28.3 % of the participants were neutral on *amusement*, and 21.7 % of the participants feel *amusement* ( $M= 1.71$ ). 50 % of the participants did not feel *admiration*, 38.3 % of the participants were neutral on *admiration*, and 11.7 % of the participants feel *admiration* ( $M= 1.61$ ). 30 % of the participants did not feel *satisfaction*, 40 % of the participants were neutral on *satisfaction*, and 30 % of the participants feel *satisfaction* ( $M= 2.00$ ) (Table 4.5).



**Figure 4.1.9:** Car E

**Table 4.1.5:** The emotional responses of all respondents to Car E

<b>E - Disgust</b>	
	Marginal Frequency
I do not feel it	48
I am neutral	9
I feel it	3

<b>E - Inspiration</b>	
	Marginal Frequency
I do not feel it	20
I am neutral	25
I feel it	15

<b>E - Indignation</b>	
	Marginal Frequency
I do not feel it	47
I am neutral	9
I feel it	4

<b>E - Desire</b>	
	Marginal Frequency
I do not feel it	32
I am neutral	17
I feel it	11

<b>E - Contempt</b>	
	Marginal Frequency
I do not feel it	40
I am neutral	14
I feel it	6

<b>E - Pleasant Surprise</b>	
	Marginal Frequency
I do not feel it	22
I am neutral	20
I feel it	18

<b>E - Boredom</b>	
	Marginal Frequency
I do not feel it	37
I am neutral	15
I feel it	8

<b>E - Fascination</b>	
	Marginal Frequency
I do not feel it	12
I am neutral	21
I feel it	27

<b>E - Unpleasant Surprise</b>	
	Marginal Frequency
I do not feel it	53
I am neutral	7
I feel it	0

<b>E - Amusement</b>	
	Marginal Frequency
I do not feel it	30
I am neutral	17
I feel it	13

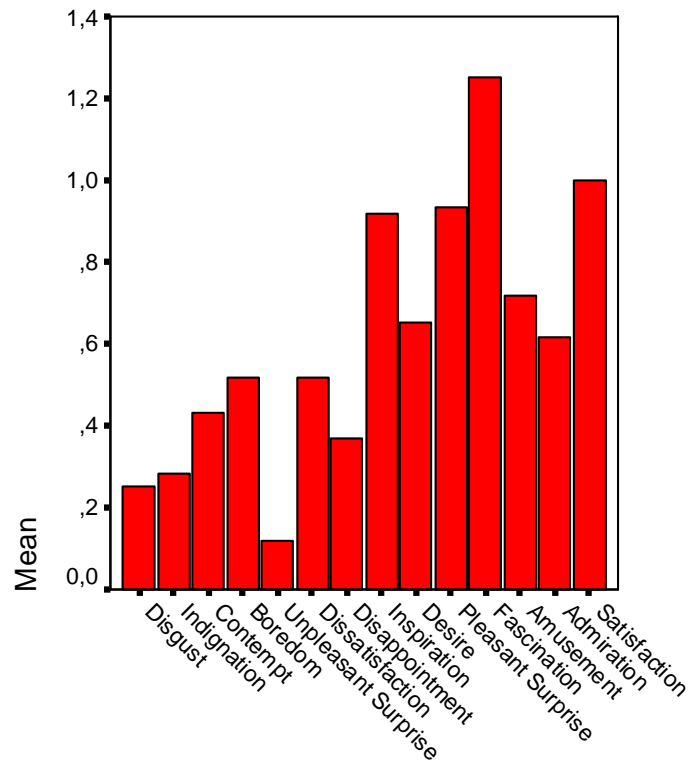
<b>E - Dissatisfaction</b>	
	Marginal Frequency
I do not feel it	40
I am neutral	9
I feel it	11

<b>E - Admiration</b>	
	Marginal Frequency
I do not feel it	30
I am neutral	23
I feel it	7

<b>E - Disappointment</b>	
	Marginal Frequency
I do not feel it	43
I am neutral	12
I feel it	5

<b>E - Satisfaction</b>	
	Marginal Frequency
I do not feel it	18
I am neutral	24
I feel it	18

Figure 4.10 shows the means of 14 emotional responds to Car E. In the figure, it is seen that Car E evoked more positive emotions among participants. The most elicited emotion was *fascination* and the least elicited emotion was *unpleasant surprise*.



**Figure 4.10:** Means of 14 emotional responds to Car E

Figure 4.11 shows the stimulus of Car F. To the F Car, 91.7 % of the participants did not feel *disgust*, 5 % of the participants were neutral on *disgust*, and 3.3 % of the participants feel *disgust* (M= 1.11). 86.7 % of the participants did not feel *indignation*, 10 % of the participants were neutral on *indignation*, and 3.3 % of the participants feel *indignation* (M= 1.16). 56.7 % of the participants did not feel *contempt*, 33.3 % of the participants were neutral on *contempt*, and 10 % of the participants feel *contempt* (M= 1.53). 66.7 % of the participants did not feel *boredom*, 18.3 % of the participants were neutral on *boredom*, and 15 % of the participants feel *boredom* (M= 1.48). 95 % of the participants did not feel *unpleasant surprise*, 3.3 % of the participants were neutral on *unpleasant surprise*, and 1.7 % of the participants feel *unpleasant surprise* (M= 1.06). 65 % of the participants did not feel *dissatisfaction*, 21.7 % of the participants were neutral on *dissatisfaction*, and 13.3 % of the participants feel *dissatisfaction* (M= 1.48). 71.7 % of the participants did not feel *disappointment*, 21.7 % of the participants were neutral on *disappointment*, and 6.7 % of the participants feel *disappointment* (M= 1.35).

48.3 % of the participants did not feel *inspiration*, 35 % of the participants were neutral on *inspiration*, and 16.7 % of the participants feel *inspiration* (M= 1.68). 51.7

% of the participants did not feel *desire*, 26.7 % of the participants were neutral on *desire*, and 21.7 % of the participants feel *desire* (M= 1.70). 51.7 % of the participants did not feel *pleasant surprise*, 31.7 % of the participants were neutral on *pleasant surprise*, and 16.7 % of the participants feel *pleasant surprise* (M= 1.65). 21.7 % of the participants did not feel *fascination*, 46.7 % of the participants were neutral on *fascination*, and 31.7 % of the participants feel *fascination* (M= 2.10). 76.7 % of the participants did not feel *amusement*, 18.3 % of the participants were neutral on *amusement*, and 5 % of the participants feel *amusement* (M= 1.28). 46.7 % of the participants did not feel *admiration*, 35 % of the participants were neutral on *admiration*, and 18.3 % of the participants feel *admiration* (M= 1.71). 28.3 % of the participants did not feel *satisfaction*, 41.7 % of the participants were neutral on *satisfaction*, and 30 % of the participants feel *satisfaction* (M= 2.01) (Table 4.6).



**Figure 4.1.11:** Car F

**Table 4.1.6:** The emotional responses of all respondents to Car F

<b>F - Disgust</b>	
	Marginal Frequency
I do not feel it	55
I am neutral	3
I feel it	2

<b>F - Inspiration</b>	
	Marginal Frequency
I do not feel it	29
I am neutral	21
I feel it	10

<b>F - Indignation</b>	
	Marginal Frequency
I do not feel it	52
I am neutral	6
I feel it	2

<b>F - Desire</b>	
	Marginal Frequency
I do not feel it	31
I am neutral	16
I feel it	13

<b>F - Contempt</b>	
	Marginal Frequency
I do not feel it	34
I am neutral	20
I feel it	6

<b>F - Pleasant Surprise</b>	
	Marginal Frequency
I do not feel it	31
I am neutral	19
I feel it	10

<b>F - Boredom</b>	
	Marginal Frequency
I do not feel it	40
I am neutral	11
I feel it	9

<b>F - Fascination</b>	
	Marginal Frequency
I do not feel it	13
I am neutral	28
I feel it	19

<b>F - Unpleasant Surprise</b>	
	Marginal Frequency
I do not feel it	57
I am neutral	2
I feel it	1

<b>F - Amusement</b>	
	Marginal Frequency
I do not feel it	46
I am neutral	11
I feel it	3

<b>F - Dissatisfaction</b>	
	Marginal Frequency
I do not feel it	39
I am neutral	13
I feel it	8

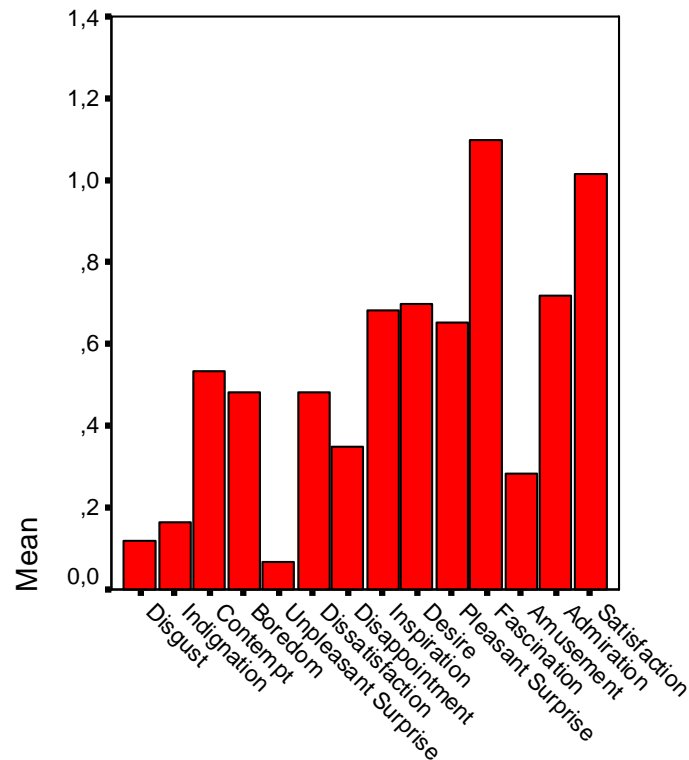
<b>F - Admiration</b>	
	Marginal Frequency
I do not feel it	28
I am neutral	21
I feel it	11

<b>F - Disappointment</b>	
	Marginal Frequency
I do not feel it	43
I am neutral	13
I feel it	4

<b>F - Satisfaction</b>	
	Marginal Frequency
I do not feel it	17
I am neutral	25
I feel it	18

Figure 4.12 shows the means of 14 emotional responds to Car F. In the figure, it is seen that Car F evoked more positive emotions among participants. The most elicited emotion was *fascination* and the least elicited emotion was *unpleasant surprise*.





**Figure 4.12:** Means of 14 emotional responds to Car F

Figure 4.13 shows the stimulus of Car G. To the G Car, 76.7 % of the participants did not feel *disgust*, 18.3 % of the participants were neutral on *disgust*, and 5 % of the participants feel *disgust* (M= 1.28). 80 % of the participants did not feel *indignation*, 13.3 % of the participants were neutral on *indignation*, and 6.7 % of the participants feel *indignation* (M= 1.26). 70 % of the participants did not feel *contempt*, 25 % of the participants were neutral on *contempt*, and 5 % of the participants feel *contempt* (M= 1.35). 61.7 % of the participants did not feel *boredom*, 21.7 % of the participants were neutral on *boredom*, and 16.7 % of the participants feel *boredom* (M= 1.55). 83.3 % of the participants did not feel *unpleasant surprise*, 11.7 % of the participants were neutral on *unpleasant surprise*, and 5 % of the participants feel *unpleasant surprise* (M= 1.21). 58.3 % of the participants did not feel *dissatisfaction*, 25 % of the participants were neutral on *dissatisfaction*, and 16.7 % of the participants feel *dissatisfaction* (M= 1.58). 65 % of the participants did not feel *disappointment*, 25 % of the participants were neutral on *disappointment*, and 10 % of the participants feel *disappointment* (M= 1.45).

35 % of the participants did not feel *inspiration*, 36.7 % of the participants were neutral on *inspiration*, and 28.3 % of the participants feel *inspiration* (M= 1.93). 43.3

% of the participants did not feel *desire*, 35 % of the participants were neutral on *desire*, and 21.7 % of the participants feel *desire* (M= 1.78). 38.3 % of the participants did not feel *pleasant surprise*, 40 % of the participants were neutral on *pleasant surprise*, and 21.7 % of the participants feel *pleasant surprise* (M= 1.83). 28.3 % of the participants did not feel *fascination*, 43.3 % of the participants were neutral on *fascination*, and 28.3 % of the participants feel *fascination* (M= 2.00). 65 % of the participants did not feel *amusement*, 28.3 % of the participants were neutral on *amusement*, and 6.7 % of the participants feel *amusement* (M= 1.41). 40 % of the participants did not feel *admiration*, 46.7 % of the participants were neutral on *admiration*, and 13.3 % of the participants feel *admiration* (M= 1.73). 35 % of the participants did not feel *satisfaction*, 33.3 % of the participants were neutral on *satisfaction*, and 31.7 % of the participants feel *satisfaction* (M= 1.96) (Table 4.7).



**Figure 4.13:** Car G

**Table 4.7:** The emotional responses of all respondents to Car G

<b>G - Disgust</b>	
	Marginal Frequency
I do not feel it	46
I am neutral	11
I feel it	3

<b>G - Inspiration</b>	
	Marginal Frequency
I do not feel it	21
I am neutral	22
I feel it	17

<b>G - Indignation</b>	
	Marginal Frequency
I do not feel it	48
I am neutral	8
I feel it	4

<b>G - Desire</b>	
	Marginal Frequency
I do not feel it	26
I am neutral	21
I feel it	13

<b>G - Contempt</b>	
	Marginal Frequency
I do not feel it	42
I am neutral	15
I feel it	3

<b>G - Pleasant Surprise</b>	
	Marginal Frequency
I do not feel it	23
I am neutral	24
I feel it	13

<b>G - Boredom</b>	
	Marginal Frequency
I do not feel it	37
I am neutral	13
I feel it	10

<b>G - Fascination</b>	
	Marginal Frequency
I do not feel it	17
I am neutral	26
I feel it	17

<b>G - Unpleasant Surprise</b>	
	Marginal Frequency
I do not feel it	50
I am neutral	7
I feel it	3

<b>G - Amusement</b>	
	Marginal Frequency
I do not feel it	39
I am neutral	17
I feel it	4

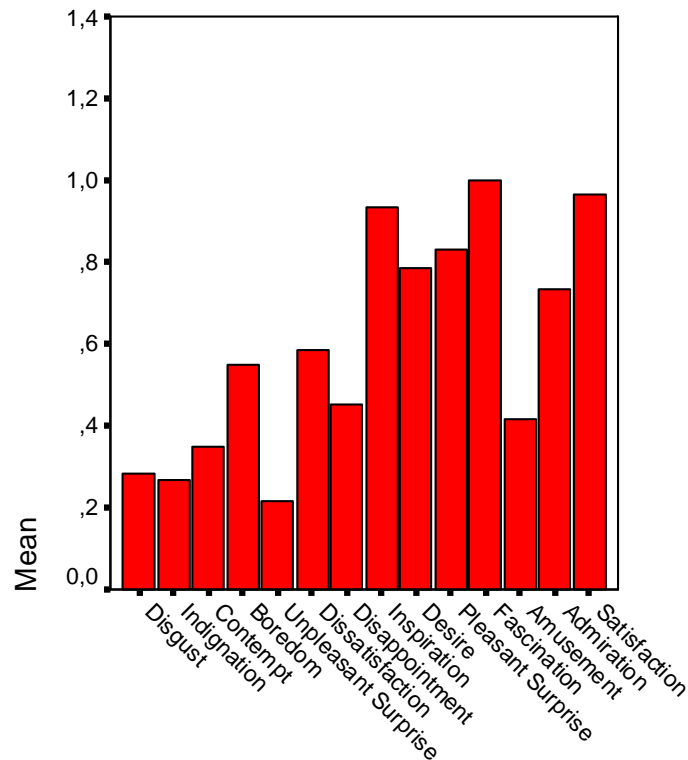
<b>G - Dissatisfaction</b>	
	Marginal Frequency
I do not feel it	35
I am neutral	15
I feel it	10

<b>G - Admiration</b>	
	Marginal Frequency
I do not feel it	24
I am neutral	28
I feel it	8

<b>G - Disappointment</b>	
	Marginal Frequency
I do not feel it	39
I am neutral	15
I feel it	6

<b>G - Satisfaction</b>	
	Marginal Frequency
I do not feel it	21
I am neutral	20
I feel it	19

Figure 4.14 shows the means of 14 emotional responds to Car G. In the figure, it is seen that Car G evoked more positive emotions among participants. The most elicited emotion was *fascination* and the least elicited emotion was *unpleasant surprise*.



**Figure 4.14:** Means of 14 emotional responds to Car G

## 4.2. Descriptive Statistics of Responses According to the Gender Difference

In this section, the differences of the responses of female and male participants to each car model will be shown. Before applying MANOVA analysis, a numerical comparison will be made between the means of responses that were coded as 1, 2 and 3.

### 4.2.1. Emotional Responses to Car A

Car A is a Bugatti Veyron, the concept car of Bugatti. It has an extremely daring silhouette. It is a sports car that is designed to express an extreme powerful appearance.

In Table 4.8 the comparison of means of negative emotional responses to Car A is shown. It is clearly seen that female participants feel more negative emotional responses to Car A than male participants. For example, the mean of contempt of female participants is  $M= 1.73$ , however the mean of contempt of male participants is  $M= 1.46$ . That means female participants feel more contempt than male participants

to Car A. In another example, it is seen that female participants were more dissatisfied ( $M= 1.8$ ) than male participants ( $M= 1.56$ ).

**Table 4.8:** Negative emotional responses to Car A

Gender		A - Disgust	A - Indignation	A - Contempt	A - Boredom	A - Unpleasant Surprise	A - Dissatisfaction	A - Disappointment
female	Mean	<b>1,53</b>	<b>1,3</b>	<b>1,73</b>	<b>1,26</b>	<b>1,56</b>	<b>1,8</b>	<b>1,5</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,81	0,59	0,78	0,58	0,77	0,92	0,77
male	Mean	<b>1,33</b>	<b>1,3</b>	<b>1,46</b>	<b>1,26</b>	<b>1,46</b>	<b>1,56</b>	<b>1,53</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,66	0,7	0,68	0,52	0,77	0,81	0,73
Total	Mean	1,43	1,3	1,6	1,26	1,51	1,68	1,51
	N	60	60	60	60	60	60	60
	Std. Deviation	0,74	0,64	0,74	0,54	0,77	0,87	0,74

In Table 4.9 the comparison of means of positive emotional responses to Car A is shown. It is clearly seen that male participants feel more positive emotional responses than female participants to Car A. For example, male participants feel desire ( $M= 1.73$ ) more than female participants ( $M= 2.13$ ). Also, male participants feel fascination ( $M= 2.1$ ) more than female participants ( $M= 1.86$ ) to Car A.

**Table 4.9:** Positive emotional responses to Car A

Gender		A - Inspiration	A - Desire	A - Pleasant Surprise	A - Fascination	A - Amusement	A - Admiration	A - Satisfaction
female	Mean	<b>1,7</b>	<b>1,73</b>	<b>1,86</b>	<b>1,86</b>	<b>1,2</b>	<b>1,93</b>	<b>1,76</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,79	0,82	0,86	0,81	0,48	0,82	0,77
male	Mean	<b>2,03</b>	<b>2,13</b>	<b>2,13</b>	<b>2,1</b>	<b>1,66</b>	<b>2,3</b>	<b>1,93</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,76	0,89	0,77	0,75	0,8	0,79	0,82
Total	Mean	1,86	1,93	2	1,98	1,43	2,11	1,85
	N	60	60	60	60	60	60	60
	Std. Deviation	0,79	0,88	0,82	0,79	0,69	0,82	0,79

#### 4.2.2. Emotional Responses to Car B

Car B is a Hummer H3, the concept model of Hummer. It has a tough appearance that is called as a “high-tech muscle”.

In Table 4.10 the comparison of means of negative emotional responses to Car B is shown. It is seen that male and female participants gave similar responses to Car B except a few conditions. For example, male participants feel disgust as more as the female participants, or male and female participants feel unpleasantly surprised at

similar levels to Car B. However, it is seen that male participants feel more boredom (M= 2.00) than female participants (M= 1.56), or female participants feel more indignation (M= 1.73) than male participants (M= 1.56).

**Table 4.10:** Negative emotional responses to Car B

Gender		B - Disgust	B - Indignation	B - Contempt	B - Boredom	B - Unpleasant Surprise	B - Dissatisfaction	B - Disappointment
female	Mean	<b>1,6</b>	<b>1,73</b>	<b>1,76</b>	<b>1,56</b>	<b>1,53</b>	<b>2,06</b>	<b>1,86</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,77	0,82	0,89	0,72	0,73	0,86	0,81
male	Mean	<b>1,63</b>	<b>1,56</b>	<b>2,03</b>	<b>2</b>	<b>1,56</b>	<b>2,26</b>	<b>1,76</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,8	0,77	0,76	0,78	0,77	0,82	0,89
Total	Mean	1,61	1,65	1,9	1,78	1,55	2,16	1,81
	N	60	60	60	60	60	60	60
	Std. Deviation	0,78	0,79	0,83	0,78	0,74	0,84	0,85

In Table 4.11 the comparison of means of positive emotional responses to Car B is shown. It is seen that all the means are above 2.00 that means responses to positive emotions about Car B are negative. Male and female participants gave similar responses to positive emotions for Car B. For example, male participants feel inspiration (M= 1.46) as much as female participants (M= 1.56).

**Table 4.11:** Positive emotional responses to Car B

Gender		B - Inspiration	B - Desire	B - Pleasant Surprise	B - Fascination	B - Amusement	B - Admiration	B - Satisfaction
female	Mean	<b>1,56</b>	<b>1,5</b>	<b>1,63</b>	<b>1,63</b>	<b>1,3</b>	<b>1,63</b>	<b>1,46</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,77	0,86	0,85	0,71	0,65	0,8	0,68
male	Mean	<b>1,46</b>	<b>1,4</b>	<b>1,4</b>	<b>1,7</b>	<b>1,46</b>	<b>1,5</b>	<b>1,6</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,68	0,56	0,62	0,74	0,73	0,73	0,81
Total	Mean	1,51	1,45	1,51	1,66	1,38	1,56	1,53
	N	60	60	60	60	60	60	60
	Std. Deviation	0,72	0,72	0,74	0,72	0,69	0,76	0,74

#### 4.2.3. Emotional Responses to Car C

Car C is a Kia Cee'd, a concept model of Kia. It is called “sporty wagon” that is a dressed up version of the five-door hatch. With its tough appearance, it is also designed to combine strongly solid forms and sensitively flowing lines.

In Table 4.12 the comparison of means of negative emotional responses to Car C is shown. It is seen that all responses to negative emotions are above 2.00 that means

participants did not feel extreme negative feelings to Car C. Female and male participants gave similar responses except disappointment. Male participants feel more disappointment ( $M= 1.50$ ) than female participants ( $M= 1.23$ ).

**Table 4.12:** Negative emotional responses to Car C

Gender		C - Disgust	C - Indignation	C - Contempt	C - Boredom	C - Unpleasant Surprise	C - Dissatisfaction	C - Disappointment
female	Mean	<b>1,11</b>	<b>1,11</b>	<b>1,26</b>	<b>1,36</b>	<b>1,23</b>	<b>1,36</b>	<b>1,23</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,3	0,3	0,52	0,66	0,56	0,71	0,5
male	Mean	<b>1,16</b>	<b>1,13</b>	<b>1,26</b>	<b>1,43</b>	<b>1,26</b>	<b>1,43</b>	<b>1,5</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,46	0,34	0,52	0,67	0,58	0,67	0,68
Total	Mean	1,13	1,11	1,26	1,4	1,25	1,4	1,36
	N	60	60	60	60	60	60	60
	Std. Deviation	0,38	0,32	0,51	0,66	0,57	0,69	0,61

In Table 4.13 the comparison of means of positive emotional responses to Car C is shown. It is seen that participants feel positive emotional responses to Car C. Female and male participants gave similar responses except satisfaction. Male participants feel more satisfaction ( $M= 2.23$ ) than female participants ( $M=1.96$ ).

**Table 4.13:** Positive emotional responses to Car C

Gender		C - Inspiration	C - Desire	C - Pleasant Surprise	C - Fascination	C - Amusement	C - Admiration	C - Satisfaction
female	Mean	<b>1,86</b>	<b>1,86</b>	<b>1,86</b>	<b>2,13</b>	<b>1,23</b>	<b>1,93</b>	<b>1,96</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,73	0,77	0,81	0,73	0,5	0,82	0,81
male	Mean	<b>1,9</b>	<b>1,8</b>	<b>1,96</b>	<b>2,1</b>	<b>1,23</b>	<b>1,9</b>	<b>2,23</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,75	0,81	0,81	0,61	0,5	0,8	0,77
Total	Mean	<b>1,88</b>	<b>1,83</b>	<b>1,91</b>	<b>2,11</b>	<b>1,23</b>	<b>1,91</b>	<b>2,1</b>
	N	60	60	60	60	60	60	60
	Std. Deviation	0,73	0,78	0,81	0,66	0,5	0,8	0,79

#### 4.2.4. Emotional Responses to Car D

Car D is a Peugeot 908 RC, a concept model of Peugeot. It is a design that combines dynamic performance, comfort, and luxury. With a low-lying exterior body, Peugeot 908 RC has a stylish, elegant design.

In Table 4.14 the comparison of means of negative emotional responses to Car D is shown. It is seen that female and male participants gave similar responses to Car D.

For example, female and male participants gave the same responds of contempt (M= 1.56).

**Table 4.14:** Negative emotional responses to Car D

Gender		D - Disgust	D - Indignation	D - Contempt	D - Boredom	D - Unpleasant Surprise	D - Dissatisfaction	D - Disappointment
female	Mean	<b>1,2</b>	<b>1,26</b>	<b>1,56</b>	<b>1,36</b>	<b>1,3</b>	<b>1,5</b>	<b>1,43</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,48	0,58	0,72	0,66	0,65	0,73	0,62
male	Mean	<b>1,36</b>	<b>1,3</b>	<b>1,56</b>	<b>1,46</b>	<b>1,5</b>	<b>1,66</b>	<b>1,53</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,66	0,65	0,81	0,68	0,73	0,84	0,77
Total	Mean	1,28	1,28	1,56	1,41	1,4	1,58	1,48
	N	60	60	60	60	60	60	60
	Std. Deviation	0,58	0,61	0,76	0,67	0,69	0,78	0,7

In Table 4.15 the comparison of means of positive emotional responses to Car D is shown. It is seen that male participants gave more positive responds than female participants except fascination. For example, male participants felt more admiration (M= 2.16) than female participants (M= 2.06), or male participants felt more satisfaction (M= 1.93) than female participants (M= 1.86).

**Table 4.15:** Positive emotional responses to Car D

Gender		D - Inspiration	D - Desire	D - Pleasant Surprise	D - Fascination	D - Amusement	D - Admiration	D - Satisfaction
female	Mean	<b>1,9</b>	<b>1,9</b>	<b>1,93</b>	<b>2,16</b>	<b>1,36</b>	<b>2,06</b>	<b>1,86</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,8	0,88	0,82	0,64	0,61	0,94	0,89
male	Mean	<b>2,1</b>	<b>2,03</b>	<b>2</b>	<b>2,03</b>	<b>1,4</b>	<b>2,16</b>	<b>1,93</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,84	0,92	0,78	0,76	0,72	0,83	0,91
Total	Mean	2	1,96	1,96	2,1	1,38	2,11	1,9
	N	60	60	60	60	60	60	60
	Std. Deviation	0,82	0,9	0,8	0,7	0,66	0,88	0,89

#### 4.2.5. Emotional Responses to Car E

Car E is a Pininfarina Nido, concept car of Pininfarina. It is a small two-seated car that is designed in the principle of safety.

In Table 4.16 the comparison of means of negative emotional responses to Car E is shown. It is seen that male participants felt more negative emotional responses than female participants to Car E. For example, male participants felt more boredom and dissatisfaction (M= 1.66) than female participants (M= 1.36).



**Table 4.16: Negative emotional responses to Car E**

Gender		E - Disgust	E - Indignation	E - Contempt	E - Boredom	E - Unpleasant Surprise	E - Dissatisfaction	E - Disappointment
female	Mean	<b>1,23</b>	<b>1,26</b>	<b>1,33</b>	<b>1,36</b>	<b>1,13</b>	<b>1,36</b>	<b>1,4</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,56	0,58	0,61	0,66	0,34	0,66	0,67
male	Mean	<b>1,26</b>	<b>1,3</b>	<b>1,53</b>	<b>1,66</b>	<b>1,1</b>	<b>1,66</b>	<b>1,33</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,52	0,59	0,73	0,75	0,31	0,88	0,61
Total	Mean	1,25	1,28	1,43	1,51	1,11	1,51	1,36
	N	60	60	60	60	60	60	60
	Std. Deviation	0,54	0,58	0,67	0,72	0,32	0,79	0,63

In Table 4.17 the comparison of means of positive emotional responses to Car E is shown. As above, it is seen that female participants felt more positive emotional responses. For example, female participants felt more pleasant surprise (M= 2.1) than male participants (M= 1.76), or female participants felt more inspiration (M= 2.03) than male participants (M= 1.80).

**Table 4.17: Positive emotional responses to Car E**

Gender		E - Inspiration	E - Desire	E - Pleasant Surprise	E - Fascination	E - Amusement	E - Admiration	E - Satisfaction
female	Mean	<b>2,03</b>	<b>1,86</b>	<b>2,1</b>	<b>2,4</b>	<b>1,86</b>	<b>1,86</b>	<b>2,2</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,71	0,86	0,84	0,77	0,77	0,77	0,76
male	Mean	<b>1,8</b>	<b>1,43</b>	<b>1,76</b>	<b>2,1</b>	<b>1,56</b>	<b>1,36</b>	<b>1,8</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,81	0,62	0,77	0,75	0,81	0,49	0,76
Total	Mean	1,91	1,65	1,93	2,25	1,71	1,61	2
	N	60	60	60	60	60	60	60
	Std. Deviation	0,76	0,77	0,82	0,77	0,81	0,69	0,78

#### 4.2.6. Emotional Responses to Car F

Car F is a Renault Koleos, concept car of Renault. It is a four-wheel drive, sporty vehicle that has dynamic lines.

In Table 4.18 the comparison of means of negative emotional responses to Car F is shown. It is seen that male participants felt more negative emotional responses than female participants to Car F, except boredom. For example, male participants felt

disappointment (M= 1.46) more than female participants (M= 1.23), but female participants felt boredom (M= 1.56) more than male participants (M= 1.40).

**Table 4.18:** Negative emotional responses to Car F

Gender		F Disgust	- F Indignation	- F Contempt	- F Boredom	- F - Unpleasant Surprise	F Dissatisfaction	- F Disappointment
female	Mean	<b>1,06</b>	<b>1,13</b>	<b>1,43</b>	<b>1,56</b>	<b>1</b>	<b>1,36</b>	<b>1,23</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,25	0,34	0,56	0,77	0	0,61	0,51
male	Mean	<b>1,16</b>	<b>1,2</b>	<b>1,63</b>	<b>1,4</b>	<b>1,13</b>	<b>1,6</b>	<b>1,46</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,53	0,55	0,76	0,72	0,43	0,81	0,68
Total	Mean	1,11	1,16	1,53	1,48	1,06	1,48	1,35
	N	60	60	60	60	60	60	60
	Std. Deviation	0,41	0,45	0,67	0,74	0,31	0,72	0,61

In Table 4.19 the comparison of means of positive emotional responses to Car F is shown. On the contrary of the above table, here it is seen that male participants felt more positive emotional responses than female participants to Car F, except admiration. For example, male participants felt inspiration (M= 1.80) more than female participants (M= 1.56).

**Table 4.19:** Positive emotional responses to Car F

Gender		F Inspiration	- F Desire	- F - Pleasant Surprise	F Fascination	- F Amusement	- F Admiration	- F Satisfaction
female	Mean	<b>1,56</b>	<b>1,66</b>	<b>1,56</b>	<b>2</b>	<b>1,13</b>	<b>1,8</b>	<b>1,93</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,72	0,75	0,77	0,69	0,34	0,81	0,78
male	Mean	<b>1,8</b>	<b>1,73</b>	<b>1,73</b>	<b>2,2</b>	<b>1,43</b>	<b>1,63</b>	<b>2,1</b>
	N	30	30	30	30	30	30	30
	Std. Deviation	0,76	0,86	0,73	0,76	0,67	0,71	0,75
Total	Mean	1,68	1,7	1,65	2,1	1,28	1,71	2,01
	N	60	60	60	60	60	60	60
	Std. Deviation	0,74	0,81	0,75	0,72	0,55	0,76	0,77

#### 4.2.7. Emotional Responses to Car G

Car G is a Volkswagen Iroc, concept model of Volkswagen. It is a stylistic sports car design that has four-seats.

In Table 4.20 the comparison of means of negative emotional responses to Car G is shown. It is seen that the responses of female and male participants varies in terms of each emotion. Male participants felt more contempt, boredom, dissatisfaction and

disappointment than female participants, but also male participants felt less disgust, indignation and unpleasant surprise than female participants.

**Table 4.20:** Negative emotional responses to Car G

Gender		G - Disgust	G - Indignation	G - Contempt	G - Boredom	G - Unpleasant Surprise	G - Dissatisfaction	G - Disappointment
female	Mean	<b>1,33</b>	<b>1,33</b>	<b>1,16</b>	<b>1,53</b>	<b>1,3</b>	<b>1,53</b>	<b>1,36</b>
	N	30	30	30	30	30	30	30
	Std.							
	Deviation	0,6	0,66	0,37	0,77	0,65	0,81	0,66
male	Mean	<b>1,23</b>	<b>1,2</b>	<b>1,53</b>	<b>1,56</b>	<b>1,13</b>	<b>1,63</b>	<b>1,53</b>
	N	30	30	30	30	30	30	30
	Std.							
	Deviation	0,5	0,48	0,68	0,77	0,34	0,71	0,68
Total	Mean	1,28	1,26	1,35	1,55	1,21	1,58	1,45
	N	60	60	60	60	60	60	60
	Std.							
	Deviation	0,55	0,57	0,57	0,76	0,52	0,76	0,67

In Table 4.21 the comparison of means of positive emotional responses to Car G is shown. It is seen that male participants felt more inspiration, desire, pleasant surprise, fascination and admiration than female participants, but also male participants felt less amusement and satisfaction than female participants.

**Table 4.21:** Positive emotional responses to Car G

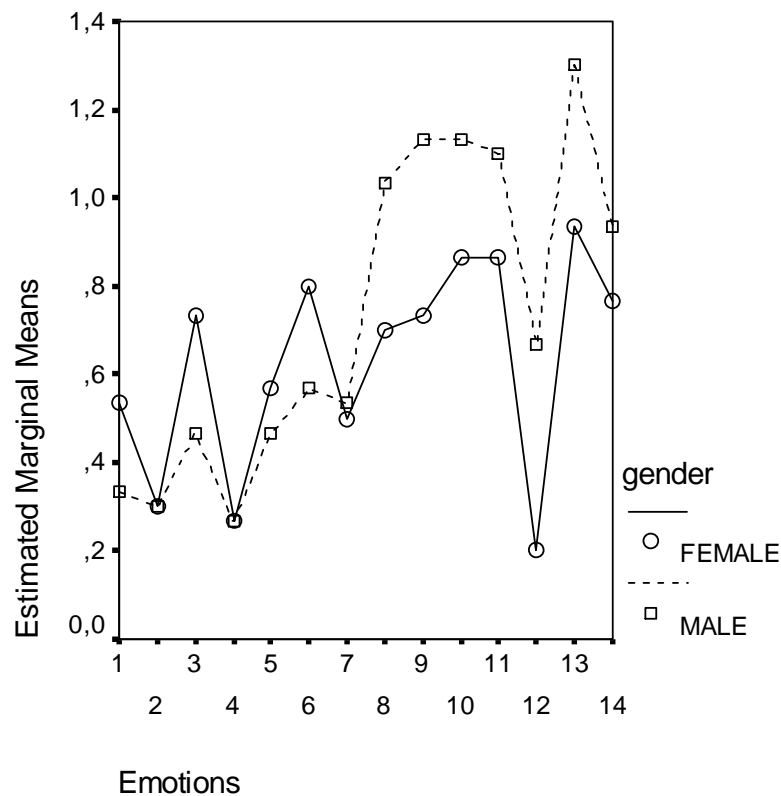
Gender		G - Inspiration	G - Desire	G - Pleasant Surprise	G - Fascination	G - Amusement	G - Admiration	G - Satisfaction
female	Mean	<b>1,93</b>	<b>1,76</b>	<b>1,76</b>	<b>1,96</b>	<b>1,46</b>	<b>1,6</b>	<b>2,03</b>
	N	30	30	30	30	30	30	30
	Std.							
	Deviation	0,78	0,85	0,77	0,76	0,62	0,67	0,8
male	Mean	<b>1,93</b>	<b>1,8</b>	<b>1,9</b>	<b>2,03</b>	<b>1,36</b>	<b>1,86</b>	<b>1,9</b>
	N	30	30	30	30	30	30	30
	Std.							
	Deviation	0,82	0,71	0,75	0,76	0,61	0,68	0,84
Total	Mean	1,93	1,78	1,83	2	1,41	1,73	1,96
	N	60	60	60	60	60	60	60
	Std.							
	Deviation	0,79	0,78	0,76	0,75	0,61	0,68	0,82

### 4.3. Comparison across Genders

In this section, following the descriptive analysis, the effect of gender on the emotional responses will be explored and the differences between male and female participants' responses on 7 car models will be analyzed. To conduct such an analysis, MANOVA was applied for each car models (seven levels), with gender (two levels) as between-participant factor, and the emotion (14 levels) as dependent variable.

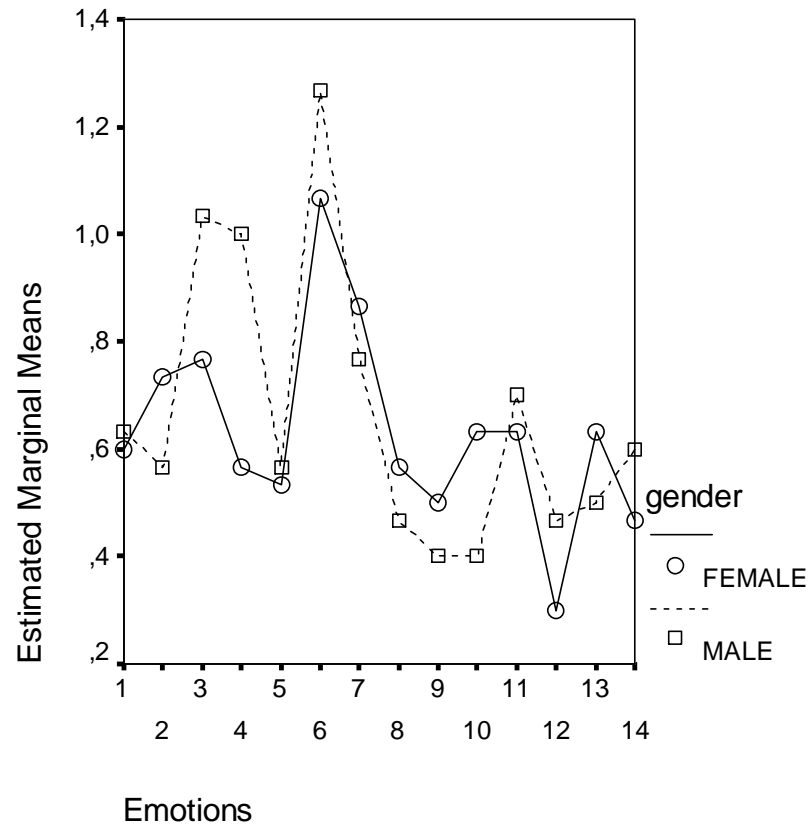
MANOVA was run seven times for each car, to find out significant differences between two gender groups on each emotion type. See Appendix E for Tests of Between-Subjects Effects Tables for each car.

According to the results, significant difference was found between genders on the *amusement* emotion for Car A. Figure 4.15 provides the plot of means across gender and emotions towards Car A. The 12<sup>th</sup> emotion is *amusement* that is the only emotion showing significant difference on gender toward Car A. It can be translated as male participants feel more amusement than female participants towards Car A.



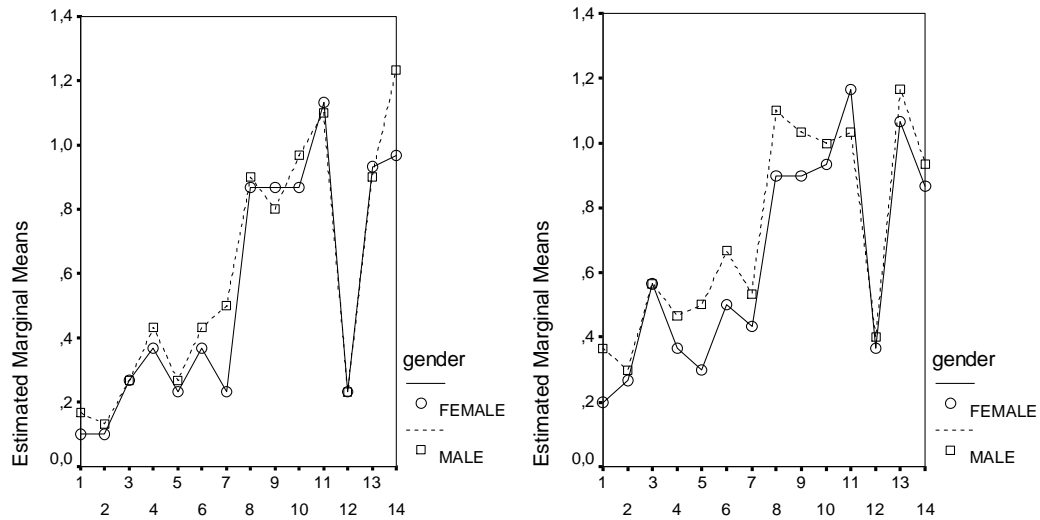
**Figure 4.15:** Plot of means of the gender groups on emotions to Car A

Towards Car B, the emotion *boredom* is found to be significantly difference between gender groups. Figure 4.16 provides the plot of means across gender and emotions towards Car B. The 4<sup>th</sup> emotion is boredom and the significant difference can be followed on the plot. It can be translated as male participants feel more boredom than female participants towards Car B.



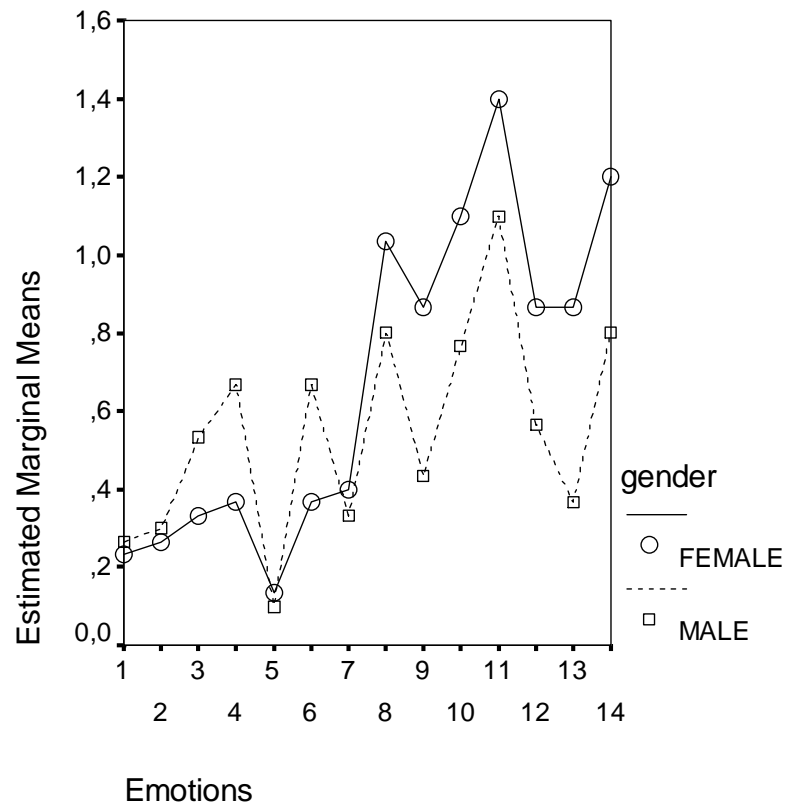
**Figure 4.16:** Plot of means of the gender groups on emotions to Car B

Towards Car C and Car D, no significant difference was found between genders on the emotions. Figure 4.17 provides the plot of means across gender and emotions towards Car C.



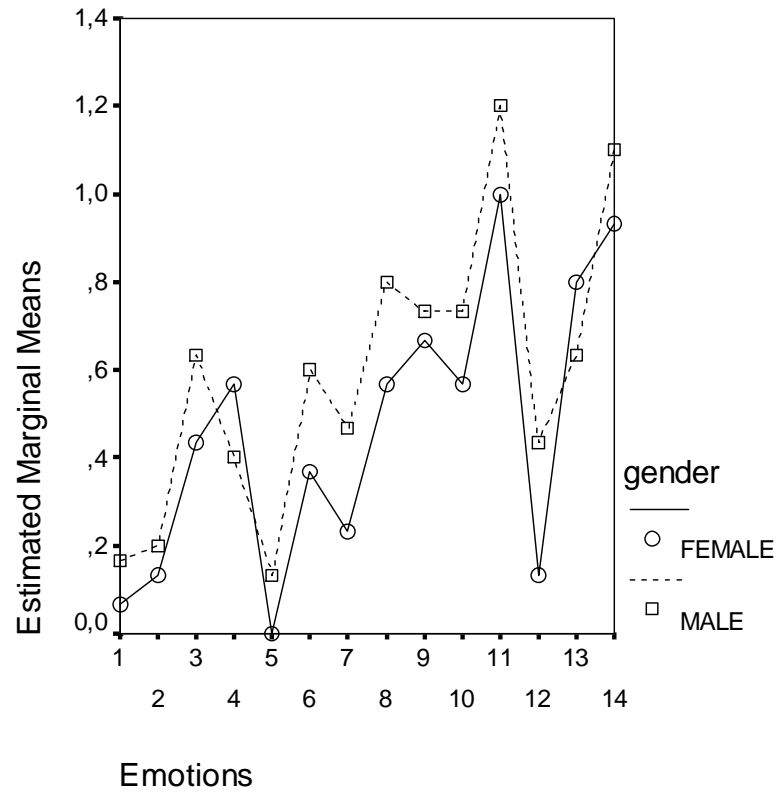
**Figure 4.17:** Plot of means of the gender groups on emotions to Car C and Car D

Towards Car E, significant difference was found between genders on the *desire*, *admiration* and *satisfaction* emotions for Car E. Figure 4.18 provides the plot of means across gender and emotions towards Car E. The 9<sup>th</sup> emotion *desire*, 13<sup>th</sup> emotion *admiration* and 14<sup>th</sup> emotion *satisfaction* show significant difference on gender toward Car E. It can be translated as female participants feel more desire, admiration and satisfaction than male participants towards Car E.



**Figure 4.18:** Plot of means of the gender groups on emotions to Car E

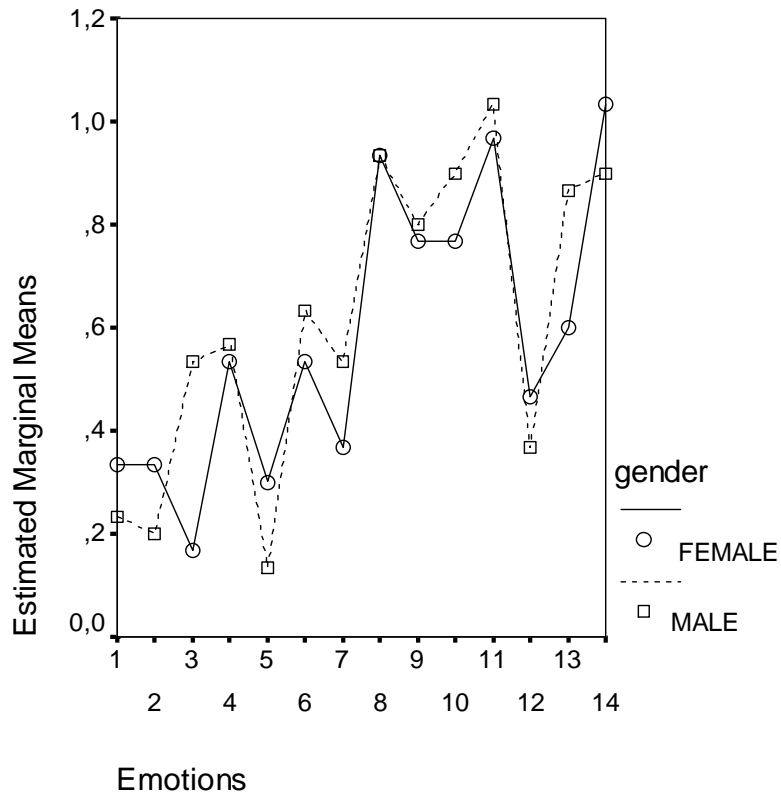
Towards Car F, the emotion *amusement* is found to be significantly difference between gender groups. Figure 4.19 provides the plot of means across gender and emotions towards Car F. The 12<sup>th</sup> emotion is amusement and the significant difference can be followed on the plot. It can be translated as male participants feel more amusement than female participants towards Car F.



**Figure 4.19:** Plot of means of the gender groups on emotions to Car F

Towards Car G, significant difference was found between genders on the *contempt* emotion. Figure 4.20 provides the plot of means across gender and emotions towards Car G. The 19<sup>th</sup> emotion *desire*, 3<sup>rd</sup> emotion *contempt* shows significant difference on gender toward Car G. It can be translated as male participants feel more contempt than female participants towards Car G.





**Figure 4.20:** Plot of means of the gender groups on emotions to Car G

As it is summarized in the plots, the means of gender groups' emotional responses to seven car models differ significantly in a few emotions. While comparison of the means of emotional responses to Car C and Car D do not differ, especially Car E differs on gender significantly on three emotions. It shows female respondents express to Car E more pleasant emotions such as desire, admiration and satisfaction than male respondents.

## 5. DISCUSSION AND CONCLUSION

This study aimed to investigate emotional responses to conceptual car designs and determine differences across gender groups. In the research, the latest version of Product Emotion Measurement Instrument (PrEmo 7.0) was used for the research to communicate emotional responses of the users. The research assistants (N= 60) at Faculty of Architecture, Istanbul Technical University participated in this research. The study was applied to 30 male and 30 female research assistants between 23-42 years old.

What are the characteristics that make one product more pleasurable than another? In this study relationships were found between emotions evoked by car design and genders. According to the findings of the research, Car C (Kia Ceed) was the product that evokes the most pleasant emotions, and Car B (Hummer H3) got the lowest mark in the descriptive statistics. However, Car E (Pininfarina Nido) differed on gender significantly on three emotions: *desire*, *admiration* and *satisfaction*. For instance, for Car C (Kia Ceed )and Car D (Peugeot 908 RC ) no significant gender differences were found with respect to the emotions it elicited. Pininfarina Nido is a small two-seated car that is designed in the principle of safety. According to the comparison across genders, female participants feel more positive emotions to Car E than male participants. As Car E is a small, compact city car design, it can be stated that women feel more pleasurable feelings to small car designs.

There are several reasons of using PrEmo in this study. First of all, it is a non-verbal measurement instrument, but also it uses self-report technique. This means, it aims to communicate users' emotional data without using a word. A non-verbal research method can be used in multi-cultural context, and also participants do not hesitate to express themselves in a non-verbal method, as translating emotions in a verbal way can be difficult. Also, one of the benefits of the PrEmo is that it can measure mixed emotions besides basic emotions. Participants reported that interface of the software is user-friendly and enjoyable to use, as there are animation characters that portray dynamic facial, bodily, and vocal expressions of each emotion. However,

participants held the questionnaire seven times to vote each car one by one. Thus, some of the participants reported that it took so much time and effort to complete the task. Another feedback from the participants was about the similarity of emotional expressions of animation characters, especially positive emotions. Participants reported that they could hardly find difference between positive emotions. This problem is needed to be reexamined if PrEmo is suitable to apply in Turkey context.

In the current study, PrEmo is used as the instrument. Although PrEmo has several benefits, it has limitations. PrEmo measures the emotions towards static product design; the user-product interaction is ignored. However, Desmet (2003) states that the emotions measured by PrEmo do not represent emotions that are experienced towards dynamic human product interaction. Although the first impression is very important on purchase decisions, a new instrument can be developed to elicit the emotional data of the user during the user-product interaction. However, the data collected by PrEmo can be used to guide designers in the development of new products.

The purpose of this study was to listen to the voice of the emotional responses of the users towards a group of product. In the literature, the most similar studies to the current study are Desmet, Hekkert and Jacobs's study (2000); Desmet's study (2003) in a multi-cultural context; and Desmet, Hekkert and Hillen's study (2003) that examines values and emotions. However, this research was conducted with 60 Turkish participants (30 male, 30 female) in Istanbul and investigated the significant difference of emotional responses between gender differences. At the same time, this study can be called as a replication of Desmet's studies on PrEmo, but in a different context. Desmet's study (2003) was conducted among four different countries (Japan, United States, Finland, and The Netherlands) to prove the PrEmo is a multi-cultural instrument. In the second step, a between culture study was conducted between groups from Japan and the Netherlands with the stimulus of six car models (Audi A2, Mazda Demio, Toyota bB, Fiat Multipla, Opel Zafira, and Toyota Funcargo). As a result, it was seen that Japanese reported higher ratings on pleasant emotions than the Dutch to each car, especially admiration, satisfaction and fascination were found to be the most expressed emotions by Japanese. In Desmet, Hekkert and Hillen's study (2003), 40 participants are asked to report their emotional responses to six car models. According to the results of the value test that was held

between the participants, two value-groups were formed: ambitious and lighthearted. In this study, Volkswagen Beetle and Alfa 147 were the products that evoke the most pleasant emotions. Besides value groups showed an effect on six (i.e. contempt, dissatisfaction, boredom, admiration, satisfaction, and fascination) of the 14 measured emotions. For the remaining eight emotions, no significant effect was found. In the following paragraphs, the findings of the current study will be discussed in regard to the analyses conducted and the related literature.

McDonagh and Weightman state (2003) different people relate the same product in their own way depending the product's characteristics and their own. In addition, they also add that some products may have gender-specific characteristics such as feminine or masculine that connects with target user group. According to a study they conducted, it was found that purchasers of kettles tend to be female; the purchasers of televisions tend to be male, whilst cars are purchased and used by both genders. However, they add that males make their own decisions about cars for themselves whilst females are more influenced by male advisors or had been involved in joint decisions (Ibid, 2003). From another point of view, Croson and Gneezy (2004) state that the cause of gender differences may be ingrained or taught and he adds that the researcher are tend to find significant differences on gender because in the literature on gender differences are more likely to publish papers that find a gender difference than paper that do not. To define the reason of difference between genders, the difference between emotional expressions should be considered. Conservative perception suggests that women are more "emotional" than men. According to the studies of Kring and Gordon (1998), women are more expressive than men; however, women do not report experiencing more emotion than men. Men and women differ in their skin conductance reactivity, but this difference does not mean women are more emotional than men.

People interact with different objects and environment during life-time; also people feel and express emotions toward the objects around. There are various types of emotions that people experience, but the emotions that are expressed to a product are called product emotions (Desmet, 2002). People feel and express emotions to product through different concerns and purposes, for example instrumental product emotions such as satisfaction / dissatisfaction, fulfillment / disappointment; aesthetic product emotions such as Feeling attracted, desiring or disgusting; social product emotions

such as indignation or contempt; surprise product emotions such as pleasantly or unpleasantly surprise; and interest product emotions such as fascination, boredom, and inspiration (Desmet, 2002). Also, products evoke emotions by three main ways: as objects, as agents and as events (Desmet and Hekkert, 2002). In this research, the target group of product was selected as conceptual cars. Because, cars evoke strong emotions in appearance (Desmet, Hekkert and Jacobs, 2000) and according to McDonagh and Weightman's (2003) study car is a product that is purchased and used by both genders. In the pilot study, seven similar car models were used as stimuli, however when the same stimuli was applied with PrEmo, participants reported that they were too similar to recognize and each participant's votes to each car did not differentiate. Also, participants reported that they were familiar with these car models in daily life and had difficulty in being objective. Then, it was decided to use conceptual car models as stimuli. These cars were the conceptual models of their brands and were not a piece of daily life. In addition, different styles were selected for differentiation, such as sports cars, jeeps, or small city cars. Thus, it could be possible for participants to express different product emotions to each model.

The current study also has several limitations. The study was conducted on the research assistants from Istanbul Technical University, Faculty of Architecture, and the results are only generalizable to the population of the research assistants of Faculty of Architecture, ITU. The study should be replicated with different populations in order to ensure the consistency of the findings. Another limitation of the study is that the surveys are only valid for the time they are implemented. Replication at a different time with the same population is also needed.

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## **APPENDIX A**

### **The car images used in the prototype study**



**Figure A.1: VW Polo**



**Figure A.2: Citroën C3**





**Figure A.3:** Fiat Punto



**Figure A.4:** Ford Fiesta



**Figure A.5:** Honda Jazz



**Figure A.6:** Hyundai Getz



**Figure A.7:** Toyota Yaris

## APPENDIX B

### The questionnaire form used in the pilot study

*Değerli katılımcı,*

*İstanbul Teknik Üniversitesi Endüstri Ürünleri Tasarımı Bölümü'nde yüksek lisans yapmaktayım. Ürünlere karşı hissedilen olumlu ve olumsuz heyecanların (duyguların) ürün seçimindeki etkisini araştıran bir tez hazırlıyorum. Hazırlanan ankette belirteceğiniz görüşleriniz bu araştırmayla doğrudan ilgilidir.*

*Bu ankette yer alacak görüşleriniz ve kişisel bilgileriniz kesinlikle gizli kalacak ve sadece bu araştırma kapsamında kullanılacaktır.*

*Yardımlarınız için teşekkür ederim.*

*Ezgi ERDOĞAN YILMAZ  
İstanbul Teknik Üniversitesi  
Endüstri Ürünleri Tasarımı Bölümü*

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<b>Eğitim durumu:</b>	İlk	Orta	Lise	Üniversite	Y. Lisans	Doktora
	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Cinsiyet:**.....

**Yaş:**.....

**Meslek:**.....

**Otomobil sahibi misiniz?**

Evet

Hayır

<input type="text"/>	<input type="text"/>
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**Ehliyetiniz var mı?**

Evet

Hayır

<input type="text"/>	<input type="text"/>
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## ÜRÜN NO:1

### 1. Bu ürün bende hoş bir sürpriz hissi uyandırdı.

Kesinlikle katılmıyorum		Kararsızım		Kesinlikle katılıyorum
1	2	3	4	5

### 2. Bu, benim için ilham verici bir ürün.

Kesinlikle katılmıyorum		Kararsızım		Kesinlikle katılıyorum
1	2	3	4	5

### 3. Bu ürünü eğlenceli buldum.

Kesinlikle katılmıyorum		Kararsızım		Kesinlikle katılıyorum
1	2	3	4	5

### 4. Bu ürüne hayran oldum.

Kesinlikle katılmıyorum		Kararsızım		Kesinlikle katılıyorum
1	2	3	4	5

### 5. Bu ürün beni çok etkiledi.

Kesinlikle katılmıyorum		Kararsızım		Kesinlikle katılıyorum
1	2	3	4	5

### 6. Bu ürünü tatmin edici buldum.

Kesinlikle katılmıyorum		Kararsızım		Kesinlikle katılıyorum
1	2	3	4	5

**7. Bu ürünü bayağı buldum.**

Kesinlikle  
katılmıyorum

Kararsızım

Kesinlikle  
katılıyorum

1	2	3	4	5
---	---	---	---	---

**8. Bu ürünü iğrenç buldum.**

Kesinlikle  
katılmıyorum

Kararsızım

Kesinlikle  
katılıyorum

1	2	3	4	5
---	---	---	---	---

**9. Bu ürün beni hayal kırıklığına uğrattı.**

Kesinlikle  
katılmıyorum

Kararsızım

Kesinlikle  
katılıyorum

1	2	3	4	5
---	---	---	---	---

**10. Bu ürün beni tatmin etmedi.**

Kesinlikle  
katılmıyorum

Kararsızım

Kesinlikle  
katılıyorum

1	2	3	4	5
---	---	---	---	---

**11. Bu ürünü sıkıcı buldum.**

Kesinlikle  
katılmıyorum

Kararsızım

Kesinlikle  
katılıyorum

1	2	3	4	5
---	---	---	---	---

**12. Bu ürün beni sınırlendirdi.**

Kesinlikle  
katılmıyorum

Kararsızım

Kesinlikle  
katılıyorum

1	2	3	4	5
---	---	---	---	---

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**Education Level:**   Primary   Secondary   High   University   Graduate   PhD  
                                  School   School   School   Degree   Degree   Degree

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**Gender:**.....

**Age:**.....

**Occupation:**.....

**Do you have a car?**

Yes

No

--	--

**Do you have a driving license?**

Yes

No

--	--

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## PRODUCT NO:1

**1. I feel pleasantly surprised when I see this product.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**2. This product makes me feel inspiration.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**3. This product is amusing.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**4. I feel admiration when I see this product.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**5. I feel fascination when I see this product.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**6. This product gives me satisfaction.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**7. This product makes me feel contempt.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**8. This product is disgusting.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**9. I feel disappointment when I see this product.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**10. This product gives me dissatisfaction.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---



**11. I feel boredom when I see this product.**

Strongly  
Disagree

Neutral

Strongly  
Agree

1	2	3	4	5
---	---	---	---	---

**12. This product makes me feel indignation.**

Strongly  
Disagree

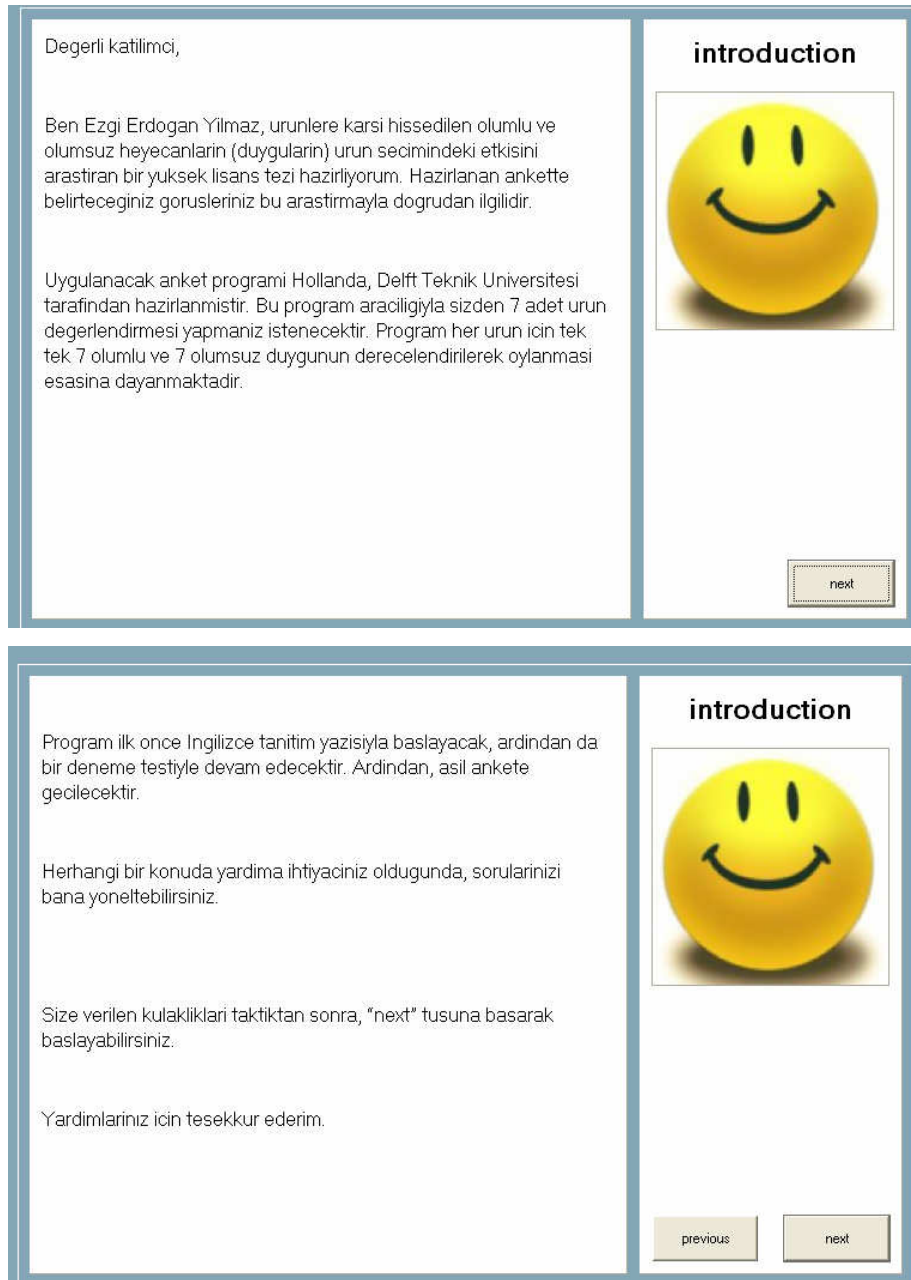
Neutral

Strongly  
Agree

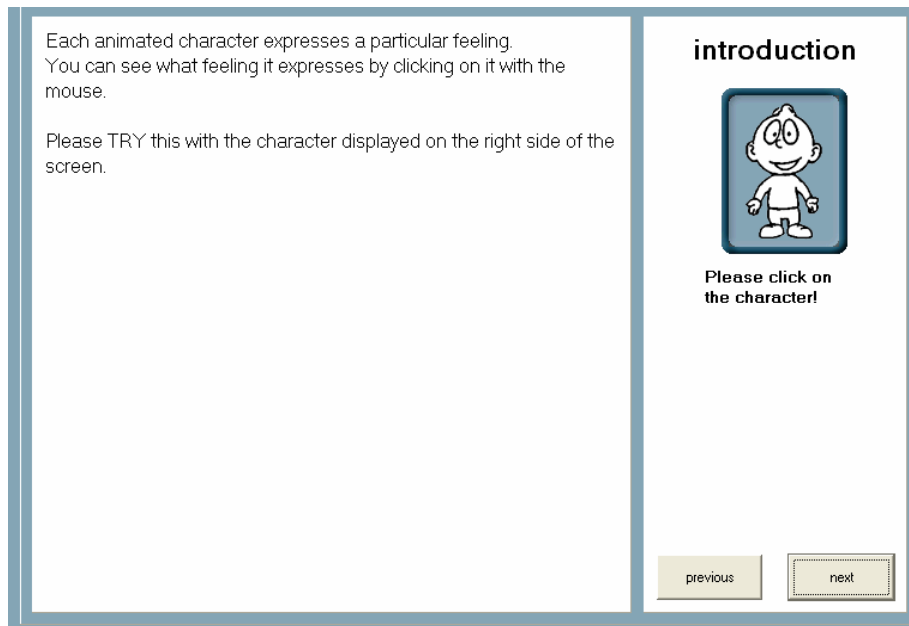
1	2	3	4	5
---	---	---	---	---

## APPENDIX C

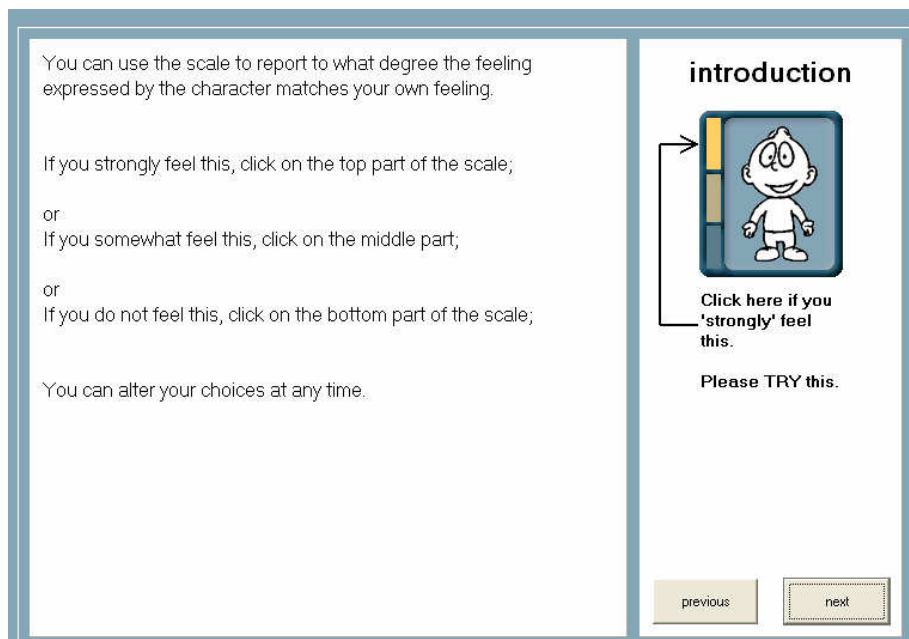
### The screen shots of the software



**Figure C.1:** The introduction given to the participants



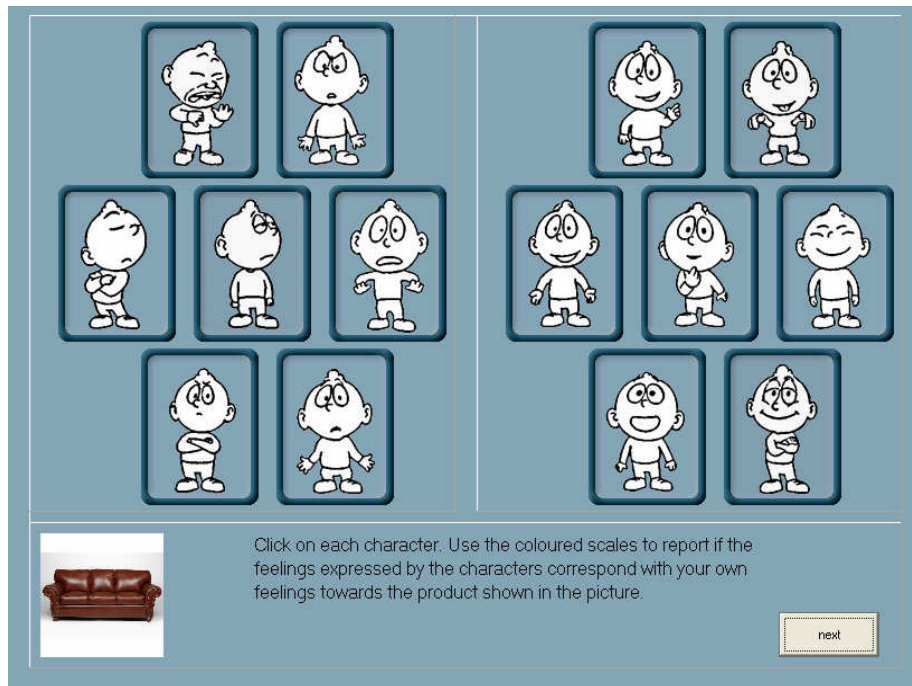
**Figure C.2:** The explanation that guides how to use the software



**Figure C.3:** The guide that shows how to rate each emotion



**Figure C.4:** The exercise part before starting the experiment to guide the respondents how to use the software



**Figure C.5:** The measurement interface that shows each emotion grouped in negative and positive for the exercise product

## APPENDIX D

### The car images used in the research



**Figure D.1:** Bugatti Veyron (Car A)



**Figure D.2:** Hummer H3 (Car B)



**Figure D.3:** Kia Ceed (Car C)



**Figure D.4:** Peugeot 908 RC (Car D)





**Figure D.5:** Pininfarina Nido (Car E)



**Figure D.6:** Renault Koleos (Car F)



**Figure D.7:** VW Iroc (Car G)



## APPENDIX E

### Tests of Between-Subjects Effects

**Table E.1: Car A**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
GENDER	Disgust	,600	1	,600	1,083	,302
	Indignation	,000	1	,000	,000	1,000
	Contempt	1,067	1	1,067	1,974	,165
	Boredom	,000	1	,000	,000	1,000
	Unpleasant Surprise	,150	1	,150	,250	,619
	Dissatisfaction	,817	1	,817	1,072	,305
	Disappointment	,017	1	,017	,029	,865
	Inspiration	1,667	1	1,667	2,741	,103
	Desire	2,400	1	2,400	3,212	,078
	Pleasant Surprise	1,067	1	1,067	1,589	,213
	Fascination	,817	1	,817	1,310	,257
	Amusement	3,267	1	3,267	7,440	<b>,008</b>
	Admiration	2,017	1	2,017	3,065	,085
	Satisfaction	,417	1	,417	,649	,424

**Table E.2: Car B**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
GENDER	Disgust	,017	1	,017	,027	,871
	Indignation	,417	1	,417	,649	,424
	Contempt	1,067	1	1,067	1,534	,221
	Boredom	2,817	1	2,817	4,896	<b>,031</b>
	Unpleasant Surprise	,017	1	,017	,029	,864
	Dissatisfaction	,600	1	,600	,834	,365
	Disappointment	,150	1	,150	,203	,654
	Inspiration	,150	1	,150	,282	,597
	Desire	,150	1	,150	,283	,597
	Pleasant Surprise	,817	1	,817	1,473	,230
	Fascination	,067	1	,067	,124	,726
	Amusement	,417	1	,417	,870	,355
	Admiration	,267	1	,267	,449	,506
	Satisfaction	,267	1	,267	,473	,494

**Table E.3: Car C**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
GENDER	Disgust	,067	1	,067	,436	,512
	Indignation	,017	1	,017	,157	,694
	Contempt	,000	1	,000	,000	1,000
	Boredom	,067	1	,067	,147	,703
	Unpleasant Surprise	,017	1	,017	,050	,823
	Dissatisfaction	,067	1	,067	,136	,713
	Disappointment	1,067	1	1,067	2,965	,090
	Inspiration	,017	1	,017	,030	,863
	Desire	,067	1	,067	,107	,745
	Pleasant Surprise	,150	1	,150	,226	,636
	Fascination	,017	1	,017	,037	,848
	Amusement	,000	1	,000	,000	1,000
	Admiration	,017	1	,017	,025	,875
	Satisfaction	1,067	1	1,067	1,703	,197

**Table E.4: Car D**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
GENDER	Disgust	,417	1	,417	1,223	,273
	Indignation	,017	1	,017	,044	,835
	Contempt	,000	1	,000	,000	1,000
	Boredom	,150	1	,150	,329	,568
	Unpleasant Surprise	,600	1	,600	1,252	,268
	Dissatisfaction	,417	1	,417	,668	,417
	Disappointment	,150	1	,150	,302	,585
	Inspiration	,600	1	,600	,883	,351
	Desire	,267	1	,267	,324	,571
	Pleasant Surprise	,067	1	,067	,102	,750
	Fascination	,267	1	,267	,531	,469
	Amusement	,017	1	,017	,037	,848
	Admiration	,150	1	,150	,189	,665
	Satisfaction	,067	1	,067	,082	,776

**Table E.5: Car E**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
GENDER	Disgust	,017	1	,017	,056	,814
	Indignation	,017	1	,017	,048	,827
	Contempt	,600	1	,600	1,332	,253
	Boredom	1,350	1	1,350	2,642	,109
	Unpleasant Surprise	,017	1	,017	,157	,694
	Dissatisfaction	1,350	1	1,350	2,197	,144
	Disappointment	,067	1	,067	,162	,689
	Inspiration	,817	1	,817	1,403	,241
	Desire	2,817	1	2,817	4,976	<b>,030</b>
	Pleasant Surprise	1,667	1	1,667	2,539	,116
	Fascination	1,350	1	1,350	2,310	,134
	Amusement	1,350	1	1,350	2,126	,150
	Admiration	3,750	1	3,750	8,902	<b>,004</b>
	Satisfaction	2,400	1	2,400	4,143	<b>,046</b>

**Table E.6: Car F**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
GENDER	Disgust	,150	1	,150	,867	,356
	Indignation	,067	1	,067	,315	,577
	Contempt	,600	1	,600	1,322	,255
	Boredom	,417	1	,417	,742	,393
	Unpleasant Surprise	,267	1	,267	2,829	,098
	Dissatisfaction	,817	1	,817	1,570	,215
	Disappointment	,817	1	,817	2,274	,137
	Inspiration	,817	1	,817	1,473	,230
	Desire	,067	1	,067	,100	,753
	Pleasant Surprise	,417	1	,417	,727	,397
	Fascination	,600	1	,600	1,130	,292
	Amusement	1,350	1	1,350	4,651	<b>,035</b>
	Admiration	,417	1	,417	,716	,401
	Satisfaction	,417	1	,417	,699	,407

**Table E.7: Car G**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
GENDER	Disgust	,150	1	,150	,482	,490
	Indignation	,267	1	,267	,795	,376
	Contempt	2,017	1	2,017	6,633	<b>,013</b>
	Boredom	,017	1	,017	,028	,868
	Unpleasant Surprise	,417	1	,417	1,533	,221
	Dissatisfaction	,150	1	,150	,253	,617
	Disappointment	,417	1	,417	,914	,343
	Inspiration	,000	1	,000	,000	1,000
	Desire	,017	1	,017	,027	,871
	Pleasant Surprise	,267	1	,267	,454	,503
	Fascination	,067	1	,067	,114	,737
	Amusement	,150	1	,150	,388	,536
	Admiration	1,067	1	1,067	2,320	,133
	Satisfaction	,267	1	,267	,390	,535

## **CURRICULUM VITAE**

Ezgi Erdoğan Yılmaz was born in Bursa in 1982. She received her B.Sc. degree in Department of Industrial Design, İstanbul Technical University in 2004 with Honours Second Degree. She has worked as an industrial designer in an office furniture company from June, 2004 to October, 2006. She got married in September, 2005.

She is also a scuba diver. She got PADI Advanced Open Water Diver Certificate in July, 2005 and PADI Deep Diver in December, 2005. Her particular interests are trekking, playing tennis, percussions and collecting 3D animation movies.