

Values and emotions; an empirical investigation in the relationship between emotional responses to products and human values

**Pieter Desmet, Paul Hekkert and
Merijn Hillen**

Abstract

This paper explores the relationship between product design and emotional responses. Although emotions evoked by products are idiosyncratic (i.e. different people can have different feelings towards the same product), universal patterns can be identified in the underlying process of how these emotions are evoked. In psychology, the functionalist approach towards emotions offers theoretical foundations that can be used to explain how products evoke emotions and why different designs will result in different responses (e.g., fascination, desire, disgust, indignation, surprise, boredom, amusement, etcetera). In this approach, emotional responses are regarded as the outcome of an appraisal process in which the product is linked to underlying human concerns. If a product is appraised to collide with a concern it will evoke an unpleasant emotion, whereas it will evoke a pleasant emotion when appraised to correspond with the concern. The paper reports an empirical study that was designed to investigate the relationship between such human concerns and emotions evoked by six car designs. In this study, a new non-verbal self-report instrument was used to measure a set of 14 emotions. Each emotion in this set is portrayed by an animated cartoon character by means of dynamic facial, bodily, and vocal expression, and presented on a computer interface. Participants reported their responses by selecting those animations that corresponded with their felt emotion(s). It was found that people with different values experienced different emotions towards the car models. For example, respondents who score high on the values "to be independent," and "to be stress-free" are significantly more disgusted by the Volkswagen new Beetle than those that score high on the value "have an own identity," and "seek challenges." Rather than disgust, this latter group feels fascination towards the Beetle. In the discussion section, the implications of this research for design practice and design research are discussed.

INTRODUCTION

In recent years, the design community has discovered a new focus point: emotion or experience. Major corporations (e.g. Nokia, Philips, Nike) claim to have adopted an emotional design strategy for their product development, and design research has accepted this new interest for the experiential or emotional consequences of product use with open arms, leading to an increasing amount of publications and specialised conferences (e.g. Green & Jordan, 2002; McDonagh et al., 2003). Even Donald Norman, the founding father of usable and understandable design, has now started to stand up for the role of emotion in design (Norman, 2002). As a result, it seems no longer sufficient for a product to function properly, to be usable and efficient, or to have an aesthetic appeal. People are emotional beings and products can address our emotions in multiple ways. We can be inspired

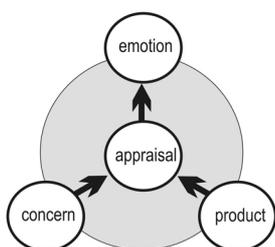
by the shape of a new car, frustrated by the malfunctioning of our computer, or proud of owning a fancy pair of glasses that provides us with status. In all our encounters with the artificial world, emotions pop up and they strongly contribute to our perception, preferences, and our general well-being.

But how much control do designers have over these apparently intangible human responses? Can we indeed design for a particular emotion or experience? Too often experience design ends up in a superficial application of styling aspects or cosmetic interventions. And in the field of human factors, this approach is restricted to a generalised attempt to make products pleasurable or enjoyable. Recently, some studies have been reported to take a more systematic and profound approach and this has resulted in product designs that address our emotions at a number of levels (e.g. Desmet & Dijkhuis, 2003; Hekkert et al., 2003).

Despite these promising endeavours, our emotional responses seem difficult to predict and it is easy to see that people can respond in a variety of ways to the same design. For emotion-driven design to become a mature design strategy, we need to understand why, when, and how products evoke particular emotions. The recently developed model of product emotions paves the way for such an understanding (Desmet & Hekkert, 2002; Desmet, 2002). This model, as described in the next section, explains the underlying process responsible for our emotional reaction to a particular design. A key variable within this model is the concern people have when confronted with a product. It predicts that differences in people's responses could be traced back to differences in the concerns people hold. In this paper, we empirically test this prediction by exploring the relationship between one type of concern, i.e. values, and our emotional responses to various car models. The key question therefore is, can we explain the variation in emotional reactions to these designs by the values people subscribe to.

THE BASIS OF PRODUCT EMOTIONS

People differ with respect to their emotional responses towards a given product. One person, for example, may be inspired by the Volkswagen New Beetle, whereas the same car model may disappoint another person. These differences have also been found in empirical studies (see e.g. Desmet, 2003). More interesting than to know *which* particular emotions are evoked by a product, is to understand *why* it evokes these particular emotions. This information can support the designer in his or her attempts to shape the emotional impact of the design. Understanding emotional responses to products requires theoretical propositions about how these emotional responses are related to the product's appearance and the characteristics of the person who experiences the emotions. This seems difficult, if not impossible, because of the above exemplified idiosyncratic and personal nature of emotions. Nevertheless, in spite of these interpersonal differences, the process of emotions, that is, the way in which emotions are evoked, is universal. In psychology, the cognitive, functionalist position on emotions posits that all emotions serve an *adaptive* function. In this view, emotions are instrumental because they establish our position in relation to our environment, pulling us toward certain people, objects, actions and ideas, and pushing us away from others (Frijda, 1986). Desmet (2002) used this view to draw up a general model of 'product emotions' that sets forth three main parameters: (1) appraisal, (2) concern, and (3) stimulus. These three parameters and their interplay determine if a product elicits an emotion, and if so, which particular emotion is evoked (see Figure 1).



An emotion always involves an assessment of how an object may harm or benefit a person (Arnold, 1960). According to Arnold (1960, p. 175) an appraisal, "the direct, immediate sense judgement of weal or woe," is at the heart of every emotion. The appraisal psychologists consider emotions to be the mechanism that

Figure 1 (the basic model of product emotions (source: Desmet, 2002).

signals when events are favourable or harmful to one's concerns. This implies that every emotion hides a concern, a more or less stable preference for certain states of the world (Frijda, 1986). According to Frijda, concerns can be regarded as the points of reference in the appraisal process. A product will only evoke an emotion if it either matches or mismatches a concern. Why do I feel attracted to an umbrella? Because I have a concern for staying dry. And why am I frustrated when my computer repeatedly crashes? Because I have a concern for efficiency.

The model of product emotions illustrates that there is no one-to-one relationship between the design of a product and the emotion it elicits. An emotion is not evoked by the product as such, but by the appraised significance of this product for our concerns. As a consequence, emotions can only be understood in relation to the person who is experiencing them. Designers, therefore, can only predict or manipulate the emotional impact of their designs when they are aware of the concerns of the particular person for whom they design these products.

MEASURING CONCERNS

In view of the model described above, it can be postulated that one can explain (or predict) emotions if one has insight in the underlying concerns that are relevant for a particular product. Therefore, a logical step in the research to product emotions is to investigate the possibility of measuring concerns. The difficulty in understanding underlying concerns is that the number and the variety of human concerns is endless. Various typologies of concerns have been developed in the fields of organizational behaviour (e.g. Maslow, 1943), personality psychology (e.g. Murray, 1938), social psychology (e.g. Rokeach, 1973), and consumer behaviour (e.g. Hanna, 1980). Although researchers developing these typologies differ to a large degree in the terminology they use (i.e. needs, goals, commitments, drives, motives, or values), they share an interest in universal human 'desired end states.' Schwartz (1992) for example, developed an often-cited typology that includes 10 distinct value types (i.e. power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity and security).

Values are generally measured by means of questionnaires. The most often applied values inventory is the Rokeach Value Survey (RVS) developed by Rokeach (1968). The RVS measures 18 terminal and 18 instrumental values, where terminal values have to do with preferred end-states of existence (e.g. a comfortable life, social recognition, and freedom) and instrumental values are related to modes of conduct (e.g. ambitious, clean, and loving). A limitation of the RVS is that it was developed specifically for the United States of America and it has not been studied to what degree the scale can be applied in other cultures.

Hofstede (1991) posits that only some of the values that are important in a particular culture also prevail in other cultures. He found that the Rokeach value 'salvation,' for example, is not understood by most Dutch people. To overcome this limitation, Oppenhuisen (2001) adapted the RVS to be applicable in the Dutch culture. The scale of Oppenhuisen assesses 12 basic values (i.e. *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*). Oppenhuisen posits that these values are mutually independent. One may for example have the value 'to seek challenge,' and at the same time have the value 'to be relaxed.' In the current study, Oppenhuisen's scale has been used to explore the relationship between emotional responses to six car models and underlying values.

METHOD

Participants

In this study, Dutch people ($N = 40$) with a drivers license participated. It was decided to include both young participants (18-27 years old; ten male and ten female) and older participants (40-60 years old; ten male and ten female) because it was expected to find differences in values between these younger and older people.

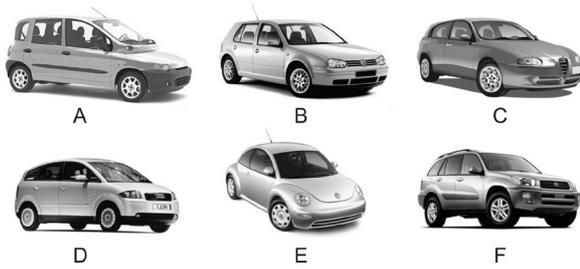


Figure 2 (six stimuli used in the study).

Stimuli

The stimuli were colour photos of the six car models in Figure 2. These stimuli were selected because previous studies have indicated that (a) car models can evoke strong emotional responses, and (b) that emotional responses can strongly differ between individuals (Desmet, 2002). Each of the car models is suited for transporting four persons, is priced between 18.000 and 20.000, and is painted silver or light-grey.

Material

Customary verbal and nonverbal instruments are not optimal for measuring emotional responses to consumer products. First, emotions evoked by products are generally less intense than the so-called basic emotions such as anger and fear (see e.g. Ekman, 1972). Second, products often evoke mixed emotions, that is, combinations of emotions experienced simultaneously. For this reason an instrument was developed to measure specially these typically subtle and mixed product emotions: the Product Emotion Measurement instrument (PrEmo; see Desmet, 2003). PrEmo, a non-verbal self-report instrument, measures 14 emotions that were selected to represent a cross-

section of all emotions that are often elicited by consumer products. Seven of these emotions are pleasant (i.e. *desire, pleasant surprise, inspiration, amusement, admiration, satisfaction, and fascination*), and seven are unpleasant (i.e. *indignation, contempt, disgust, unpleasant surprise, dissatisfaction, disappointment, and boredom*). Instead of relying on words, respondents can rate their emotions with the use of expressive cartoon animations. In the instrument, each of the 14 measured emotions is portrayed with an animated cartoon character by means of dynamic facial, bodily, and vocal expression, and presented on a computer interface (see Figure 3). Participants are instructed to report their responses by selecting those animations that correspond with their felt emotion(s).

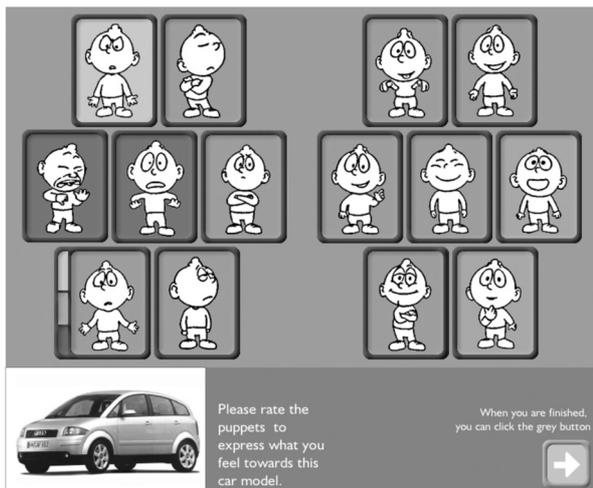


Figure3 (Product Emotion Measurement instrument interface).

The interface of PrEmo depicts stills of the 14 animations. A (hidden) three-point scale accompanies each still. 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." 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 view 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.

For the current study, a computer program was designed that included PrEmo to measure emotional responses and a questionnaire to measure the 12 Oppenheim basic values. Each of these basic values is measured with four value-items. Hence, the questionnaire consists of 48 items. Respondents must report the importance of these items by grading them with a mark between 1 ("this value is not important to me") to 10 ("this value is very important to me"). The program also included scales to measure preferences and a questionnaire concerned with demographic variables (the results of this questionnaire and these scales are not reported in this paper).

Procedure

Participants were first given an introduction which explained the purpose and procedure of the experiment. They were told that the test ran automatically on a computer, and they were instructed to start the procedure when they were ready. Subsequently, the computer explained the task and started the procedure. To avoid order effects, 20 participants started with the questionnaire and the other 20 started with PrEmo. Participants who started with the PrEmo task were first introduced with PrEmo and carried out an exercise in the use of PrEmo. After the introduction and the exercise, participants were presented with the six car models in random order. After looking at a model, participants were asked to report their emotional response(s) to that particular model. They were told that they could take as much time as they needed, but they were asked to avoid too much reflection because we were interested in their spontaneous emotional responses. When they had finished rating all six models they were instructed to fill out the value questionnaire.

RESULTS

Emotional responses

In order to obtain a graphical representation of the emotional responses, a correspondence analysis was performed with two factors: Emotion (14 levels), and Car (6 levels). The emotion levels represent the 14 emotions measured by PrEmo; the Car levels represent the six stimuli. Figure 4 shows the resulting ‘product & emotion’ space.

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	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	6.54	(1.84)	-.30	.25	.40	.45	.15	.30
Unpl. surprise	.90	1.48	-.05	-.05	.20	.25	.05	.45
Dissatisfaction	2.77	1.50	-.20	.05	.45	.50	.05	.05
Disappointment	.15	.19	-.20	.05	-.05	-.05	.00	.05
Boredom	.13	3.12	-.75	.05	.40	.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	.35	-.50	-.25	-.10	.05	.00
Inspiration	.12	(2.11)	(.40)	(-.50)	-.25	.05	-.20	.30
Satisfaction	1.05	1.71	.25	-.45	(-.45)	-.20	.20	.05
Fascination	.29	(1.83)	.30	-.50	-.30	-.05	.00	.25

Value-group is between-participant effect (n₁-group 1 = 20; n₂-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.

Figure 4 (‘product & emotion’ space of the six stimuli used in the study).

often pleasant emotions than the other car models, Model A (Fiat Multipla) evoked most unpleasant emotions. Models F (Toyota RAV4) and D (Audi A2) appear to have evoked relatively more mixed emotions, such as contempt and disappointment *and* amusement and inspiration.

Values

The score for each of the 12 basic values was obtained by averaging the ratings on the four related value-items. The first step to investigate the relationship between reported values and emotional responses was to cluster the 40 participants on the basis of their values in ‘value-groups,’ that is, subgroups of participants that show small within-group and large between-group differences in the reported values. With the use of a k-means cluster analysis, the participants were clustered in two value-groups (for this analysis the value scores were standardized). Both value-groups consisted of 20 participants (see Table 1).

The table indicates that there are neither between-value-groups gender differences nor between-value-group age differences. However, there appears to be an age-gender interaction effect: whereas value-group 1 includes

The space in Figure 4 visualizes the associations between the car models and the reported emotional responses. Pleasant emotions are labelled with a triangle and unpleasant with a square. The distances between the car models reflect the relationships between these models in terms of evoked emotions (with similar models plotted close together). Similarly, the distances between the car models and the emotions reflect the relationship between them. This means that car models that are plotted close to each other elicited similar emotions, whereas those plotted at a distance from each other elicited different emotions. Model E (Volkswagen New Beetle) and C (Alfa 147), for example, elicited more

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

Table 1 (distribution of age and gender over the two value groups).

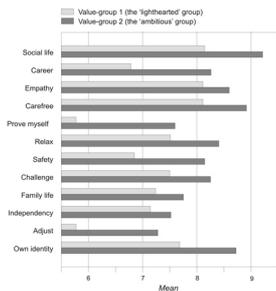


Figure 5 (mean value ratings of value-group 1 and value-group 2).

relatively less importance to these values (as compared to the other values). In other words, the participants in value-group 1 care relatively less about having a career and feel less need to prove themselves. In these values they differentiate from the participants in value-group 2 who **do** care relatively more about a career and feel the need to prove themselves and to adjust to other people. In consonance with their value-profiles, the first group is labelled the ‘lighthearted,’ and the second the ‘ambitious.’

Values & emotion

The effect of value-group membership on the emotional responses was analyzed for each of the 14 measured emotions with a two-way repeated measures MANOVA, with Car (six levels) as within-participant factor, Value-group (two levels) as between-participant factor, and the emotion as dependent variable. The table shows main effects for Value-group (second column), Car x Value-group interactions (third column), and mean value-group differences for each car. First, the analysis showed main effects for Value-group on contempt (i.e. M-ambitious = 1.53; M-lighthearted = 1.33). This indicates that, in general, the **ambitious** were more contemptuous than the **lighthearted**. Secondly, for the emotion boredom, the analyses showed a significant Car x Value-group interaction. An interaction effect for a particular emotion indicates that the Value-group effect depends on which car is being considered.

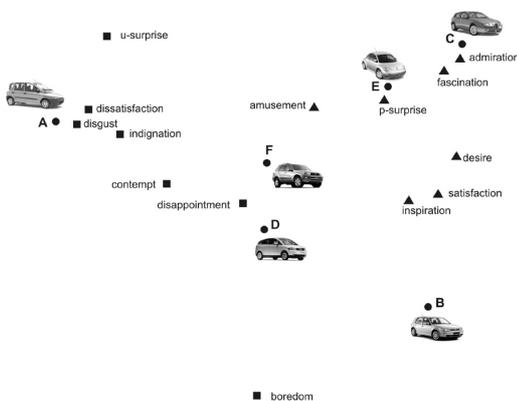


Table 2 (relationship between value-group membership and emotional responses).

mainly older men and younger women, value-group 2 includes mainly younger men and older women. Graphical representations of the values of both value-groups are depicted in Figure 5. This figure shows the mean reported value ratings of participants in each group.

The effect of value-group membership on each value was analyzed with a one-way ANOVA (value-group membership as a between factor and the value as the dependent). These analyses showed that the between-value-groups differences are significant ($p < .05$) for all values, except for **independency** and **family life**. Figure 5 indicates that the major difference between the value-groups is that group 2 finds all values more important than group 1. When observed in more detail, the figure also indicates that the value-groups differ with respect to the values ‘to have a career,’ ‘to prove yourself,’ and ‘to adjust.’ Value-group 1 attaches

In Table 2, two effects catch the eye. First, the degree to which the responses of the participants in the two value-groups differ (i.e. between group difference) varies between the car models. The ANOVA for the separate cars indicate that the value-groups differed in three emotional responses towards model B and C, two emotional responses to model A and D, and one emotional response to model F. The analysis showed no significant effect of affect-group-membership on the emotional responses to model E. Second, the car models in which the responses of the value-groups differ most are models that are typically seen as cars for young ambitious men. The **ambitious** experience significantly less contempt, dissatisfaction and boredom

towards model C (Alfa 147) and significantly more admiration, fascination and satisfaction towards model B (Volkswagen Golf) than the *lighthearted*. Contrasting, the *ambitious* significantly less admire and are more bored by the 'family car' model A (Fiat Multipla) than the *lighthearted*.

GENERAL DISCUSSION

In this study relationships were found between emotions evoked by car design and underlying human values. On the one hand, these findings imply that knowledge of the intended users' values can be useful for predicting emotional responses to new designs. On the other hand, the observed relationships were not strong enough to have a notable predictive value. Value-group membership 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. This does not mean that there are no strong and invariant relationships between emotional responses and underlying human concerns. An important limitation of the current study was the limited focus on values instead of the broader concept of concerns (see Figure 1). These values do not represent all types of concerns that are hypothesised to underlie emotional responses to products (e.g. 'goals:' how we would like things to be, and 'standards:' how we believe products should behave). In appraisal research, it is often found that *particular* emotion types are related to *particular* concern types. Roseman et al. (1994) for example, found distinct underlying concern types for up to ten emotion types. Therefore, if the study had included a wider range of human concern types, more effects might have been found.

A second limitation of the value questionnaire is that all included values are *general* values. Frijda (1986) suggested that there is a distinction between concerns that are terminal and those that are instrumental. Some concerns are terminal (or basic) in the sense that they are not derived from higher-level concerns. Terminal concerns are abstract and universal, for example 'entertainment' and 'individuality.' Instrumental concerns are derived from terminal concerns and are therefore less abstract and more immediate. They can be seen as serving the higher order terminal concerns. Examples of instrumental concerns are 'communication' and 'honesty' (both derived from the terminal concern of belonging). The proposition that some concerns are more basic than others is widely accepted and can be found in other fields of research (see e.g. the means-end model developed by Gutman (1991) in the field of consumer research). Gutman found that classifications of general values fail to provide an understanding of how concrete aspects of products are related to consumer aspirations. Such an understanding requires insights in the instrumental (more concrete) values. This implies that stronger relationships may be found between human concerns and emotional responses when the focus is on instrumental rather than general values. In our future research we will aim to find methods and instruments that can be used to understand the relationship between emotional responses to products and the full repertoire of underlying concerns.

REFERENCES

- Arnold, M.B. (1960). *Emotion and personality: vol 1. Psychological aspects*. New York: Columbia University Press.
- Desmet, P.M.A. (2003). Measuring motion: Development and application of an instrument to measure emotional responses to products. In M.A. Blythe, A.F. Monk, K. Overbeeke, and P.C. Wright (Eds.), *Funology: From usability to enjoyment*. (pp. 111-123). Dordrecht: Kluwer Academic Publishers.
- Desmet, P.M.A. (2002). *Designing emotions*. Unpublished doctoral thesis. ISBN 90-9015877-4.
- Desmet, P.M.A., & Dijkhuis, E. (2003). A wheelchair can be fun: A case of emotion-driven design. *Proceedings of DPPI03*, Pittsburg, USA.
- Desmet, P.M.A., & Hekkert, P. (2002). The basis of product emotions. In W. Green & P. Jordan, P. (Eds.) *Pleasure with products, beyond usability* (pp 60-68). London: Taylor & Francis.
- Ekman, P. (1971). Universals and cultural differences in facial expressions of emotions. In J.K. Cole (Ed.), *Nebraska Symposium on Motivation 1971* (pp. 207-283). Lincoln: University of Nebraska Press.
- Frijda, N.H. (1986). *The emotions*. Cambridge: Cambridge University Press
- Green, W. & Jordan, P. (2002). *Pleasure with products, beyond usability*. London: Taylor & Francis.
- Gutman, J. (1991). Exploring the nature of linkages between consequences and values. *Journal of Business Research*, 22, 146-148.
- Hanna, J.G. (1980). A typology of consumer needs. *Research in Marketing*, 3, 83-104.
- Hekkert, P., Mostert, M. & Stompff, G. (2003). Dancing with a machine: A case of experience-driven design. *Proceedings of DPPI03*, Pittsburg, USA.
- Hofstede, G. (1991). *Cultures and organisations, software of the mind*. London: McGraw-Hill Book Compagny.
- Maslow, A. (1943). *A theory of human motivation*. *Psychology Review*, 50, 370-396.
- McDonagh, D., Hekkert, P., van Erp, J., & Gyi, D. (Eds.) (2003). *Design and Emotion, Episode III: The experience of everyday things*. London: Taylor & Francis, in press.
- Murray, H.A. (1938). *Explorations in personality*. New York: Oxford University Press.
- Norman, D.A. (2002). Emotion & Design: Attractive things work better. *Interactions*, July & August 2002.
- Oppenhuisen, M. (2000). *Een schaap in de bus? Een onderzoek naar waarden van de Nederlander [a study of the values of the Dutch]*. Amsterdam: Stichting Wetenschappelijk Onderzoek Commerciële Communicatie, SWOCC.
- Rokeach, M. (1968). *Beliefs, attitudes, and values: A theory of organization and change*. San Francisco: Jossey-Bass.
- Rokeach, M. (1973). *The nature of human values*. New York: The Free Press.
- Schwarz, S.H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in Experimental Psychology and Social Psychology*, 25, 1-65.

P.M.A. Desmet, P. Hekkert, & M.G. Hillen

Delft University of Technology, School of Industrial Design
Landbergstraat 15
2628 CE Delft
The Netherlands

p.m.a.Desmet@io.tudelft.nl
p.p.m.Hekkert@io.tudelft.nl
merijnhillen@hotmail.com



Pieter Desmet is assistant professor at Industrial Design Delft. He has a background as an industrial designer and obtained a PhD degree with research focused on emotional product experience. His main interest is the relationship between the design of products and the emotional responses they elicit. He is board member of the international Design & Emotion Society. More information on: <http://studiolab.io.tudelft.nl/desmet>



Paul Hekkert is associate professor of Design at Industrial Design Delft. He has a background in experimental psychology and in 1995 he obtained his PhD degree for a thesis on the determinants of aesthetic preference. He is involved in research on product experience, including aesthetics, emotion, multi-modal experience, and attachment, and has developed an interaction-centred design approach, called Vision in Product design (ViP). He is a board member of the European Academy of Design and chairman of the Design & Emotion Society. More information on: <http://studiolab.io.tudelft.nl/hekkert>



Merijn Hillen is a design student at the school of Industrial Design at the Delft University of Technology. Next to this study she has been working in Italy on liberal arts (photography and drawing). She has a special interest in conceptual design and the product as an object of art. Her current focus is on design philosophy and design methodology.