

PLEASANTNESS AND AROUSAL IN TWENTY-FIVE POSITIVE EMOTIONS ELICITED BY DURABLE PRODUCTS

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ABSTRACT

This study reports quantitative research into two basic dimensions of emotions: pleasantness and arousal. Fifty-nine participants evaluated these two dimensions for a set of twenty-five positive emotions in relation to human-product interactions. Three levels of arousal were identified: 'exciting', 'median' and 'calm'. Nine emotions were found to be exciting, namely energetic, euphoria, amusement, desire, joy, love, inspiration, lust and surprise. Ten emotions were found to be median in arousal, namely fascination, satisfaction, confidence, pride, anticipation, enchantment, courage, hope, worship and admiration. Six emotions were found to be calm, namely relaxation, relief, kindness, dreaminess, respect and sympathy. Three levels of pleasantness were also identified: 'very pleasant', 'mildly pleasant' and 'pleasant'. Six emotions were found to be very pleasant, namely amusement, joy, satisfaction, inspiration, euphoria and love. Thirteen emotions were found to be mildly pleasant, namely relief, relaxation, kindness, dreaminess, confidence, fascination, pride, enchantment, anticipation, energetic, desire, lust and surprise. Finally six emotions were found to be pleasant, namely respect, sympathy, admiration, courage, hope and worship. The results of this study can guide designers to define the emotional tone of the user experience that they are aiming for.

KEYWORDS: *design for emotions, pleasantness, arousal, positive emotions, user experience.*

INTRODUCTION

In the field of psychology scholars tend to agree that emotions involve various dimensions or modalities (Scherer, 2005; Frijda, 1986; Russell, 2003; Roseman and Smith, 2001). Expression, bodily arousal and subjective experience are examples of these (Scherer, 2005). In particular, two dimensions that have captured scholars' attention are pleasantness and arousal. Pleasantness characterises the hedonic valence of an emotion and arousal its bodily symptoms. Thus, emotions are pleasant or unpleasant as well as calm or exciting. Based on the idea that all affective states arise from these two dimensions, Russell (2003) captured these affective states through the concept of *core affect*, which has also been used to explain user experience (Desmet and Hekkert, 2007). Pleasure and arousal have also led to the development of tools to measure human emotions, which have been adopted in general affective research (Lang, 1980) as well as in user experience research (Isbister, et al., 2007; Vastenburg et al., 2011; Laurans

et al., 2012; Desmet, 2002). For example, the self-assessment manikin, known as the SAM method, is a tool based on a series of human cartoons that are used to measure, among others, pleasantness and arousal (Lang, 1980). It is important to consider pleasantness and arousal in emotional design because emotions can lead to different behavioural consequences (Frijda, 1986; Laros et al., 2005) and these dimensions are descriptive of the associated behavioural states. Designers, for instance, can reflect on whether a product or service should be designed to elicit feelings of relaxation or inspiration. Both relaxed and inspired people may feel good during human-product interaction. However, the behavioural reactions involved are different, as relaxed people become inactive and withdrawn (state of low arousal), while inspired people become more active (state of high arousal) and are stimulated to create something out of their inspiration (Desmet, 2012; Ortiz Nicolás, 2014). Research has shown that design decisions can be taken to stimulate one of these states. For example, it has been documented that arousal can be increased in stores if they are designed using warm colours (Kueller and Mikkelsen

lides, 1993) and fast tempo music (Holbrook and Gardner, 1993). In the field of product design the use of colour and the type of interaction can be linked to decisions that enhance a low or high arousal experience. Arousal is also relevant because intense (i.e. high arousal) emotions were perceived by a group of designers to be more difficult to design for (Ortíz Nicolás, et al., 2013). Pleasantness is also influential for user experience because all experiences have some kind of feeling-tone that may be classified as pleasant, unpleasant, or neutral, a response that is regulated by human emotions (Varela et al., 1991). Thus, emotions colour experience (McCarthy and Wright, 2004) and the hue depends on the involved pleasantness and arousal.

Pleasure is an element that in recent years has received significant attention in research into user experience (e.g. Jordan, 2000). Pleasure is generally considered to be the most abstract and superordinate dimension of an emotional experience (Laros et al., 2005). Research into consumer behaviour has shown the benefits of studying pleasure at a subordinate level based on basic (Laros et al., 2005) and complex (Richins, 1997) emotions. The results of this research indicate that a focus on basic emotions has greater explanatory power than an emphasis on the superordinate dimension, i.e. pleasure (Laros et al., 2005). Following a similar line of thought, scholars in the field of user experience have reported that pleasure is an umbrella term and as a result is too general to understand or to design for (Desmet, 2012). To overcome this limitation the term has been deconstructed. Research has, in fact, identified a set of twenty-five positive emotions that are relevant for product design and pleasant experiences (Desmet, 2012). This work has constituted an important step towards a better understanding of pleasure in user experience. However, it does not provide a detailed analysis of the emotions in terms of arousal and pleasantness.

Building on the view that pleasantness and arousal are two basic dimensions of emotions that have not been studied in depth in previous research, the aim of this study is to investigate the nuances of pleasantness and arousal in twenty-five positive emotions experienced in response to durable products. There is a need to develop knowledge relevant to the field of product design because emotional experiences in human-product interactions are different from those gained in human-human interactions (McCarthy and Wright, 2004). For example, the joy of solving a task cannot be assumed to be the same as the joy of requited love and the frustration caused by an unresponsive partner is not the same as the frustration caused by an unresponsive computer (McCarthy and Wright, 2004). The latter indicates that pleasure and arousal vary in human-product interactions.

PRODUCTS AND EMOTIONS

It is well established that products elicit emotional responses (Frijda, 1986; Desmet, 2002; Norman 2004). However, some emotions are experienced more often than others in human-product interaction. To identify those emotions, Desmet

(2002) assembled a list of positive and negative emotions on the basis of studies carried out in the field of psychology. Using questionnaire research, he determined which of these emotions are most frequently triggered by products. A challenge of this approach, however, is that it relies on the participants' ability to recall previous experiences. To overcome this issue, Desmet used collages showing products from different categories to stimulate participants' recall regarding emotional experiences. A similar study involving the employment of collages and a list of emotions was carried out by Ortíz Nicolás and Hernández López (2008) to identify product-relevant emotions in a new cultural context. More recently, Desmet (2012) reported the use of six collages to identify positive emotions evoked by products. In this study, however, Desmet indicated that the collages were used to give participants an idea of the possibilities that they might consider instead of serving merely as a recall tool. In conclusion, all these studies started with pre-defined lists of emotions, which were presented to users through questionnaires, and all employed collages to stimulate their recall.

UNDERSTANDING TWO DIMENSIONS OF TWENTY FIVE POSITIVE EMOTIONS

This section presents the process followed to carry out this study, including the research approach, participants, materials and procedure.

Research approach

As discussed above, previous studies have investigated user emotions using questionnaires and collages. Building on this work, this research relies on the use of a questionnaire to identify the pleasantness and arousal of an emotion set. The main difference between this research and previous work is that it aims to investigate nuances of pleasantness and arousal in twenty-five positive emotions when experienced in response to durable products, rather than their relevance to product design, which has already been identified in (Desmet, 2012; Ortíz Nicolás and Hernández López, 2008; Desmet, 2002).

Research in the field of psychology has traditionally used bipolar dimensions to examine both pleasantness and arousal (Russell, 2003; Scherer, 2005). For example, it has employed a bipolar descriptor for pleasantness such as pleasant-unpleasant (Scherer, 2005). This study, instead, because of its focus on positive emotions, has employed a monopolar descriptor for pleasantness such as pleasant-very pleasant. For arousal, in contrast, it has relied on a traditional bipolar descriptor such as calm-excited because this dimension does not have a negative connotation.

Respondents

Fifty-nine respondents participated to the study (37 males and 22 females). The number of respondents was determined by

referring to figures used in previous comparable studies (see Desmet, 2002; Ortíz Nicolás and Hernández López, 2008) and the requirement to compute a statistical analysis. The respondents were of various nationalities, French and British being the two commonest. Participants had no relation to the fields of product or industrial design. Most were students enrolled at Imperial College London. Forty-five were undergraduate students, seven were postgraduates and the remaining seven were professionals. Participants were aged between 19 and 39 (mean = 23.73; SD = 5.47). Eleven were native English speakers and the others had a good command of the language.

Material

The material used in the study included a questionnaire, a set of instructions, and five collages.

A two-part questionnaire was developed. In the first part participants answered demographic questions, about age, gender, and background. In the second part, participants rated twenty-five positive emotions in relation to pleasantness (from '1 = pleasant' to '5 = very pleasant') and arousal (from '1 = calm' to '9 = excited'). The emotions used in this research are: admiration, amusement, anticipation, confidence, courage, desire, dreaminess, enchanted, energetic, euphoria, fascination, hope, inspiration, joy, kindness, love, lust, pride, relaxed, relief, respect, satisfaction, surprise, sympathy, and worship. These emotions were identified by Desmet (2012) based on their relevance to human-product interactions. Three versions of the questionnaire were generated with the emotions appearing in randomised order.

Written instructions were developed to clarify the concepts of pleasantness and arousal for participants, which were presented to them on sheets of A4 paper. The complete instructions can be found in Ortíz Nicolás (2014). Five collages depicting a large variety of daily used products were employed. These were borrowed from a previous study (Desmet, 2012). The collages were printed out in high quality colour on A3 paper, see Figure 1.

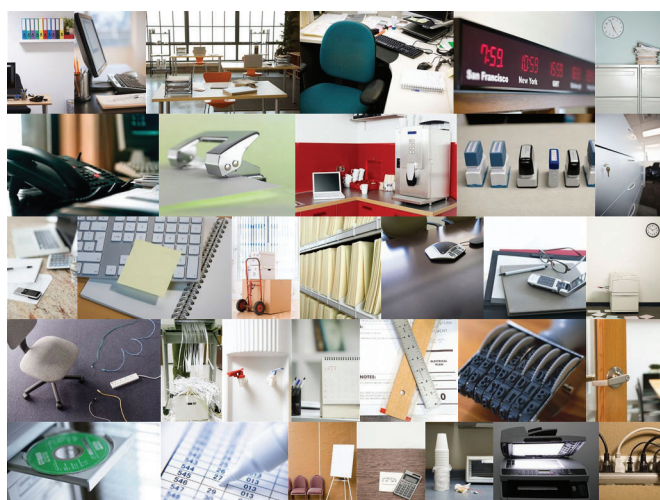


Figure 1. An example of one of the collages that was used to stimulate participants' recall

Procedure

First, participants were informed that the focus of the study was on positive emotions and durable products, which were defined for them as manufactured items that are expected to have a relatively long useful life, e.g. a bike, a kettle or a digital camera. Second, participants received five collages intended to stimulate their memory; they were allowed to look at them for approximately 30 seconds each. A similar time was used in previous studies. Third, participants received written instructions on how to fill in the questionnaire, in which the concepts of pleasantness and arousal were explained. Respondents were also informed that they could cross out the emotions that they felt were not provoked by durable products. Participants took an average of 15 minutes to complete the questionnaire. The procedure was carried out individually in a quiet room.

EMOTION NAME	N	Pleasant		Arousal		NPE: Exclusion
		Mean	SD	Mean	SD	
Joy	59	4.56	0.73	6.47	1.58	0
Love	52	4.42	0.82	6.35	1.93	6
Satisfaction	59	4.27	0.98	5.02	2.20	0
Amusement	59	4.19	0.90	6.85	1.46	0
Euphoria	58	4.19	1.08	7.31	1.89	1
Inspiration	59	4.15	0.94	6.29	1.97	0
Energetic	58	3.97	1.23	7.69	1.50	1
Confidence	59	3.97	1.00	4.98	2.00	0
Desire	59	3.86	1.01	7.00	1.58	0
Fascination	58	3.79	0.87	5.69	1.88	1
Relaxation	59	3.66	1.29	2.68	2.10	0
Relief	59	3.73	1.19	3.63	2.02	0
Lust	50	3.58	1.20	7.04	1.97	9
Kindness	53	3.57	1.14	3.87	1.90	6
Pride	59	3.42	1.13	5.02	2.19	0
Enchantment	58	3.31	1.33	4.95	2.40	1
dreaminess	59	3.24	1.28	3.10	2.47	0
Surprise	58	3.19	1.25	6.28	1.99	1
Anticipation	59	3.12	1.27	6.02	2.04	0
Courage	58	2.93	1.30	5.66	2.28	0
Admiration	59	2.90	1.12	4.36	1.94	1
Hope	59	2.78	1.35	4.95	1.92	0
Worship	44	2.76	1.38	4.64	2.53	15
Respect	53	2.64	1.39	3.15	1.89	6
Sympathy	48	2.63	1.38	3.08	2.07	11

Table 1. Pleasantness and arousal of emotions (No: Number of responses; M: mean; SD: standard deviation; NPE: Number of participants who excluded the emotion)

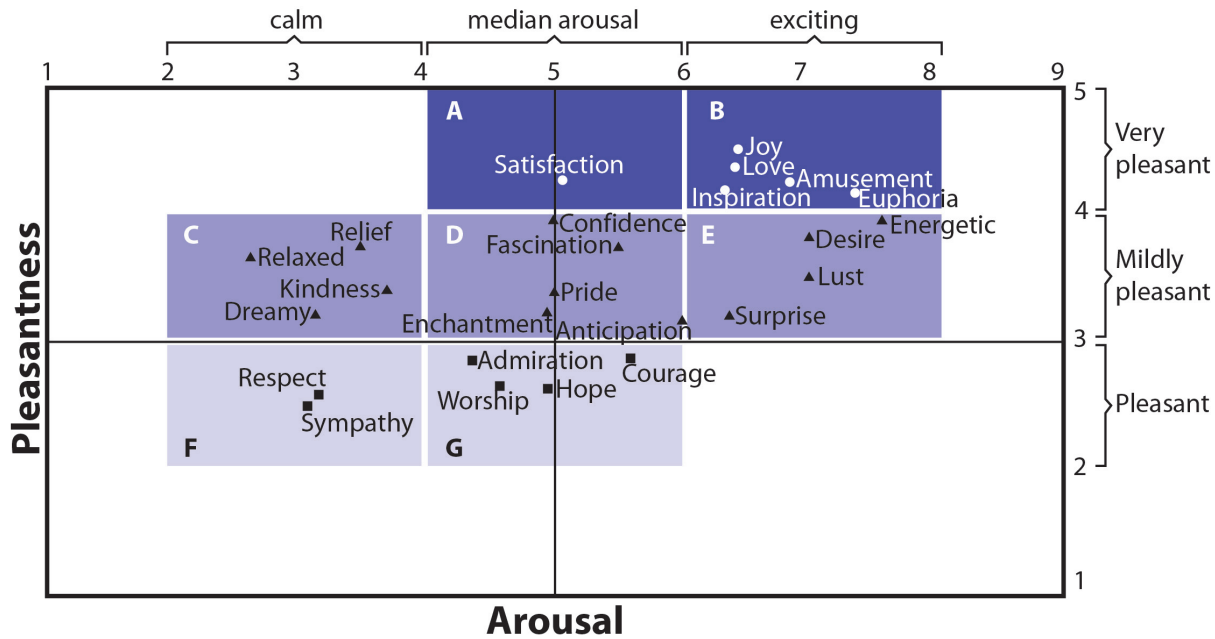


Figure 2. Pleasantness and arousal of the emotions

Results

This section first presents the results for pleasantness and arousal of emotions and second the emotions that participants indicated as not being provoked by durable products. The pleasantness and arousal of the emotions are displayed in Table 1.

To further explore these differences, emotions were plotted on a two-dimensional diagram (Figure 2) with pleasantness as the vertical and arousal as the horizontal axis. For ease of interpretation, seven 'positive emotion domains' are visualised in the graphical plot with three levels of arousal: calm, median, and exciting (from 1 to 9) and three levels of pleasantness: pleasant, mildly pleasant and very pleasant (from 1 to 5). These levels combine to create nine positive emotion domains, which are each briefly described below.

Domain A: Median arousal - very pleasant emotions

One emotion was found to be more or less exciting and very pleasant, namely satisfaction.

Domain B: Exciting - very pleasant emotions

Five emotions were found to be exciting and very pleasant, namely joy, love, amusement, inspiration, and euphoria.

Domain C: calm - mildly pleasant emotions

Four emotions were found to be calm and mildly pleasant, namely relief, relaxed, kindness, and dreamy.

Domain D: Median arousal - mildly pleasant emotions

Five emotions were found to be median in arousal and mildly pleasant, namely confidence, fascination, pride, enchantment and anticipation.

Domain E: Exciting - mildly pleasant emotions

Four emotions were found to be exciting and mildly pleasant, namely energetic, desire, lust and surprise.

Domain F: calm - pleasant emotions

Two emotions were found to be calm and pleasant, namely respect and sympathy.

Domain G: Median arousal - pleasant emotions

Finally, four emotions were found to be median arousal and pleasant, namely admiration, courage, hope and worship.

As can be seen in Figure 2, the additional two domains "excited - pleasant" and "calm and very pleasant" do not contain emotions.

The last aspect to report is that nineteen participants (32% of the total) removed at least one emotion, indicating that they did not experience certain emotions in relation to durable products. The emotions that were most frequently crossed out were as follows: worship (25%), sympathy (19%), lust (15%), love (12%), kindness (10%) and respect (10%).

DISCUSSION

The aim of this study was to investigate the pleasantness and arousal of twenty-five positive emotions. As indicated in the introduction, pleasure is the most abstract and superordinate dimension of emotions (Laros et al., 2005); and it is also an umbrella term that is too general and difficult to design for (Desmet, 2012). The results of this study show that emotions elicited in human-product interactions are pleasant, mildly pleasant and very pleasant, a finding that calls for further research in order to deconstruct the term pleasure (Laros et al., 2005; Desmet, 2012). In addition, it was possible to identify that with respect to arousal, emotions are exciting, median and calm. Figure 2 introduced seven positive emotion domains. It is interesting to note that the domains "excited and pleasant" and "calm and very pleasant" do not contain

emotions. These domains are at the opposite extremes of the three levels of pleasantness or arousal. This indicates that, in general, calm positive emotions may not be perceived as the most pleasant positive emotions and, likewise, that moderately pleasant emotions may not be perceived as the most exciting. It is important to consider, however, that the domains in Figure 2 do not represent fixed classes of emotion because they were defined by the authors.

Pleasantness

Differences in pleasure in user experience are to some extent implied in previous research into user experience, e.g. in terms of the sources that stimulate pleasure, i.e. physical, psychological, ideological and social (Jordan, 2000), and specific product attributes that enhance pleasure (Burns and Evans 2000; Porter et al., 2008). It is possible that the emotions experienced during pleasant experiences will enable scholars to develop a detailed account of those differences. The latter is suggested because it is well-established that there are differences in the experience of positive emotions (Scherer, 2005; Frijda, 1986; Russell, 2003; Roseman and Smith, 2001). For example, the emotion joy creates the urge to play and be playful, encompassing not only physical and social play, but also intellectual and artistic play (Fredrickson, 1998). The latter behavioural reactions can hardly be associated with satisfaction, which is frequently experienced with products when they work well (Desmet, 2012; Ortiz Nicolás et al., 2013). The results of this study indicate that satisfaction is a very pleasant emotion. The experience of satisfaction, as very pleasant, explains to some extent the findings of Burns and Evans (2000), who reported that when executed well the basic functionality of a product is a source of pleasure. This pleasure, however, may never be able to put a smile on the face of the user, as argued by Hassenzahl (2010). This is because research on emotions indicates that satisfaction cannot stimulate a behavioural reaction such as smiling. Putting a smile on the user's face may be achieved by focusing on other factors such as user aspirations, self-image, values and needs (Jordan, 2000). It may also be achieved by focusing on emotions such as joy or amusement, which might stimulate a behavioural reaction such as a smile. It may, therefore, be concluded that the pleasure gain from a product design based on satisfaction is different from a design based on joy.

Research in user experience has also suggested different types of experiences (e.g. Hassenzahl et al., 2010; Ortiz Nicolas et al., 2013a). For example, two types of pleasant experiences identified as a result of interacting with great products are significant and pragmatic. The latter is based on excellent instrumental performance and the former on the significant role that the product has in users' lives (Ortiz Nicolas et al., 2013a). Interestingly, the emotions involved in each of these two experiences vary. In the pragmatic experience the most frequently felt emotions were satisfaction, relaxation and amusement; for the significant experience, by contrast, the most frequently felt emotions were joy, satisfaction, relaxation, confidence,

inspiration and pride (Ortiz Nicolas et al., 2013a). These findings are in line with the idea that focusing on emotions has greater explanatory power than the superordinate dimension, i.e. pleasure (Laros et al., 2006; Desmet, 2012).

Other aspects that may explain the differences between emotions in terms of pleasure are reported next. It has been identified that some emotions, such as joy or pride, stimulate well-being (Ellsworth and Smith, 1988; Fredrickson, 2003). The agency of pleasure may also explain the differences between the pleasantness of emotions, i.e. those assigned to the self may be more pleasant than those triggered by external agents. For instance, confidence may be more pleasant than respect because when experiencing it the person feels that he or she is in control. This indicates that solutions that shift from products to people seem to be experienced more pleasantly.

Arousal

A fundamental difference between emotions resides in the way in which they are felt, i.e. exciting, median arousal, and calm (Russell, 2003; Scherer, 2005; Varela et al., 1991). For instance, exciting emotions are clearly distinctive because high arousal makes people notice them. The results of this study show that the set of twenty-five positive emotions includes fewer calm emotions than exciting and median arousal. This may be explained by taking into account the findings of research on emotions, which have suggested that there are more negative basic emotions than positive ones (see a comparison of views in Ortony and Turner, 1990) and that basic emotions tend to be exciting, e.g. anger, fear, anxiety, joy, and happiness. The latter finding may indicate that human beings have developed a richer language to describe exciting states in comparison to calm states. It would be interesting to study calm experiences provoked by products in detail, in order to identify if there is a similar richness of experienced emotions as in exciting experiences. It is also expected that exciting experiences caused by interaction with products should elicit specific emotions, i.e. high in arousal.

Design implications

Previous research into arousal has identified specific attributes that designers should implement in the design of products if arousal is to be stimulated, i.e. warm colours (Kueller and Mikkellides, 1993). The results of this study offer designers the option of focusing on emotions that are high or low in arousal when they are attempting to design an exciting or calm experience. This broadens design opportunities, because emotions are elicited by at least the following aspects: product, interaction, the meaning of the product, activity, the self, and others (Desmet, 2012). Designers could, for instance, focus on particular activities that enhance relaxation instead of just focusing on specific colours.

Research in the field of consumer behaviour has also shown that designers should consider the manipulation of arousal in stores based on consumer motivations. When consumers

are motivated by recreation, high arousal has a positive effect on pleasantness. However, when consumers have a task-oriented motivation, high arousal decreases pleasantness (Kaltcheva et al., 2006). As was identified in this study the most pleasant emotions involve median and high arousal. This may not always be desirable, as previous research has identified. For instance, an excited experience is not appropriate for all product categories, e.g., to provide an obvious example, calm experiences may fit better in hospitals and exciting ones in amusement parks. Designers could use the results of this study to reflect on the level of arousal and pleasantness that the project at hand deserves. Based on this reflection designers could select the most appropriate emotions, which may directly impact on decisions concerning the configuration of the product. In conclusion, a fundamental issue that this study stimulates is the importance of seeking out and defining the appropriate emotional tone required of the design. Designers can consider occasions when moderately pleasant feelings are more appropriate than very pleasant feelings. The issues that will define which experience to design for, and how to determine a fitting target experience, remain to be investigated.

The results of this study build on a predefined set of twenty-five positive emotions (Desmet, 2012). Other characteristics of the set have also been investigated and can be found in Ortíz Nicolás et al., (2013) and Yoon et al., (2013). The overall aim of investigating positive emotions is to develop a robust source of knowledge that designers can rely upon. This study adds to that source of knowledge.

Limitations and future research

Even though this study used collages to diminish the biases of recalling emotions it is acknowledged that responding to a collage is not the same as interacting with actual products. Future research could reduce recall bias by using a set of products that users can actually see and interact with. Previous work has suggested that defining a product sample to study emotions is an alternative way to reduce recall bias (e.g. Hassenzahl, 2004; Ortíz Nicolás, and Hernández López, 2008; Ortíz Nicolás, 2014). It is important to report that studying pleasantness and arousal is not sufficient to capture further differences among the emotions studied (see also Ekman, 1999). A line of research suggested by this study is to explore whether a calm experience is less pleasant than an exciting one, as the findings of this study suggest. Finally, further research is required in order to understand the reasons why some participants in this research reported worship, sympathy, lust, love, kindness and respect as emotions that were not experienced in their interactions with products.

CONCLUSIONS

This study has presented empirical research that investigated a set of twenty-five positive emotions according to two dimensions i.e. pleasantness and arousal. For these positive emo-

tions, three basic levels of pleasantness were identified, namely *pleasant*, *mildly pleasant* and *very pleasant*, as well as three basic levels of arousal, namely *exciting*, *median* and *calm*.

This research builds upon previous work, which identified a set of twenty-five positive emotions that represent the repertoire of positive emotions that people may experience in human-product interaction. The contribution of this particular study concerns the investigation of two dimensions of emotions. At this stage, the knowledge developed through the study may be used by designers to inform the selection of some emotions over others, when aiming to control the level of pleasantness and arousal of an experience in the specific context of a design brief. It may also be used to choose emotions when developing tools to measure emotions elicited by products and to organise emotions based on arousal and pleasantness.

The methodological approach used in this study was useful to examine the pleasantness and arousal of twenty-five positive emotions. Based on the results we conclude that a pleasant-very pleasant and an exciting-calm scale capture basic differences between emotions. To gain deeper knowledge of the subtleties and nuances of the emotions, qualitative research methods may be an alternative. Investigating other qualities and dimensions of emotions, such as behavioural reactions and agency, is important to create more detailed profiles.

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