Escaping the emotional blur
Design tools for facilitating positive emotional granularity

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Escaping
the emotional blur:

Design tools for facilitating
positive emotional
granularity

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TUDelft

Escaping the emotional blur
Design tools for facilitating positive emotional granularity

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FEEL GOOD
ENJOY!

JOY IS TIMELESS.
JOY IS BMW.

Some products are routinely described by the "feeling good" or "joyous", but what lies beneath these words?

Table of contents

6. Developing usage guidelines for a card-based design tool: A case of the positive emotional granularity cards   109

7. EmotionPrism: A design tool that communicates 25 pleasurable human-product interactions   129

8. 'Feeling good' unpacked: Developing design tools to facilitate a differentiated understanding of positive emotions   157

9. General discussion   177

Summary   197

Acknowledgements   211

About the author   217

1. Introduction

Early this year, the movie-streaming service Netflix hinted at a plan to ditch its five-star movie rating system (McAlone, 2016). Over the years the company has come to realise that the star, which is meant to symbolise 'fun', is often interpreted as meaning something different, making its user ratings unreliable. For example, if you had fun watching a comedy movie you may give it a five-star rating because it made you laugh. However, others who were equally entertained watching the same film may nevertheless give it the lowest ratings possible because its black humour was too sarcastic. The problem is that even if the star is presented literally as denoting 'enjoyment' or 'fun', the rating system remains misleading. Imagine a documentary film that is a bit dry or sad, but intellectually fulfilling to watch. If the ratings are based solely on how much fun people get out of it, the system will think that the film failed to amuse people, doing injustice to the different kind of enjoyment it facilitates.

Confusion caused by ambiguous representations also seems to occur when designing for emotion. In emotion-driven design, most designs aim to make people *feel good*. However, if we simply aim for 'feeling good', the design process may cause misunderstanding amongst members of the design team, clients and/or users because, like the Netflix stars, 'feeling good' is too blurry to serve as a design direction because it leaves room for many different interpretations. There is a multitude of pleasant emotions, such as relaxation, pride and fascination, each of which has different effects on users' feelings, thoughts and behaviour. Recognising their differences and being precise about the intended emotional impact will surely help to minimise confusion and enable designers to appropriately target the experience desired by their clients and/or users.

1.1.   Research overview

Our emotional states (both positive and negative) can strongly influence our perceptions, decision-making and behaviour, which has ramifications for how we interact with products and services. For this reason user emotion has received much attention in design research, with affective states emerging as a key variable when designing for experiences and well-being (e.g., Desmet, 2002; Gaver, 2009; Hassenzahl, 2010; McCarthy & Wright, 2004). Various studies have contributed to our understanding of how knowledge of emotion can be incorporated into design processes (see Desmet & Hekkert, 2009 for an overview). Much of the emotion research in design is grounded in psychology, explaining what causes emotions to occur and how they can be classified. This is reasonable in that the underlying process of human emotions is universal (Frijda, 2007), and thus is also applicable to emotions evoked by design. The only difference is that in design research the focus is on a particular type of emotional stimuli, i.e., products (Desmet, Fokkinga, Ozkaramanli, & Yoon, 2016).

Many design tools and education materials have been built on sets of 'basic emotions' drawn from the psychology literature, typically including five to eight basic emotions. However, borrowing emotion classifications from psychology is not always appropriate or fully compatible with design when one takes the multitude of emotions in daily interactions into account[1]. In particular, positive emotions that are experienced in response to products are far too diverse and mixed to be simply shoehorned into basic emotion sets (Desmet, 2002).

In my view, most approaches and frameworks in design do not adequately reflect the broad diversity of positive emotions. They tend to deal with a handful of positive emotions and are thus limited in the extent to which they help designers to distinguish the finer differences between positive emotions. Just as there are many ways of feeling bad because of products (e.g., disappointment because of the poor performance of a new computer

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[1] In daily interactions with a product, a host of different emotions are experienced during an unfolding usage and ownership episodes. For example, a fitness tracker that monitors one's activity may inspire a person with its sophisticated features today, but the same person may be annoyed or frustrated by it tomorrow when realising that its obtrusive colour does not fit her outfit. The emotional relationship between the user and the product continuously emerges and evolves over time depending on in which contexts the product is placed, how it is used, how it is talked about and what meanings the user allocates to it (see Haddon, 2007 for a detailed discussion).

or irritation at a sudden failure in data retrieval), there are also many different types of feeling good. For example, we can be interested in a mobile phone game that features a novel user interface, feel relieved at completing a mission in a game that seemed impossible and be proud at being ranked top among fellow game players. While all these emotions are pleasant, each of them represents a different experience. Desmet (2012) found that people can experience at least 25 different positive emotions when interacting with products.

Making fine-grained distinctions between positive emotions can be compared to being a wine expert. Expert vintners are more aware of specific features of a wide range of wines (e.g., taste, age and grape type) and better at differentiating them using explicit classifications, than are novice vintners (Solomon, 1997). The advantage of having this expertise is that they are able to describe the unique qualities of wines in detail and choose the right one for a particular situation. Similarly, having a broad repertoire and an in-depth understanding of positive emotions may enable designers to select the most appropriate positive emotions to design for and to communicate those emotions clearly (e.g., design for pride and relaxation). Given the variety of activities involved in the design process (e.g., user research and design conceptualisation), it is expected that distinguishing nuances between positive emotions could open up a number of new opportunities for designers.

Just as we are not all equally good at distinguishing between wines, not all people are equally sensitive to nuances between positive emotions[2]. This individual difference is called Positive Emotional Granularity (PEG). PEG refers to "*the tendency to communicate experiences of positive emotions with precision and specificity*" (Tugade, Frederickson, & Feldman Barrett, 2004, p. 1162). For example, an individual with high PEG articulates the distinctiveness of an emotional state (e.g., 'I felt confident with a hint of pride'). In contrast, those lower in granularity tend to express their emotions with less distinct terminology (e.g., 'I was feeling good').

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[2] The literature on alexithymia suggests that the inability to differentiate emotions is a common symptom. Alexithymia is described as a trait in which individuals have difficulty in distinguishing and elaborating emotions, and communicating them to others (Taylor, 1984). The prevalence rate of alexithymia was estimated to be about 10% in a large sample of the Finnish population (Salminen, Saarijärvi, Äärelä, Toikka, & Kauhanen, 1999).

Recent studies in psychology have transcended the traditional focus on generalised pleasure and generated insights into the characteristics of a set of distinct positive emotions (see Tugade, Shiota, & Kirby, 2014 for an overview). Several studies have been published that explain differences regarding expressions, causes and behavioural impact (e.g., Diener, 2009; Sauter, 2010; Tong, 2014). However, ways of supporting the PEG of designers, and the practical benefits to design processes of doing so, have received little attention in design research and education.

I propose that designers can benefit from having a fine-grained overview of positive emotions and the ability to make use of this knowledge in their design decisions. Building on this proposition, the present research aims to develop an understanding of how designers can be supported to systematically consider diverse and nuanced positive emotions in design processes, and how this can contribute to effective design processes. The project seeks to answer four related and consecutive research questions:

1. What are the opportunities for PEG in design processes?

2. What are the challenges that designers face when designing for nuanced positive emotions, in practice?

3. How can the PEG of designers be facilitated?

4. What are the strengths and limitations of strategies to facilitate PEG?

This research contributes to the field of experience design by elucidating how PEG adds value to design processes and how designers' PEG can be effectively facilitated. In addition, the research has generated a set of concrete design tools that designers can use when designing for nuanced positive emotions. The following sections briefly describe the research approach and outcome, followed by an outline of the thesis.

1.2.   Research approach

This research builds on literature from design research and psychology. Theories on positive emotions and PEG have been combined with technical knowledge and research methods in design research. Table 1.1 provides the key overview of the thesis structure, setup of the research project and main outcomes.

The thesis reports on a total of eight studies (studies A to H), in which various research methods—both qualitative and quantitative—have been triangulated to address the research questions. Interviews were

conducted to gain insights into the practical value of PEG in design processes (research question 1); a case study was employed to identify when and what types of challenges designers would encounter in the process of designing products that evoke nuanced positive emotions (research question 2); strategies to facilitate PEG were explored by iterations of developing and testing prototypes of design tools. The iterations involved several methods such as design workshops, performances with actors and surveys (research question 3); and a focus group set-up with design experts was used to examine the usefulness of the strategies in supporting particular design activities (research question 4).

Since little was known about how designers' PEG can be fostered, the decision was taken to develop an understanding through the considerations, inspiration and reflections that emerged throughout the iterations of building and testing design tools. The overarching approach encompassing the research activities was 'research through design', where the act of designing new solutions and reflecting on the processes involved is regarded as a means of generating knowledge (Stappers, 2007). A series of tools and techniques was conceptualised for research purposes, and tested with designers in the contexts of both design education and practice.

1.3.   Research outcome

The research has generated insights into when and how PEG becomes useful in design processes, how designers can create products that evoke nuanced positive emotions and how designers' PEG can be stimulated. The insights gained from the research emerged from, and reside in, the resulting design tools, each of which reflects different strategies to convey nuances between positive emotions and the situations in which they are used. The developed tools have been applied in several design projects, conducted in both design practice and education contexts (studies B, E and G). In the process of developing and evaluating them, a series of additional research outcomes has emerged, ranging from certain elements incorporated into the tools to an approach to creating tool usage guidelines. The columns 'tool', 'main outcome' and 'supporting content' in Table 1.1 describe the deliverables of the research in detail.

RESEARCH QUESTION	STUDY	CHAPTER
		2 What are positive emotions and how can they be differentiated?
Research question 1 What are the opportunities for emotional granularity in design processes?	**A** An interview study that explores how designers can benefit from positive emotional granularity	**3** When feeling good is not good enough: Seven key opportunities for emotional granularity in product development
Research question 2 What are the challenges that designers face when designing for nuanced positive emotions in practice?	**B** A case study that investigates the challenges in eliciting nuanced positive emotions	**4** The mood street: Design for nuanced positive emotions
Research question 3 How can positive emotional granularity be facilitated by means of design tools?	**C** Literature review on general conditions that evoke a set of positive emotions **D** Collection and validation of visual representations that display behavioural manifestations of positive emotions	**5** Embodied typology of positive emotions: The development of a tool to facilitate emotional granularity in design
	E Three design workshops that evaluate the positive emotional granularity cards	**6** Developing usage guidelines for a card-based design tool: A case of the positive emotional granularity cards
	F Generation and validation of movies that express positive emotions in interactions with products **G** A design workshop that evaluates the EmotionPrism tool	**7** EmotionPrism: The development of a design tool that communicates 25 pleasurable human—product interactions
Research question 4 What are the strengths and limitations of the ways of facilitating PEG in design processes?	**H** A focus group investigating strengths and weaknesses of different design tools with respect to their applicability in a design process	**8** 'Feeling good' unpacked: Developing design tools to facilitate a differentiated understanding of positive emotions
		9 General discussion

Table 1.1. Thesis overview

TOOL	MAIN OUTCOME	SUPPORTING CONTENT
	A theoretical foundation for the phenomenon of positive emotions	
	Seven key opportunities to work with positive emotional granularity in product development processes	An overview of the types of emotional intelligence that elucidates the place of emotional granularity
		Implications for research on facilitating emotional granularity in design
		Recommendations for developing a design tool to facilitate emotional granularity
	Nine lessons that discuss the challenges involved in designing for nuanced positive emotions and how they can be overcome	An overview of appraisal approach and design process in the case study
		Design examples that aim to evoke different positive emotions
The positive emotional granularity cards	Core relational themes of positive emotions	Application possibilities for the positive emotional granularity cards in a design process
	A set of validated visuals of behavioural manifestations of positive emotions	
Usage guidelines for the positive emotional granularity cards	A set of instructions for using the positive emotional granularity cards	An approach to developing usage guidelines for a card based design tool
	A set of improvement recommendations for the design	
The EmotionPrism	A set of validated videos that express positive emotions in hand—object interactions	An overview of thought—action tendencies of positive emotions
	Insights about the usefulness of EmotionPrism	
The positive emotional granularity cards, the EmotionPrism, and four additional design tools (an audio library of user anecdotes and three interactive installations)	Insights about when and how the four developed tools could be applied in design processes and their strengths and weaknesses	Introduction of the two additional design tools

1.4. Outline of the thesis

This thesis is composed of a series of scientific publications in conjunction with two introductory and one concluding chapters. The body of the thesis consists of three journal papers and four peer-reviewed conference papers. These chapters were co-authored by the promotor and co-promotor of the research; the author of this thesis is the first author of all papers and responsible for the study designs, data analyses, interpretation and writing. As shown in Table 1.1 there are six entry points for reading the thesis, allowing readers to choose the chapters most pertinent to their respective interests: (1) research question, (2) study, (3) chapter, (4) tool, (5) main outcome and (6) supporting content. Chapters are ordered according to the research questions.

Chapter 2 addresses the question of what positive emotions mean and how they can be differentiated. The literature on the phenomenon of positive emotions is discussed, serving as a starting point for the theoretical and empirical work expounded upon in this thesis.

Chapter 3 addresses the first research question relating to the opportunities for PEG, through an interview study (study A) that explored the potential benefits of PEG in product development processes. The chapter describes when and how PEG becomes useful for designers, and what kinds of PEG supports designers want. This study's results served to specify the foci of the tool development phase of the research.

Chapter 4 addresses the second research question, which tackles the challenges of designing for nuanced positive emotions in practice with a focus on how design activities can be supported to evoke nuanced positive emotions. Reflecting on the process of a design case study (study B), the chapter discusses the challenges involved in design activities and how they can be overcome. The results generated initial insights into how nuances between positive emotions can be conveyed to designers and how such knowledge can be applied to design activities.

Chapters 5, 6 and 7 address the third research question, exploring ways in which designers can be supported in PEG through the development and evaluation of PEG tools. Chapter 5 presents 'positive emotional granularity cards', a design tool that describes characteristics of distinct positive emotions. The cards were created as a versatile research tool; they served as a stimulus to probe designers' expectations and needs in PEG tool use. In the chapter the development process is described in detail, along with the application possibilities of the cards in a design

project (studies C and D).

Chapter 6 reports on three design workshops in which the positive emotional granularity cards were used for three different design activities (study E). The study focused on understanding designers' situational needs in tool applications and how they can be supported to make full use of the tool to fit their purposes. The added value of provisional tool usage guidelines is discussed and an approach to developing usage guidelines that incorporate designers' needs and their own creative techniques presented. The findings inspired design directions for additional design tools.

Chapter 7 reports on the development and evaluation of 'EmotionPrism', a tool that communicates the expressive interaction qualities of positive emotions. The development of the tool was inspired by designers' need for an overview of how positive emotions differentially influence the way a user interacts with a product (from studies A and B). The chapter reports on study F, which explored whether positive emotions in human−product interactions can be characterised by distinct and observable expressions. This also served as the basis for tool development. A design workshop in which the tool was applied opened discussion on its usefulness and limitations (study G).

Chapter 8 addresses the fourth research question, concerning the strengths and weaknesses of strategies to facilitate PEG. The chapter presents a comparative overview of four different design tools, each of which employed a different strategy to facilitate PEG. The tools served as research means in a focus group (study H), by which their strengths and weaknesses with regard to their applicability were analysed. The study generated insights into when and how each of the strategies becomes useful to convey nuances between positive emotions.

Finally, the thesis closes with **Chapter 9** in which the key findings of the studies and issues for additional research are discussed. The implications of the research are presented with directions for future work.

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2.   What are positive emotions and how can they be differentiated?

A wide variety of theories and definitions of emotion has been proposed by emotion researchers (c.f., P. R. Kleinginna Jr. & Kleinginna, 1981). Research on emotions in areas as diverse as philosophy, psychology, neuroscience and design has focused on different emotion phenomena. Accordingly, there appears to be no formalised definition that can be applied to any kind of emotion research. Nevertheless, there is an emerging consensus in psychology that emotions are conceptualised as brief and involuntary subjective experiences that are accompanied by multi-componential responses that enable people to adapt to the opportunities and challenges derived from a stimulus event (Scherer, 2005). The components are feelings (subjective experience of the emotion), appraisal (evaluation of objects and events), expressive behaviour (communication of reactions like facial and vocal expressions), physiological responses (bodily changes like heartbeat, sweating and muscle tension) and instrumental behaviour (thought and action tendencies, like approach and avoidance) (for an overview, see Moors, 2009; Scherer, 2005). In the current research, I adopt the multi-componential view of emotions because of its usefulness in systematically considering several facets of an emotion and relationships between emotions.

So far, I have not explicitly described what exactly 'positive emotion' means. From our experiences, we all intuitively know what a positive (and a negative) emotion is, and what it feels like to have a positive emotion—an experience that puts a smile on our face. In everyday life, we do not need to theoretically conceptualise the nature of positive emotions. However, in a research context it is not sufficient to rely solely on our implicit understanding of positive emotions. Nonetheless, design researchers often rely on intuitive definitions without conceptual precision, using 'positive emotion' as a unitary umbrella term to refer to any kind of subjective experience considered pleasant or the opposite of painful. As a consequence, the resulting research outcomes (e.g., design

methods and tools) tend to overlook important differences between positive emotions and other affective states (e.g., positive mood) (c.f., Desmet, 2015). Besides, different people have different ideas about what makes a positive emotion positive (Carver, 2010). The positive versus negative distinction, as well as distinctions between positive emotions, have been infused with a variety of different theoretical perspectives. As a consequence, various sets of positive emotions have been proposed (Kirby, Tugade, & Shiota, 2014b).

Given the goal and its approach of this thesis, in which design tools are developed, it is important to specify how positive emotions are defined and how they can be differentiated. For this reason, five basic questions are addressed that have served as a starting point for the theoretical and empirical work of this thesis: (1) what makes positive emotions positive?, (2) how do positive emotions differ from other positive affective states?, (3) what is the function of positive emotions?, (4) how can positive emotions be differentiated?, and (5) how are positive emotions experienced in human–product interactions?

2.1.   What makes positive emotions positive?

Several ways of making a distinction between a positive and a negative emotion have been proposed, reflecting diverse theoretical perspectives. There are three widely accepted perspectives that can be considered either individually or combined: cognitive, behavioural and experiential.

First, the cognitive perspective is based on the proposition that emotions are elicited by an appraisal of a situation (Smith, Tong, & Ellsworth, 2014). Appraisal refers to a direct and immediate sense judgement of the significance of a stimulus (e.g., event, object or thought) in relation to the person's well-being (Frijda, 2007; Lazarus, 1991). In this perspective, an emotional state can be defined as positive when the individual appraises the stimulus as being beneficial (or non-threatening). In contrast, negative emotions are evoked by stimuli that are appraised as being unbeneficial.

Second, the behavioural perspective emphasises the behavioural effects of emotions, distinguishing positive from negative emotion according to two aspects (Watson, Wiese, Vaidya, & Tellegen, 1999). One, is that the behaviour incited by positive emotions involves 'approach' and those sparked by negative emotions yield 'avoidance'. The other, is that whereas positive emotions result in favourable (i.e., desirable or honourable) behaviour (e.g., sharing one's resources), negative emotions result in

unfavourable behaviour (e.g., intimidating someone) (Averill, 1975).

Third, the experiential perspective focuses on the experience of valence, a subjective sense of positivity or negativity accompanying the experience (Smith & Ellsworth, 1985); positive emotions are felt to be pleasant, negative emotions unpleasant.

It is important to note that an emotion that is classified as positive by one of the three perspectives, might not be similarly classified by another. Anger, for example, is typically considered a negative emotion from a cognitive and experiential perspective, but studies of the behavioural perspective have shown that anger stimulates a strong approach and confrontation tendency (e.g., Kirby, Morrow, & Yih, 2014a). From a cognitive perspective, hope is usually classified as a positive emotion because it occurs when a situation is perceived to be optimistic (Scherer, 2001). However, hope is not necessarily always felt to be pleasant, as the experience of it connotes an unguaranteed promise. Moreover, there are atypical instances in which negative emotions like fear and distress are felt to be pleasurable (Wilson-Mendenhall, Barrett, & Barsalou, 2013). Examples include the energising fear aroused by a rollercoaster or the spirited distress evoked by a sarcastic remark that makes a mean colleague skulk away[3].

Some emotions, such as joy, relaxation and satisfaction, are obviously regarded as positive. However, some, such as hope and compassion, are at the fringes of the distinction between positive and negative emotions. Given the aim of the current research, I am interested in these nuanced positive emotions too. For the current research, it was decided to use an eclectic approach. Emotions were regarded as positive if they satisfied at least two of the following criteria: (1) the emotions involve pleasant feelings, (2) the stimuli are appraised as being beneficial (or non-threatening) to oneself, and (3) the emotions result in beneficial behaviours for oneself or others. For example, the emotion compassion is considered positive in this research; it may not feel pleasant (i.e., the first criterion), but the situation could be appraised as being non-threatening because the sufferers' distresses are not inflected on oneself (i.e., the second criterion), and the emotion motivates the person to help the

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[3] While interesting, atypical negative emotions are not considered positive in this research because while pleasant, negative emotions occur as antecedents of experiences, which is not the focus of the research.

sufferers (i.e., the third criterion) (Lazarus, 1991).

2.2. How does a positive emotion differ from other positive affective states?

To refer to a pleasant experience, we often use terms like positive emotions, good mood and sensorial pleasure interchangeably. Sometimes these terms are used with no explicit distinction in research contexts as well (e.g., Isen, 2000). In contrast, some researchers have argued that while these terms sound alike, not all of them can be considered positive emotion (e.g., Fredrickson & Branigan, 2001).

2.2.1. Positive emotion versus sensory pleasure

Positive emotion and sensory pleasure are closely related and the distinction between the two has often remained unarticulated. Sensory pleasure refers to the pleasure aroused through sensory modalities such as visual, auditory, olfactory, gustatory and tactile experiences (Fredrickson & Cohn, 2008). Sensory pleasure includes, for example, the sweet taste of chocolate, the pleasant rustling sound of the wind in the trees, the fruity smell of one's shampoo and the smooth silky touch of a duvet. Among emotion researchers, there is no general consensus as to whether or not sensory pleasure can be considered a positive emotion (for an in-depth discussion, see Ekman, 2012). In the present research, I adopt the view of Desmet (2012), which understands sensory pleasure as one way in which positive emotions are experienced, i.e., a source of positive emotion[4]. Several studies on positive emotions in human–product interactions have shown that positive emotions often arise through direct sensation (e.g., Demir, Desmet, & Hekkert, 2009; Desmet, 2002; Norman, 2004). For example, on a hot day an air conditioner would freshly cool off the sweat and heat (i.e., sensation), which may lead to feelings of joy, satisfaction or relaxation (i.e., positive emotion). In other words, in this thesis, sensation itself is not considered to be an emotion but rather a subjective experience that can (but does not necessarily) act as a stimulus that evokes a full-blown emotion.

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[4] There are six basic sources of positive emotions in human–product interactions (Desmet, 2012). Positive emotions can be evoked by (1) the sensory properties of an object, (2) meaning associated with the object, (3) interaction with the object, (4) activity facilitated by the interaction, (5) oneself interacting with the object, and (6) other people involved in the interaction.

> **Affect**
> A broad range of feelings that people experience.
>
> **Positive emotion**
> - Caused by specific event
> - Very brief in duration (seconds or minutes)
> - Specific and numerous (distinct positive emotions such as joy, kindness, interest and confidence)
>
> **Positive mood**
> - Cause is often general and unclear
> - Last longer than emotions (hours or days)
> - More general distinction between positive mood

Figure 2.1. Affect, positive emotion and positive mood (adapted from Robbins, Judge, & Campbell, 2012, p. 261)

Positive emotion versus positive mood

Positive emotion and positive mood are similar affective experiences because both involve transient subjective feelings and can strongly influence people's perception, behaviours and attitudes (Kelley & Hoffman, 1997). While analogous, they differ in terms of what causes them, how long they last and how explicitly they are recognised.

Emotions are acute and typically evoked by explicit causes (e.g., events, thoughts and memories), but moods have diffuse or a number of combined causes, not being directed towards specific stimuli (Ekman, 2012). Because of this, we often do not know and are unable to articulate why we are in a particular mood (e.g., cheerful and relaxed mood). In contrast, it is usually possible to work out what has caused a certain positive emotion (Frijda, 2007); we know what makes us proud, what satisfies us and what interests us. Another key difference is that emotions are much shorter than moods, lasting at most seconds or minutes. The duration of moods can be all day or sometimes a few days (Beedie, Terry, & Lane, 2005).

While emotion and mood are different, they are not mutually independent. Both influence each other in terms of what they elicit (Fredrickson & Branigan, 2001). When in a cheerful mood, for example, we are more likely to experience a feeling of joy in relation to an event that does not typically make us feel joyful. Similarly, emotions also influence mood states. A person who frequently experiences positive emotions is likely to be in a cheerful or excited mood.

The current research aims to support designers' explicit understanding of positive emotions in their practices. The rationale for looking specifically at emotion rather than other affective states is that the explicit relationship between an emotion and its cause makes it possible for designers to address emotion through their products as stimuli (Desmet, 2002). The research aim goes beyond offering a range of verbal descriptions of positive emotions; the multifaceted qualities of distinct positive emotions, such as when and how the emotion arises and how it influences an individual's behaviour, need to be clearly communicated to designers. Although positive moods are an interesting subject to study, their inclusion would not particularly contribute to the research; differences between positive moods are elusive in terms of their causes, and the relationship between positive mood states and their effects on user behaviours is indistinct. Therefore, it was decided not to include differentiated positive mood states in the current research.

2.3. What is the function of positive emotions?

Positive emotions such as love, kindness, pride, admiration and fascination, are not just words that we use. Even though these emotions are subtle and short-lived, they are deeply felt and can incite changes in our thoughts and actions. For instance, one day at a flea market in Delft, in the Netherlands, I stumbled upon a vintage twin-lens reflex camera that had a peculiar structure. Fascinated, I immediately started exploring how it worked and why it was designed that way. The more I learned about the design, the more my interest in vintage cameras grew. Over the years I have collected a series of vintage cameras. This has allowed me not only to develop my knowledge but also to connect with a network of camera enthusiasts with whom I have shared a vast amount of information.

The 'broaden-and-build theory of positive emotions' developed by Fredrickson (1998; 2003) suggests that positive emotions play an essential role in building up our personal well-being resources. The theory begins with the immediate effects of positive emotions, which broaden our repertoire of thoughts and actions. This, in turn, enables our behaviours to be open, flexible, explorative, adaptive and playful, leading to long-term effects of frequent positive emotions. Subsequently, the behaviours incited by positive emotions enable us to build resources (e.g., knowledge, social bonding) that make lasting contributions to our growth and well-being. For example, the physical play stimulated by joy can lead to long-term improvements in health while the strategies for play can foster intellectual resources, resulting in strengthened social
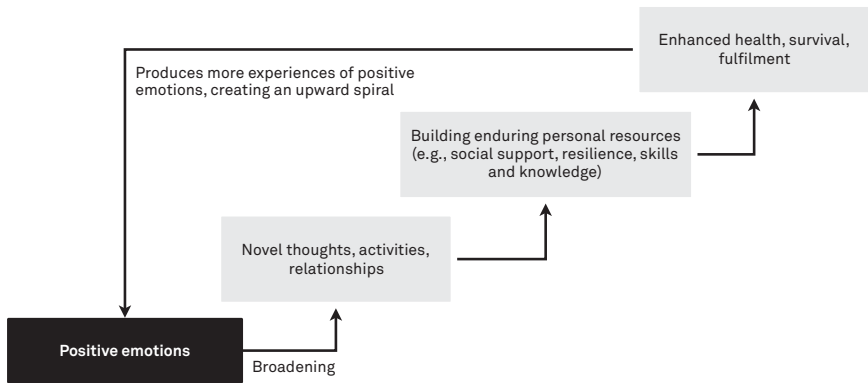
Figure 2.2. The broaden-and-build theory of positive emotions (adapted from Fredrickson & Cohn, 2008, p. 783)

relationships (Sherrod & Singer, 1985). The knowledge and relationships gained through positive emotions like my experience with the vintage camera can also be explained by the theory. Figure 2.2 visualises the effects of positive emotions based on the broaden-and-build theory.

Researchers have recently started exploring the differential effects of distinct positive emotions on people's thoughts and actions, i.e., thought–action tendencies. For example, Sprecher and Fehr (2005) found that compassion induces people to be altruistic and less punitive in their social interactions; Algoe and Haidt (2009) showed that admiration spurs people into adopting the ideas and values of that someone (or something) they admire; and Worline, Wrzensniewski, and Rafaeli (2002) showed that courage motivates people to persist in pursuing their goals in the face of setbacks.

In line with studies on the effects of positive emotions, design researchers have started to explore if and how design can evoke specific positive emotions with the purpose of deliberately influencing user behaviour. For instance, Ludden, Schifferstein, and Hekkert (2012) used sensory incongruity between visual and tactual experiences as a means of evoking pleasant surprise, which was found to have the long-term effect of stimulating further exploration of the product. Mugge, Schoormans, and Schifferstein (2008) used personalisation of a product as a strategy to facilitate a feeling of attachment, which can encourage its irreplaceability and prolonged use. It appears advantageous for designers to have an overview of thought–action tendencies associated with a range of positive emotions, because the ability to deliberately influence user behaviour is

one of the key motivations of designing for emotion (Desmet & Hekkert, 2009). Therefore, thought–action tendencies of positive emotions are comprehensively examined and used as a key component of tool development in Chapters 5 and 7 of this thesis. In addition, the necessity of understanding the differential long-term impact of positive emotions is briefly discussed in Chapter 7.

2.4.   How can positive emotions be differentiated?

2.4.1. Dimensional approach

Traditionally, differentiation of emotions has been studied using two approaches: the dimensional approach and the categorical approach (Zachar, 2012). The main assumption of models that follow the dimensional approach is that emotions can be effectively described by and visually positioned within the continuous space structured by certain dimensions. These dimensions typically include measures of valence (pleasantness versus unpleasantness) and activation (high arousal versus low arousal). For example, the Positive Activation – Negative Activation (PANA) model (Watson & Tellegen, 1985) contains 20 emotions—ten positive (e.g., interested, strong and enthusiastic) and ten negative (e.g., jittery, hostile and ashamed)—classified along two dimensions. Another example is the circumplex model (Russell, 1980), in which emotions are organised in a circular shape (see Figure 2.3). In this model, 'calm', 'relaxed' and 'serene' fall into the pleasant–sleep segment, while 'excite', 'delighted' and 'happy' are placed within the pleasant–arousal segment.

The dimensional approach has been widely applied to the development of design tools that address emotional experiences, because of the comprehensive way in which it structures emotions. For example, AffectAura (McDuff et al., 2012), a tool that monitors changes in a user's emotional states, differentiates emotions along the dimensions of valence, arousal and engagement. The dimensional approach appears useful for presenting a quick overview of various emotions. However, it has been criticised for its limitation to make fine distinctions between emotions. Confidence and fascination, for example, are clearly different emotional states, but are seen as being almost identical when located on the dimensions of pleasantness and arousal (Nicolás, Aurisicchio, & Desmet, 2014). In short, with this approach there is a risk that some positive emotions are not clearly distinguishable. Given that the aim of the current research is to facilitate designers' PEG, reducing the diversity of positive emotions to a few dimensions seems inappropriate.
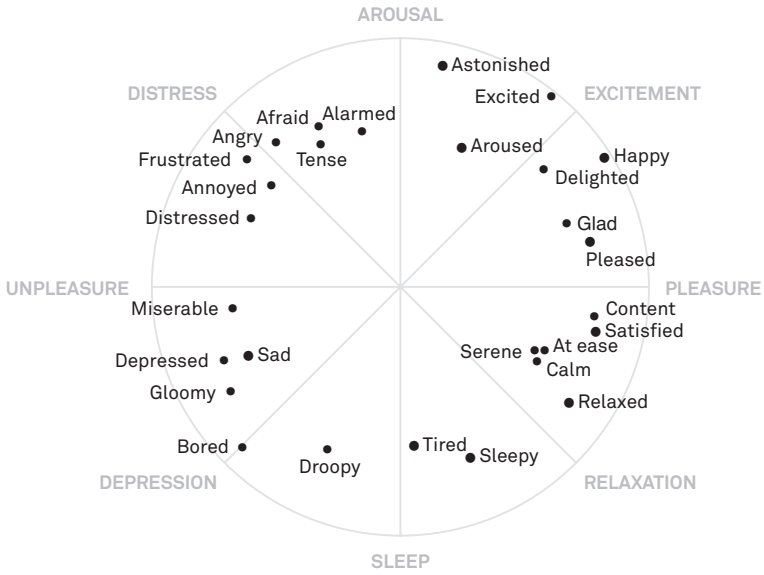
Figure 2.3. Emotions on the circumplex model of affect (adapted from Russell, 1980, p. 1169)
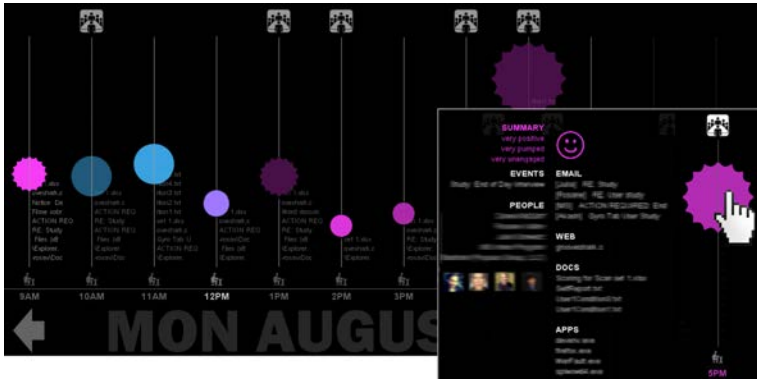
Figure 2.4. An example of design tools that have adopted the dimensional approach: AffectAura (McDuff, Karlson, Kapoor, Roseway, & Czerwinski, 2012)

2.4.2. Categorical approach

Under the categorical approach, emotion is regarded as a unique pattern of multi-component responses (e.g., appraisals, expressions, subjective feelings etc.), and as such emotions can be differentiated and categorised according to a particular emotion component (Fontaine, 2013). Recently, researchers have started exploring characteristics of distinct positive

EMPATHY	AFFECTION	ASPIRATION
Sympathy, Kindness,Respect	Love, Admiration, Worship	Dreaminess, Lust, Desire
ENJOYMENT	OPTIMISM	ANIMATION
Euphoria, Joy, Amusement	Courage, Hope, Anticipation	Surprise, Being energetic
ASSURANCE	INTEREST	GRATIFICATION
Pride, Confidence	Inspiration, Enchantment, Fascination	Relief, Relaxation, Satisfaction

Figure 2.5. Typology of 25 positive emotions categorised in nine emotional types (adapted from Desmet, 2012)

Figure 2.6. An example of design tools that have adopted the categorical approach: PrEmo (Desmet, 2002; Laurans & Desmet, 2012)

emotions based on various emotion components. For example, Tong (2014) classified 13 positive emotions in terms of their causes (i.e., appraisals), while Campos, Shiota, Keltner, Gonzaga, and Goetz (2013) investigated similarities between eight positive emotions based on expressive displays and causes.

These studies have shown that similarity between positive emotions differs depending on what kind of emotion component is selected as the criterion for differentiation. For example, contentment and joy are considered similar with regard to their eliciting conditions because both are experienced when a situation is appraised as being safe and advantageous to reaching a goal. But, they are considerably different in terms of facial expressions and body postures (Campos et al., 2013).

Using appraisal models in psychology, Desmet (2003) proposed five theoretical categories of product emotions focusing on eliciting conditions: surprise emotions, instrumental emotions, aesthetic emotions, social emotions and interest emotions. The classification emphasises the benefit to designers of being aware of the patterns that

underlie a wealth of different emotions to stimulate (or prevent) certain emotions through designs. More recently, Desmet (2012) introduced a typology of positive emotions that consists of 25 positive emotions categorised into nine clusters. The emotions were derived from a componential analysis of positive emotion lexicons, and the categorisation was based on an empirical study that examined similarity between emotions in terms of a combination of appraisal, thought–action tendency and subjective feelings. All the emotions included were found to arise during product use.

The categorical approach has been applied to design tools to emphasise certain emotion components that are relevant to support specific design activities. One example that uses a categorical approach is the Product Emotion Measurement Tool (PrEmo) (Desmet, 2002; Laurans & Desmet, 2012), a non-verbal self-report tool for measuring the emotions of users. In the tool, 14 emotions (seven positive emotions) are differentiated by an animated character portraying them with facial and bodily expressions combined with vocal tones. The major advantage of the categorical approach is that positive emotions can be differentiated and compared according to certain emotion components, which enables the multifaceted qualities of an emotion to be understood holistically. I therefore decided to adopt a categorical approach for looking into nuances between positive emotions. Because the typology of positive emotions is fine-grained yet concise, meeting the criteria set out in section 2.1, Desmet's (2012) typology is applied in particular to the development of design tools. Although differentiation of positive emotions has been addressed in many studies, each study has focused on slightly different sets of positive emotions, making it difficult to gain a comparative, fine-grained overview. Therefore, by adopting the categorical approach and building on the typology of positive emotions, differentiated eliciting conditions of positive emotions (in Chapter 5) and thought–action tendencies of positive emotions (in Chapter 7) are comprehensively investigated.
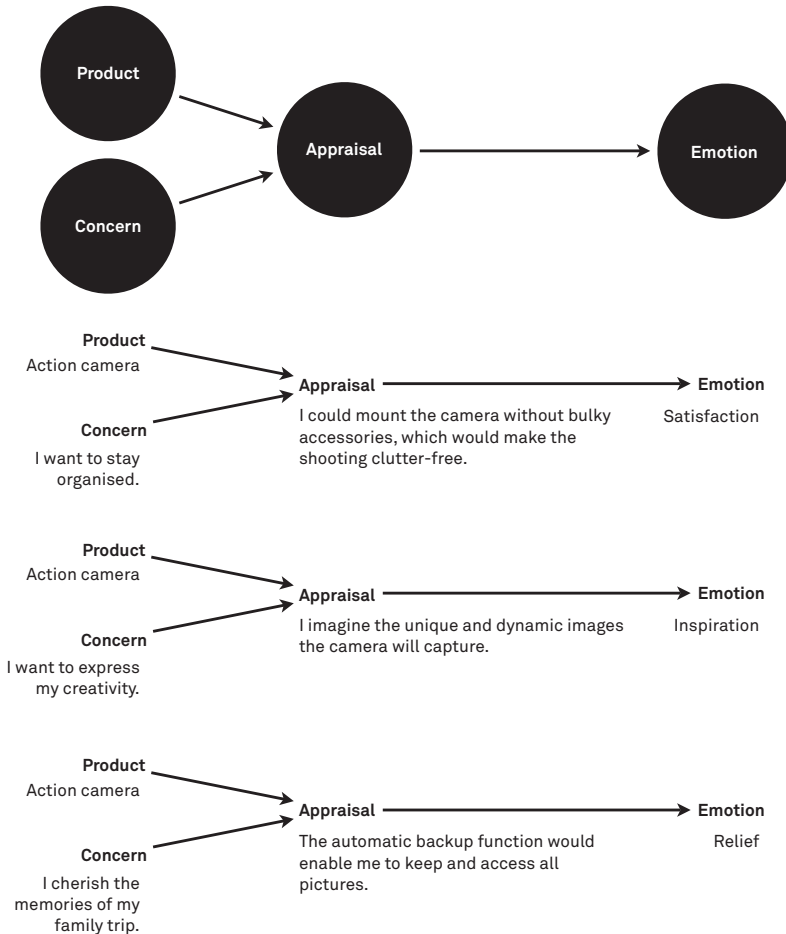
Figure 2.7. The basic product emotion model that explains the underlying processes of emotion elicitations (adapted from Desmet, 2002)

2.5. How are positive emotions experienced in human–product interactions?

To deliberately evoke particular emotions with design, it is important for designers to know under what conditions each of the different positive emotions is experienced, i.e., the emotion–specific eliciting conditions. The basic idea is that designers would be able to purposely evoke specific positive emotions by creating products that meet certain eliciting conditions.

Several theoretical frameworks have been introduced to help understand

how products evoke positive emotions. Using the psychological pleasure framework of Tiger (1992), Jordan (2000) distinguished four sources of product pleasure, while Desmet (2002) explained the general process by which product emotions arise, based on appraisal theory. In line with a neurobiological approach, Norman (2004) identified three sources of product emotions. Finally, Hassenzahl (2010) introduced six needs associated with positive experience relating to universal human needs. Although these frameworks have different theoretical backgrounds and use different terminologies, they share the idea that few one-to-one relationships between product properties (e.g., appearance, material, movement etc.) and emotions exist, and that emotional responses are in fact based on personal (and subjective) meanings derived from the product. In most cases, the types of emotion are not determined by the product itself, but by the personal concerns that influence how users interpret the product.

Desmet's approach is particularly interesting for the purpose of the current research, because the appraisal perspective offers a way of understanding the underlying psychological process responsible for distinct emotional responses to a product. According to the basic product emotion model (Desmet, 2002), the type of user emotion is determined by an appraisal in which personal concerns act as a reference point. The concern that a user has when interacting with a product influences the way he/she appraises it, defining the resulting emotion (see Figure 2.7). This implies that differences in people's emotional responses can be referred back to differences in the concerns they have (and how the stimulus is appraised to be relevant to these concerns). For instance, a user with a concern of being free from clutter may experience satisfaction with an action camera that can be easily installed anywhere without bulky accessories. For the same camera, a different user whose concern is for expressing creativity may experience inspiration because of the unique and dynamic images the camera can capture. Those who cherish the moments in which pictures are taken may feel relief because of the camera's automatic backup function. The main advantage of the model is that it explains how nuanced positive emotions arise from product use and related variables, i.e., concerns, product and appraisal. Moreover, the process represented by the model is universal (Desmet, 2002). Given this advantage, in Chapter 4 of this thesis, the model serves as a theoretical framework for structuring a design process that aims to evoke nuanced positive emotions.

Most positive emotions evoked by products are not always about the

products themselves (Desmet, 2012). Positive emotions in human-product interactions can be either directly elicited by products or indirectly elicited by activities and interactions facilitated by the products. For example, people can be amused by a smart watch that has a funny or playful appearance, and they also can be fascinated by the designer's creativity and skills expressed by the smart watch or by what other people can do with it. In other words, products themselves evoke positive emotions, and they also provide contexts for emotions: activities, interactions and associations facilitated by them serve as sources of positive emotions. Desmet (2012) proposed six main sources of positive emotions based on a collection of example cases in which people experience positive emotions in human-product interactions: Object, meaning, interaction, activity, self, and other. The different sources can be summarised as follows:

- Object-focus: Positive emotions experienced in response to the material qualities of the product (e.g., appearance, taste, tactile quality, sound, and fragrance).

- Meaning-focus: Positive emotions experienced in response to associated or symbolised meanings of the product.

- Interaction-focus: Positive emotions evoked by how the product responds to the user when he/she is using it.

- Activity-focus: Positive emotions experienced in response to the activity enabled or facilitated by the product.

- Self-focus: Positive emotions experienced in response to ourselves; the effects of using or owing products. people are emotional about who they are and how others perceive them.

- Other-focus: Positive emotions evoked by the effects of other people's activities on us, in which the product plays some role. In this focus, interactions with other people are influenced or facilitated by products.

These different sources of positive emotions imply that it is important to look beyond the material qualities of a product when designing for positive emotions and to search for different opportunities together, i.e., enabling, facilitating, or influencing the different sources by means of design. In Chapter 4 of this thesis, the six sources of positive emotions are used as a framework that guides designers to explore different ways to evoke a of distinct positive emotion when generating product ideas.

2.6. Towards designing for nuanced positive emotions

Traditionally, attention has been paid to user emotions particularly when design causes unpleasant experiences (Desmet & Hekkert, 2009). This has led the focus of design to be directed at avoiding negative emotions instead of intentionally stimulating and sustaining positive emotional experiences. That is changing, and there is now increasing emphasis on the role of positive emotions in design research (e.g., Desmet & Pohlmeyer, 2013; Hassenzahl, 2010). I believe that designers can benefit greatly from developing an understanding of positive emotions. The critical roles that positive emotions play in perception, thoughts, behaviour and, by extension, improved well-being, support the argument that designing for positive emotions is important. In particular, distinguishing nuances between positive emotions illuminates a promising new direction in experience design. As a starting point, this section has discussed some of the key literature on the phenomenon of positive emotions. I have addressed the questions of how a distinction between a positive and a negative emotion can be made, how positive emotions differ from similar positive affective states, how positive emotions can be classified, what the functions of positive emotions are and what process underlies positive emotional responses to a product. The implications of all this for the current research were discussed, and relevant theoretical models and approaches were chosen, which will serve as a theoretical foundation for the work presented in the following chapters. Now that an overview of the phenomenon of positive emotions has been achieved, the next step is to identify the practical relevance of differentiating positive emotions in the context of designing a product.

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3. When 'feeling good' is not good enough: Seven key opportunities for emotional granularity in product development

Abstract

This paper reports a study that explored the usefulness of positive emotional granularity (PEG) in the product development process. PEG reflects the ability to interpret and represent the experience of positive emotions with precision and specificity. Interviews were conducted with twenty-five design professionals to understand their needs and expectations with respect to the value of PEG in product development processes. Across all product development stages, sixteen PEG benefits were identified and grouped into seven key opportunities: getting in-depth understanding of user emotions, determining the emotional impact of a product, dealing with organisational support, keeping continuity of emotional intentions in communications, facilitating design creativity, strengthening emotional coherence and managing emotions within a product development team. The findings indicate that the benefits of PEG are mainly associated with activities in design conceptualisation and evaluation, being less relevant in the embodiment phase. The article also reports on the different attitudes of professionals with different roles in product development towards the relevance of PEG for their practices. The implications for research into facilitating PEG and recommendations for developing design tools are discussed.

Relevance to design practice: This paper details the value of differentiating between positive emotions in design practice. It outlines how design activities can be supported by a structured overview of positive emotion types in terms of meanings, eliciting conditions and influences on user behaviour.

3.1.   Introduction

The role of emotions in human–product interactions and the benefits of design that evokes positive emotions have been discussed extensively in the design research literature (e.g. Crilly, Moultrie, & Clarkson, 2004; Desmet & Hekkert, 2007). Understanding user emotions has been shown to be relevant to design for several reasons. They strongly influence usage behaviour (Tractinsky, Katz, & Ikar, 2000) and the richness of usage experiences (Fokkinga & Desmet, 2012). In addition, emotions influence brand loyalty (Chitturi, 2009), product attachment (Mugge, Schoormans, & Schifferstein, 2005) and users' subjective well-being in the long run (Desmet & Pohlmeyer, 2013). Inspired by these beneficial effects of emotions in user experience, designers have pursued emotion-focused design processes with the intention to design for positive user experiences. In practice, however, designers are confronted with various challenges throughout the design process in their efforts to deliberately evoke intended emotions (Goffin & Micheli, 2010; Yoon, Pohlmeyer, & Desmet, 2014b). An example is the challenge to ensure that all design team members have a shared understanding and expectations in respect of the intended emotional experience. Emotional design may not reach its full potential when these intentions remain unstated in the design process, which can result in unforeseen or even unwanted user behaviour and experiences (see Jacobs, 1999, for an example). Hence, in emotion-focused design processes, it is beneficial to have the ability to specify and communicate the intended emotional impact of the design with clarity and precision. We postulate that one complicating factor in doing so is that designers are not equipped with an equally developed *emotional granularity*. Emotional granularity refers to the extent to which an individual can precisely and specifically interpret and articulate their own and other's emotional states (Lindquist & Barrett, 2008). We propose that emotional granularity can be of use as a contextualised competence in a design process to support designers to clearly understand users' emotions towards products and to envision particular emotions when conceptualising designs.

Several frameworks have been proposed to guide designers to design products that stimulate positive experiences. For example, Jordan (2000) introduced four sources of product pleasure based on psychological

pleasure theory. Norman (2004) proposed three levels of pleasurable product experiences based on neurobiological emotion theory. Hassenzahl (2010; 2013) suggested six universal psychological needs as sources of positive product experience. These frameworks enhance designers' understanding of emotional experiences by explaining how emotions arise in human–product interactions and how a design can affect users' emotions. However, they do not contribute much to the designers' emotional granularity because they mainly focus on general valance, experiences that are positive or pleasurable versus negative or unpleasant. In our view, helping designers to consider and communicate emotions in a more fine-grained manner can be beneficial because product emotions are more nuanced than what is captured with a general bipolar dimension of valance. Desmet (2012) showed that people can experience at least 25 different positive emotions in human–product interactions, ranging from pride, amusement and hope to love. Although these emotions are all pleasurable, they differ in terms of feelings, the conditions that evoke them and their influence on behaviour and thoughts (Scherer, 2005). For example, pleasant surprise pulls a person's attention towards a product, leading to increased product recall and recognition (Ludden, Hekkert, & Schifferstein, 2008). A product that evokes inspiration infuses a user with new and creative thoughts, facilitating a shift in perspective (Desmet, 2008). A feeling of interest engages a user to actively explore product attributes and functionalities and prolongs the duration of use, resulting in an increased understanding of a product (Yoon, Desmet, & van der Helm, 2012).

Given these differences, it can be advantageous for designers to be able to discern and articulate various types of emotions with specificity in their design activities, e.g., user research, design conceptualisation and concept evaluation (Desmet & Schifferstein, 2012; Yoon, Pohlmeyer, & Desmet, 2014b). We can compare emotions to colours. Designers never end up deciding for a mere 'bright' colour because although 'apple green,' 'Tuscany cyan' and 'summer yellow' are all examples of bright colours, each creates a very different product appearance. Likewise, aiming to design for 'feeling good' is not good enough when deliberately designing for emotions because there are many emotions that 'feel good' and not all of them are appropriate or desirable for every design, e.g., surprise instead of relaxation.

This may sound obvious, but contrary to negative emotions, making distinctions between positive emotions can be more difficult than is often realised. Positive emotions are relatively less differentiated across the

various components of the emotion process than negative emotions (Fredrickson & Cohn, 2008). For instance, interest, amusement and pride are not easily distinguishable from one another in terms of facial expressions as all result in a so-called "Duchenne smile," i.e., raised lip corners accompanied by muscle contraction around the eyes (Campos, Shiota, Keltner, Gonzaga, & Goetz, 2013; Ekman, 2003). Similarly, some positive emotions come with less palpable thought-action tendencies. Thought-action tendency refers to the tendency that emotions spark both mind and body to act in certain ways, affecting the relationship between the individual and the object of their emotions (Fredrickson & Cohn, 2008). It is often easy to identify differences between negative emotions by observing behavioural manifestations, for example, of anger (the tendency to confront) and disgust (the tendency to reject). By contrast, most positive emotions are characterised by the tendency to approach and continue, the differences being subtle (Frijda, 2007), e.g., altruistic actions triggered by sympathy (Goetz, Keltner, & Simon-Thomas, 2010) and the act of perseverance stimulated by courage (Worline, Wrzesniewski, & Rafaeli, 2002). Besides, when people talk about their positive emotional experiences, the distinctions among positive emotions and other affective states like sensory pleasure and mood tend to blend (Smith, Tong, & Ellsworth, 2014). This implies that it is less natural for people to have positive emotional granularity by contrast to negative emotional granularity, distinguishing nuances of positive emotions requiring a more thorough understanding of the multi-faceted aspects of emotional experiences, such as feelings, behavioural manifestations and eliciting conditions.

In design, a nuanced understanding of positive emotions is of particular importance because most design is intended to evoke positive emotions. The value of describing subjective responses with fine-grained distinctions has been widely demonstrated in the field of Kansai Engineering, which represents a body of methodologies that enable the quantification of relationships between design parameters and subjective experiences (Schütte, Eklund, Ishihara, & Nagamachi, 2008). Although similar to Kansei Engineering, the field of emotional design is more theory- than data-based, focusing on the psychological processes that underlie user emotions. Nonetheless, the value of considering nuances in experiential distinctions also applies to theory-based approaches to emotional design.

This idea is supported by several studies that focused on distinct positive emotions in design, exploring the conditions that evoke them in human–

product interactions. For example, Ludden et al. (2008) focused on pleasant surprise, Russo and Hekkert (2007) on love, Demir, Desmet, and Hekkert (2009) on satisfaction and joy, Yoon et al. (2012) on interest, Nicolás, Aurisicchio, and Desmet (2013) on confidence and anticipation, Desmet (2008) on inspiration and desire, Mugge et al. (2005) on product attachment, and Yu and Nam (2014) on humour. An understanding of the underlying eliciting conditions is advantageous when the design process starts with predefined target emotions. Desmet, Porcelijn, and Van Dijk (2007) report an example in their design of a mobile phone that evoked a 'wow-experience'. They discovered that even though the various stakeholders involved in the project had agreed that the aim was to evoke a wow-experience, each had a very different idea about this experience. The researchers organised a session that used a set of fine-grained emotion terms to generate a shared understanding of the intended experience. The shared understanding turned out to be a combination of several positive emotions: fascination, pleasant surprise and desire. In this project, clarifying the emotional intention enabled a focused design process and the ability to measure the emotional impact of the generated designs.

Positive Emotional Granularity (PEG) means "the tendency to represent experiences of positive emotion with precision and specificity" (Tugade, Fredrickson, & Feldman Barrett, 2004, p. 1162). Despite the potential value of PEG, to date scant attention has been paid in design research to this topic and its practical implications. We can propose the added value of PEG to design processes (e.g., clear explication of user emotions) from a theoretical point of view, but it is unknown if designers see its added value in their practice. For this reason, we undertook an interview study to obtain an overview of the expectations and needs of design professionals with respect to PEG. The research questions were: Do design professionals see benefits in having a nuanced understanding of positive emotions in design processes? And if so, what are these benefits and in what stage(s) of the design process will PEG be useful? Ideally, this study will result in insights that will help developing design (education) material that can offer PEG support in design practice.

The second section of the paper reports the study. The first section provides a general introduction to emotional granularity, positioning it in the bigger context of emotional intelligence. The paper concludes with a discussion of the implications of the study and suggestions for future research.
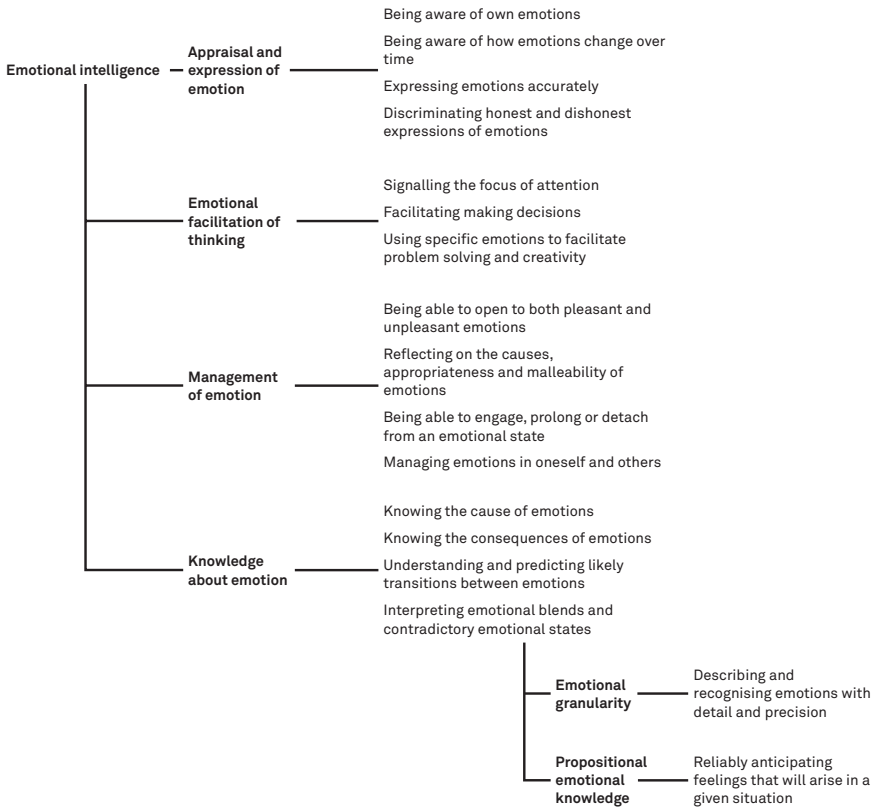
Figure 3.1. Emotional granularity positioned by comparison to four aspects of emotional intelligence (based on the works of Salovey et al. (2008) and Hay and Diehl (2011))

3.2. Four facets of emotional intelligence

Emotional granularity is one component of the larger concept of emotional intelligence (EI). EI, which is also referred to as emotional competence, is the ability to appropriately understand and reflectively manage emotions in the self and others (Mayer & Salovey, 1997). It reflects the extent to which a person can process sophisticated information about emotions and emotion-related stimuli and their ability to use the information as a guide to thinking and behaviour. Salovey, Detweiler-Bedell, B. T., Detweiler-Bedell, J. B., and Mayer (2008) describe the roles of EI based on its four different aspects: (1) the appraisal and expression of emotion, (2) emotional facilitation of thinking, (3) management of emotions and (4) knowledge about emotions (see Figure 3.1).

The first aspect of EI relates to individual differences in the ability to properly determine and express one's emotions and to be sympathetic to

the emotions of others. It also includes perceiving non-verbal signals and emotions represented in stimuli such as art (Mayer, Salovey, & Caruso, 2004). Some people are attentive to their feelings and can suitably express their emotions, whereas some people cannot adequately express or are unaware of their emotions (Zhou & George, 2003). This aspect is particularly advantageous in social contexts as the accurate expressive display of emotion ensures that people are able to effectively communicate with others (George, 2000).

The second aspect concerns using emotions to aid cognitive processes. Emotions and cognition are highly interconnected and EI enables people to use emotions for the effective cognitive processing of information (Zhou & George, 2003). For example, emotions signal what should be the focus of attention (Frijda, 2007) and enable one to make decisions. The ability to predict how one would feel if a certain event occurs helps a decision-maker choose between multiple options (Baumeister, Vohs, DeWall, & Zhang, 2007; Damasio, 1999). Emotions also facilitate certain kinds of cognitive processes; positive emotions stimulate creative thinking and inductive reasoning, whereas negative emotions stimulate attention to details, detection of problems and careful information processing (Fredrickson, 2013; Isen, Daubman, & Nowicki, 1987).

The third aspect of EI relates to managing the emotions of oneself and others. Research has found that people strive to maintain positive affective states and to alleviate negative affect (Mayer & Salovey, 1995). Some people are better than others at managing emotions to maintain a positive state for themselves and for others. For example, a person may feel anger when they find that the vacuum cleaner does not perform as expected. In this case, a person with high EI would not immediately show an outburst of anger. Instead, they would first analyse the source of their anger: Was it actually caused by the cleaner's poor performance? Or was it the frustration about the cat that seems to take pride in shedding hair all over the place? Or was it actually attributed to their partner who had carelessly forgotten to recharge the battery? In the latter case, instead of peevishly accusing and blaming the partner, a person would express their own feelings in a non-confrontational way, checking the partners' emotions at the same time; are they slightly worried or apologetic? The tone of voice and reaction would adopt the emotions of both of them, which would be likely to calm the feeling of anger. Essentially, emotion management requires the ability to reflect on what one has done in light of personal concerns or social norms, the current emotion and drawing conclusions about how an alternative behaviour would create better

emotional states (Baumeister et al., 2007; Zhou & George, 2003).

The fourth aspect concerns the emotion knowledge that people use to understand and reason the causes of the emotions experienced by themselves or by others and how these blend to generate other emotions. 'Knowing' emotions constitutes several dimensions such as propositional emotion knowledge and emotional granularity. Propositional emotion knowledge is the degree to which a person can reliably anticipate and describe which feelings would arise in a hypothetical situation, e.g., how would you feel if the battery of your mobile phone runs out when you desperately need to make an urgent call? (Lindquist & Barrett, 2008). As was mentioned in the introduction, emotional granularity, also referred to as differentiation (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000), reflects the ability to describe and recognise their own or others' emotions with detail and precision (Lindquist & Barrett, 2008). Highly granular people describe the emotional experiences in discrete emotion terms to identify their distinctiveness. For example, in response to a given situation, an individual with high emotional granularity may report "feeling pride, with a hint of joy" whereas someone with less granularity would describe "feeling nice" or "happy". Differentiating emotions enables a person to adequately convey one's own or others emotional states, make inferences about them and make predictions about how to act (Barrett, Gross, Christensen, & Benvenuto, 2001).

The four aspects of EI are conceptually distinct, but also closely associated with each other. Psychology literature reports that emotion knowledge is also related to the degree to which a person is aware of their emotional states in both the past and the present, i.e., the appraisal and expression of emotion (Barrett et al., 2001). EI also has a strong association with the management of emotions. Tugade et al. (2004) show that emotional granularity confers how well a person can understand and cope with unwanted situations and communicate effectively, thinking of an array of behavioural options that could lead them to positive emotional states.

3.3.   Identifying opportunities to work with PEG[5]

The previous section explained the concept of emotional granularity in relation to other aspects of emotional intelligence. This section reports an interview study conducted to explore the roles of PEG from the perspectives of design professionals. Yoon, Desmet, and Pohlmeyer (2013) showed that design students were convinced that a design process could benefit from PEG in various cross-functional communications such as inquiring about stakeholders' concerns. The study presented here investigated the practitioners' perspectives regarding the entire product development process by involving design professionals, both designers and professionals in other functions. The different roles of individuals within a product development team were taken into account. A model of the product development process was selected from the literature to position opportunities to apply PEG in relation to different product development phases.

3.3.1. Roles in a product development team

For the current study, five roles for team members in a product development process were selected based on those specified by ISO (2010) and Ulrich and Eppinger (1995): product manager, user researcher[6], designer[7], development engineer and marketer (see Table 3.1). Involving these different roles is relevant because (1) the main benefits of PEG

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[5] This section is a reworked version of "Nuances of Emotions in Product Development: Seven Key Opportunities Identified by Design Professionals" (Yoon, Pohlmeyer, & Desmet, 2014a).

[6] Although it is commonly suggested in the literature that designers conduct user research having contacts with users (Leonard & Rayport, 1997), in practice, the person who performs the user research and the person who manages the design is usually not the same person. The research is often conducted by a third party (e.g., an external consultancy) (Visser, 2009). For this reason, we regarded user researcher and designer as distinct roles in this study. Depending on the circumstances of the project (e.g., size of the company and project budget), the distinction between the two roles could be either clear or blended. Besides, the identified roles might have different names in different organisations, but their primary roles are the same (c.f. Saffer, 2009).

[7] Since the aim of this study was to explore the potential benefits of PEG in product development processes, we use the term 'designer' for the consistency and clarity in the paper instead of referring to the self-identified positions by the participating designers (e.g., industrial designer, usability expert, and interaction designer). The same applies to the other roles.

Role	Responsibilities
Product manager	Managing the project or product, including the product specifications, setting priorities, planning and coordinating efforts
User researcher	Identifying user needs and the contexts of product use, conveying the collected insights to designers and evaluating design concepts
Designer	Creatively integrating all the requirements of the design brief into a design of the appearance and behaviour of the product
Development engineer	Planning, operating and coordinating the production system to produce the product
Marketer	Identifying the product opportunities and the target market segments, and arranging target prices, the launch and promotion of the product and brand

Table 3.1. Different roles within a product development team

might vary for each role and (2) at each stage of a product development process, various functions are involved and in most of the stages, design is integrated into several collaborative activities. For example, in the fuzzy-front end, designers collaborate with user researchers and marketers to identify user requirements (Visser, 2009) and designers cooperate with marketers and engineers in concurrent engineering ("Prescriptive models of the design process," 1995a).

3.3.2. Product development process

To identify when PEG is relevant in a product development process, we used the model of Buijs (2012) as a framework for our study (Figure 3.2). The model describes the continuous process of developing a product from the use of existing products to a change in the company's strategic product position. The model consists of five cyclic stages: product in use, strategy formulation, design brief formulation, development and market introduction.[8]

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[8] For the sake of clarity in mapping the advantages of PEG with each stage, we show the stages from 'product in use', but there is neither a beginning nor an end in this circular model (Buijs, 2003); launching a new product on the market and the successful use of the product will lead to competitors' reactions (e.g., introducing better performing or more affordable products). This will cause the original company to start the development process of the next generation product line to regain its competitiveness.
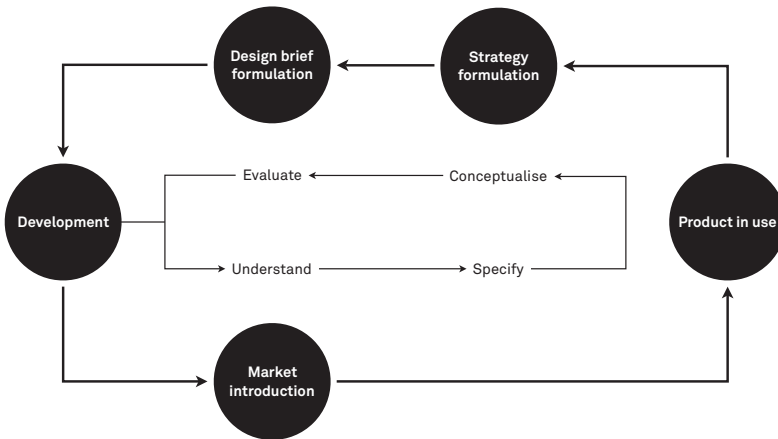
Figure 3.2. Product development model used in this study (adapted from Buijs, 2012; ISO, 2010)

The different stages can be summarised as follows:

- Product in use: The actual use of the product takes place. The company investigates user feedback and the responses from competitors, resulting in a change of the strategy.

- Strategy formulation: The earlier recognised needs are validated. Market opportunities and internal competency are analysed, resulting in new product ideas.

- Design brief formulation: The needs of the potential end-users are investigated in detail. The ideas are transformed into concrete product ideas and described in the design brief.

- Development: The design brief is translated into design concepts and the concepts are tested. The product's final design is engineered to be optimal for production.

- Market introduction: The product is launched, produced, distributed and sold.

In the model of a product development process, conceptualisation and embodiment take place in the development stage (Buijs, 2012). In our reference model, we added a Human-Centred Design (HCD) process to 'development' to elaborate the design activities and related benefits of PEG based on ISO (2010). There are four main activities in HCD processes: (1) understanding and specifying the context of use, (2) specifying user requirements, (3) producing design solutions and (4) evaluating the design. The following section reports where PEG becomes advantageous, based on the phases of a product development cycle defined above.

3.3.3. Method

Participants

The recruitment of interviewees was based on the selected five roles. For each role, five practitioners were recruited, each with a minimum of three years of work experience (in total 25 participants). The participants were affiliated with 13 companies in four countries (Netherlands: 10, United Kingdom: 1, Singapore: 1 and Germany: 1). The companies were drawn from a wide range of business sectors including telecommunication, consumer electronics, software, finance service, food, furniture, airline service and design consultancy (e.g., Philips, Wacom, OCBC bank, PepsiCo and KLM Royal Dutch airlines). Involving people from varied backgrounds sought to gain a variety of perspectives. The main selection criterion was to have an equal distribution of the five roles. Participants were recruited from the authors' professional networks and were not paid for their contribution.

Role	Sector	Company	Years of work experience	Country
Product manager A	Airline	A	27 years	NL
Product manager B	Telecommunication	B	5 years 4 months	NL
Product manager C	Finance	C	12 years 6 months	SG
Product manager D	Software	D	5 years 7 months	DE
Product manager E	Software	D	17 years	DE
User researcher A	Design consultancy	E	5 years 2 months	NL
User researcher B	Design consultancy	F	7 years	NL
User researcher C	Consumer electronics	G	3 years 9 months	NL
User researcher D	Consumer electronics	G	5 years 10 months	NL
User researcher E	Finance	H	11 years 4 months	UK
Designer A	Design consultancy	E	3 years 6 months	NL
Designer B	Design consultancy	E	22 years	NL
Designer C	Design consultancy	I	3 years 4 months	NL
Designer D	Design consultancy	J	4 years 4 months	NL
Designer E	Software	D	6 years 8 months	DE
Development engineer A	Furniture	K	4 years 1 month	NL
Development engineer B	Juvenile and bicycle products	L	14 years	NL
Development engineer C	Juvenile and bicycle products	L	23 years 1 month	NL
Development engineer D	Design consultancy	E	17 years	NL
Development engineer E	Software	D	8 years	DE
Marketer A	Furniture	K	9 years 6 months	NL
Marketer B	Food	M	7 years, 10 months	NL
Marketer C	Consumer electronics	G	7 years 1 month	NL
Marketer D	Consumer electronics	G	4 years 4 months	NL
Marketer E	Software	D	13 years 4 months	DE

Table 3.2. Interviewees at the case companies (DE=Germany. NL=The Netherlands, UK=The United Kingdom, SG=Singapore)

Procedure

Semi-structured interviews were conducted individually, each consisting of three phases: sensitising, interviewing and discussing. The aim of the sensitisation phase was to stimulate the participants' general awareness of the nuances of positive emotions. In advance of the interview, each participant was asked to think of product examples and provided with the definitions of three emotions: pride, confidence and fascination. Desmet (2012) shows that similarity between confidence and pride is the highest among 25 positive emotions while fascination is perceived very

differently. Stimulating participants to think of the differences between two similar positive emotions and one dissimilar positive emotion sought to facilitate their awareness of the nuanced nature of positive emotions. In the beginning of the session, the participant presented three product examples through which they had experienced each of the given three emotions respectively. The concept of PEG was presented following the explanation of Lindquist and Barrett (2008, p. 516): "people who are emotionally granular use emotion expressions such as love, relief, interest, and confidence to represent discrete qualities of certain experiences. Those lower in granularity use emotion expressions in a less precise way using global terms such as feeling nice or happy" (p. 516). To help the participant, Desmet's (2012, p. 6) visualisation of a structured typology of 25 positive emotions was provided. An A3 sized sheet was provided with the product development model of Buijs (2012) and the key stages and entailed activities were explained. Next, the participant was invited to generate ideas about how and when high PEG might support the process of their own tasks and its possible benefits for other roles. The participant was instructed to write their ideas on the A3 sheet. There was no time limitation. After the idea generation, each participant discussed the ideas with the interviewer (first author). All sessions lasted about 1.5 hours and were audio recorded. All data collected during the sensitisation exercise and the interview was combined.

Data Analysis

The process of data analysis was based on thematic analysis (Braun & Clarke, 2006), a qualitative analytic method for reporting patterns within data. Recorded audio data, ideas on sheets and the notes of the interviewer were transcribed and coded. The model of product development process and the five roles specified in the previous section (see Figure 3.2 and Table 3.1) were used to deductively set the codes of stages and roles, i.e., pre-set codes, while the codes of benefits and related design activities were inductively derived from the quotes and notes, i.e., emergent codes. "End-users", "stakeholders" and "entire team" were added to the pre-set codes, these groups being frequently mentioned as possible beneficiaries of PEG during the interviews. This coding scheme was structured to provide an overview of when, for whom and for which activities high PEG could be beneficial. For example, one participating designer said: *"In the development stage, the communication between team members can be more efficient in translating the intended emotions to product characters that can embody the values."* This response was considered to contain three meaning units and was assigned to three different codes. The first text segment 'In the

development stage' fitted into the code "development". The second text unit was "the communication between team members"—this text was considered to fit into the code "product development team". The third text segment "communication between team members can be more efficient in translating the intended emotions" was considered to fit into the code "communicating the design intention in terms of emotional experience". For each suggested idea, the related activities were clustered according to possible benefits. Then, the clusters were organised based on product development stages and roles. The generated clusters were named and paired with the suggestive quotes.

3.4. Results

We firstly report our observations during the sensitisation exercises. Next, we describe the opportunities to work with PEG that were suggested by the participants. Then, additional observations from the interviews are reported with a focus on the participants' opinions on the usefulness of PEG.

3.4.1. Preparation for the interviews

The sample products that the participants chose for the sensitisation exercise were diverse, including a sport utility vehicle, hiking boots, a fountain pen and mini-tents. Most participants reported that the exercise helped them to realise that there is more than mere pleasure to be considered in product development. The designers, user researchers and marketers tended to immediately grasp the concept of nuances of positive emotions and its relevance to product development, whereas the product managers and development engineers needed more elaborate explanations. Although these two groups exhibited their interest in the research topic, they were initially uncertain about their contribution to the study, ascribing this to their lack of knowledge about emotions. Across all five roles, the participants found the typology of positive emotions helpful in understanding the nuanced nature of positive emotions. They compared the emotions in the typology, some of them using the emotion terms in the typology to point out other positive emotions they had felt towards the sample products. In general, the participants mentioned that they enjoyed the exercise and that it made them more aware of the study topic.

3.4.2. Opportunities to work with PEG

The benefits identified were categorised into seven main groups, each consisting of various advantages related to specific design stages and roles. Table 3.3 gives an overview of the main findings in the order of the product development process.

In the following, we report and discuss the main groups and related opportunities, illustrating these with participant quotes.

Getting an in-depth understanding of user emotions

> *It makes me vigilant when observing people considering if the target positive emotion can be actually experienced* (User researcher D).

> *The emotions in our tool are a little bit random. It would be interesting to have a structured list of positive emotions, so when people see them, they can point out things and explain the meaning behind it* (User researcher B).

User researchers and designers responded that in observational research, having a developed PEG would enable them to carefully and precisely interpret end-users' affective responses on the basis of expressive behaviours that end-users show in response to a given product or situation. User researchers found it helpful to develop a research tool that could be used for measuring user emotions by including a comprehensive set of positive emotions. It was mentioned that based on the results of measured emotions, they would be able to lay out the changes to user emotions in a series of instances in product use. The suggested implications were benchmarking the emotional impact of competing products in the stage of formulating a strategy, validating the emotional impact of a concept in the development stage and measuring end-users' responses in the product use stage.

Opportunities	Stages	Roles
Getting in-depth understanding of user emotions − Interpreting end-users' affective states in responses to a product − Measuring end-users' responses in product use − Benchmarking competing products in terms of emotional impact − Validating the emotional impact of a product concept	− Product in use − Strategy formulation − 'Understand and evaluate' in development	− User researcher − Designer
Determining emotional impact of a product − Identifying the areas to improve and add positive emotional impact of a product in its usage − Specifying emotional impact of a product in design brief − Specifying design intention in terms of interaction effects − Associating brand expression with specific positive emotions in determining emotional impact of a product	− Design brief formulation − 'Specify' in development	− Product manager − User researcher − Designer − Marketer
Dealing with organisational support − Demonstrating the added values of emotion-driven approach by comparing products in terms of end-users' emotional responses with granularity − Guiding key-stakeholders to (re)formulate the project goal by helping them get a deep understanding of end-users' emotional states in relation to a product or a situation	− Strategy formulation − 'Understand' in development	− Product manager − User researcher − Designer
Keeping continuity of emotional impact in communications − Building a shared understanding on the meaning of the determined positive emotions across all functions. − Helping a product development team have increased empathy towards end-users through explicit communication of user emotions	− 'Specify' in development	− Entire team
Facilitating design creativity − Facilitating creative exploration to design problems by helping designers envision various positive emotional responses of end-users to a product − Translating the intended positive emotions to product qualities based on the specific eliciting conditions of the emotions	− 'Conceptualise' in development	− Designer
Strengthening emotional coherence − Ensuring coherent communication to end-users through elicitation of consistent emotions in both product usage and marketing communications	− Market introduction	− Designer − Marketer
Managing emotions within a product development team − Fostering specific positive emotions within a product development team with an intention to support each stage's main activities	− Entire stages	− Entire team

Table 3.3. An overview of the suggested benefits of PEG in a product development process

Determining the emotional impact of a product

> *We don't want to just satisfy our customers. We want to deliver more than that such as a sheer awe or desire. For this, it is essential to be able to understand and represent the details of the customers' emotional states (Marketer D).*

> *I am more interested in nuances of behavioural impact that positive emotions could spark because that's more concrete than putting some emotion words. It already shows why we design for certain emotions. For example, when I designed a website of a museum, I aimed to make a user stay longer on webpages, thus he has more chance to get to know art-pieces of the museum. I did it by designing the interface to evoke fascination (Designer C).*

For the strategy formulation stage, marketers and designers found that knowing the current user emotions in response to an existing product on a detailed level would enable the identification of desirable positive emotions to be addressed; it could help them pinpoint the most critical areas to improve, to preserve, or alternatively, to give additional positive emotional impact. This, in turn, helps to specify which positive emotions to evoke in the design brief formulation stage. Differentiating positive emotions and being aware of associated behavioural effects were considered important when determining the emotional impact of a product; e.g., gentle behaviour triggered by kindness and playful behaviour triggered by amusement. They noted that as a secondary function in later stages, the specified positive emotions would serve to validate if the product could evoke the predefined ones or facilitate the intended behavioural effects when evaluating a design concept or prototypes.

Dealing with organisational support

> *Clients or managers usually tend to consider emotion-driven approach as peripheral to the success of a new product and care more about the result that it will financially produce, rather than the approach that generates the success (Marketer C).*

Designers and user researchers talked about the need to demonstrate the added value of the emotion-driven design approach to draw enough organisational support from other roles in pursuing the approach. They suggested that it might be helpful to show why a certain product is preferred over a different one by revealing the end-users' different responses with fine-grained emotion terms, and, if possible, their consequential business impact. The participants assumed that with this approach, others involved in the design process could also gain a deep

understanding of how end-users feel about a certain product or situation and realise how important it is to consider emotions in product development.

Keeping continuity of emotional impact in communications

An external agency prepares a creative work for us such as a packaging design, but when we test it, consumers' answers are often far from our expectation. But, the agency always says, 'We did it as you asked' (Marketer B).

I often see development engineers ignore the design suggestions and go totally different direction. ... Perhaps, it's because the current design brief is not effective ... they don't get what it feels like to be in the shoes of our users (User researcher E).

When the design process evolves from design brief formulation to development, the determined target emotions need to keep their salience, not losing granularity until they are conveyed to designers or engineers. However, in practice, it was found that the information goes through several interpretations from person to person before it reaches the designers or engineers. People also often have different understandings of the same emotion, so the interpretation of the design goal can differ considerably from person to person. All five roles agreed that having developed PEG would help the entire team gain a shared understanding of the meaning of various positive emotions that they use in communication and in having shared expectations about the intended emotional outcome.

Facilitating design creativity

If you design a chair, kindness, sympathy, respect... these could be starting points. You take one of these as a design theme, and later you can try other emotions too (Designer A).

Each emotion requires a different design approach and because of this difference, the sooner you realise what is right strategy, the better you can translate the emotion into the design (Designer B).

Designers valued PEG for stimulating divergent thinking, especially in the conceptualisation phase. Having a high level of PEG could help envision various of the positive emotional responses of end-users and in thinking about how a product could lead end-users to experience intended positive emotions. Participants particularly acknowledged the given typology of positive emotions as a source of inspiration, assuming that it would guide them to a wide diversity of design directions. Since each emotion involves different eliciting conditions, they pointed out that the ability to

distinguish the unique patterns of eliciting conditions could be useful in translating the intended emotions into design elements such as qualities of interaction and physical form. Some designers noted that it might be helpful to have an overview of the eliciting conditions as a reference, for example, emotion-specific appraisal patterns.

Strengthening emotional coherence

> *The story of user experience should stay consistent in terms of feelings. ... I guess that design brief can be already used by both designers and marketers, not spending extra time for making a marketing plan from scratch (Marketer E).*

Marketers and designers suggested that it is important to coherently communicate to end-users, through eliciting consistent emotions with both product design and marketing communications such as advertisements, distinguishing nuances of positive emotions being essential to do so. They mentioned that a developed PEG would help them to explicitly share the idea of the intended emotions across the functions. Thus, in the market introduction stage, marketers can stress the identical emotional experience when producing marketing materials, ensuring that the emotions facilitated by marketing communications do not deviate from the emotions that are experienced during the actual product use.

Managing emotions within a product development team

> *In later stages, people usually do not feel inspiration and curiosity. They just pay attention to fulfilling pre-defined requirements. They still can be creative and the process has to facilitate this. They should feel pride because of their creative contribution. If I don't know the differences between these positive emotions, I don't know what to facilitate*
> *(Product manager A).*

Besides the benefits that directly influence activities in product development, participants also mentioned some implications of PEG for emotion regulation. Product managers found it useful to be aware of nuances of positive emotions to foster appropriate positive emotions within a product development team by reflecting each stage's main activities. Product managers emphasised that it is important to create a sense of team pride. For this, it is essential to understand the emotional states of the team and to facilitate appropriate positive emotions because team pride helps motivate and unify everyone associated with a project.

3.4.3. Responses towards the usefulness of PEG

Overall, the participants agreed that designers can benefit from being aware of differences between positive emotions in their daily practices. In particular, designers, user researchers and marketers emphasised the importance of having developed PEG to engage and empower product managers and development engineers in the emotion-driven design processes. One user researcher said:

> *A manager is involved in and manages the entire process. Because these emotions are a vision of a future product, they guide the process. It should be clear where the team is heading in the process. If the manager doesn't understand what we want to elicit, then he feels very insecure and judge the approach and the ideas in it as well (User researcher B).*

Designers, user researchers and marketers noted that a design tool or a technique would be necessary to support the suggested opportunities that require a cross-function collaboration and that the development of such a tool should reflect the different concerns and terminologies of the various roles. They suggested that an increased level of PEG would allow the whole product development team to be frontloaded with specific positive emotions and associated user needs early in the product development process. The concerted effort leveraged by PEG could significantly contribute to the design of products in the end.

There were also some less positive responses from the participants. Product managers and development engineers identified fewer PEG benefits than those in other roles and showed less enthusiasm for its advantages regarding their tasks. Some product managers were prone to downplay user emotions as a success factor in a product compared to other issues such as product price and project budget. They reported that the emotion-driven design approach was unfamiliar to their daily practices. One product manager mentioned that although he acknowledged the value of being equipped with a high level of PEG, decisions related to emotional experience were not within the scope of his work, being an exclusive domain of designers' intuition and their authority.

Development engineers often mentioned that they were mainly responsible for the realisation and optimisation of a product, seeing little practical benefits in PEG. One software engineer responded, *"I mainly think about how to write code that is effective and reliable. My job is often explicitly defined. I just get informed or receive advice from the marketing*

department" (Development engineer E). Development engineers noted that they already consider emotions in their work, but they often do so implicitly rather than explicitly. Besides, issues related to product emotion were usually about eliminating negative experiences to ensure safety and quality of products. Another development engineer reported that despite the value of discussing the emotional impact of a product in conjunction with other roles, he considered it burdensome to talk about emotions: *"I studied mechanical engineering that mostly deals with technical information. Communication of this subjective experience takes a totally different skill."* (Development engineer A).

3.5. General discussion

This study explored how and when people involved in product development can benefit from PEG. Results revealed seven main opportunities in which beneficial effects of PEG in relation to specific activities and roles can be expected across all stages of a product development process. The ability to precisely recognise others' emotions facilitates (1) a deep understanding of users. Having a structured overview of positive emotions supports (2) designers' precise determination of design intentions, which can increase the chance that a design will have the appropriate emotional impact. Furthermore, considering a broad array of users' emotional responses can (3) stimulate creativity in the design process. Additional opportunities include (4) maintaining the continuity of a design's emotional impact across product development communications and (5) increasing organisational support by being able to demonstrate the added value of an emotion-focused design process as well as (6) strengthening emotional coherence in communications targeting end-users. From an organisational perspective, PEG can also be beneficial when (7) managing emotions within a product development team. In general, the benefits of PEG were mainly associated with activities in design conceptualisation and evaluation, appearing to be less relevant in the embodiment phase.

The study showed that designers were in need of a holistic understanding of positive emotional experiences beyond provision of a set of fine-grained emotion words. They stressed the need to be able to compare positive emotions from a multi-componential perspective. For designers, PEG was seen as helpful when they envision the desired usage behaviours incited by various positive emotions as it allows them to reason and justify what kinds of positive emotions would be appropriate to address. Understanding the underlying eliciting conditions such as appraisals was

considered valuable; designers can purposefully satisfy or violate certain conditions by manipulating product properties as determinants of specific emotions. Having a repertoire of positive emotions could stimulate lateral thinking as designing for multiple positive emotions can guide designers to look beyond obvious design directions, resulting in new alternative solutions. It was reported that PEG would be crucial for user researchers as it would enable them to immerse themselves in the users' experiences by looking closely at users' emotional states. This, in turn, could help them identify which positive emotions need to be addressed in design to build a shared understanding of the emotional intentions within the product development team.

During the interviews, product managers and development engineers rarely reported the advantages of PEG in relation to their work processes. Although the participants in these two roles generated some ideas, most were associated with activities in other roles or with benefits for an entire team. Some participants even reported that PEG is not relevant to them because considering user emotions is not part of their responsibilities (e.g., allocating project resources and assessing production feasibility). Nonetheless, the other team members considered high PEG of product managers and development engineers crucial in order to pursue an emotion-focused design process. Designers, user researchers and marketers suggested that it could ensure the active involvement of these two roles' in product development throughout the entire process, which can contribute to the management of the design process and key design decisions such as determination and communication of emotional intentions.

Goffin and Micheli's (2010) study showed that in the context of communication on design, managers tend to perceive differences in emotion words as irrelevant and hardly use the term 'emotion' while designers consider them crucial in conveying the significance of a design, frequently referring to emotion words. Perhaps because managers and development engineers rarely use words linked to emotion in their daily practice and are relatively unfamiliar with an emotion-driven approach compared to their colleagues, during the interviews they could not spontaneously see the value of PEG in their roles. Alternative research methods or more sophisticated sensitisation processes could be used in future studies to further explore potential PEG benefits for these two roles.

This paper focused on positive emotions considering that products are

generally designed to evoke positive emotions. Negative emotional granularity might be equally advantageous in design. During the interviews, designers and user researchers stressed that distinguishing nuances among negative emotions is also important to getting insights into users' demands and desires. Moreover, design sometimes deliberately targets negative experiences (Fokkinga & Desmet, 2012). For instance, a feeling of rejection could stimulate artistic creativity (Akinola & Mendes, 2008) and sadness makes people less judgmental of other people's behaviour (Schnall, Haidt, Clore, & Jordan, 2008). We should note that other qualities are equally important for emotion-focused design; having PEG is not a guarantee for success. Because emotions are essentially subjective, emotion-focused design requires user-centred and/or participatory design techniques to ensure a proper understanding of the experiences of the intended users and related contextual factors.

3.5.1. Limitations

The sample size was relatively small. Involving only five participants for each role might not be sufficient to fully reveal the relevance of PEG. However, in the analysis process, we noticed that after coding the data collected from half of the participants, the findings were already saturated. In other words, no additional opportunities were identified when coding the second half of the data set. From this, we assume that interviewing more people would not result in noticeably more insights. Another limitation was that the study only focused on design activities taking place in a company. Dorst (2009) emphasises that design activities also happen across projects and companies, e.g., building an environment that stimulates collective creativity and a company culture that fosters commitment from stakeholders. In future work, broadening the scope of the design activities would be useful to better understand the relevance of PEG.

We are aware there may have been an acquiescence bias in which participants generally tend to avoid negative answers. Since the researcher (first author) presented the aim of the study and moderated the interviews himself, the participants would be inclined to come up with useful applications of PEG out of politeness and hardly report when PEG would become less relevant or even impede their work.

3.5.2. Implications of emotional granularity for future research

Each of the seven identified opportunities is worthy of investigating as they involve different aspects of emotion and the resulting insights can

support designers in each opportunity. For example, the need to assess user emotions has already led to the development of refined assessment tools such as PrEmo ("Measuring Emotions," 2003) that measure user emotions. These tools go beyond the distinction of positive-negative emotions and provide users with a repertoire of emotions to choose from.

People begin to have granular categorisation of emotions when they are exposed to a wider range of emotions, are taught a rich set of emotion vocabularies and learn to represent the experiences with greater detail (Lindquist & Barrett, 2008). Likewise, the ability to precisely identify expressions develops when mirroring those who are emotionally granular and who use emotion words in a correct way to depict emotional states. Because this implies that emotional granularity can be enhanced, we propose that designers' emotional granularity can be supported with design tools that can help them in taking advantage of the identified opportunities. As argued by Lindquist and Barrett, how people use and think about emotion words does not aptly map the detail in what people know about emotions. An individual's understanding of emotions becomes granular when there is an explicit association between feelings, situational contexts and emotion words. Reminiscing about emotional memories is also known to be useful to learn the concepts of particular emotions; discussing the feelings that were evoked in the given situation, the consequences of expressing the emotion, or how he/she coped with or sustained the emotions can lead to a nuanced understanding of emotions (Fivush, Berlin, Sales, Mennuti-Washburn, & Cassidy, 2003). In developing design supports, these factors should be taken into account.

Regarding the opportunity 'evoking specific emotions', knowledge of the differentiated eliciting conditions needs to be increased to help designers understand the determinants of emotions. Several studies on eliciting conditions have been recently published. Tong (2014) investigated appraisals of 13 positive emotions and Campos et al. (2013) compared core-relational themes of eight positive emotions. In design research, a possible research direction could be to investigate if the general insights into eliciting conditions are applicable in human–product interactions. Resulting insights can support designers to deliberately elicit intended positive emotions.

Concerning the opportunity 'determining emotional intentions', the findings from the study presented in this paper indicate that emotion can not only be a design goal itself, but also be used as a means to stimulate specific usage behaviour as positive emotions involve distinct and specific

behavioural effects (Fredrickson, 2013). To support designers to trigger the desired usage behaviour by means of specific positive emotions, an understanding of what kinds of specific effects different positive emotions have on human–product interactions has to be developed.

Recent research has shown that positive emotions cannot only be observed in the face, but also in other expressions such as posture, voice tone, touch and gaze ("Nonverbal Expressions of Positive Emotions," 2014). App, McIntosh, Reed and Hertenstein (2011) argue that these different channels are related to the functions of emotions; the full-body expression is of relevance for emotions associated with social status such as pride and admiration while touch is used for intimate emotions such as love and sympathy. Advancing an understanding of behavioural manifestations of positive emotions can support designers to grasp users' affective states and predict likely actions.

3.5.3. Recommendations for developing a design tool to facilitate PEG

During the interviews, most participants mentioned that they were surprised by the usefulness of having knowledge of emotions and wanted to have tools that could support them in this. For example, this could be a tool that facilitates design creativity for a designer and a tool to measure emotions for a user researcher. The seven identified opportunities could serve as a starting point for developing such design tools.

There would be no single tool that could serve all of the seven key opportunities and 16 advantages because they address different needs and expectations of design professionals for PEG and each of them is relevant for different roles. This, however, does not mean that 16 different tools need to be separately developed. Perhaps a design tool and tool techniques could be developed in accordance with several opportunities. By tool technique, we refer to the way in which a tool is employed (Sanders & Stappers, 2012). For example, a card set that incorporates emotion terms and representative pictures of emotion expressions could be used for multiple purposes. Such a set could provide user researchers with a quick overview of positive emotions when they specify design intentions. Randomly chosen cards could inspire designers to consider non-obvious positive emotions when they generate product ideas or could help marketers as a reference when they explain the desired emotional experiences to others.

Provision of multiple entry points to compare positive emotions seems to

be crucial. The opportunity 'determining emotional impact of a product' showed that the participants wanted to browse through and compare the similarity between positive emotions based on several criteria in order to be more deliberate when specifying emotional intentions. Depending on the criterion, the similarity between positive emotions would be differently arranged (e.g., similarity based on effects on behaviour, interpersonal versus non-interpersonal emotions, feelings and eliciting conditions). This would support informed design decisions based on a systematic understanding of the multi-faceted aspects of positive emotions.

The level of granularity should adapt to the situation in which the tool is applied. The current study uncovered various situations in which designers can benefit from a fine-grained classification of positive emotions, but there might be some situations where a moderate level of granularity is more useful. Some designers and user researchers mentioned that when they report to a client about a general design direction, they would not want to have to go through all of the 25 positive emotions. They found the nine categories in the set sufficient for effective communication.

Given the effectiveness of the sensitisation exercise in the study, we postulate that concrete examples that depict certain positive emotional experiences in human–product interactions could help designers in getting a grip on nuances between positive emotions. In human–product interactions, positive emotions can be elicited by multiple sources (Desmet, 2012): the material qualities of the product, the associated meanings of the product, the interactive qualities when using the product, the activity facilitated by the product, the effects of using or owning the product and the effects of other people's activities on us in which the product plays some role. These different sources can be demonstrated with the collection of examples. This would stimulate designers to explore various design opportunities for facilitating the intended emotions.

Our research aims to understand how designers can be assisted in purposefully creating positive experiences that go beyond general pleasure. Given the fact that there are multifarious positive emotions that can be experienced in human–product interactions, we believe that the first step to design for such nuanced experiences is to understand these nuances. The next steps are to explore strategies to facilitate PEG and to develop tools that can be used in the design process because in general, natural language is limiting to express subtle emotional experiences.

Applications of the resulting tools in design cases or an experimental study that could demonstrate the effects of PEG would help further validate the benefits of PEG in design. The 16 advantages identified from the interview study could serve as the starting point for the validation.

This paper sheds light on the roles of PEG among various EI aspects. However, benefits of the other aspects, such as appraisal and expression, emotional facilitation of thinking and the management of emotions are no less relevant to design. We presume that all aspects of EI can be valuable, not only for the design activities within a product development cycle, but also for the activities that take place beyond the scope of product development. As found in the study, the management of emotions can contribute to cultivating productive working relationships. This is in line with Mayer and Salovey's (1997) suggestion that those with high EI might be adept at managing projects that involve products with emotions and aesthetics and that this could affect the quality of the design outcome. Agarwal (2010) notes that a high degree of EI is critical for creating an emotionally safe environment for designers to freely express their ideas and emotions, making persuasive argumentation regarding emotional aspects of a product and fostering commitment from the stakeholders. However, there has been no empirical study regarding what types of emotional intelligence can contribute to these achievements in design activities. Future research is needed to address this.

3.6. Conclusion

This paper offers new insights into how PEG can be of relevance in product development processes. The study findings show that PEG can serve several design activities across all product design stages. The main contribution is the overview of opportunities as identified by design practitioners. The results support the proposition that it is valuable to have a nuanced understanding of positive emotions and that emotional granularity in product development processes can ultimately provide end-users with better, more fitting, positive experiences.

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4. The mood street: Designing for nuanced positive emotions

This chapter is entirely based on: Yoon, J., Pohlmeyer, A. E., & Desmet, P. M. A. (2014). The mood street: Designing for nuanced positive emotions (pp. 707–716). Presented at the NordiCHI, Helsinki, Finland.

Abstract

This paper addresses how design activities can be supported to evoke nuanced positive emotions through a design case. The topic of nuances of positive emotions and values of differentiating positive emotions in a design process are discussed. The case follows appraisal approach, which implicates that the way people appraise an event determines the type of emotion. Design students created design interventions to specifically elicit one out of ten positive emotions in the context of an airline crew centre: anticipation, confidence, being energetic, inspiration, joy, kindness, pride, relaxation, respect, and sympathy. Three examples are provided to show how the approach has been used to generate design concepts. Reflecting on the design process, nine lessons are outlined, all of which discusses the challenges involved in the approach and how those challenges could be overcome.

Keywords: Design for emotions, Positive emotions, Appraisal, user-centred design, Design case, Exploratory study

4.1. Introduction

In the field of HCI and design research, various approaches and frameworks that facilitate emotion-focused design processes have been developed such as a framework based on psychological pleasure theory (Jordan, 1999), a framework based on neurobiological emotion theory (Norman, 2004), and a framework based on psychological needs (Hassenzahl, 2006). Although these frameworks are helpful for designers to understand the roles of (positive and negative) emotions during product usage and to consider various ways in which products influence user emotions, they tend to only focus on valance: an experience can be positive, pleasurable, enjoyable or negative, unpleasant, disturbing (Mano, 2004). However, there is more than the basic pleasure-displeasure distinction and products can evoke differentiated emotions. We can for example, be proud of using a laptop computer made of recyclable materials, be aflutter in anticipation of a planned trip looking at a boarding pass, or have a feeling of cathartic relief while playing a role-playing game on a mobile phone. Desmet (2012) claimed that emotions experienced in response to a product or a service is more nuanced than valance, and showed that people can experience at least 25 different positive emotions while interacting with a product such as desire, kindness, confidence, and fascination. Although these emotions are all pleasurable, each is different from one another in terms of feelings, eliciting conditions and how they influence people's behaviour (Frijda, 2007). According to the 'broaden and build' theory, proposed by Fredrickson (1998), positive emotions have distinct and specific behavioural effects: joy encourages to be playful in the broadest sense of the world (e.g., physical, social and artistic play), contentment leads a person to savour the life circumstances and recent success (Fredrickson, 1998), hope prompts a person to stay open to new information and motivates sustained effort in the face of a challenge (Lyubomirsky, King, & Diener, 2005; Snyder, 2002). It has been shown that in human–product interactions, positive emotions stimulate differentiated behavioural effects as well. For instance, surprise draws a person's attention to the product, leading to increased product recall and recognition (Ludden, Hekkert, & Schifferstein, 2008). A product that evokes inspiration infuses a user with new and creative thoughts, facilitating a shift in perspective (Desmet, 2008). A feeling of interest engages a user to actively explore the product attributes and functionalities, and prolongs the duration of use, resulting in an increased understanding about the product (Yoon, Desmet, & van der Helm, 2012).

We propose that differentiating between positive emotions that go beyond general ideas of pleasure can be useful for designers in their design processes. Perhaps, in the conceptualisation phase it may broaden the view of designers in relation to users' emotional responses and therewith stimulating design creativity, and being more precise in intended experiential effects may increase the effectiveness of the design solution (for an overview, see (Yoon, Pohlmeyer, & Desmet, 2014)). Although the studies on distinct positive emotions mentioned above give insights in the underlying eliciting conditions and related behavioural effects in human–product interactions, they usually focus on one specific emotion, not taking nuances between various positive emotions into consideration, and do not provide much details in how they describe what challenges are involved in design processes, and how these challenges could be overcome. An example of such a challenge is to ensure that all design team members have the identical understanding and expectations for the quality of desired emotional experiences that the design solution is supposed to facilitate. For these reasons, the current paper aims to report the lessons we learned from a design case that was driven by multifaceted emotional intentions: (1) the gained lessons can support designers to deliberately elicit specific positive emotional experiences, and (2) the identified challenges can ensure what kinds of design supports (e.g., tools, techniques, guidelines) could be of relevance in the design process. Thus, the overall question addressed in this paper is: how can design activities be supported to elicit nuanced positive emotions? The lessons illustrated in this paper were explored within the setting of the design project 'Mood Street' organised in a course at Delft University of Technology.

This paper begins by introducing the topic of nuances of positive emotions and the aim of the study. The second section introduces the design project. The third section gives a brief overview of the approach we took in the project, which serves as a framework for the study. Next, we present some examples of the generated concepts. We will then report the lessons we learned ranging from issues that arose during the project to possible opportunities to resolve them. On the basis of the experience in the project, some methodological challenges involved in the process of designing for nuanced positive emotions are discussed with proposals for future research.

4.2.   Nuances of positive emotions

Contrary to negative emotions, positive emotions are relatively undifferentiated: joy, amusement and serenity are not easily distinguished from one another in terms of facial expressions as they all result in a smile (Ekman, 2003). Similarly, action-tendency, another component of emotional experiences (Frijda, 2007), is less obvious for positive emotions than for negative ones. Due to subtle differences between positive emotions, most commonly used sets of basic emotions (e.g., Plutchik, 1980) include fewer positive emotions than negative emotions, and emotion research in psychology has predominantly focused on negative emotions. Likewise, distinctions between various positive emotions have been largely ignored in the design research literature (Desmet, 2012). In design research, although various frameworks and approaches have been proposed to support design activities that are driven by the goal of facilitating positive experience, they have not methodically considered nuances between positive emotions. They tend to focus on general pleasure or some oversimplified sets of positive emotions, having limitations in granularity. As a consequence, practical issues such as underlying barriers or enablers involved in the process of designing for different types of positive emotions have remained largely unveiled. This limited focus is disadvantageous for designers because they mostly wish to deliberately create positive emotional experiences such as fascination, sympathy, admiration or hope. Although these positive emotions are all pleasurable, the approach to designing for each of them takes different steps because each emotion involves different eliciting conditions: designing for desire is a fundamentally different challenge than designing for relaxation, or for relief. Therefore, by making a design case and reflecting the design process, we explored when and how design activities can be supported in the process of evoking nuanced positive emotions.

4.3.   Design case—Mood street project

The case that is hereafter reported was conducted in an eight-weeks master level design course 'design for emotion and subjective well-being', together with KLM Royal Dutch Airlines (hereafter referred to as 'KLM'). Twenty students followed the course.

4.3.1. Background

The crew centre of the airline locates at Schiphol airport in Amsterdam and there are approximately 9000 cabin crews employed. The airline's

management of the crew centre initiated the 'Mood Street' design project because they noticed that it is desirable to support the cabin crews to feel prepared for international flight. Because of the large number of cabin attendants, they rarely fly with the same crews. They often meet each other for the first time only a few hours before the flight. The management had identified the preparation procedure for the flight as an opportunity to support the cabin crews and wanted design interventions to improve this experience. In this project, there was no predefined means (e.g., design a product, application, space, campaign, etc.), but the goal of positive emotional experiences for the cabin crews was set.

4.4. Design approach

In this project, we took the appraisal approach introduced by Desmet (2002) to create design interventions that facilitate positive emotional experiences. The appraisal approach has been demonstrated to be useful for designing with the intention of both eliciting and avoiding specific emotions as it explains how different emotions are elicited by different underlying processes (Roseman, 2001). In this approach, the process starts with specifying emotional intentions of the design and identifying the appraisals that evoke intended emotions. Next, the concerns underlying the appraisals are identified. Based on the appraisals and related concerns, product (or service) concepts are developed (see Figure 4.1).

4.4.1. Step 1: Determining emotional intentions

In this step, a designer clarifies (1) the emotional intention (the emotion that should be experienced by the users) and (2) the design context in which the design will be used, if not specified previously. The emotional intention can be specific (e.g., interest (Yoon et al., 2012)) or a compound experience (e.g., wow experience that combines fascination, desire, and pleasant surprise (Desmet, Porcelijn, & Van Dijk, 2007)), or general pleasure (Desmet, 2010). Once emotional intention is specified, designers determine particular appraisals that are related to elicitation of the intended emotion. For example, to evoke interest, the product must be appraised as novel, unfamiliar, and understandable (Yoon et al., 2012), and to evoke desire, the product must be appraised as promising and fit for ownership (Desmet, 2008).
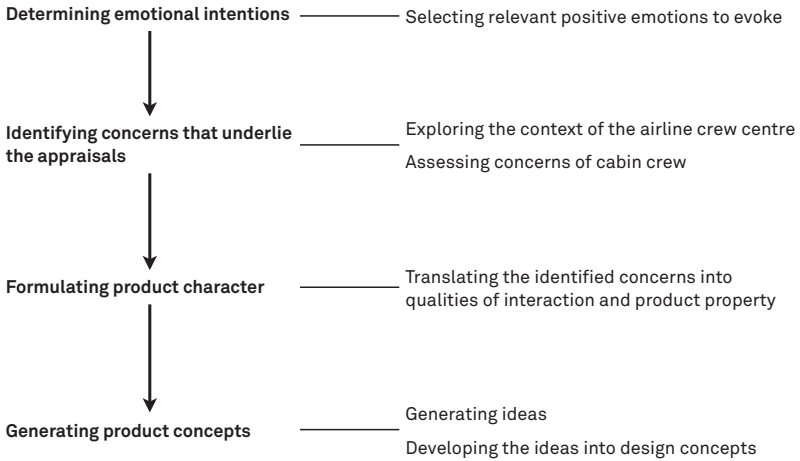
Figure 4.1. Appraisal based emotion-driven design approach
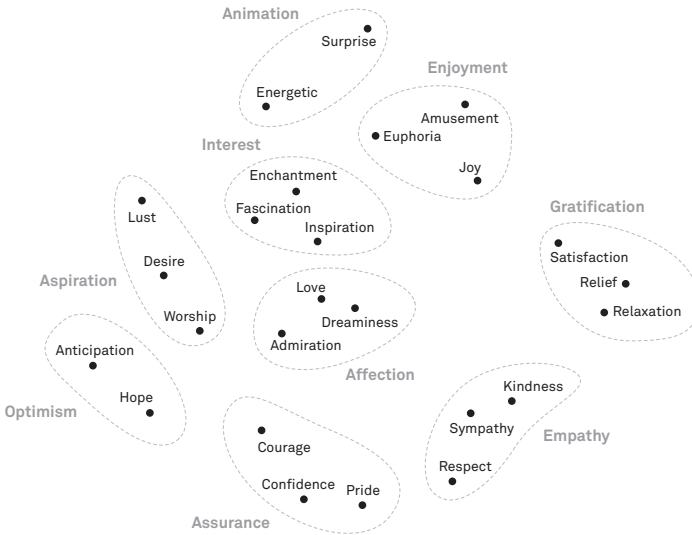
Figure 4.2. Visualisation of similarity among the 25 positive emotions (Desmet, 2012, p. 6)

In a kick-off meeting that involved the authors (second and third) and two managers of the crew centre, the emotional intentions were envisioned. Typology of positive emotions developed by Desmet (2012) was used as a reference for determining the positive emotions that are desirable for the given situation (Figure 4.2). The result was a set of ten positive emotions: anticipation, confidence, being energetic, inspiration, joy, kindness, pride, relaxation, respect, and sympathy. In the course, the students were split

Group	Emotion	Definition	Core-relational theme
1	Relaxation	To enjoy a calm state of being free from mental or physical tension or concern	It arises in a pleasant situation, when it is certain that an undesirable event will not occur in any way.
	Pride	To experience an enjoyable sense of self-worth or achievement	One's praiseworthy behaviour surpasses internal or external standard, and/or one recognises that others appreciate it.
2	Being energetic	To enjoy a high-spirited state of being energetic or vitalised	Something pleasant facilitates the enthusiasm and determination to do something.
	Sympathy	To experience an urge to identify with someone's feelings of misfortune or distress	One recognises that someone is suffering a distress and is motivated to be helpful.
3	Joy	To be pleased about (or taking pleasure in) something or some desirable event	Something that facilitates goal accomplishment happens or provides sensory pleasure.
	Respect	To experience a tendency to regard someone as worthy, good or valuable	A praiseworthy character of someone conforms to internal or external standard.
4	Kindness	To experience a tendency to protect or contribute to the well-being of someone	One finds relatedness with someone and is motivated to be conducive to his/her goal achievement.
	Anticipation	To eagerly await an anticipated desirable event that is expected to happen	One notices that there is a high chance that a desired event will actually take place.
5	Confidence	To experience faith in oneself or one's abilities to achieve or to act right	It is certain that one is capable of overcoming a challenge in the process of realising his/her goal.
	Inspiration	To experience a sudden and overwhelming feeling of creative impulse	One is awakened to the realisation of a relational meaning of something and is enabled to do something creative.

Table 4.1. The determined emotional intentions, definitions and core-relational themes (Desmet, 2012; Yoon, Desmet, & Pohlmeyer, 2013)

into five groups of four, and two positive emotions were assigned to each group. We allocated a pair of dissimilar positive emotions based on the typology to facilitate their awareness on differentiated aspects of the given positive emotions. We considered the number of the positive emotions to be appropriate for the students; challenging, but feasible in the time available. There was an exercise in which students shared their own experiences and definitions of the ten positive emotions, and discuss how the given emotions differ from each other. Next, the students were provided with the definitions and appraisals of the chosen emotions in the form of appraisal components and core-relational themes that represent a summary of the related appraisal components (Lazarus, 1991). Table 4.1 gives an overview of the definitions and core-relational themes of the chosen ten positive emotions.

4.4.2. Step 2: Identifying concerns that underlie the appraisals

This phase was to identify the cabin crews' concerns that are related to the appraisals of the intended emotions. According to Frijda (1986),

personal concerns are the determinant factor of appraisal process, therewith affect emotional experiences; when we appraise something as praiseworthy to our concerns, we may experience pride, or when we appraise something as goal-conducive to our concerns, we may experience joy. Therefore, understanding the concerns of the user is the key to effectively address the appraisals of the intended emotions in design processes (Desmet & Schifferstein, 2012).

The identification of the concerns started with a context exploration; the students immersed themselves in the context following a tour through all surroundings in the crew centre. Next, each group interviewed two cabin crewmembers to understand their concerns. Students were instructed to identify the concerns that are associated with appraisals of the intended emotions ranging from concrete (e.g., "I want to send a message") to abstract degree (e.g., "I want to be in touch with loved ones") based on the depth interview technique 'laddering' (see Reynolds & Gutman, 1988). It was to see relatedness between the identified concerns: fulfilment of concrete concerns may lead to the attainment of the related abstract concern and similarly, realising an abstract concern can satisfy a concrete concern (Demir, Desmet, & Hekkert, 2009). This stage resulted in a set of concerns that the design solutions are supposed to address.

4.4.3. Stage 3. Formulating product character

In this phase, the designer envisions how the concerns can be translated into the product character that represents the appearance of or the qualities of interaction with the product (Desmet & Schifferstein, 2012). The students were guided to formulate the product characters that can clearly represent the concerns in the form of words and/or pictures such as inviting, seductive, submissive, tender or challenged. For example, when the concerns are 'feel belonged to a community' and 'being able to contribute to a community', then the product character can be expressed by 'acceptant' and 'appreciative'. Each group made an inspiration board on which the collection of representation of product character, related concerns, associative quotes, pictures was attached. The board served as a source of inspiration and as a means to ensure the emotional fittingness of the design concepts. In the idea generation phase, the students were encouraged to refer back to the board.

Figure 4.3. An example of inspiration board that depicts product character and related concerns

4.4.4. Stage 4. Generating product concepts

In the last step, ideas for a new product (or service) were generated and developed into product concepts on the basis of the product character and concerns. With the term 'idea' we are referring to an original thought, something to further explore and experiment with, and the term 'concept' is a more advanced proposal that incorporates original ideas and design objectives (Koen et al., 2002). As a starting point of idea generation, we instructed students to use a framework that distinguishes six sources of positive emotions (Desmet, 2012): in human–product interactions, positive emotions can be experienced in response to object (the material qualities of the product), meaning (the associated meanings of the product), interaction (the interactive qualities when using the product), activity (the activity enabled or facilitated by the product), self (the effects of using or owning products), and other (the effects of other people's activities on us, in which the product plays some role). It was to help students explore various design opportunities for facilitating the intended emotions.

Students were asked to come up with twelve ideas per emotion (e.g., twelve ideas that generates experience of sympathy); in total, 120 ideas that aimed to evoke the ten positive emotions were generated. While generating ideas, three feedback sessions in which the groups shared their ideas together with lecturers of the course took place in order to discuss to what extent the ideas could elicit the intended positive emotions. In an interim meeting, the airline managers, lecturers, and students themselves evaluated and discussed all of the generated ideas together, and selected 20 ideas for further exploration. Following the meeting, the students developed the chosen ideas into product (or service) concepts. Next to this, they started developing rough models to explore how the intended character of the product can be translated into product properties. To demonstrate when and how the product concepts facilitate the intended positive emotions, scenarios were developed.

4.5. Examples of the concepts

This section shows three examples of the developed concepts, in which kindness, anticipation, confidence were aimed to evoke respectively.

4.5.1. Kindness: Good night

Good night is an application for smartphones that gives a kind wake-up call for the cabin crews when they are at home and have early flights. A lot of flight attendants do not sleep well being nervous because they are afraid of oversleeping and being late for the flight. The application detects when a flight attendant is flying early. If this is the case, the day before the flight it warns him/her to set the desired time to wake up and to charge the phone by showing a red light on the screen. Once the alarm setting is done, the screen turns green and stays the same colour until the set time. This assures the flight attendant even when he/she wakes up in the middle of the night by simply showing the green colour. At the set time, the screen turns orange and starts alarming to wake him/her up. In this moment, he/she needs to enter the scheduled flight number to turn it off and to confirm that he/she is awake. The purser can see the statuses of crewmembers' alarm settings through colour indicators. If the alarm does not go off, the flight attendant gets a call from the purser. In this way, the cabin crews kindly look after each other, and feel connected even before they actually meet.
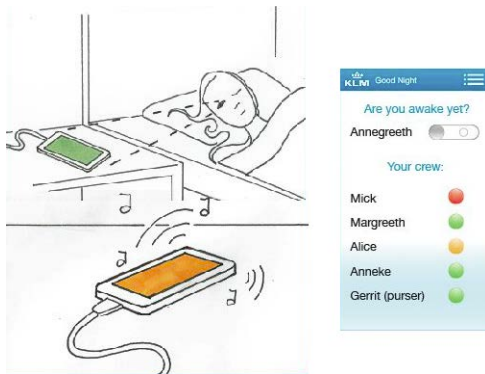
Figure 4.4. A smartphone application designed to evoke kindness in usage (design by Inge van der Lee, Amanda Lee Jakobsen, Suwen Shen and Maik de Rooij)

Figure 4.5. An installation designed to evoke anticipation in the preparation of flights (designed by Inge van der Lee, Amanda Lee Jakobsen, Suwen Shen and Maik de Rooij)

Figure 4.6. A camera used to evoke confidence before the flights (designed by Lorenzo Romagnoli, Mitra Malkamy, Manon Kühne and Noortje Habets)

4.5.2. Anticipation: The curtain

The curtain is a concept that leads the cabin crews to be expectant of the upcoming flight. Cabin crews feel the routine in the crew centre as 'preparation area' when stepping into the airport. There is a separation curtain installed between the crew centre and the airport to make the cabin crews perceive these two spaces clearly separated. As the cabin crews walk altogether towards the gate of the airport, the closed curtain slowly starts opening and the lights around the curtain frame glow one by one. When all the lights are on, the curtain is completely open. This moment builds up a feeling of anticipation and signals that they are prepared to work as professionals.

4.5.3. Confidence: The big button

The big button is a design for a new ritual that cabin crewmembers can do before flying in order to augment a sense that the team is ready for its performance like the rituals a sport team has before entering a match. The intensity of the light on the button grows according to the number of people touching it representing the mixed energy of the entire members. When every crewmember has hands on the button, the light is at full power. The crew members push it together and a picture of the their hands on the button is taken. The picture shows their hands and is sent to them at the end of the trip. This moment reinforces the feeling that they are capable of managing all tasks as a team in trusting each other.

4.5.4. Discussion

Although these concepts are developed to specifically evoke certain positive emotions, they would evoke different positive emotions in addition to the intended ones because products can evoke emotions in various ways (Desmet, 2012). For example, 'Good night' evokes kindness by enabling the cabin crews to support each other (being kind to colleagues), and may simultaneously evoke relaxation as well by ensuring that he/she will be able to be on time (relaxation attributed to the expected consequence of using the application).

Note that the given examples are meant to illustrate designing for nuanced positive emotions apart from the likelihood of implementation in practice. For example, the concept 'Big button' would not be implemented: it would be rather inadequate to be used in KLM's professional environment.

4.6. Lessons learned

Following the completion of the project, a focus group session was conducted with five students. From each of the five groups, one student representative participated in. Based on our observations in the design process, the generated concepts and the focus group, we present lessons learned that we think are necessary to consider supporting design activities in designing for nuanced positive emotions.

4.6.1. Lessons in the first stage: determining emotional intentions

Internalising concepts of intended emotions

> *Personal reflection gives us an intuitive sense of the emotion, and these theoretic definitions also give methodical sense too. We need both* (Student B).

Although the definitions of the ten positive emotions were given to help everyone in a group have a common understanding on the conception of the intended emotions, students found them still abstract. Most of the students mentioned that the exercise in which they reflected personal experience of the given emotions was valuable to deepen their understanding; they discussed for example, when they had the feeling of joy and respect, and what happened that time and how they reacted in that situation, discovering the differences and similarities in their experiences. Combined this exercise with the provided definitions, students could clarify and establish a consensual concept on the assigned emotions, which helped them avoid misunderstandings and miscommunications about the design intentions throughout the design process.

Understanding appraisals of the intended emotions

> *Experience of sympathy starts with recognising that someone is in need. For this, it is essential to make a design intervention that creates a moment of sharing intimate information. Having this idea in mind, we could sort out what to ask during the interview* (Student C).

Students used the provided appraisal patterns as a reference for understanding eliciting conditions of the given emotions and for self-questioning their ideas in idea generation phase: students related the ideas back to the appraisal patterns to check if their ideas were in line with the appraisals of the given emotions. While useful to have the

patterns of how people experience the emotions, not all groups used the provided appraisal patterns and core relational themes. Students mentioned that terminologies in appraisal patterns (e.g., agency, coping ability, etc.) appeared to be tricky to interpret and it was unclear how product properties could be related to them. Furthermore, since the names of appraisal components vary somewhat across appraisal researchers (Ellsworth & Scherer, 2002), some students were confused when the names were different from their knowledge. This implies that providing the eliciting conditions in the textual form of appraisal patterns would be not directly applicable for a design process.

Being aware of a comprehensive set of positive emotions

> *It was useful to have a full picture of positive emotions. The typology helped us see how our intended emotions are related with other emotions. For example, feeling respect involves various emotions in its episode; respect can be facilitated through being empathised from someone else* (Student E).

Although each group had two specific emotions to design for, most of the students stated that they could benefit from having a general overview of positive emotions to construe the antecedents of the intended emotions. Students used the typology of positive emotions (Desmet, 2012) as a reference to see how the intended emotions are related with other positive emotions. Some positive emotional experiences involve other positive emotions as their antecedents. For example, relief arises when something hoped is finally realised and felt satisfactory (Lazarus, 1991). This means that to evoke relief, it is necessary to consider the experience of hope and satisfaction in parallel. The group 'respect' found that a feeling of being respected could be facilitated when a person notices that other people highly regard what he/she is proud of. In line with this idea, they designed a festive event in which a member of cabin crew feels proud of reaching certain miles and, the colleagues can celebrate and express that they highly regard his/her achievement.

4.6.2. Lessons in the second stage: identifying concerns that underlie the appraisals

Focusing on particular emotions to design for

> *We knew when to go deeper and to ask for more details during the interview. Having specific emotions in this phase helped us frame our questions, otherwise it is hard to see the points to dig in* (Student B).

Students found it advantageous to have specific emotions as design intention when they were identifying user concerns. During the interview, they could clearly structure their questions and focus on selecting most relevant user concerns, rather than on trying to cover everything; once the interviewee mentioned a certain thing that seemed to be closely related to the intended emotion and appraisals, the students could further probe it. Likewise, having specific emotions made the process of data analysis efficient; students arranged the collected data through the lens of their design intentions (i.e., the given two emotions), considering in what situations the given emotions become important, and what kinds of concerns could be appropriate to relate with the design solutions.

Specifying appropriate concerns to design for

> *The idea was derived from very personal concern. Because the concern was personal, it might evoke joy for that person. However, for someone who does not have the same concern, there might be no joy* (Student A).

Students strived to identify the concerns that were relevant for a large group of people. For instance, the group who worked on 'joy' expressed difficulty in selection of appropriate concerns[9]. They mentioned that the goal related concern that they selected was too concrete (e.g., "I want to have a good coffee before a long flight.") and it seemed to be not always relevant for the majority of cabin crews. In addition, we observed that when students solely focused on the concerns in the concrete level, there was a tendency to already provide design solutions instead of trying to identify an overarching concern. Therefore, we propose that in order to select most proper concerns, it is required to guide designers to identify concerns thoroughly covering from concrete to abstract level.

Shared appraisals in varied positive emotions

> *Our concept would evoke joy to some degree, but not explicitly. Perhaps, you may associate users' responses with different positive emotions such as pride* (Student A).

Although all five groups followed the same design process, students perceived that some emotions were more challenging to design for. We

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[9] There are two types of joy: joy as characterised by a feeling from progress towards one's goals (Lazarus, 1991), and joy experienced from sensorial pleasure, which is goal-independent (Scherer, 2001). The group found it difficult for the former.

argue that this difficulty arouse because some positive emotions share the same appraisals so that it was difficult to clearly differentiate. For instance, joy, pride, and satisfaction share the appraisal of 'appreciation of present circumstance', and joy shares the appraisal of 'goal achievement' with pride (Ellsworth & Smith, 1988). This means that the eliciting condition for joy also characterise pride. Ortony, et al. (1988) suggest that to differentiate pride from joy, an event (or stimulus) should be appraised to be not easy to achieve, or the result of an event should be beyond expectation. We propose that to support designers to evoke a certain emotion with clear differentiation, designers need to be equipped with a detailed overview of nuanced eliciting conditions so that they can compare what is shared, and what is different between similar positive emotions.

4.6.3. Lessons in the third stage: formulating product character

Representing product character

> *The board was very useful. Quotes, pictures, and statements embodied the qualities of interactions and product properties. Literally, it was an inspiration board* (Student C).

Using rich operational means to represent the product character (e.g., quote, photo, statement, collage) helped students get a sense of how the chosen concerns can be materialised. As to the approach to formulating character, students somewhat struggled in representing quality of a product that embodied the concerns. In general, they used two approaches: either a metaphorical or literal way. We observed that when the product character was made in a very literal way, the character tended to actually end up in the final design. For example, the group who worked on kindness expressed the product character through a statement "Flirting is a way of showing kindness", and their final concept was an interactive mirror that gives a personal 'flirting' message to a flight attendant. While concrete, the product character made in a literal way was not evocative of creative exploration. We think that product character needs to be open-ended and inviting interpretation to some degree; the product character should not rigidly dictate the design direction.

4.6.4.   Lessons in the fourth stage: generating product concepts

Staying open to other emotions for divergent thinking

> *In this phase, having two specific emotions restricted our creativity. Some promising ideas seemed to evoke other positive emotions rather than the intended ones. We were too hasty in discarding them. Perhaps, we could build on those ideas and tweak them to evoke our target emotions* (Student E).

Students mentioned that sticking to the given two positive emotions somehow limited them in exploring various design opportunities. They assumed that apart from the specified emotional intention, envisioning various positive emotional responses of users could be also useful in that it could help them expand their solution space. Thus, it would be helpful to encourage designers to incorporate other positive emotions with the predefined ones so as to broaden their view.

Note that although this lesson seems to contrast the fourth lesson 'focusing on particular emotions to design for', they are clearly different in that each lesson is to serve a different design activity: the fourth lesson is about helping designers to deliberately converge from a diversity of positive emotions to the highly relevant ones in order to deepen understanding on users, and the eighth lesson is to help designers to diverge their view to explore an array of design solutions.

Exploring different sources of positive emotions

> *We tried to challenge ourselves to come up with ideas based on each of the sources. It helped us see different opportunities and create unique ideas* (Student C).

Students used the framework of six sources of positive emotions (Desmet, 2012) as an idea generation technique. For example, when they felt stuck while focusing on 'object', they started thinking of how other sources such as meaning or activity could play a role in facilitating the intended emotional experience. They found this framework particularly useful for an experience-driven design project because the framework helped them avoid being fixated to a certain stimuli type and focus on changing the experience.

4.7. General discussion

Studies in HCI and design research traditionally have focused on generalised pleasure or displeasure in user experience, giving little attention to differentiated nature of positive emotions and to how these differentiated emotional experiences can be facilitated with designs. Through a design case that followed appraisal approach, we identified the challenges that designers face in the process of designing for nuanced positive emotions and discussed how those challenges could be overcome: we investigated (1) how designers can assimilate their emotional intentions in the project; (2) how they can identify appropriate user concerns that are associated with the appraisals of the intended emotions; (3) how they can translate the concerns into concrete ideas that evoke the predefined emotions. Along with the lessons, our approach and used materials presented in this paper (e.g., typology of positive emotions) can provide designers with a frame of thought that can help them systematically structure their design processes such a way that the design outcome has the specific emotional impact.

The findings illustrated in this paper provides a first step to purposely generate positive experiences, but we should be aware that emotions are subjective thereby a resulting experience could deviate from the prediction (Desmet & Schifferstein, 2012); the way people appraise a stimuli can differ from each other. For example, a person may appraise a product as novel whereas someone may appraise the same product as stereotyped due to his/her different background. Likewise, the concept 'Good morning' would probably not evoke a feeling of kindness if the service is used by a flight attendant who is less afraid of waking up early and is confident of being on time. Therefore when designing for emotion, user-centred approach and in-depth understanding on the context and users' concerns (e.g., goals, values, and aspirations) are crucial in that this enables the designer to envision how users will appraise the design solution. Reflecting our experience, it is suggested that the implementations of each step should be based on the insights that are shared and checked with the actual users in order to make sure that the final design is developed to have the intended emotional impact. The premise for this is that the design process supports users to express their emotional responses in a fine-grained way. Discussing emotional responses to products with users is challenging; emotional states are difficult to articulate, especially the types felt at low intensity, and users often experience multiple emotions simultaneously, with each different product aspect (e.g., appearance, functionalities, comfortability) (Desmet

& Schifferstein, 2012). Given the complexity in emotions experienced in human–product interactions, tools that measure distinct emotions such as PrEmo (Desmet, 2003) and Geneva emotion wheel (Scherer, 2005) could be applied to understand user emotions.

We focused on positive emotions in this study, but this does not mean that positive emotions are only worthwhile designing for and a panacea for all situations. Note that there are some situations where pursuing behavioural effects of positive emotions are not appropriate, e.g., people in dangerous situation should remain focused or ready to escape and for this, moderate degree of negative emotions such as fear or anxiety would be required. Therefore, designers should make sure that they have a solid understanding on the context and users, and should question about what kinds of emotional impact are most relevant for the context, and when is suitable to experience certain emotions.

The current study comes with some limitations. Since the illustrated lessons are mainly derived from the design activities in early stages of a design process, they would be not fully comprehensive; there might be different design challenges involved in the rest stages such as product (or service) realisation and validation of emotional impact on users, which are not covered in this study. With the help of more case studies that encompasses entire scope of a design process, some details in the approach could be further developed and additional lessons could be gained. As outlined in Cross (2004), there are differences between inexperienced designers and expert designers in performing various design activities such as gathering information, scoping and framing a design problem, searching for solutions. This implies that the differences in expertise could influence on how a certain design approach is carried out. Regarding the expertise of the participating design students, we are aware that a student cohort is not representative for all designers. The same study, if conducted with design professionals, may have resulted in different patterns. Another issue is that the setup of the design case was somewhat unnatural; dividing designers into several groups and allocating particular emotions to them would not be the case in real design practice. Rather, the reality of design is much more sophisticated and holistic than is shown in the design case. Note that through this controlled setup, we intended to outline the issues to consider in designing for nuanced positive emotions because this allowed us to observe differentiated design challenges involved in evoking ten different positive emotions under the same condition.

All the lessons we learned taken together, we think that a key factor is to support designers to have developed 'emotion knowledge' in their design processes. Emotion knowledge is the knowledge that people use to understand and reason about emotions in terms of causes and consequences of the emotions experienced by themselves or by others. This knowledge is also related to the ability to express and talk about emotional experiences (in both past and present) (Barrett, Gross, Christensen, & Benvenuto, 2001); as the lessons in our experience showed, designers and design processes can benefit from differentiating various positive emotions, articulating the desired emotional states to facilitate, discerning distinctiveness in terms of eliciting conditions, and reasoning underlying user concerns that are associated with the particular positive emotions. Hence, we postulate that to deliberately design for positive emotions, it is of importance to structure a design process that leverages designers to work with developed emotion knowledge. It is especially relevant because as found in Desmet (2012), not all designers have a structured overview of positive emotion types and are good at communicating emotional experiences with specificity. This implies that some designers might have a difficult time in specifying what kinds of positive emotional responses they need to design for. As next steps of this research, we aim to explore how a nuanced understanding on positive emotions can be facilitated, and to develop tools and techniques that can be used in the design process based on the lessons we gained in this study. We expect that the findings illustrated in this paper can serve as a guide for further researches and design projects that aim to create positive experience, and hope that more attention will be given to the values of bringing the concept of nuances of positive emotions into a design process in HCI community.

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5. Embodied typology of positive emotions: The development of a tool to facilitate emotional granularity in design

Abstract

This paper introduces a tool that has been developed to facilitate emotional granularity in design: 'Embodied Typology of Positive Emotions'. Emotional granularity reflects individual differences in the ability to precisely represent and interpret one's own and others' emotional states, referring to distinct emotion words rather than merely to a general feeling of pleasantness. It can be advantageous for designers to have high emotional granularity. In design, the awareness of and ability to label nuances in emotions may facilitate to recognise users' complex emotional responses with accuracy, and to specify design intentions in terms of emotional impact more clearly. The tool supports an understanding of 25 positive emotions by providing definitions of emotion labels, eliciting conditions, and visuals of expressive behavioural manifestations. This paper describes the tool, its development process, as well as ideas for applications in design. Implications of the tool and future research steps are discussed.

Keywords: Emotional Granularity, Positive Emotions, Design Tool

5.1.   Introduction

Using a product can elicit all kinds of emotions such as joy, pride, frustration, hope, disappointment and sympathy (Desmet, 2012). Some people are more aware of the differences between these emotions than others. This is called emotional granularity (Lindquist & Barrett, 2008). Emotional granularity reflects individual differences in the ability to precisely represent and interpret one's own and others' emotional states, referring to distinct emotion words rather than merely to a general feeling of pleasantness (Lindquist & Barrett, 2008; Tugade, Fredrickson, & Feldman Barrett, 2004). A person with high emotional granularity can articulate an emotional experience with discrete emotion words (such as confidence, satisfaction, amusement, pride, relief, etc.) to explicitly represent the distinctiveness. On the other hand, an individual with low emotional granularity tends to report a distinct emotional experience in a blurred way using a global term such as good, pleasant or happy (Tugade et al., 2004). Positive psychology literature suggests that there are various benefits of having a developed emotional granularity: high emotional granularity enables people to be more flexible, effective, and resilient than those with low emotional granularity (Tugade et al., 2004). In various studies it was found that individual differences in the tendency to precisely label emotional experiences are associated with emotion regulations and coping abilities (e.g., Aspinwall & Taylor, 1997; Tugade et al., 2004). In stressful situations, those with high emotional granularity are likely to engage in thorough consideration of information and think of an array of behavioural options. Furthermore, emotional granularity is known to be associated with empathy: the ability to recognise emotions from others with precision is better among those higher in empathy (Mayer & Salovey, 1993). In design, empathy has been a defining characteristic of designer-user relationship that facilitates the understanding of a user from his / her perspective and knowing what it feels like to be that person (Wright & McCarthy, 2008). Regarding the beneficial effects of emotional granularity, it can be advantageous for designers to have developed emotional granularity. We see at least two advantages for designers to have high emotional granularity: (1) it helps them in the initial design stages to empathise with the complex emotional responses of users, and (2) it helps them formulate nuanced design goals in terms of intended emotional impact of their designs. Despite the value of emotional granularity, to date little attention has been paid in design research to this topic and its practical implications. Since little is known about how emotional granularity can be facilitated, this research focused on developing a design tool that can facilitate emotional granularity.

Contrary to negative emotions, positive emotions are somewhat undifferentiated. For example, joy, amusement and serenity are not easily distinguished from one another in terms of facial expressions as they all result in a smile (Fredrickson, 2003). Similarly, action-tendency, another component of emotional experiences (Frijda, 2007; Scherer, 2005), is less differentiated for positive than for negative emotions. In contrast, we can readily identify the differences between negative emotions such as anger, sadness, or fear by observing behavioural manifestations. This implies that it comes less natural for people to have positive than to have negative emotional granularity. For designers however, it is especially relevant to have high positive emotional granularity because their intentions are usually to evoke positive emotional experiences. Hence, we decided to develop a tool that can help designers in developing their positive emotional granularity.

This paper firstly reports the process of developing the design tool 'Embodied Typology of Positive Emotions'. Next, a workshop is reported that was carried out to explore how the tool can be applied in a design process. Based on these ideas, applications of the tool in the design processes are proposed. The implications and limitations of the tool are discussed and future research steps are proposed in the general discussion section.

5.2. Development of embodied typology of positive emotions

Several basic emotion-sets have been suggested (e.g., Ekman, 2003; Frijda, 2007; Izard, 1977) that include one to five of the following positive emotions: joy, love, interest, anticipation, and pleasant surprise. The disadvantage of these sets is that they are oversimplified to represent the variety of human emotions, thus they are not useful to facilitate emotional granularity. Desmet (2012) found that there are at least 25 positive emotions that can be experienced in response to products, and formulated a typology of positive emotions (see Figure 5.1). We decided to use this typology as a basis since it is concise, but fine-grained enough to illustrate distinctiveness of various emotional experiences.

EMPATHY	AFFECTION	ASPIRATION
Sympathy, Kindness, Respect	Love, Admiration, Worship	Dreaminess, Lust, Desire
ENJOYMENT	OPTIMISM	ANIMATION
Euphoria, Joy, Amusement	Courage, Hope, Anticipation	Surprise, Being energetic
ASSURANCE	INTEREST	GRATIFICATION
Pride, Confidence	Inspiration, Enchantment, Fascination	Relief, Relaxation, Satisfaction

Figure 5.1. Typology of 25 positive emotions categorised in nine emotional types (adapted from Desmet (2012))

Although the typology provides an overview of various positive emotions, solely providing a list of emotion words and definitions seems not to be enough to help designers to capture fine nuances between emotions. It is therefore worthwhile to explore different components of emotions such as eliciting conditions, expressions, and behavioural manifestations. As all emotions are different in terms of these components (Scherer, 2005), we assume that understanding the distinctiveness of the 25 positive emotions regarding these different components would potentially contribute to facilitating emotional granularity. As Wallbott's study (1998) showed, behavioural manifestations are indicative of a specific emotional state. In line with this idea, we believe that providing visuals of behavioural manifestations with the typology can make it more comprehensive. It can be also useful to know when and how a distinct emotion arises to better identify nuances between positive emotions. Therefore, we aimed to integrate the typology with a set of rich representations for each of the 25 emotions, providing multiple sources of information in terms of conditions that elicit the emotions and images of people having these emotions in real contexts. We collected images that clearly characterise the behavioural manifestations the 25 positive emotions, formulated the eliciting conditions, and arranged them according to the typology.

5.2.1. Defining eliciting conditions of 25 discrete positive emotions

All emotions have unique 'core relational themes' that represent the conditions that elicit them (Lazarus, 1991). Core relational themes of the 25 positive emotions were formulated to describe the eliciting conditions on the basis of 25 sources within the appraisal theory based literature (see Appendix 1). However, only few references address the emotions kindness, worship, dreaminess, euphoria, courage, being energetic, and enchantment. For those emotions, core relational themes were formulated based on the examples of eliciting conditions in human–product interactions, collected in Desmet's study (2012). Table 5.1 shows the core relational themes of the positive emotions.

Emotion type	Emotion	Core relational themes
Empathy	Sympathy	One recognises that someone is suffering a distress and is motivated to be helpful.
	Kindness	One finds relatedness with someone and is motivated to be conducive to his/her goal achievement.
	Respect	A praiseworthy character of someone conforms to internal or external standard.
Affection	Love	An appealing character of someone provides a likelihood of mutual affection or something facilitates associations with a loved one.
	Admiration	Someone's praiseworthy behaviour surpasses internal or external standard.
	Dreaminess	Something facilitates a stepping outside of the current experience and leads to associations with an experience (either in the past or future).
Aspiration	Lust	Someone's sexual appeal corresponds to one's appetite or facilitates associations with an erotic interaction.
	Desire	Something potentially beneficial for personal concerns is expected to be reachable.
	Worship	An appealing character of someone surpasses one's internal or external standard or when something facilitates associations with an idolised one.
Enjoyment	Euphoria	Something extraordinary that enables to surpass one's boundaries happens.
	Joy	Something that facilitates goal accomplishment happens or provides sensory pleasure.
	Amusement	One is awakened to the realisation of a relational meaning of something absurd in a clever and witty way.
Optimism	Hope	One finds a prospect of accomplishing his/her wishes.
	Anticipation	One notices that there is a high chance that a desired event will actually take place.
	Courage	It is certain that my behaviour will ensure a removal of an obstacle and improve chance of goal accomplishment.
Animation	Surprise	Something unexpectedly happens beyond one's expectation.
	Being energetic	Something pleasant facilitates the enthusiasm and determination to do something.
Assurance	Pride	One's praiseworthy behaviour surpasses internal or external standard, and/or one recognises that others appreciate it.
	Confidence	It is certain that one is capable of overcoming a challenge in the process of realising his/her goal.
Interest	Inspiration	One is awakened to the realisation of a relational meaning of something and is enabled to do something creative.
	Enchantment	An appealing and/or mysterious character of something facilitates physical or mental isolation in a pleasant way.

Emotion type	Emotion	Core relational themes
	Fascination	Something unexpected and mysterious happens offering a clue to understanding.
Gratification	Relief	It is certain that an undesirable situation has gone away or changed into better situation.
	Relaxation	It arises in a pleasant situation, when it is certain that an undesirable event will not occur in any way.
	Satisfaction	An expected desirable event has been realised conforming to or surpassing internal or external standard.

Table 5.1. Core relational themes of the positive emotions

5.2.2. Visuals of behavioural manifestations of the 25 positive emotions

This section describes the process of collecting and validating the visuals of behavioural manifestations of emotions in three steps: (1) collecting and selecting visuals of the positive emotions, (2) validating the image-sets, and (3) improving and re-validating the invalid image-sets.

Collecting and selecting visuals of behavioural manifestation of the 25 positive emotions

For each emotion, descriptive pictures were collected based on the discriminating features such as emotion words and thought-action tendencies by using online imagery databases (e.g., Gettyimages.com). Thought-action tendencies are states of readiness to carry out a certain action or thought, involving both bodily arousal and cognitive preparation following emotion appraisals. Different emotions correspond to different sets of action and thought tendencies (Frijda, 2007). To search the images that characterise fascination, for example, the following search queries were used: (1) emotion word: fascination; (2) synonyms: engaged, concentration, engrossed, involved, attention, curious; (3) thought-action tendency: focus, immerse, captivation, absorbed, investigative, probing. For each emotion, 20 images were collected (in total 500 images) and evaluated to sort out the clearest representations. The collected pictures usually illustrated both behavioural manifestations of people and the contexts that affect the causes of emotions (e.g., being proud of winning a game). Although the pictures embodied visual information of contexts and behavioural manifestations, there was ambiguity of interpretations. In order to minimise ambiguity, we decided to use four pictures to explicitly represent each emotion. We assumed that by presenting various pictures together, people could catch what specific emotion the pictures characterise because the pictures could share common qualities of the behavioural manifestations of the intended emotion. The number of

Collecting and selecting visuals of the 25 positive emotions

Results:
Twenty five image-sets with four highly rated images

Validating the image-sets

Results:
Distinctiveness ratings of the image-sets
Identification of the invalid image-sets

Improving and re-validating the invalid images

Results:
Revision of the invalid image-sets
Distinctiveness ratings of the invalid image-sets

Figure 5.2. The procedure of collecting and validating the visuals of behavioural manifestations of emotions

pictures was based on practicality: each emotion should be represented with various images, but it should be manageable to interpret at once.

Before evaluating the collected pictures, the amount of pictures was reduced from 20 to 10 pictures by five design researchers because 20 pictures for each emotion was considered to be an overload for proper evaluation. The design researchers were Ph.D. candidates who have experience in product design and emotional design research at the faculty of Industrial Design Engineering of Delft University of Technology. The task was to select ten pictures that best represent each of the 25 positive emotions by using an online-survey. For each emotion, the emotion word, its definition, and 20 images were presented. The procedure was conducted individually and the order of emotions and presented pictures were randomised. Ten images that received high ratings within each emotion were chosen for further evaluation. In order to make sure that the mix of images was diverse and accurate, two criteria for selecting the pictures were applied: (1) pictures in the set should be clear representations of the specific emotion and (2) pictures in the set should be diverse. According to these criteria, similar pictures and ambiguous pictures were filtered out. Also, an attempt was made to remove pictures that describe culture-dependent behaviours. The selected 10 pictures per positive emotion were further evaluated with 19 respondents (female n=9) by using an online-survey. The age ranged between 22 and 33 (mean=24.37, SD=2.95). The recruited participants were master students of the 'Design & Emotion' course at Delft University of Technology. They received course credit for their participation. The procedure was the same with the one used in the pre-selection stage. The respondents were guided to select 5 (out of 10) pictures that best visualise the given

emotion. After data collection, four highly rated pictures were determined for each emotion. Besides the ratings, the diversity criterion also influenced the selection. If there were two similar pictures for a specific emotion, the picture that received the lower score was not included in the set, and instead the picture that was the next in the rank of the survey result was selected.

Validating the collected pictures

A validation study with 19 participants (11 female) was carried out to evaluate if the chosen pictures could effectively characterise the target emotions, and whether they were distinct from other similar positive emotions. The age of the participants ranged between 18 and 36 years (mean=24.2, SD=4.37). All participants were master students or Ph.D. candidates at the faculty of Industrial Design Engineering of Delft University of Technology and were paid five euros for their participation. The session took 30 minutes. Image-sets that represent the 25 different positive emotions were printed. Each image-set consisted of the chosen four pictures. Twenty-five positive emotion words were presented on a table clustered to nine groups that were drawn from the typology of positive emotions (Desmet, 2012), see Figure 5.1. The procedure was conducted individually. The task was to place the 25 image-sets under the emotion group where they might best fit in. Definitions of the positive emotion words were provided to ensure a consistent understanding of the given emotions. Participants were allowed to write other emotion words if they thought that an image-set did not match any of the nine groups. The order of the image-sets was randomised for each session. After finishing the categorisation, a questionnaire was filled in. With a five-point scale, each image-set was evaluated to what extent it represented a certain emotion within the group to which it was placed. This was done to evaluate if an image-set can be recognised as a clear representation of a specific emotion, not other neighbouring emotions in the same group. The session ended with an interview in which the participants openly explained the way they categorised the image-sets.

Proportion of the chosen groups of positive emotions
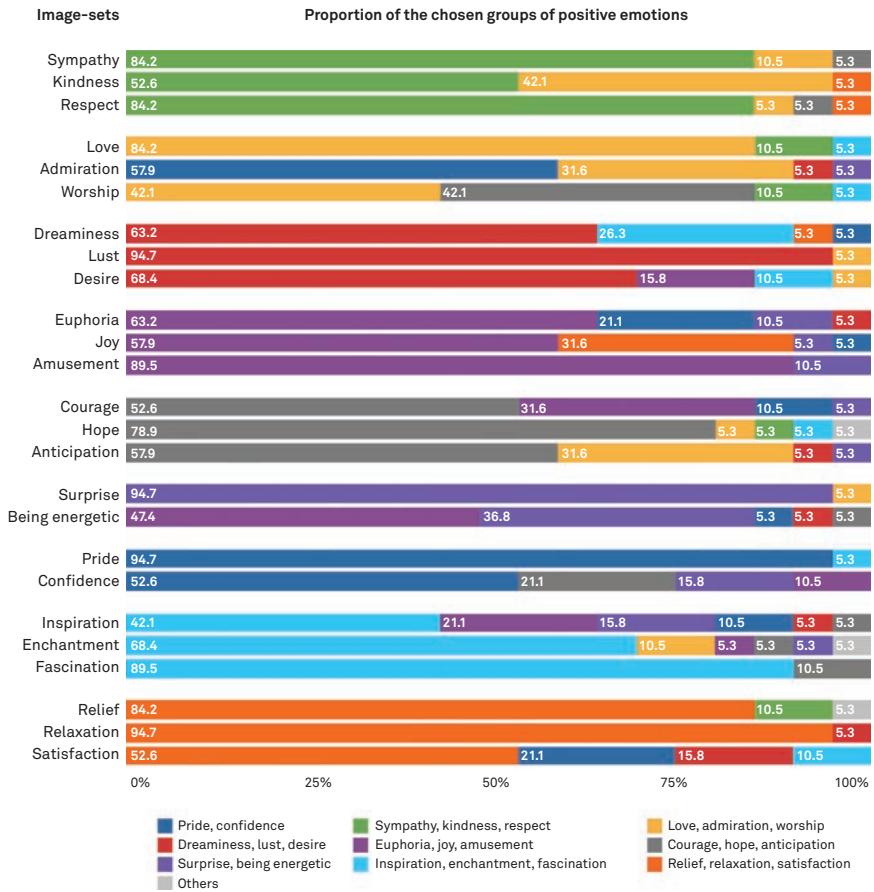
Figure 5.3. Proportion of categorisations of the image-sets to positive emotion groups

Results

The collected data were analysed in two steps: (1) the proportion of how well the image-sets were categorised was checked. (2) Next, the rating scale of each image-set with the intended emotion was compared with the ratings of other emotions in the same group. The graph in Figure 5.3 indicates the proportion of the selected groups for each image-set. Proportion of correct categorisation was above 50% in most cases except for the image-sets representing admiration (31.6%), being energetic (36.8%), worship (42.1%), and inspiration (42.1%). These image-sets were considered invalid.

For the image-sets that were correctly categorised, the mean values of scale ratings were analysed to determine if they were also specific to the

Image-set	N	Scale (Disagree: 1, Agree: 5)	Image-set	N	Scale (Disagree: 1, Agree: 5)
Sympathy	16	Sympathy: 4.88, Kindness: 3.81, Respect: 2.56	Courage	10	Courage: 5, Anticipation: 2.3, Hope: 2.2
Kindness	10	Kindness: 4.9, Sympathy: 3.3, Respect: 2.5	Hope	15	Hope: 4.6, Anticipation: 3.4, Courage: 1.93
Respect	16	Respect: 4.94, Kindness: 2.19, Sympathy: 2.13	Anticipation	11	Anticipation: 4.91, Hope: 4.09, Courage: 1.82
Love	16	Love: 4.94, Admiration: 2.5, Worship: 2.19	Surprise	18	Surprise: 5.00, Being energetic: 2.33
Admiration	6	Admiration: 4.67, Worship: 3.83, Love: 1.67	Being energetic	7	Being energetic: 4.43, Surprise: 1.57
Worship	8	Worship: 4.63, Admiration: 4.13, Love: 2.13	Pride	18	Pride: 4.72, Confidence: 3.89
Dreaminess	12	Dreaminess: 5, Desire: 2.17, Lust: 1.25	Confidence	10	Confidence: 4.1, Pride: 3.6
Lust	18	Lust: 4.94, Desire: 4.17, Dreaminess: 1.83	Inspiration	8	Inspiration: 4.5, Enchantment: 3.38, Fascination: 2.13
Desire	13	Desire: 4.85, Lust: 3.08, Dreaminess: 2.31	Enchantment	13	Enchantment: 4.15, Fascination: 3.54, Inspiration: 1.92
Euphoria	12	Euphoria: 4.67, Joy: 3.75, Amusement: 2.83	Fascination	17	Fascination: 4.47, Inspiration: 2.94, Enchantment: 2.88
Joy	11	Joy: 4.36, Amusement: 3.64, Euphoria: 3.36	Relief	16	Relief: 4.56, Relaxed: 3.31, Satisfaction: 2.25
Amusement	17	Joy: 4.53, Amusement: 4.18, Euphoria: 3.06	Relaxation	18	Relaxed: 4.78, Satisfaction: 3.83, Relief: 2.28
			Satisfaction	10	Satisfaction: 4.7, relief: 2.9, relaxed: 3.3

Table 5.2. Mean values of scale ratings of the image-sets for the intended emotions

target emotions. In almost all cases, the image-sets well matched with the intended emotions indicating the highest ratings compared to other similar emotions in the same group, and were in all cases above the mid-point of the scale (3) (see Table 5.2). For example, courage was in the highest level for the image-set 'courage', which means that the image-set was recognised as a clear representation of courage over the other two emotions in the same group of optimism: hope and anticipation. For the image-set of amusement, the score of joy was slightly higher than that of amusement. Nonetheless, we decided to regard it as valid for two reasons: first, it was well recognised as a part of the group enjoyment (see Table 5.1) with high percentage (89.5%) in categorisation. Secondly, the score of amusement (4.18) was higher than midpoint.
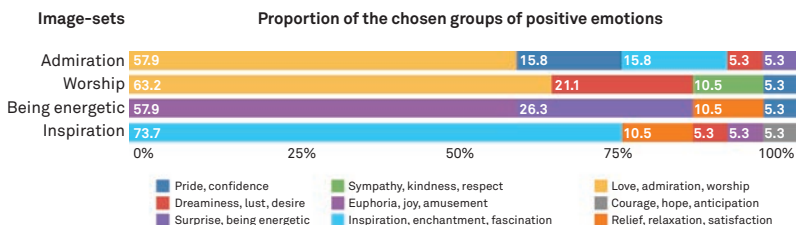
Figure 5.4. Proportion of categorisations of the revised image-sets to positive emotion groups

Image-set	N	Scale (Disagree: 1, Agree: 5)	Image-set	N	Scale (Disagree: 1, Agree: 5)
Admiration	11	Admiration: 5.00, Worship: 4.09, Love: 2.45	Worship	12	Worship: 4.50, Admiration: 4.08, Love: 3.42
Inspiration	14	Inspiration: 4.57, Fascination: 3.79, Enchantment: 3.71	Being energetic	5	Being energetic: 5.00, Surprise: 2.20

Table 5.3. Mean values of scale ratings of the improved image-sets for the intended emotions

Improving the invalid image-sets

The image-sets of 'admiration, worship, being energetic, and inspiration' were edited or altered to better represent the intended emotions by reflecting the participants' comments. The modified image-sets were re-validated with regards to whether they specifically represent the intended emotions. The procedure was the same as in the previous validation study. Nineteen participants (female: 11) participated and the age was between 24 and 36 years (mean=28.53, SD=4.29. All participants were master students or Ph.D. candidates at the faculty of Industrial Design Engineering of Delft University of Technology, and were not paid. The task was to place the four image-sets under the groups where they might best fit in. Next, with a five-point scale, each image-set was evaluated to what extent it represented a certain emotion in the group in which it was placed.

The results indicated that the proportions of correct categorisations were higher than the previous version in three image-sets: Admiration (57.9%, n=11), worship (63.2%, n=12), and Inspiration (73.7%, n=14). However, the image-set of 'Being energetic' did not show an increase in correct categorisation to the group animation (surprise, being energetic) (26.3%, n=5). This image-set therefore remains invalid. In the mean values of scale ratings, the image-sets of admiration, worship, and inspiration showed highest ratings for the intended emotions compared to similar emotions in the same group and were all above the mid-point (3) (see
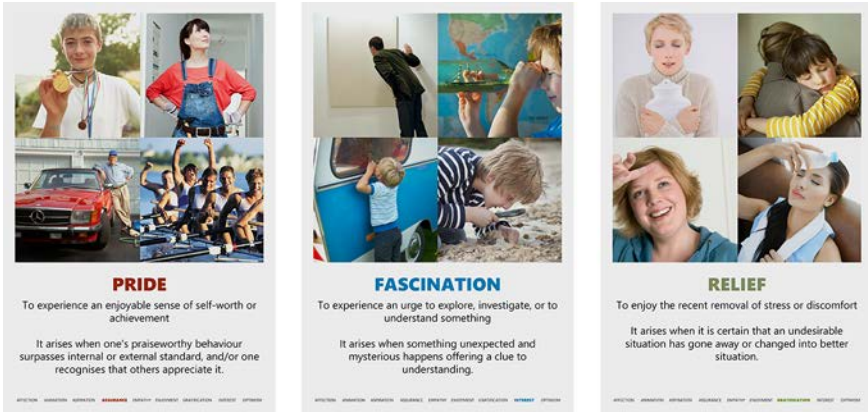
Figure 5.5. Three examples of the Embodied Typology of Positive Emotions

Table 5.3).

5.2.3. Integration of the developed elements

The generated eliciting conditions, visuals and definitions of the emotion words were incorporated into a set of 25 cards in A6 paper size (see Figure 5.5). The card format was selected since it is effective to be communicated to designers as well as effective to share and arrange the contents with others. A card format has been used in many design tools such as Collective Action Toolkit from Frog and Learner Centred Toolkit from BBC. Drawn from Desmet's typology (2012), the card-set was labelled according to the nine emotion categories to make it easy to browse and sort the cards.

5.3. Applications of the developed tool in a design process

As a pilot study, a workshop with five master-degree designers who have a minimum of three years work experience was conducted to explore (1) the relevance of emotional granularity in design and (2) how the tool can be applied in a design process. In the beginning of the session, the tool was introduced to the participants providing a brief explanation about its purpose and the concept of emotional granularity. Participants were asked to briefly introduce their general design processes, roles, and approaches to fulfilling their responsibilities. First, they discussed if it could be useful to develop emotional granularity as designers. Next, they were guided to discuss how the tool could support them by specifically

describing when it could be beneficial and what advantageous effects it might have in a design process. The structure of the discussions was left open, and the interviewer (the first author) took notes during the two-hour session.

5.3.1. Results

Participants reported that it could be advantageous to develop emotional granularity as designers, mentioning that it might facilitate designer-user bonding since designers could empathise with their users by better understanding their emotions. Also they found that this ability could be helpful to approach design problems with a set of different perspectives as emotional granularity may stimulate them to take into account users' varied emotional responses and the related product aspects. Overall, they agreed that in light of the benefits of emotional granularity, it would be desirable to have a tool or a technique that can support designers to have high emotional granularity. With respect to the developed tool, they appreciated the way information is presented. They found it effective to combine verbal and visual descriptions of an emotion.

The reported ideas of the tool applications were categorised according to the similarity of their applications to specific stages within a human-centred design process, i.e., ISO 9241-210 (2010). Participants suggested that the tool could be used as a source of inspiration in every stage of a design process in general. The ideas were mainly about using the tool to gain insights early on about project stakeholders' or users' concerns and to inform or evaluate the design of new products. Figure 5.6 illustrates the suggested applications of the tool per design phase.

Understanding and specifying the context of use ———— Inquiring stakeholders' concerns to formulate the vision of a product or a service

Investigating competitive products' emotional values

Documenting an emotional journey in either observations or user scenarios

Specifying the user requirements ———— Specifying design intentions in terms of emotional impact

Producing design solutions to meet user requirements ———— Facilitating creativity in design conceptualisation

Formulating a marketing strategy

Evaluating the designs against user requirements ———— Conducting walkthroughs of the emotional effects of designs
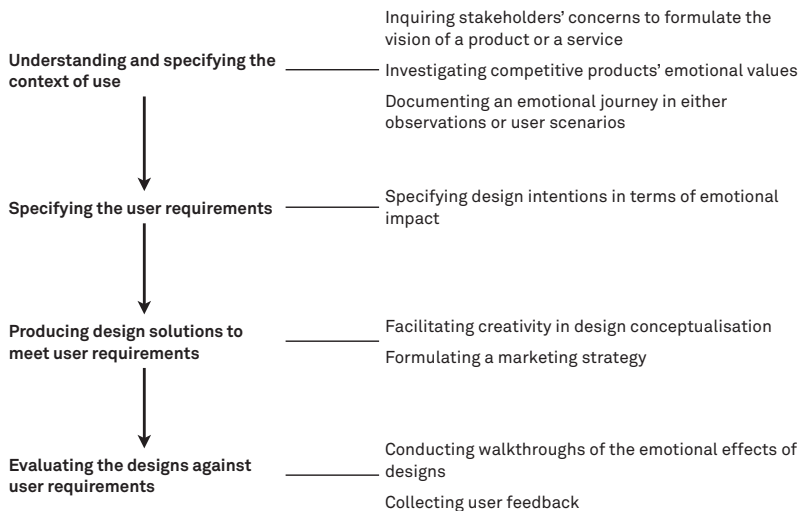
Collecting user feedback

Figure 5.6. Suggested applications of 'Embodied Typology of Positive Emotions' in a human-centred design process

The main ideas of the applications gathered during the workshop are as follows. Almost all participants reported that the tool can be used as a reference that assists the stakeholders such as a client or product development teams to explicitly communicate the desired emotional experiences that a new product is expected to, or should, evoke (inquiring stakeholders' concerns to formulate the vision / specifying design intentions in terms of emotional impact). Some participants mentioned that the tool can be used as a means to describe a user's emotional states in various stages of product use: a flow of user emotions can be mapped with the cards as a visual representation of changes in emotions (mapping emotional journey in scenarios / observations). One participant pointed out that using the tool could facilitate designers to constantly consider users' emotions so that they could keep their users in the centre of the focus during a design process. Most participants mentioned that the tool might facilitate divergent thinking in design conceptualisation. Designers might use the tool to explore various design directions. By selecting some cards that represent differentiated positive emotions and trying to evoke them referring to the eliciting conditions described in the tool, designers could generate different concepts since each positive emotion would guide to a different design direction (creativity facilitation). Additionally, it was mentioned that the positive emotions addressed in the design process also could be employed in formulating a marketing strategy. Finally, participants said that the tool can support users to articulate their emotions in response to a product in the evaluation process: users could

pick cards that represent their emotions that they experienced while using a product, and explicitly report what specific product attributes triggered each emotion. In sum, participants found that applications of the tool could assist designers in every stage of a design process offering a variety of advantages.

5.4. Conclusion and general discussion

In this paper, we have reported the development of a tool, 'Embodied Typology of Positive Emotions', for facilitating positive emotional granularity, and pointed out first ideas for potential applications in a design process. The validation study demonstrated that each image-set could distinctively characterise the intended emotion. In a workshop conducted to explore the application possibilities of the tool, participants confirmed that for designers it is desirable to have high emotional granularity, and reported that the tool could be used as a means to effectively probe and discuss their design activities with project stakeholders.

However, the findings also indicated that some issues need to be resolved to enhance the validity of the tool. The pictures that represent 'being energetic' were often perceived as characterising the emotion group 'euphoria, joy, amusement'. For the image-set, the participants gave the highest rate for joy (joy: 4.25, amusement: 3.56, euphoria 3.33), which implies that there was an overlap with the pictures that express different positive emotions. This imprecise differentiation could be explained with the high similarity between the two groups. Desmet's study (2012) showed that similarity between these two groups ('being energetic, surprise' versus 'euphoria, joy, amusement') was the highest among the nine positive emotion groups (see Figure 5.1). This means that in a broad perspective, the image-set of 'being energetic' may fit in a superordinate category that covers both groups. Note that the low validity of this image-set is not very problematic in the context of the design tool because, rather than being used in isolation, the set is used in combination with the appropriate emotion word and a definition of the emotion. There is a need to investigate if the descriptions of the eliciting conditions differ enough to indicate distinctiveness of each of the positive emotions.

During the discussion on the tool applications, participants made some suggestions to enhance the tool. One participant mentioned that it might be useful to provide examples of anecdotes or quotes that illustrate when and how a user experiences a certain emotion in relation to a product.

Another suggestion was to make the card-set classifiable according to thought-action tendencies. It was often addressed that sorting the cards out based on thought-action tendencies might be supportive in certain design activities such as specifying design intentions (e.g., design for acceptance, a thought-action tendency of respect). These suggestions imply that the tool should not only be developed to effectively facilitate positive emotional granularity, but also be developed to be suitable for certain design activities. Within the collected ideas of the tool application, there were some activities in which designers use the tool together with other stakeholders such as a client and a project manager (see Figure 5.6). Although participating designers addressed the tool could be useful in cross-functional communications with other stakeholders, it is uncertain whether other stakeholders would see the value of having positive emotional granularity in the same manner and be open to use the tool. As stated in Goffi and Micheli (2010), other stakeholders often do not have sufficient understanding of benefits of design-driven approach and feel uncomfortable to adopt it in product development process themselves. Therefore, it is required to involve other stakeholders in further identifying the opportunities to work with positive emotional granularity and in improving the tool.

At present, we are in the process of validating actual effects of using the tool based on the gathered ideas of application possibilities. We will refine the current tool and continue to develop new design tools and techniques for training emotional granularity and exploring detailed application possibilities, incorporating the collected suggestions.

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5.6. Appendix 1: Appraisal literature reviewed for formulating eliciting conditions

Emotion Type	Appraisal literature reviewed
Empathy	**Sympathy:** Dickert, Sagara (2011), Lazarus (1991) / **Kindness:** Desmet (2012) / **Respect:** Desmet (2012)
Affection	**Love:** Ellsworth and Smith (1988) / **Admiration:** Desmet (2002), Ortony, Clore (1988) / **Dreaminess:** Desmet (2012)
Aspiration	**Lust:** Frijda (2007) / **Desire:** Desmet (2002; 2008), Frijda (2007) / **Worship:** Lazarus (1991)
Enjoyment	**Euphoria:** Desmet (2012) / **Joy:** Demir, Desmet (2009), Ellsworth and Scherer (2003), Frijda, Kuipers (1989), Roseman (1996), Roseman (2001), Roseman and Evdokas (2004), Scherer (2001; 2005) / **Amusement:** Desmet (2002), Ruch (1993)
Optimism	**Hope:** Lazarus (1991), Roseman (2001), Roseman and Evdokas (2004) / **Anticipation:** Lazarus (1991), Ortony, Clore (1988) / **Courage:** Desmet (2012)
Animation	**Surprise:** Desmet (2003), Ellsworth and Smith (1988), Frijda (2007), Ludden, Schifferstein (2008), Roseman (1996) / **Being energetic:** Desmet (2012)
Assurance	**Pride:** Goetz, Frenzel (2009), Herrald and Tomaka (2002), Lazarus (1991), Ortony, Clore (1988), Roseman (2001) / **Confidence:** Ellsworth and Smith (1988)
Interest	**Inspiration:** Desmet (2008), Arieti (1976) / **Enchantment:** Desmet (2012) / **Fascination:** Desmet (2003), Ellsworth and Smith (1988), Kaplan (1992), Silvia (2008), Tan (2008)
Gratification	**Relief:** Frijda (2007), Lazarus (1991), Ortony, Clore (1988), Roseman (2001) / **Relaxation:** Ellsworth and Smith (1988), Fredrickson (1998) / **Satisfaction:** Demir, Desmet (2009), Goetz, Frenzel (2009), Ortony, Clore (1996), Scherer (2005)

6. Developing usage guidelines for a card-based design tool: A case of the positive emotional granularity cards

Abstract

Background: Card-based design tools have gained popularity as a means to communicate research insights and to make them usable in a design process. There are various examples of card tools and guidelines for developing a card set itself, yet there has been little research into how the usage of card tools can be systematically formulated. Although the existing literature on card tools often presents certain usages, it rarely explicates how the usage was structured, and provides few references to the underlying decisions.

Method: Through a case study of the positive emotional granularity cards, this paper presents a bottom-up approach in which designers' needs and their own techniques to use the cards are reflected in formulating new card usage guidelines. Three design workshops were conducted, each of which explored how designers made use of the cards in the three design activities respectively: (1) assimilating nuances of positive emotions; (2) specifying emotional intentions; and (3) generating product ideas. In a creative session with design researchers, the workshop findings were translated into usage guidelines.

Results: There were individual differences in designers' ability to make use of the PEG cards. At one end of the spectrum was the designer who immediately started to play and explore the cards, creating his or her own usage rules. At the other end of the spectrum was the designer who

needed instructions to get started. Most designers explored usage, but at the same time they felt insecure about getting value without having some guidance. The workshops allowed us to spot the benefits and drawbacks of the techniques the designers used, and to identify their needs in using the PEG cards. The creative session resulted in the PEG card guidelines that assist and inspire designers in the three design activities.

Conclusion: Provisional usage guidelines can considerably contribute to a card tool's usefulness, even if the card usage is envisioned to be open-ended and versatile. The bottom-up approach proved valuable to generate new insights into how a card set can best be used and how designers can be guided when using the card set.

Keywords: Design tool, Card-based tool, Emotional design, Emotional granularity

6.1. Introduction

Card-based design tools have become a popular means to disseminate insights from design research and to make them usable in a design process. For example, Lockton (2013) developed Design with Intent, a card set that introduces a range of techniques for understanding and changing environmental and social behaviours. Lucero and Arrasvuori (2013) created PLEX cards to communicate the 22 categories of a 'playful experiences' framework to designers who want to design for playfulness. The general advantages of card-based tools are tangibility and visualised contents; designers are enabled to browse quickly through and organise the cards, gaining the knowledge inscribed on the cards (Beck, Obrist, Bernhaupt, & Tscheligi, 2008; Lafrenière, Dayton, & Muller, 1999). Recent studies on card-based tools have generated guidelines for developing effective card tools. Wölfel and Merritt (2013), for instance, analysed several widely used card-based tools and introduced a set of design dimensions, e.g., the scope of use, intended purpose and formal quality. These dimensions can serve as a reference to plan features of a new card tool carefully.

Despite the popularity of card-based tools, there has been little research into how the usage of card tools and its guideline can be deliberately formulated. Card usage means the ways in which cards are employed for certain purposes in a design process (Sanders & Stappers, 2012). Although the existing literature on card tools often presents certain usages (e.g., Lenz, Diefenbach, & Hassenzahl, 2013; Raftopoulos, 2015), it rarely explicates how the usage was generated and provides few references to the underlying decisions. Thus, creating an effective usage

of cards (i.e., how to use the cards) and guidelines on the usage can still be challenging for those who want to introduce a card tool and its practical applications to designers. In our view, it is crucial to develop an understanding of how usage guidelines can be systematically generated. No amount of well-crafted cards will make them useful if designers are not well aware of how they can tap into the cards for their practice.

From our experiences, the development of usage guidelines is not less important than the card set itself. We developed the positive emotional granularity cards with a goal to support emotion-driven design processes (Yoon, Desmet, & Pohlmeyer, 2013). Positive Emotional Granularity (PEG) refers to the ability to represent the experience of positive emotions with precision and specificity (Tugade, Fredrickson, & Feldman Barrett, 2004). The PEG cards explain distinct characteristics of several positive emotions through theoretical descriptions and pictures (see Figure 6.1). With an expectation that the PEG cards are self-evident, the usage was made to be open-ended. After the PEG cards were implemented on many occasions, we noticed that some designers could creatively use the cards themselves, while other designers were not able to get the value of the cards. They were uncertain when and how the PEG cards could be useful.

This observation made us realise the necessity of providing usage guidelines to ensure that designers can make use of the PEG cards. Especially interesting was the observation that some designers could ingeniously appropriate the PEG cards to fit their intended purposes. The techniques used looked valuable to share with other designers. From this, we found that there is also value for us to look at how designers use the cards and learn from them to develop usage guidelines. Similarly, previous studies on design creativity have shown that designers exhibit patterns of creative behaviours when provided with a tool, and it can be of benefit to capture these patterns and instil them into a design method (Benami & Jin, 2002). It can, therefore, be advantageous to take a bottom-up approach to developing a usage guideline in which designers' needs and their own ways to use the cards are reflected in formulating a new usage. It is assumed that the resulting usage will be well accepted and more feasible to apply than if it is generated solely based on a design researchers' vision, as in a top-down approach.

Figure 6.1. Positive emotional granularity cards

This paper focuses on the development of card usage guidelines by means of the bottom-up approach. The guiding question of this research is, "how can a usage guideline of a card-based tool be developed in a structured way?" Specifically, we present a case study formulating usages of the PEG cards with a focus on applications in the three design activities: (1) assimilating nuances of positive emotions; (2) specifying emotional intentions (i.e. the emotion that should be experienced by the users); and (3) generating product ideas. The foci were selected based on the benefits of PEG in a design process (Yoon, Pohlmeyer, & Desmet, 2014; 2016 for an overview).

This paper can support design researchers as a reference when developing card set usage guidelines. The first part presents the PEG cards. Next, three design workshops are reported that investigated how designers use the PEG cards. The third part reports the development of the usage guidelines. The paper ends with a general discussion, including limitations, future research direction, and a general reflection on the development of a design tool.

6.2.   The positive emotional granularity cards

Consumer products can evoke a wide range of positive emotions, such as amusement, confidence, relief and pride (Desmet, 2008). Each of these emotions represents a different experience and stimulates different user thoughts and behaviours (e.g., Campos, Shiota, Keltner, Gonzaga, & Goetz, 2013; Fredrickson, 2013). Despite the diversity of positive emotions, most frameworks and tools for emotion-driven design (e.g., Jordan, 2000; Norman, 2004) have tended only to deal with valence and arousal, being limited in leveraging designers to consider nuances between positive emotions.

For designers, having a broad repertoire of positive emotions and being aware of their different nuances can have several benefits. Firstly, it can support a precise determination of design intentions, which can increase the chances that the design outcome will have the desired emotional impact. Secondly, articulating emotional states with fine-grained emotion terms enables coherent communication throughout the design process; and thirdly, considering an array of users' positive emotional responses can stimulate divergent design directions, as each emotion involves a different elicitation condition (for a complete overview of benefits, see Yoon et al., 2014; 2016).

We developed the PEG cards with the intention to support these benefits (Yoon et al., 2013). The PEG card set consists of 25 cards, each representing one emotion from a typology of positive emotions that are often experienced in human–product interactions (Desmet, 2012). The cards contain multi-layered information: emotion labels, behavioural tendencies, definitions, visuals of behavioural expressions and eliciting conditions (see Figure 6.2). For each emotion, four indicative pictures were used to minimise ambiguity. In previous explorations, this number was found to balance diversity and overview. All pictures have been validated. In addition, a description of the conditions that evoke an emotion was included, drawn from cognitive emotion theory (i.e., core relational theme; see Lazarus, 1991). A detailed description of the development process can be found in Yoon et al. (2013).

KINDNESS

Conducive, supportive

To experience a tendency to protect or contribute to the well-being of someone

It arises when one finds relatedness with someone and is motivated to be conducive to his/her goal achievement.

Interest

FASCINATION

Engaged, explorative

To experience an urge to explore, investigate, or to understand something

It arises when something unexpected and mysterious happens offering a clue to understanding.

Assurance

CONFIDENCE

Challenged, determined

To experience mental or moral strength to withstand or cope with the situation

It arises when it is certain that one is capable of overcoming a challenge in the process of realizing his/her goal.

Affection

DREAMINESS

Meditative, reflective

To enjoy a calm state of introspection and thoughtfulness

It arises when something facilitates a stepping outside of the current experience and leads to associations with an experience (either in the past or future).

Figure 6.2. Four examples of positive emotional granularity cards

6.3.   Design case: Development of the PEG card guidelines

This section describes the process of developing usage guidelines for the PEG cards. The process included three main stages: (1) exploring the use of the PEG cards; (2) generating ideas for usage; and (3) formulating instructions to use the PEG cards.

6.3.1. Stage 1: Exploring the use of the PEG cards

As a first stage, we explored how designers use the PEG cards, focusing on their own techniques and the experienced difficulties to resolve.

6.3.2. The PEG cards in use

The PEG cards were used in three design workshops, each of which focused on (1) assimilating nuances between positive emotions; (2) specifying emotions to design for; and (3) generating product ideas, respectively. A workshop as a research method has been widely used in the development of design tools because it facilitates a natural situation where participants are actively encouraged to work with the tools (e.g., Lockton, 2013; Sleeswijk Visser, van der Lugt, & Stappers, 2007). The workshops took place in industrial practice and design education. In the first two workshops, there were no provisional instructions for using the PEG cards. In the third workshop, instructions were provided. The procedure of that workshop was inspired by a usage proposed by designers in an initial exploration (Yoon et al., 2013).

The first workshop was conducted with 12 design practitioners as part of the master-class 'Design for Emotion' at Delft University of Technology. The group was split into four groups of three, and each group received the PEG cards. As a stimulus, the watering can 'Taboo' designed by Sander van der Haar was presented (Figure 6.3). Each group reviewed the PEG cards and discussed the emotions they had towards the stimulus by referring to the cards. Next, all groups presented the results of their explorations, including the emotions they selected and the product properties (e.g., shape, material and colour) that were related to these emotions.

The second workshop took place at an Amsterdam-based design consultancy (Sunidee) and involved ten professionals of various disciplines (five designers, two product managers, one marketer and two master design students), divided into two groups of five. The workshop

Figure 6.3. Participants discussing the emotions that the given stimulus evokes (left) and the stimulus used in the workshop (right)

assignment was to envision product-service systems for a smart home with an emphasis on safety and security. As the start, the participants reviewed the PEG cards and were guided to determine target emotions by selecting an individual or a combination of the cards.

The third workshop involved four master design students from Delft University of Technology. The task was to generate product ideas that can improve the communication between caregivers in a hospital. The design students were instructed to pick a random card individually from the card set and to generate ideas that could evoke the emotion represented by the card. They took another card and continued generating ideas again if they thought that the chosen emotion was far off or they felt the flow of ideation dropped.

All three workshops ended with a discussion in which the participants discussed how they used the PEG cards and how the cards could be improved. The first and third workshops were audio-recorded and discussions were transcribed. The second workshop was not recorded due to the non-disclosure agreement of the contents; in this case, the facilitator took notes during the workshop. The observations, recorded audio data, notes of the facilitators and generated ideas from the workshops were combined in the analysis. Participants' statements associated with card usages were mapped out based on the three design activities. Next, they were clustered based on similarity in terms of advantage and disadvantage.

6.3.3. Results and implications for usage guidelines

It was observed that there were individual differences in designers' ability to make use of the PEG cards. At one end of the spectrum was the designer who could immediately start to play and explore the cards, creating his or her own usage rules. At the other end of the spectrum was the designer who needed instructions to get started. Most designers appeared to be somewhere in the middle. They explored usage, but at the same time felt insecure about getting the most value out of it without having some guidance. Although the participants enjoyed the versatile quality of the PEG cards, they missed guidelines or proposed application steps.

In this section, the observed usages are reported, along with the implications for further developing the usage guidelines.

Usage in the first workshop for assimilating nuances between positive emotions

The PEG cards appeared useful for introducing the differences between positive emotions to the participants. By referring to the cards, the participants could spontaneously articulate three to seven types of feeling they had in response to the stimulus, such as surprise, fascination and desire. They reported that the act of spreading out the cards on the table and comparing them helped to understand the distinct qualities of emotions in the set.

At the start of the workshop, the participants had slightly different notions of the meanings of some emotions. They sometimes picked a card based on first impressions, examined the information on the card and then discarded it upon realising that the definition of the emotion was different from what they had initially understood. In addition, while they mentioned valuing the theoretical descriptions on the cards, they tended only to look at the emotion words and pictures. They mentioned that the descriptions looked 'wordy' and were uncertain how the information could help them in the given task.

The results indicated that card usage should allow designers to take the time to explore the content on the cards, because they would miss the contained information when relying only on the first glance. Also, the usage should guide users to actively interpret the contents beyond literal comprehension.

Usage in the second workshop for specifying target emotions

The participants reviewed which emotions would fit the given design context by browsing through the cards and sorting them out on the table. Cards were organised based on relevance, and cards were removed if they seemed to be irrelevant. Participants reported that the pictures on the cards were useful to infer what kinds of experience would be appropriate to facilitate, because the pictures implicated the general situations that evoke particular emotions and associated emotion expressions. When satisfied with the selection, participants used it as the basis for the next step.

Other techniques that were used were shuffling the cards, making pairs of similar emotions, and sharing personal experiences in which they had experienced certain emotions. In particular, taking a moment to recall personal experiences and sharing them within a group seemed to facilitate an open atmosphere and active discussion. The designers who shared personal stories mentioned that recalling their experiences helped them to be more aware of nuances between emotions and how different the emotional experiences of users would be.

The participants were uncertain if all the emotions that they had selected were relevant for the design context. They noted that the selection was based solely on their knowledge and previous experience, without an empathetic understanding of users.

The workshop revealed the importance of supporting designers to empathise with users to choose proper emotions to design for. For this, usage actions need to help designers, considering users' goals and concerns and related contextual factors, e.g., time and activities of people in the context.

Usage in the third workshop for generating product ideas

Observations and participant feedback indicated that the cards and the guideline provided in the workshop were useful to create a large number of initial ideas quickly. The act of shuffling was perceived as amusing, helping them to stay engaged in the workshop. Participants reported that drawing a new card from the deck stimulated them to explore different design directions, and randomly chosen cards encouraged them to consider non-obvious emotions that they would otherwise never have tried. At the same time, however, the randomness of emotion selection was not always inspiring; some emotions (that seemed to be irrelevant for the design brief) resulted in a creative dead-end.

Some designers tried to combine more than one emotion into a target 'emotion profile'. It was observed that this helped the designers to produce more elaborate and novel ideas than when they used only a single target emotion. Some emotions were found to be difficult to design for. Participants noted that the difficulty was not primarily because of the emotion type, but the combination of the design context (i.e., a hospital) and the specific emotions. However, they did not see this as a critical issue in the context of generating product ideas. They used the different emotions as a source of inspiration in their creative processes, not a rigid target of the design.

Some participants, especially non-designers, found it difficult to translate the core relational themes into product properties, e.g., appearance and movement. Related to this, they suggested that the inclusion of concrete product examples in the cards would help to infer how design could be made to be in line with the core relational themes. In contrast, others were concerned that such examples would hinder the designers' creativity, as it could incline them towards the example solutions.

The randomness in using the PEG cards appeared to be useful to explore emotions that were not part of the designers' regular repertoire, resulting in broadened design directions. However, designers should not be forced to spend time on emotions that are irrelevant for the design brief. Having an emotion profile that consists of several target emotions was found to be useful for generating more novel and advanced ideas than working towards a single target emotion. For idea generation, card usage should guide designers to consider multiple emotions as a design intention.

6.3.4. Usability of the PEG cards

The participants noticed a lack of diversity in the choice of the pictures for some emotions. Moreover, they mentioned that the pictures of some emotions (e.g., desire and relaxation) were clichéd. This caused the participants to make rash one-to-one associations between the situations and emotion types instead of construing the underlying processes that cause the emotions.

The need for customisability was often raised. In some cases, participants could not find an emotion term they wanted to express from the cards (e.g., a feeling of trust and gratitude) and wanted the option to create their own cards. Another issue was that participants wanted to use multiple copies of a card when they were dealing with several sets of emotional intentions that consist of multiple emotions.

6.3.5. Stage 2: Generating ideas for the PEG card guidelines

Based on the findings from the workshops, the PEG card guidelines were formulated. This section reports a creative session in which ideas for the card usage were generated, followed by the proposed guidelines.

Creative session: generating ideas

A two-hour creative session was organised in which the authors and three additional design researchers (Ph.D. candidates in emotion-driven design research) generated the PEG card guidelines. The foci of the card applications were the same as in the workshops: understanding nuances of positive emotions, determining the emotional impact of a product, and diverging design directions when generating product ideas. The creative session consisted of three parts: (1) the findings from the workshops were shared; (2) participants discussed the processes within the three design activities; and (3) they created guidelines for using the PEG cards for the three activities.

The proposed ideas were subsequently reviewed by the authors with a focus on their supportiveness in the three given design activities. The proposed ideas involved various exercises that adopt techniques from emotion research and collective decision making, e.g., the contemplation technique (Schorr, 2001; Wallbott, 1998) and the repertory grid technique (Castellani, 2011). These exercises aimed to provide a structured procedure to explore and reason the relationships between emotions. One idea, for example, was to guide designers to develop a narrative together by referring to multiple cards. In addition, many ideas utilised additional materials to leverage the usage effectively, e.g., a sketchpad and a timeline on a board.

6.3.6. Stage 3: Formulating usage guidelines of the PEG cards

The authors consolidated the suggested ideas into a set of PEG card guidelines by considering the findings from the workshops as design requirements (see section 3.1.2). The guidelines were formulated for a group setting. The following section presents the usage guidelines of the PEG cards for the three design activities.

Resulting instructions

Understanding nuances between positive emotions

The guideline intends to provide designers with a quick overview of the emotions in the set and explore the contents of the PEG cards. The

repertory grid technique (Castellani, 2011) was incorporated into the guideline to stimulate designers to discern the characteristics of the emotions carefully.

The PEG cards can provide designers with a wide repertoire of positive emotions. The cards enable the designers to browse through and compare the emotions in the set, and to explore and understand their different characteristics.

> *Split into groups of three (or four) members. Go through all cards in the deck and randomly take three cards (three per participant). Read the contents on the cards and reflect on how the texts and pictures on the cards are related to one another. Compare the three emotions, thinking about how the emotions are similar to and different from one another. Discard the emotion that seems dissimilar to the other two emotions. Explain to the group members how you compared them and why you discarded one. Have all members explain. Next, reflect on moments in which you experienced the two remaining emotions in relation to products. Share your stories, answering the following questions: What happened to cause the emotion? What was going through your mind and body? How did you express your emotion? Did the experience change you in any way? Repeat this procedure to review all cards in the set.*

Determining target emotions

The guideline focused on supporting designers to consider dynamics in users' experiences with an empathic understanding of users. The ContinUX framework (Pohlmeyer, 2011) was adopted in the guideline to encourage reflection on users' goals and possible activities in different time phases in the user experience (e.g., pre-use, in use and post-use).

The PEG cards can help designers determine target emotions. This target can be a single emotion or a profile that combines several emotions (e.g., a wow experience that combines fascination, desire and pleasant surprise (Desmet, Porcelijn, & Van Dijk, 2007).

> *Divide into groups of three or four members. Specify a design context and make a list of users' activities that may take place in the context as well as a list of users' goals, along the three stages of product usage: before, during and after using a product, respectively. Discuss what users would want to achieve and what procedure they would go through for this. Write the discussed ideas on a sheet of paper. Review the generated list and select key activities that are relevant to support through designs. Next, discuss what kind of positive emotions it would be desirable to evoke and how they can support users' activities by referring to the cards. Try to answer the question "What emotions do people expect to have while taking this action?" For each activity, draw cards that seem to fit the given activity, and sort them out on the basis of relevance for that activity. Write*

down the activities and the selected target emotions.

Facilitating creativity in design conceptualisation

The guideline is intended to assist designers to generate a large number of ideas and to further elaborate the initial ideas by means of comparing and combining multiple emotions. Randomness in the card usage was kept to widen the space of exploration and encourage novel ideas.

Differentiating a wide diversity of positive emotions enables designers to envision unusual product-emotion combinations that can stimulate new design directions and usage situations. The PEG cards can be used to mediate this creative process.

> *Divide into groups of three or four members. Clarify a product type or a context to design for. Randomly draw a card from the deck (one per participant). Have a look at the information and pictures and think about what it is that causes the emotion referring to the eliciting condition described on the card. Write down the kind of conditions that need to be addressed to evoke the emotion. Next, start generating ideas that could evoke the positive emotion by trying to fulfil the conditions. Record all ideas by sketching or writing them down on paper. Explain your ideas and learn what other members came up with. Among the emotions that the other members have chosen, select one that seems to be suitable to evoke together with the emotion on your card. Then, start working on the newly chosen emotion. Elaborate the initial ideas or come up with new ideas building on the initial ones. Explain how you further developed the ideas to the others. Repeat the same procedure until all 25 emotions have been explored.*

6.3.7. Discussion

A creative session was carried out to come up with concrete usage guidelines that can assist and inspire designers when they use the PEG cards. The involvement of researchers appeared to be useful: they generated a variety of usage strategies that could effectively address the findings from the workshops.

In the session, participants' prior-knowledge on the research behind the card set seemed crucial. The recruited researchers had expertise in both design methods and emotion-driven design so that they could readily grasp the value of the card set and speculate the card usage. If they were not specialised in the research topic, we would have had to include an additional step in the creative session to inform them about emotional granularity and why the cards were designed this way.

The proposed guidelines are intended to be usage tips, and designers can use the PEG cards as they like. The PEG cards can be used in different settings and can be adapted to other design methods. There are also other design activities in which a nuanced understanding of positive emotions plays a supportive role, e.g., developing empathy for user emotions (for an overview, see Yoon et al., 2014; 2016). These different advantages could be achieved with an alternative usage or might require the development of a new tool.

6.4.   General discussion

Card-based tools have been widely used as a means to share research insights (see Wölfel & Merritt, 2013). However, how to develop good card usage has rarely been addressed in the literature on card-based design tools.

The main contribution of the paper is that the approach used in the case can help design researchers better understand how the usage of a card tool can be structured, and to develop the usage of existing and new card tools. Through a design case, the current paper presents how a usage of a card tool can be systematically created. Firstly, we conducted three design workshops that made use of the PEG cards and analysed the usage from the participating designers' views; secondly, we conducted a creative session with design researchers to formulate the PEG card guidelines.

Although the PEG cards can be used in many different ways, without guidance, not all designers were able to make full use of them. This shows that usage guidelines can considerably contribute to the card set's usefulness. From observing designers who could creatively use the cards on their own, we were able to learn the benefits (and the drawbacks) of their techniques in particular design activities. We believe the proposed usage guidelines can also be valuable for those who could freely use the cards, because the guidelines complement several observed usage strategies. In a future iteration, we plan to test and further iterate the guidelines.

Novice and experienced designers differ in how they approach design tasks. A designer's creative space increases with increased experiences (Christiaans, 1992); experienced designers tend to have a broad repertoire of design strategies and can flexibly combine multiple ones, whereas novice designers are less aware of the strategies (Ahmed, Wallace, &

Blessing, 2003). This implies that the differences in expertise could influence which techniques designers use. Likewise, in the results of the current study, it was clear that expert designers tried more diverse approaches to using the PEG cards than design students. Concerning the intention to use a workshop as a platform to learn from designers, it is recommended to involve selectively both experienced and novice designers. This would increase the opportunity to observe diverse ways to use and appropriate the cards, and to comprehensibly identify designers' experienced difficulties and their expectations in applying them.

Design researchers put substantial effort into developing card sets that are attractive and inspiring. For us, it proved valuable to invest time and effort to conduct workshops with designers, because these generated new insights into how the PEG cards can best be used and how designers can be guided when using the card set. At the same time, it was also useful to do the creative session with experts, because they were able to translate insights from the workshops into clear usage guidelines. We can recommend this combination of activities to formulate usage guidelines, even if the card set usage is envisioned to be open-ended and versatile. Based on our current findings, we believe that a set of provisional usage guidelines can help tap the potential of the card set. We hope that our current findings can serve as a guide for further research on the development of usage guidelines for card-based tools.

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7. EmotionPrism: A design tool that communicates 25 pleasurable human-product interactions

Abstract

The range of positive emotions experienced in human-product interactions is multifarious. Differentiating positive emotions (e.g., joy, love, hope, and interest) and having an awareness of associated expressive interaction qualities (e.g., playful, careful, persistent and focused interaction) can support designers to influence users' interactions in a favourable way. This paper introduces the development and application of EmotionPrism, a tool for designers to gain a better understanding specific positive emotions and related expressive interaction qualities. EmotionPrism is a collection of movie-sets that represents 25 different positive emotions in dynamic hand-object interactions, combined with theoretical descriptions of the emotions. Designers can use the tool to envision and discuss what kinds of interactions would be appropriate or desirable to incite and to select a set of relevant positive emotions accordingly by referring to the set of information as a repertoire to choose from. The paper first describes characteristics of positive emotions with a focus on expressive behaviour and then discusses considerations for the tool development. The second section reports the process of developing the tool. Thirdly, we present the results of a design workshop in which the tool was used and evaluated.

7.1.   Introduction

This paper focuses on positive emotions experienced in human–product interactions. Products can evoke a wide variety of positive emotions. We can, for example, be fascinated by an immersive virtual reality interface, have a victorious feeling when completing a video game, and be proud of being a backer of a new gadget development by using a crowd-funding service. Although these emotions are all positive or pleasant, they are characterised by distinct and special behavioural tendencies (e.g., Fredrickson, 2002; 2013). For example, hope stimulates the urge to commit to the activity at hand (Lazarus, 1991), amusement incites to share the joviality (Gervais & Wilson, 2005), and admiration motivates virtuous behaviours and to be more open to others (Algoe & Haidt, 2009). Design research has shown that these behavioural effects also apply to positive emotions in human–product interactions. For instance, Yoon, Desmet, and van der Helm (2012) showed that a feeling of interest induces a user to actively explore the product properties and functionalities, and prolongs the duration of use, resulting in an increased understanding of the product. Ludden, Hekkert, and Schifferstein (2008) found that a product that evokes pleasant surprise draws a person's attention, and has positive effects on product recall and recognition.

In this paper, we explore if positive emotions in human–product interactions are also characterised by distinct (and observable) expressions. The focus is on the expressions of hands in the interaction. In other words, does love stimulate a different 'interaction quality' than joy, fascination, pride, and etcetera? If so, insights in these expressions could act as a source of inspiration for designers who want to influence users' interactions in product use. More specifically, designers could deliberately target certain user emotions by designing for emotion-specific interaction qualities (e.g., careful, playful, or focused interaction). Being precise in terms of the interaction qualities and user emotions can increase the effectiveness of both design processes and design outcomes (Desmet & Schifferstein, 2012; Diefenbach et al., 2016). While several frameworks are currently available that explain how design evokes emotions (e.g., Desmet, 2002; Hassenzahl, 2010; Jordan, 1999; Norman, 2004), the existing theory and methodology do not yet inform the relationship between dynamic and expressive interaction qualities and user emotion.

Our approach was to develop a set of videos that show 25 different positive emotions in hand-object interactions (Figure 7.1). These videos were used as stimuli in a study that tested the degree to which people can
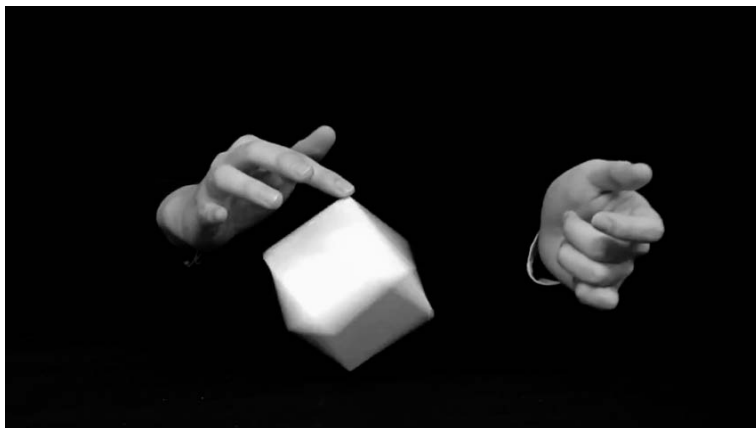
Figure 7.1. A screenshot of a movie-clip used in EmotionPrism

recognise distinct emotions in human-object interactions. In addition, they were used as the basis for a design tool: EmotionPrism. The purpose of this tool is to enable designers to increase their ability to make fine-grained distinctions about positive emotions in human-product interaction and to offer a source of inspiration in emotion-focused design processes.

The paper consists of three parts. The first describes the development of the movie clips and EmotionPrism, including the main considerations in the development process. The second part reports the study that investigated the degree to which people can identify distinct positive emotions in these movie clips. The third part presents the results of a design workshop in which designers used and evaluated EmotionPrism. The paper concludes with a discussion of implications of the work, limitations, and suggestions for future research.

7.2.   Considerations for the tool development

The development of the tool involved three main considerations: the number of positive emotions to be included, the channels to discriminate between positive emotions, and the medium of the tool. This section describes the insights gained from the literature on the characteristics of positive emotions and related design tools that explain nuanced positive emotional experiences.

Category	Positive emotion	Category	Positive emotion
Empathy	Sympathy, kindness, respect	Animation	Surprise, being energetic
Affection	Love, admiration, dreaminess	Assurance	Courage, pride, confidence
Aspiration	Lust, desire, worship	Interest	Inspiration, enchantment, fascination
Enjoyment	Euphoria, joy, amusement	Gratification	Relief, relaxation, satisfaction
Optimism	Hope, anticipation		

Table 7.1 Typology of positive emotions categorised in emotion types (adapted from Desmet (2012))

7.2.1. The number of positive emotions to be included

The first issue was to decide on the level of granularity. Although several basic emotion-sets have been proposed (e.g., Ekman, 1999; Frijda, 1986; Izard, 1977; Plutchik, 1980), compared to negative emotions, they tend to include a fewer number of positive emotions, covering one to three such as joy, love, and interest (for the discussion of imbalance between positive and negative emotions, see Fredrickson, (1998). These oversimplified sets are insufficient for representing the wide range of positive emotions experienced in human–product interactions. Desmet (2012) showed that people can experience at least 25 distinct positive emotions while interacting with products, and formulated a typology clustering them in nine categories (see Table 7.1). We decided to build on this typology because it is concise, yet fine-grained enough to illustrate a variety of positive emotional experiences.

7.2.2. Channels to discriminate between positive emotions

Given the aim to communicate expressive interaction qualities of positive emotions, it was decided to show differentiated emotional expressions *in interactions*. Recent research on emotional expression in behaviour has shown that positive emotions are associated with multiple channels like posture, voice tone, and touch (Sauter, McDonald, Gangi, & Messinger, 2014). Campos, Shiota, Keltner, Gonzaga, and Goetz (2013) compared upper body movements such as arm and torso triggered by eight positive emotions, and found that they can be distinguished based on the variability of gestural and postural expressions, e.g., sitting up straight and pulling the shoulders back accompanied by the feeling of pride, and forward leans and head tilts accompanied by interest. Hertenstein, Keltner, App, Bulleit, and Jaskolka (2006) showed that some positive

emotions like love, gratitude, and sympathy can be decoded via touch, e.g., love signalled with stroking, and even they can be inferred by merely watching other people communicate via touch. While useful, these studies only focus on how distinct positive emotions can be distinguished in general behaviour, but not on user behaviour when interacting with a product. Hence, we decided to conduct an exploratory study with actors expressing positive emotions in human–product interactions. In particular, it was decided to use hands interacting with an artefact to demonstrate differentiated expressions since most human–product interactions involve hands.

7.2.3. Medium of the tool

Various design tools that communicate positive emotional experiences have been proposed. Yoon, Pohlmeyer, and Desmet (2013), for instance, developed a card-set based on the typology of positive emotions (Desmet, 2012) that incorporated definitions of emotion terms, causes, and pictorial behavioural manifestations. Based on Sheldon et al.'s psychological needs (Sheldon, Elliot, Kim, & Kasser, 2001), Hassenzahl, Eckoldt, Diefenbach, Lenz, and Kim (2013) developed a card-set that gives an overview of a design relevant set of seven needs, all of which describe the associated positive emotional experiences with suggestive illustrations. The advantages of these card-based tools are that it is effective to share and spatially arrange the contents, facilitating informal discussions and collective creativity (Stappers, 2006). However, using static visuals is not the optimal means to express interactive behaviour. In Pasman, Boess, and Desmet (2011), it was found that when solely using pictorial and textual information, designers had a difficulty in identifying and communicating the feelings that the interaction with a product should bring for the user. This was because, as was discussed in Haidt and Keltner (1999) and Desmet (2002), emotions are displayed with temporal dynamics of actions, and nonbasic emotions such as sympathy and amusement involve a narrative in the expressions. Therefore, to ensure the rich and dynamic representation of emotions, videos were used as the main medium of the tool to supplement text-based information, e.g., emotion terms and definitions.

7.3.   Development of EmotionPrism

This section describes the process of creating and evaluating movie-clips of manifestations of positive emotions in interactions in five steps: (1) collecting thought-action tendencies of positive emotions, (2) generating, (3) selecting, (4) evaluating the movie-clips, and (5) integrating them into a design tool.

7.3.1. Phase 1. Collecting momentary thought-action repertoire of positive emotions

All emotions involve action tendencies that characterise certain behaviours (Frijda, 2007). Examples are the tendency 'to care for,' which is stimulated by love, and a tendency 'to oppose,' which is stimulated by anger. Some emotions, like contentment and interest, do not always stimulate immediate (or visible) changes in physical actions. To accommodate for these emotions, Fredrickson (1998) introduced the concept of 'thought-action tendencies,' which expresses the idea that the activities that are influenced by emotions can be both of a physical and a cognitive kind. We decided to develop general expressions of thought-action tendencies in hand-object interactions instead of depicting realistic usage behaviours in order to make the tool independent of particular context or situational meaning. The idea was that this would result in a tool that can be widely used for any design project. For this, the descriptions of thought-action tendencies of the 25 positive emotions were collected from the literature of emotion psychology and positive psychology. The collected thought-action tendencies served as a reference for the tool development, and have been incorporated into the tool. Table 7.2 describes the collected thought-action tendencies.

Emotion	Thought-action tendency	Emotion	Thought-action tendency
Sympathy	Be altruistic, be less punitive (Batson & Shaw, 1991; Sprecher & Fehr, 2005)	Hope	Be committed to, continue (Lazarus, 1993)
Kindness	Be tender, protect, monitor (Lishner, Batson, & Huss, 2011)	Anticipation	Eagerly await, be impetuous (Yoon et al., 2013)
Respect	Accept, recognise, emulate, endorse (Desmet, 2012)	Courage	Persist, endure (Desmet, 2012)
Love	Get intimate with, nurture, be approachable (Desmet, 2012; Fisher, Aron, & Brown, 2005)	Surprise	Pay attention to, take in (Smith & Ellsworth, 1985)
Admiration	Uphold, honour, affiliate with, be virtuous (Algoe & Haidt, 2009; Schindler, 2014)	Being energetic	Be lively, be bouncy (Desmet, 2012)
Dreaminess	Be introspective, meditative (Yoon et al., 2013)	Pride	Reward the self, show off, persevere, stay focused (Desmet, 2012; Williams & DeSteno, 2008)
Lust	Seek proximity, allure (Gonzaga, Turner, Keltner, Campos, & Altemus, 2006)	Confidence	Being free from doubt, control (Desmet, 2012; Nicolás, Aurisicchio, & Desmet, 2013)
Desire	Be possessive, get hold of (Desmet, 2008)	Inspiration	Be creative (Desmet, 2008)
Worship	Adopt the ideals and values, adulate (Schindler, 2014)	Enchantment	Be mesmerised, absorbed (Piff, Dietze, Feinberg, Stancato, & Keltner, 2015)
Euphoria	Be carried away, announce what has happened to others (de Rivera & Possell, 1989)	Fascination	Explore, understand (Silvia, 2005; Yoon et al., 2012)
Joy	Play, invent, fool around (Fredrickson, 2013)	Relief	Avoid the source of distress, becalmed (Tong, 2014; Yoon et al., 2013)
Amusement	Play socially, share the joviality (Fredrickson, 2013; Gervais & Wilson, 2005)	Relaxation	Relish, be unworried, indulge (Ellsworth & Smith, 1988)
		Satisfaction	Savour the current situation, take in (Fredrickson, 1998)

Table 7.2. Thought-action tendencies of 25 positive emotions

7.3.2. Phase 2. Generating manifestations of thought-action tendencies of positive emotions

Development of stimuli

Two professional actors with more than ten years of experience in theatre play were recruited. The actors were paid for their contributions. Instead of having the actors interact with a specific product such as camera or lamp, we decided to use a neutral cube that could symbolise a product in an abstract manner since the application of the tool should not be limited to the design of a particular product type. Furthermore, the use of a cube was to induce designers to focus on interactions, not being distracted by the stimulus appearance. A set of 11cm-high cubes that are similar in terms of appearance, but different in terms of materials was made. This set was developed to afford a wide range of interactions, e.g., squeezing and caressing. Based on the framework of verbal appraisals with product materials proposed by Karana (2009), seven materials were chosen: plaster, rubber, plastic, wood, Styrofoam, fabric, and sand.

Setup and procedure

Movie-clips that portray the 25 positive emotions were generated with a two-step procedure: (1) sensitising and (2) performing. The sensitisation phase had two aims: to support the actors in having a nuanced understanding of positive emotions and to enable them to prepare for their performance by exploring how the emotions can be effectively portrayed. In this phase, the actors used a sensitising booklet to reflect and write down experiences of the 25 positive emotions in relation to products. They were instructed to describe the situations with texts and drawings. To help them in understanding the target emotions, the booklet provided definitions, thought-action tendencies, and synonyms for all emotions. In addition, they were requested to brainstorm how each emotion can be expressed with hand gestures and body postures. The actors worked on three to four positive emotions a day that were considered similar based on the typology of positive emotions (Desmet, 2012). The booklet was filled in for seven days.
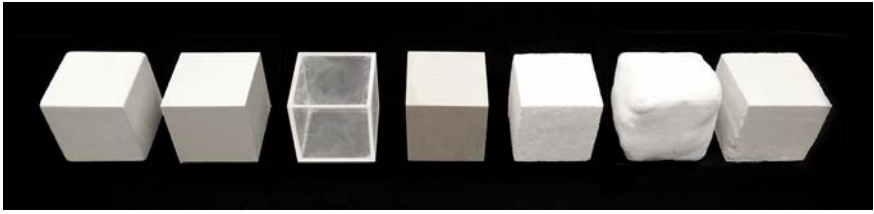
Figure 7.2. The seven cubes that served as stimuli (from left: plaster, rubber, plastic, wood, Styrofoam, fabric, and sand)

Figure 7.3. An actor acting out an emotion

For the performance session, the actors wore black clothes with long sleeves. A table on which the cubes were placed was also covered with black fabric to make the hands and cubes conspicuous. The session was individually conducted and started with a briefing about the general aim of the movies. The actors received the seven cubes and were guided to familiarise themselves with the sensorial properties by making various actions, e.g., spinning, cuddling, and juggling, for five minutes. Next, they acted out the emotions in the set one by one, swapping the seven cubes. The order of the emotion was the same with the one in the sensitisation booklet, and the actors were allowed to repeat a performance until they thought the emotion was explicitly represented.

7.3.3. Phase 3. Selecting the movie-clips that best represent thought-action tendencies

The performance sessions with the two actors resulted in 531 movie-clips (on average 21 per emotion). We presumed that presenting several movie-clips together would help designers grasp what an emotion would look like in interactions because the movie-clip could show a common interaction quality of the emotion with different manifestations. After some explorations, we decided to show four movie-clips per emotion. This number was found to balance between overview and richness: on the one hand, each emotion should be represented with various movie-clips, but on the other hand, it should be manageable to quickly go through them.

The next step in the development process was to select four movie-clips per emotion. In a pre-selection procedure, the ten best movie-clips were selected for each emotion. This was done in a session with two researchers (the first author and a master-candidate in emotion-driven design) with the use of two criteria: (1) movie-clips in the set should be clear representations of the given emotion, and (2) they should be diverse in terms of gestural and postural expressions.

Participants

The set of selected movie-clips was further reduced with the results of an online survey. 171 native-English speakers living in the United States were recruited for participation. Age ranged between 23 and 69 (M=42, SD=11.83), and the nationalities of the respondents consisted of American (90.7%), Indian (2.3%), British (1.2%), Canadian (1.2%), Georgian (1.2%), Vietnamese (1.2%), Armenian (0.6%), Italian (0.6%), Macedonian (0.6%), and Mexican (0.6%). Respondents were recruited from Amazon's Mechanical Turk, an online survey recruiting service, and they received financial compensation for their participation.

Procedure

Respondents were instructed to select the five movie-clips that best represent a specific positive emotion. The respondents were split into five groups, each of which was assigned five emotions. The group distribution is described in Table 7.3. After a short introduction that explained the general aim of the study, respondents selected five movie-clips that in their eyes, best represent an emotion. For each emotion, the emotion word, its definition, and ten movie-clips were presented. The procedure was conducted individually, and the order of emotions and presented movie-clips were randomised. It took approximately 18 minutes to

Group	Participant	Assigned emotion
1	41 (female: 22)	Surprise, amusement, enchantment, desire, and hope
2	36 (female: 19)	Being energetic, joy, inspiration, worship, and courage
3	31 (female: 14)	Euphoria, fascination, dreaminess, confidence, and sympathy
4	31 (female: 17)	Lust, admiration, pride, kindness, and relief
5	32 (female: 17)	Love, anticipation, respect, relaxation, and satisfaction

Table 7.3. Group distribution and assigned emotions

complete the task.

Results

On average, 153.32 responses per emotion were given to rate the movie clips (SD=4.25). After data collection, the four movie-clips with highest ratings were chosen for each emotion. Besides the ratings, a diversity criterion also influenced the selection. If there were two similar movie-clips for a specific emotion, the movie-clip that received the lower score was not included in the set, and instead, the movie-clip that was the next in the rank was selected. This procedure resulted in a selection of 100 movie-clips.

7.3.4. Evaluating the movie-clips

An online survey was carried out to evaluate whether the 100 movie-clips were recognised as expressing the target emotions.

Participants

30 native-English speakers living in the United States (male: 18) were recruited. The age of the participants ranged between 19 and 58 years (M=35, SD=11.37). Their nationalities were: American (94%), Indian (3%), and Sri Lankan (3%). Respondents were recruited from Amazon's Mechanical Turk and paid for their participation.

Procedure

Respondents were shown 25 movie-sets, each set consisting of four movie-clips that express one positive emotion. On average, the length of each movie-set was 23.52 seconds (SD=6.7). Respondents rated to what extent each movie-set portrayed each of the 25 emotions. The survey began by explaining the aim of the study and by briefly explaining the influence of emotions on behaviours. For each movie-set, all 25 positive emotions were presented with corresponding definitions and a ten-point rating scale (1: not representative, 10: highly representative). The order of

movie-sets and emotion words was randomised. Respondents were allowed to replay the movie-sets. It took about 1.5 hours to complete the survey.

Results

In order to examine the extent to which the respondents could recognise the intended emotion in response to each movie-set, the mean values of the scales given to the 25 positive emotions were compared. The mean values are listed in Table 7.4. Due to space limitations, the table reports the nine highest rated and the two lowest rated emotions. The full data can be reviewed at http://studiolab.ide.tudelft.nl/diopd/emotionprism-data.

A movie-set was considered to be clear when the target emotion was rated highest among the 25 emotions. In addition, when there were other emotions that received higher ratings than the target emotion, if those emotions had even higher ratings in the movie-set that they were originally intended to illustrate, we considered these movie-clips satisfactory too. This second criterion was based on the idea that in the design tool, the movie-sets will be shown in the context of the complete collection of movie-sets. In that context, the users of the design tool will easily pair the emotions with the corresponding movie-sets. For example, although for the movie-set that represents 'confidence,' amusement (7.19) and being energetic (6.48) received higher ratings than confidence (5.3), the movie-sets for 'amusement' and 'being energetic' received even higher ratings in accordance with the intended emotions, respectively (amusement: 8.7 and being energetic: 8.78). Likewise, for the movie-set 'relief,' anticipation received higher ratings (4.11) than relief (3.78). However, the movie-set was considered satisfactory because respondents matched the movie-set of 'anticipation' with even higher ratings for anticipation (7.7). As shown in Table 7.4, the movie-sets that were matched with the intended emotions with highest ratings (criterion 1) were: admiration, amusement, anticipation, desire, dreaminess, being energetic, fascination, inspiration, pride, relaxation, and respect. The movie-sets that were vested in the second criterion were: confidence, enchantment, hope, lust, relief, and surprise. The eight movie-sets of courage, euphoria, joy, kindness, love, satisfaction, sympathy, and worship did meet neither of the two criteria and could thus not be conclusively linked to the emotions that they were aimed to represent.

Movie-set	Ratings in relation to emotions											
	1	2	3	4	5	6	7	8	9	10 - 24	24	25
Admiration	AD 5.81	FA 5.67	EN 5.22	RES 5.07	PR 5.04	AN 4.67	WO 4.63	SA 4.48	IN 4.44	...	EU 1.89	LU 1.67
Amusement	AM 8.7	ENE 7.22	FA 7.04	JO 6.3	EN 5.44	EU 4.7	IN 4.67	SA 4.59	CO 4.04	...	SY 1.59	LU 1.48
Anticipation	AN 7.7	ENE 4.67	DE 4.04	FA 4.04	HO 3.7	EN 3.56	IN 3.56	AM 3.33	AD 3.22	...	COU 2.11	LO 2.07
Desire	DE 6.44	FA 5.96	AN 5.78	EN 4.59	AD 4.56	LU 4	RES 3.85	WO 3.59	COU 3.48	...	RE 1.96	REL 1.93
Dreaminess	DR 6.04	RE 5.22	EN 4.3	AN 4.19	FA 3.96	AD 3.52	DE 3.52	RES 3.52	HO 3.37	...	SU 1.81	EU 1.78
Being energetic	ENE 8.78	AM 7.41	FA 5.81	JO 5.3	EU 4.7	CO 4.56	EN 4.56	SA 3.93	IN 3.78	...	LO 1.59	SY 1.33
Fascination	FA 8.56	EN 6.3	AD 5.04	IN 4.63	AM 4.44	AN 4.22	RES 4.15	SU 3.81	DE 3.78	...	LU 2.15	REL 1.81
Inspiration	IN 6.96	FA 6.52	AM 6.04	ENE 5.15	EN 5	SA 4.48	AN 4.41	JO 3.67	CO 3.63	...	COU 1.85	LU 1.85
Pride	PR 5.96	CO 5.7	SA 5.26	FA 5.04	RES 5.04	AD 4.81	IN 4.59	AM 4.3	ENE 4.11	...	SU 1.96	LU 1.74
Relaxation	RE 6.93	KI 4.81	DR 4.7	RES 4.19	SA 4.04	LO 3.89	REL 3.85	SY 3.59	DE 3.52	...	EU 1.85	ENE 1.67
Respect	RES 6.33	PR 5.81	AD 5.74	CO 5.15	SA 4.96	KI 4.89	FA 4.67	LO 4.15	WO 4.15	...	SU 2.41	LU 1.81
Confidence	AM 7.19	ENE 6.48	CO 5.3	FA 5.22	JO 4.67	SA 4.63	EN 4.26	IN 3.89	AN 3.85	...	WO 1.85	LU 1.67
Enchantment	FA 7.96	EN 6.74	DE 5.78	AD 5.74	RES 5.52	AN 4.59	KI 4.37	LO 4.3	WO 4.3	...	COU 2.07	REL 1.85
Hope	AN 6.22	HO 5.89	WO 5.56	AD 4.7	DE 4.67	RE 4.37	EN 4.19	RES 3.96	ENE 3.7	...	REL 2	SY 2
Lust	FA 6.15	DE 5.78	EN 5.37	AD 5.19	LU 4.56	LO 4.56	KI 4.3	AN 4.04	ENE 3.85	...	SU 2.22	REL 2.19
Relief	AN 4.11	REL 3.78	ENE 3.63	FA 3.56	SA 3.41	CO 3	EN 3	AM 2.96	PR 2.7	...	LU 1.67	LO 1.63
Surprise	FA 5.7	SU 5.04	AM 5	AN 4.33	EN 4.07	ENE 4.04	SA 3.48	IN 3.41	AD 3.37	...	LU 2.04	LO 1.56
Courage	FA 5.74	AN 5.56	AM 4.52	EN 4.15	SU 4.11	SA 3.81	IN 3.7	CO 3.41	COU 3.3	...	WO 2.15	LU 1.93
Euphoria	ENE 6.85	FA 6.48	AM 6.41	JO 5.44	IN 4.85	EU 4.52	CO 4.52	SA 4.41	EN 4.22	...	LU 2	REL 1.78
Joy	AM 8.59	FA 7.26	ENE 7.19	JO 6.07	IN 6.07	EN 6.04	SA 5.33	EU 4.67	CO 4.33	...	LU 1.81	SY 1.81
Kindness	RES 6.44	AD 5.89	KI 5.22	FA 5.04	EN 4.74	WO 4.74	PR 4.67	IN 4.33	SA 4.22	...	EU 1.85	LU 1.67
Love	RES 7.3	KI 7.19	LO 6.48	AD 6.07	WO 5.85	EN 5.59	DR 5.41	SY 5.26	RE 4.93	...	COU 2.41	SU 2.22
Satisfaction	FA 7.26	EN 5.3	AD 5.26	AM 4.59	RES 4.56	SA 4.48	CO 4.48	IN 4.41	AN 4.26	...	REL 2.11	LU 1.7
Sympathy	RES 5.44	KI 4.78	WO 4.63	LO 4.33	AD 4.22	DR 4.22	RE 4.22	EN 4.19	SY 4.04	...	COU 1.89	SU 1.81
Worship	RES 6.7	AD 6.59	WO 6.52	EN 6.41	FA 5.85	DR 4.93	AN 4.74	DE 4.48	SA 4.3	...	REL 2.37	SU 2.15

Table 7.4. Mean values of scale ratings of the movie-sets for the intended emotions

AD=Admiration, AM=Amusement, AN=Anticipation, CO=Confidence, COU=Courage, DE=Desire, DR=Dreaminess, EN=Enchantment, ENE=Being energetic, FA=Fascination, EU=Euphoria, HO=Hope, IN=Inspiration, KI=Kindness, JO=Joy, LO=Love, LU=Lust, PR=Pride, RE=Relaxation, REL=Relief, RES=Respect, SA=Satisfaction, SU=Surprise, SY=Sympathy, WO=Worship

✳ : Movie-sets that received highest ratings for the intended emotion
✳ : Movie-sets that were affiliated to a blend of other emotions that received higher rates than the intended one, but those emotions appeared to be matched with the other movie-sets with higher rates.

7.3.5. Brief discussion of tool development

Manifestations of positive emotions in interactions were developed through an exploratory study and selected via an online survey. The results of a further evaluation study suggest that, in general, the distinctiveness of each emotion was captured well in the movie-sets so that several emotions could be identified even without any further information.

Reflecting on the procedure of developing the movie-sets, we postulate that the sensitisation process was effective to help the actors internalise the nuances of the 25 positive emotions, thus they could act out the emotions in an unambiguous way. The ten preselected movie-clips per emotion were based on the two researchers' decision. While the selection process was guided by the explicit criteria, we cannot discount the possibility of exclusion of some movie-clips that might better represent intended emotions than the chosen ones. For those movie-sets that were not sufficiently recognised in the evaluation study, it could be worthwhile to re-examine if the sets can be improved with alternative movie selections.

The design tool incorporates the movie-sets in combination with supplementary information about the emotions, such as emotion labels and definitions. This means that our validation approach, which was to show the movie-sets in isolation with no additional information, was conservative. Nonetheless, the results indicated that respondents were able to match 17 movie-sets with the intended emotions. While eight 'critical' movie-sets remained that did not meet the two criteria set out previously, we noticed that some of them were not markedly far off. For example, the movie-set 'worship' was closely associated with respect and admiration. These three emotions are fairly similar in terms of thought-action tendency as was found in the literature review. Likewise, in the cases of the movie-sets 'love' and 'kindness,' the corresponding emotions followed similar emotions that shared common qualities in thought-action tendencies. However, the movie-sets of sympathy, satisfaction, courage, and euphoria tended to be blended with variant emotions and the ratings towards the corresponding emotions were relatively low. For the time being, we provisionally include the critical movie-sets in the tool. In a future iteration of EmotionPrism, the eight movie-sets will be revised. We plan to review these with actors to better distinguish them from similar positive emotions.
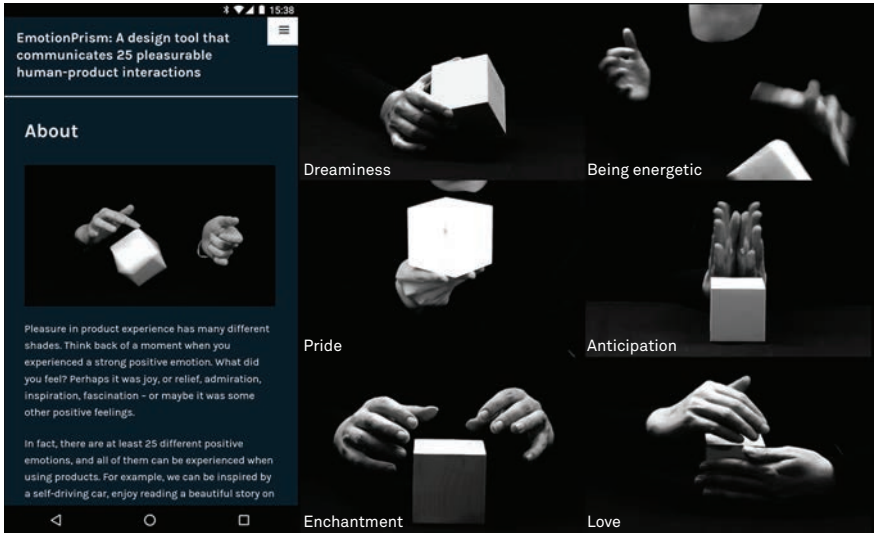
Figure 7.4. The EmotionPrism interface and examples of the movie-clips

7.3.6. Integration of the developed elements into EmotionPrism

The tool was developed into an online database that includes the generated movie-sets and the descriptions of thought-action tendencies (Figure 7.4). Besides, the emotion words, definitions, and appraisal themes were incorporated based on the typology of positive emotions (Desmet, 2012) and positive emotional granularity cards (Yoon et al., 2013). The interface displays the 25 positive emotions on top of the screen, by which a designer can navigate the emotions. Clicking an emotion label would bring the designer to the detail page of the emotion. The detail page presents the set of information in which four movie-clips self-run consecutively. The tool can be accessed at http://studiolab.ide.tudelft.nl/diopd/emotionprism. Designers can use the tool to discuss what kinds of interactions would be appropriate or desirable to incite and to select a set of relevant positive emotions accordingly by referring to the set of information as a repertoire to choose from. The usefulness of the information was tested in the application of the tool.

7.4. Application of EmotionPrism

7.4.1. Tool in use

A design workshop was conducted to explore how designers can use EmotionPrism. The workshop was used to assess the tool's effectiveness in supporting the use of a nuanced understanding of positive emotions, in envisioning the desired interactions by means of specific positive emotions, as well as in serving as a source of inspiration. The tool was evaluated both qualitatively (i.e., observation and discussion) and quantitatively (i.e., questionnaire). The workshop was planned in a way that a large amount of ideas could be rapidly generated. This was to observe emotional diversity and considered interactions in the ideas.

Setup

The workshop was carried out with 29 design students in the master level design course 'Design for Emotion' at the faculty of Industrial Design Engineering of Delft University of Technology. The designers were split into three groups, each of which involved three subgroups of three or four members. Each group was assigned a specific product: a lamp (groups 1, 2, and 3); a clothes hanger (groups 4, 5, and 6); a speaker (groups 7, 8, and 9). All nine groups worked on three different contexts: a romantic dinner, a fun workout, and a comfortable flight. The aim of this setup was to observe if the tool could be supportive across different design challenges in which appropriate positive emotions and interactions might differ.

A week before the workshop, a lecture that explained an appraisal approach of emotional design and the relationship between emotion and expressive behaviour was given. The appraisal approach introduced by Desmet (2002) states that the way people appraise an event determines the type of emotion. At the start of the workshop, the tool was introduced. All groups were assigned to create mood boards for the three contexts. This assignment was to guide the designers to be sensitised with the experiences to design for.

Questionnaire

A questionnaire was used to evaluate the tool that was composed of four parts. The items in the first part examined the designers' tool acceptance. The second part was about the helpfulness of the tool for increasing a nuanced understanding of positive emotions. The questions in the third part referred to the degree to which the tool contributed to stimulating divergent thinking. The fourth part examined helpfulness of the tool in

Part	Question	Response
Part 1	1. Indicate in which cycle(s) you used the tool.	1st cycle 1st and 2nd cycles All of the three cycles
	2. During the workshop, I revisited the tool to check whether the ideas would be in line with the effects of emotions on interactions illustrated in the movie-clips.	Yes | No
	3. After the workshop, I used the tool to check whether the elaborated concepts would be in line with the effects of emotions on interactions illustrated in the movie-clips.	Yes | No
Part 2	4. While using the tool, I could understand how different positive emotions differently influence the way a person interacts with a product.	Disagree 1 2 3 4 5 6 7 Agree
	5. The tool enabled me to consider more positive emotions than a few obvious ones while generating ideas.	Disagree 1 2 3 4 5 6 7 Agree
	6. I would have not been able to discern how each emotion differs from another in terms of expressive interaction qualities.	Disagree 1 2 3 4 5 6 7 Agree
Part 3	7. It was supportive to use the differentiated effects of emotions on interactions as the starting points of designs in diverging design directions.	Disagree 1 2 3 4 5 6 7 Agree
	8. I felt my creativity flow dropped as the design cycles proceeded.	Disagree 1 2 3 4 5 6 7 Agree
Part 4	9. It was helpful to use the tool as a reference point to communicate what kinds of interactions to address.	Disagree 1 2 3 4 5 6 7 Agree
	10. The tool enabled our group to explicitly discuss what kinds of interactions and emotions would be appropriate.	Disagree 1 2 3 4 5 6 7 Agree

Table 7.5. Questionnaire items used in the tool evaluation

facilitating explicit communication about interaction qualities among group members. The question items are described in Table 7.5.

7.4.2. Procedure

The workshop consisted of three iterative design sessions in which the designers dealt with one of the three design contexts in turn. Each design session followed a three-stage procedure: selecting positive emotions, generating product ideas, and discussing the generated ideas.

Selecting positive emotions

The groups were guided to discuss what kinds of interactions would be appropriate or desirable for the given context and product and to select three or four positive emotions accordingly by using the tool as a repertoire to choose from. No instructions were given about how the tool should be used, except that the groups were asked to go through the emotions in the tool.

Generating product ideas

Each group member took one emotion out of the chosen emotions and generated a product idea in a way that the design evokes the emotion and

stimulates the interaction quality depicted in the tool. The designers were provided with A4-sized sketchpads, and for each idea, they were asked to write down which emotion they aimed to evoke. After every seven minutes, the group members swapped the emotion with the other member until each member goes through all of the chosen emotions.

Discussing the generated product ideas and filling out the questionnaire

The workshop evolved into a discussion of the generated ideas. Within a group, the members had reviewed all ideas, and selected one best idea based on how well it fits the context, the likelihood of eliciting the intended emotion, the novelty of the idea, and the feasibility of production. The workshop ended with a discussion in which all groups openly explained the ways they used the tool for selecting emotions and generating product ideas. After the workshop, an assignment was given; every group was assigned to advance the chosen three ideas into the concrete design concepts considering the appearance of the product, its functions, and how the interactions are conducted. The final concepts were presented after a week and the designers filled out the questionnaire. The collected data per each questionnaire item were averaged for analysis.

7.4.3. Workshop results

From observing the designers during the workshop followed by a joint discussion, and based on the results of the questionnaire, tool usage and their opinions were analysed. The results are reported in this section, structured by the main objectives of the workshop. In addition to the above issues, other observations from the design outcomes and the remarks from the designers are discussed.

Attitudes towards to the tool

Attention was paid particularly to the designers' openness and acceptance towards the tool since the tool itself and the design approach, i.e., designing for nuanced positive emotions, were unconventional. The designers used the tool many times during the workshop and discussed the contents described in the tool in detail. Regarding the first impression, most designers appreciated having an overview of positive emotions that are explained from the multi-componential perspective, i.e., definition, eliciting condition, and thought-action tendency through a rich representation. They found it practical to watch the generated movie-sets, as they could readily understand how a particular emotion is manifested in human–product interactions.

Comfortable flights (102 ideas / 11 emotions)	Lamp: 56	Clothes hanger: 22	Speaker: 24
	Relaxation: 11 Dreaminess: 7 Fascination: 12 Anticipation: 6 Confidence: 5 Courage: 10 Satisfaction: 5	Relaxation: 7 Dreaminess: 7 Fascination: 2 Relief: 3 Respect: 3	Relaxation: 10 Dreaminess: 3 Anticipation: 3 Amusement: 3 Kindness: 5
Fun workout (100 ideas / 10 emotions)	Lamp: 50	Clothes hanger: 33	Speaker: 17
	Amusement: 11 Being energetic: 17 Pride: 5 Joy: 6 Confidence: 4 Surprise: 7	Amusement: 5 Being energetic: 9 Pride: 6 Joy: 3 Satisfaction: 6 Courage: 4	Amusement: 4 Being energetic: 3 Pride: 3 Satisfaction: 2 Desire: 3 Euphoria: 2
Romantic dinner (95 ideas / 11 emotions)	Lamp: 38	Clothes hanger: 32	Speaker: 25
	Enchantment: 6 Love: 5 Lust: 7 Dreaminess: 8 Hope: 5 Kindness: 4 Relaxation: 3	Enchantment: 6 Love: 3 Lust: 6 Desire: 6 Anticipation: 7 Admiration: 2 Respect: 2	Enchantment: 9 Love: 6 Lust: 3 Desire: 7

Table 7.6. Positive emotion types used as design intentions during the design workshop

The first part of the questionnaire was used as an indicator of tool acceptance. Regarding the iteration cycles in which the tool was actually applied, two of 29 designers (7.4%) used it only in the first cycle, and then left aside. Two designers (7.4%) used it till the second cycle, and 23 designers (85.2%) used it throughout all three cycles. 21 designers (77.8%) revisited the tool during the idea generation to refer back to the information described in the tool whereas four designers (14.8%) did not. After the workshop, 13 designers (48.1%) used the tool again when they advanced the chosen ideas, while 14 designers (51.9%) did not. The results indicate that most designers used the tool throughout all iteration cycles, and half of the designers voluntarily reused it after the workshop.

Use of a nuanced understanding of positive emotions

As an indicator of the degree to which the tool supported the designers to consider nuances between emotions, the numbers of the selected emotions were counted.The generated ideas were clustered based on the context, product, and emotion used in the ideas (see Table 7.6). During the workshop, 22 out of the 25 emotions in the set were used for generating ideas. The unused emotions were sympathy, worship, and inspiration. The

chosen emotions appeared to be heterogeneous from context to context, but appeared to be similar within a context across three products. For instance, the most frequently used emotions for a comfortable flight, a fun workout, and a romantic dinner were relaxation, amusement, and enchantment respectively. The remaining emotions varied depending on the product type.

The overall responses to the second part of the questionnaire were positive. The mean values given to the fourth, fifth, and sixth question were 5.59 (*SD*=0.88), 5.07 (*SD*= 0.87), and 3.55 (*SD*=1.31) respectively. Given the diversity of the types of positive emotions used during the workshop and the questionnaire results, we postulate that the tool supported designers to be aware of differentiated aspects of various positive emotions and to carefully select the emotions to design for.

Creativity support

Not surprising, as different emotions arise in different conditions, the selection of multiple emotional experiences appeared to yield a variety of design directions. The different conditions inherent in each emotion diversified the designs. Some designers reported that emotions that could be considered nonobvious helped them to generate no archetypal product ideas.

The mean value for the question seven that evaluated the effectiveness for diverging design direction was 5.48 (*SD*=0.97). The question eight evaluated if the designers felt their creativity flow dropped as the design cycles proceeded. The mean value for this question was 3.77 (*SD*=1.67) (see the questionnaire items in Table 7.5). The results imply that 25 emotions in the set served as inspirational stimulus, hinting the designers at various alternative design solutions.

Envisioning the desired interactions

The questions nine and ten in the questionnaire assessed the usefulness of the tool to communicate the appropriateness of interactions and emotions to address (see Table 7.5). The mean values for the questions nine and ten were and 4.66 (*SD*=1.46) respectively. Generally speaking, the tool supported a conscious and purposeful determination of interaction qualities by means of particular emotions. However, the relatively low ratings for the question ten are noteworthy: the process of envisioning the desired interactions appeared to require more than a structured overview of differentiated emotion expressions in interactions. We assume that this was because the design assignments were open-

ended and not framed by a clear user group and situations.

Additional observation and opinions on the tool

While observing the generated ideas, we paid attention to the similarity between the interactions depicted in the movie-sets and the interactions the designs intended to incite. We noticed that the movie-sets, which were made abstract and decontextualized, i.e., hands interacting with a cube, seemed to be open enough to invite many interpretations. Even though the designers referred to the interactions manifested in the movie-sets, most of the ideas utilised variant interactions and the expected usage behaviours illustrated in the sketches were different from the ones represented in the movie-sets while still displaying the same qualities. This implies that the designers could get a grip of what a certain emotion looks like in interactions, and make a transition into product properties.

However, it should be noted that some designers found it difficult to apply the tool to their designs. They proposed that the tool could be more informative if it would show concrete product examples and suggestive situations that evoke certain emotions, mentioning that the movie-sets were somewhat vague for translating the represented interactions into actual interactions, e.g., turning a knob for controlling the volume of a speaker. Besides, since the interactions in the movie-sets were not based on certain situations, they found it difficult to empathise with potential users, which in turn, made the process of selecting emotions difficult. This can be interpreted that it lacked in facilitating empathy with users and was insufficient to support them to make user-relevant design decisions. This may explain the reasons for the relatively low rating of the question on the helpfulness of the tool in envisioning the appropriate interactions.

Finally, some designers proposed improvements for the movie-sets. It was pointed out that since social emotions such as respect, pride, and kindness often arise in the interactions between people, not directly attributed to a product, showing only a single person in the movie-sets was limiting to characterise the emotions. It was suggested to include multiple persons in the movie-sets and illustrate how they would interact together using a product. Besides, it turned out that in some cases, the movie-clips used for one emotion was very similar in terms of expressions. For example, three out of four movie-clips of 'pride' were similarly manifested with a gesture in which an actor boastingly grabs a cube with one hand and holds it up high with the other hand. These similar movie-clips were considered redundant.

7.4.4. Brief discussion of design workshop

Through the workshop, we could see that the tool supported the designers to discern nuances between positive emotions, stimulated divergent thinking, and helped the communications of the interaction qualities to address. At the same time, we could also identify a trade-off of decontextualizing the tool. The tool was equally useful in designing for the three different contexts and product types, proving the benefits of abstract representations of emotion expressions. However, it turned out to be limiting in facilitating empathy with users, which in turn hampered the process of specifying design intentions. It is expected that the tool could provide more actionable insights for designers when the design assignment (problem or brief) includes detailed information on specific user groups and situations.

7.5.   General discussion

In this paper, we have reported the development of 'EmotionPrism', a design tool that aims to support designers (1) to be aware of the relationships between positive emotions and associated expressive interaction qualities, and (2) to deliberately incite particular interaction qualities by means of distinct positive emotions. The strength of the tool lies in its high level of granularity. Based on the typology of positive emotions (Desmet, 2012), it encompasses 25 distinct positive emotions and represents the unique expressive interaction qualities. This fine-grained pallet of positive emotions enables designers to be selective of what particular positive emotions to design for. EmotionPrism is, to our knowledge, the first collection of dynamic representations demonstrating human−object interactions in relation to distinct positive emotions.

We have evaluated the practical use of the tool in a design workshop. The results indicated that the tool enables designers to explicitly communicate the differentiated interaction qualities of positive emotions, and serves as a source of inspiration. Moreover, it was intensively used during the workshop.

However, the current version of EmotionPrism comes with some limitations. The evaluation of the generated movie-sets indicated that some movie-sets could not be unequivocally matched to the related emotions when no further information was provided. Most of these critical movie-sets tended to be perceived as representations of similar positive emotions that share analogous thought-action tendencies. Besides, as was pointed out during the workshop, diversity of expressions in each

movie-set needs to be ensured. Note that the low validity of these movie-sets might not be very problematic in the context of the design tool itself because the movie-sets are presented together with the emotion words, definitions, and eliciting conditions, as well as descriptions of thought-action tendencies. However, the movie-sets should not be used alone. The results from the workshop suggest that for the effective use of EmotionPrism for specifying design intentions, it is important to frame the design problem by a clear user group and contexts. In the workshop, design students performed a series of short assignments using the tool. In real design practice, the scope of a design process is much broader and more sophisticated than is described in the workshop. As the process of specifying emotional intentions involve various roles in a product development team (Yoon, Pohlmeyer, & Desmet, 2016), the tool is likely to be used with non-designers such as clients and marketers, but it is uncertain whether they will easily understand the purpose of the tool and adopt it in the same manner. Hence, it is also necessary to test it in a more realistic context and involve other stakeholders in improving the tool and further identifying designers' needs.

Traditionally, facial expressions have been widely used to distinguish emotion types, but for positive emotions, it has proven to be less useful because (with the exception of surprise and interest) most of them simply result in a smile (Campos et al., 2013; Mortillaro, Mehu, & Scherer, 2011). In contrast, the evaluation of the movie-sets suggests that expressive qualities of hands interacting with an artefact can be potentially used as a cue to communicate distinct positive emotions. The respondents could correctly identify 17 different positive emotions from merely watching hands that express emotions in interactions, with no additional information provided. Two reasons for this high degree of recognition seem plausible. Firstly, some gestures illustrated in the movie-sets might remind the observer of certain situations in which a particular positive emotion is likely to arise. Second, hands expressing positive emotions in interactions provides rich information: it involves several cues of emotional expression together such as posture, gesture, physical motion and touch, thereby increasing the chance of recognition. This is unique because aside from touch (e.g., Ebe & Umemuro, 2015; Hertenstein, Holmes, McCullough, & Keltner, 2009), there have been few attempts to use bodily expressions to differentiate specific positive emotions (Sauter et al., 2014). Taking into account that most of human–product interactions involve hands, it is worthwhile to further advance an understanding of how hands in interactions are associated with expressions of positive (and negative) emotions. The resulting findings can

support further developments of both design and research tools for emotion-focused design processes.

In this paper, we have mainly focused on momentary effects of positive emotions on interactions, but it should be noted that having an awareness of the long-term impact of positive emotions is also of great value for designers. In one of our studies, it was found that designers wanted to know beneficial effects of positive emotions in the long run, and purposefully design for specific positive emotions, aiming at such effects (Yoon et al., 2016). For instance, explorative behaviour stimulated by interest can result in increased knowledge, and determined behaviour stimulated by hope can contribute to enhanced resilience (for an overview of long term effects of positive emotions and underlying process, see Fredrickson, (2013). However, it has not yet been explored if these effects can be replicated in human−product interactions. Future research and design tools should address this aspect.

7.6.   Conclusion

In this paper we introduced EmotionPrism, the first design tool that visualises distinct positive emotional expressions in human-object interactions. The development and evaluation of the tool were presented and discussed. EmotionPrism is based on the proposition that products can evoke multifaceted positive emotions, and that interaction qualities can be used to target particular positive emotions. The tool was developed to support designers in developing a nuanced understanding of the relationships between positive emotions and expressions in interactions. Overall, we concluded that EmotionPrism can be a useful design resource by providing designers with a varied repertoire expressive interaction qualities that correspond to specific positive emotions.

7.7.   References

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8. 'Feeling good' unpacked: Developing design tools to facilitate a differentiated understanding of positive emotions

Abstract

The range of positive emotions experienced in human–product interactions is diverse, and understanding the differences and similarities between these positive emotions can support emotion-driven design. However, there is little knowledge about the kind of tools that are effective for leveraging the differentiated nature of positive emotions in a design process. The current study explores the possibilities of developing design tools that facilitate a nuanced understanding of positive emotions, and looks at the considerations that need to be addressed in developing such tools. Four new tools were developed that describe the distinctiveness of positive emotions in different ways, and have different formats and usages. This paper introduces the tools, and reports on a focus group study that investigated when and how the tools would be of use in design processes, and the strengths and weaknesses of the tools.

Keywords: Design for emotion, Positive emotion, Design tool, User-centred design

8.1.   Introduction

Imagine yourself as a designer having a kick-off meeting with your client. The client asks, "Please design a mobile payment service that makes people feel good". You commit to the challenge and return to your design studio. You talk with your colleagues about the project and suddenly find that they look a bit puzzled. One designer asks, "What do you mean by 'feeling good'?" He continues, "Do you mean experiencing confidence, curiosity, or amusement? These are all pleasurable feelings, yet they are different. Which ones do we need to address?".

This is an exemplary snapshot of a case for which distinguishing the nuances of positive emotions becomes an issue in a design process. We can experience a myriad of different pleasant emotions when interacting with products, and it has been found that being aware of the differences between these emotions can be advantageous for designers (Desmet, 2012). For example, this awareness can be helpful in deliberately determining the positive emotions that should be addressed upfront in a design process, and in supporting communication about users' emotional responses to a product within design teams, with clients, and with users (for an overview of the benefits of differentiating positive emotions in design, see Yoon, Pohlmeyer, & Desmet (2014)).

How, then, can we help designers to be aware of the nuances of positive emotions and to use this understanding for their practices? Perhaps, taxonomies of positive emotions that can be experienced in human–product interactions (Desmet, 2012) could serve as a repertoire to choose from when specifying emotional intentions of a design. Or having an overview of the different causes of a set of positive emotions (Campos, Shiota, Keltner, Gonzaga, & Goetz, 2013) could help with an understanding of the underlying conditions that evoke certain positive emotions. In design research, various types of design tools and techniques have been introduced with the intention of making theoretical knowledge accessible to designers and of inspiring designers in user-centred design activities; such tools include card-sets, experience prototyping (Buchenau & Suri, 2000), and design documentaries (Raijmakers, Gaver, & Bishay, 2006). Although this is a diverse range, no research has yet explored what type of tool would be effective to leverage the differentiated nature of positive emotions in a design process, or how such a tool could be developed.

In this paper, we explore how a nuanced understanding of positive emotions can be facilitated with the aid of design tools. We expect that

EMPATHY		AFFECTION		ASPIRATION	
Sympathy, Kindness,Respect		Love, Admiration, Worship		Dreaminess, Lust, Desire	

ENJOYMENT		OPTIMISM		ANIMATION	
Euphoria, Joy, Amusement		Courage, Hope, Anticipation		Surprise, Being energetic	

ASSURANCE		INTEREST		GRATIFICATION	
Pride, Confidence		Inspiration, Enchantment, Fascination		Relief, Relaxation, Satisfaction	

Figure 8.1. Typology of 25 positive emotions categorised into nine emotional types (adapted from Desmet (2012))

the resulting insights can clarify (1) what kind of tool would be appropriate for use in any particular design activity (e.g., understanding user emotions) and (2) what needs to be considered when developing such a tool. Thus, the research question is: how can the nuances of positive emotions be conveyed to designers by means of a design tool?

This paper begins by describing the research approach and the development of four design tools. The next section reports on the results of two focus groups in which design experts reviewed the tools that had been developed and discussed when they could be usefully applied, along with their strengths and weaknesses. Based on the results, this paper ends with a discussion of its limitations and of recommendations for future research.

8.2.   Approach

Given that there are few design tools available that facilitate a nuanced understanding of positive emotions and that could be used as a reference, we decided to use 'research through design' as our main approach. Research through design refers to a research method in which building and testing prototypes takes centre stage and becomes the key means of constructing knowledge (Stappers, 2007).

We decided to develop a set of design tools, each of which would help to distinguish various positive emotions in a different manner, and analyse them with design experts to identify their advantages and disadvantages. Four prototypes of design tools were conceived: positive emotional granularity cards, EmotionPrism, emotion raconteur, and emotion carousel. These tools were based on the typology of positive emotions (Desmet, 2012) that includes 25 positive emotions that can be

experienced in human–product interactions (see Figure 8.1). The tools were conceptualised to be different regarding how they described the distinctive qualities of positive emotions, and had different formats and usages. The following parts of this section describe the tools that were developed.

8.3. Developing design tools

8.3.1. Tool 1: Positive emotional granularity cards

A total of 25 positive emotional granularity cards were created (Yoon, Desmet, & Pohlmeyer, 2013). These incorporate a label defining an emotion, the general conditions in which people experience that emotion, and visual representations of the expression of the emotion. Each card represents one positive emotion. In line with Wallbott (1998), who showed that behavioural manifestations are indicative of a particular emotional state, it was assumed that providing visual representations of behavioural manifestations and concrete contexts could give a comprehensive understanding of the emotions in the set. The pictures used in the set of cards include, for example, a group of people being proud of winning a game and a man being relaxed listening to music. For each emotion, four different images were used. The chosen images were validated to check whether they could effectively characterise the target emotion, and whether they were distinct from images for other similar positive emotions. A detailed description of the validation procedure can be found in Yoon et al. (2013). All emotions have unique 'core relational themes' that represent the conditions that elicit them (Lazarus, 1991). The core relational themes of the 25 positive emotions were formulated to describe the eliciting conditions from the literature on appraisal theory, and these were printed on the cards (for an overview, see Yoon et al. (2013)). For instance, the core relational themes for respect and surprise are "*a praiseworthy characteristic of someone conforms to internal or external standard*" and "*something unexpectedly happens beyond one's expectation*", respectively.

Figure 8.2. Examples of positive emotional granularity cards

8.3.2. Tool 2: EmotionPrism

The 'EmotionPrism' tool consists of movie-sets that illustrate how people interact with a product when expressing the 25 different positive emotions (Yoon, Pohlmeyer, & Desmet, 2017). This tool was devised on the basis of the insight that positive emotions are characterised by distinct behavioural tendencies (Fredrickson, 2013). For example, joy stimulates playful interactions, and kindness makes interactions tender and protective. We postulated that having a tool that communicates the differentiated behavioural tendencies could help designers to envision user behaviour concerning particular positive emotions, and to stimulate different types of usage behaviour. It was decided to use hands interacting with an artefact as a channel to discriminate between positive emotions, since most human–product interactions involve hands. The movie-sets were generated through an exploratory study with professional actors manifesting positive emotions like squeezing and caressing. Instead of showing a specific product such as camera or lamp in the videos, this tool uses a neutral cube that symbolises a product in an abstract manner to prevent the application of the tool being limited to the design of a particular product type. Four movie-clips were generated for each emotion, and they were validated through online surveys (for the details of the validation process, see Yoon et al. (2017)). Designers can use the movie-sets incorporated in the tool to discuss what kinds of usage behaviour would be appropriate or desirable for a design context and a product, and, from this, can select a set of relevant positive emotions by referring to the repertoire in the movie-sets.
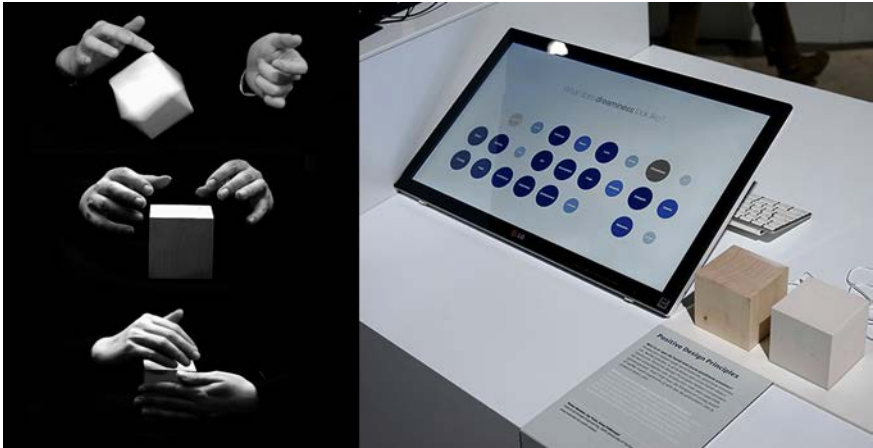
Figure 8.3. Screenshots of movies (from top: joy, enchantment, and love) and the interface of the EmotionPrism

Figure 8.4. A screenshot of the app through which the anecdotes can be played

8.3.3. Tool 3: Emotion raconteur

'Emotion raconteur' is a sound library of users' anecdotes. The anecdotes were collected from actual users' experiences of feeling positive emotions when using products (Desmet, 2012). The anecdotes illustrate how a product plays a role as the cause of an emotion in a certain context and how users react to the product. For instance, an anecdote used for the emotion 'sympathy' was "*sometimes I see an old car that has been*

damaged and taped with glue. The owner does not seem to have enough money to repair it properly. I imagine how difficult her life is and feel sympathy." The idea behind this tool was that, as argued in Demir (2010), anecdotes that depict certain emotional experiences can help designers to become aware of the antecedents of an emotion, or, in other words, what caused the feeling. It has also been shown that in a narrative, distinct emotions can be clearly perceived at the sentence level beyond simple valance classification (Buitinck, van Amerongen, Tan, & de Rijke, 2015). It has been proved that some specific positive emotions can be identified via vocal cues, such as bursts of admiration and amused laughter (Schröder, 2003). Since emotions expressed in an anecdote can be more accurately and quickly communicated when they are supplemented by paralinguistic cues such as voice tone inflection (Epley & Kruger, 2005; Pell et al., 2015), we decided to voice-record the anecdotes with professional voice actors. Each emotion is illustrated in three or four anecdotes (there were 86 in total), and the recorded audio files are incorporated into an audio application through which the anecdotes can be navigated based on emotion type and product type.

8.3.4. Tool 4: Emotion carousel

Emotion carousel is a package of three interactive installations, 'Assurance,' 'Enjoyment, and 'Interest,' each of which enables designers to explore three similar positive emotions in an interactive way (covering nine emotions in total). We assumed that, in line with the results of Buchenau and Suri (2000), offering first-hand experiences of particular emotions in a physically staged setup could give a visceral sense of differences between the emotions.

Figure 8.5. Participants interacting with the installation 'Assurance'

Figure 8.6. Participants interacting with the installation 'Enjoyment'

Figure 8.7. Participants interacting with the installation 'Interest'

Assurance

This tool is intended to show what it is like to feel confident, courageous and proud in interactions. The tool consists of several interactive stepping stones placed some distance apart. When a participant stands on a stepping stone, it emits a genial sound with a light effect, confirming that it is safe to jump on, which makes the jumper confident to keep on stepping forward. When he/she encounters a stone that is one metre away, the stone on which he/she is standing gives a signal that the next one can be reached, and there are light and sound effects that also give an inviting signal. This leads the person to forge ahead with courage. After all the stepping stones have been stepped on, they start celebrating by blinking their lights and playing songs. This gives the person a sense of achievement, facilitating a feeling of pride.

Enjoyment

This tool intends to evoke three emotions: joy, amusement and euphoria. The tool consists of a series of soft balls connected to each other. When a person touches a ball, a light comes to the ball he/she is touching and then leaves again. The slowly breathing light encourages him/her to follow it and to pat the balls gently. While this is happening, the tool explains through a speaker that the sensory pleasure could give a feeling of joy. The tool then invites the participant to a game of 'catch me if you can', which is intended to evoke amusement. Lights start fast moving and jumping about, challenging the player to catch them. When a light is grabbed, it stays in the ball. As several lights are moving, additional players need to be involved to catch all the moving lights, which makes the interaction more socially playful. While the game is being played, the tool explains the feeling the players are likely to have, which is amusement. When all the lights have been caught, all the balls start flashing on and off to signal the successful end of the game. This accomplishment gained through joint efforts makes the experience euphoric.

Interest

The Interest tool has a large sphere with a series of lights and speakers nestled inside. By changing its behaviour, it creates three different conditions in which people can experience enchantment, fascination, and inspiration. For enchantment, the sphere hangs out of the person's reach, putting him/her in a passive position, and mysteriously glows while emitting slow sounds. After a while, the sphere comes down and invites the participant to come close to it; a spot starts blinking and the participant is attracted to touch it. When the spot is touched, another spot starts flashing, building a pattern of lights. While doing this, the participant becomes fascinated and curious about what kind of pattern will emerge. After this cycle, the inspiration phase starts. The sphere gives him/her the opportunity to create his/her own pattern of lights and melodies by touching different spots. This encourages the person to play and inspires him/her to express his/her creative ideas.

8.4.   Assessing the tools

While all four of the tools we developed are meant to cover a broad repertoire of positive emotions, they address different aspects of emotional experiences and use varied forms, which implies that they might have different strengths and weaknesses. We postulated that, depending on the type of design activity, which could be communication

of users' emotional states or specification of emotional intentions, the usefulness of each tool would differ to some degree. For example, the images used in the card-set would help designers grasp and imagine the situations in which the emotions arise, while the movie-sets used in the EmotionPrism, which was made abstract and without a particular context, would stimulate designers to imagine the effects of emotions on interactions.

Two focus groups were brought together and the developed tools were reviewed by a panel of design experts, focusing on how the tools could contribute to helping designers to discern a variety of positive emotions, on when it would be useful to apply the tools, and on the strengths and weaknesses of the tools.

8.4.1. Method

Procedure

Two mixed groups of design experts participated in the study: four design teachers, four design professionals, and one emotion expert. The design teachers and emotion expert were recruited from the Faculty of Industrial Design Engineering of Delft University of Technology. On average, the design teachers had 28.3 years of experience in education; the emotion expert had 6.5 years of experience in emotion-driven design research. The design professionals were from four design consultancies and self-identified their roles as a usability engineer, an industrial designer, an interaction designer and a user researcher. On average, they had 4.5 years of experience in design practice. The emotion expert was in charge of guiding the participants to keep their focus on emotions during the sessions, not allowing them to be distracted by other subjects such as the technologies applied in the prototypes. The participants were recruited from the authors' professional networks and were paid for their contributions.

The focus group survey consisted of three phases: learning the topic of the study, reviewing the prototypes of the tools, and discussing the characteristics of the tools. At the beginning of the session, the first author explained the benefits for designers of discerning and articulating nuances between positive emotions, based on the findings in Yoon et al. (2014), and the purpose of developing the tools. Next, the participants watched demonstration movies that illustrated how designers could use the tools. The prototypes of the tools were placed on a table, and the participants were guided to try them out. Although the prototypes of the

emotion carousel were presented, the computational components were left inactive because of the intricacies of the installation.

The participants then compared how each tool can account for differences between positive emotions, such as by description or experience. The tools were reviewed in turn, and the participants described the type of design context in which the tools would be useful, along with their strengths and weaknesses. They made suggestions regarding additional issues that should not be overlooked when developing a new tool. Each session took two hours and was audio-recorded.

Data analysis

All audio recordings of the two focus groups were transcribed verbatim and coded on the basis of tool applications, strengths, weaknesses, and suggestions. In the analysis of the transcripts, the emphasis was on identifying themes relating to how the nuances of positive emotions were explained, instead of on other themes prevalent in the transcripts such as general impressions of the fidelity of the prototypes. In the process of analysis, data related to general considerations for design tools such as size, available time and budget, and location for use, were also omitted.

8.5. Results

Overall, the participants agreed that designers could benefit in various design activities from being aware of the differences between positive emotions. The concepts of the tools that had been developed were positively accepted, and the elements incorporated in them, such as pictures and videos, were seen to have been carefully selected and to be relevant inputs that could serve as references or as education material. The participants were convinced that designers and design students could use the given tools to learn about the multi-faceted aspects of positive emotions. In this section, the main strengths and weaknesses perceived by the participants are reported, with examples of their responses. Table 8.1 gives an overview of the main findings.

Tool	Design activity	Strengths	Weaknesses
Positive emotional granularity cards	To deepen designers' knowledge of emotions To use a shared language for emotions within a design team	Minimise the risk of misleading interpretation Help articulation of emotional states with fine-grained terms Effective for sharing and arranging content with others A quick overview through pictures Help infer when and how particular emotions arise	Abstract descriptions of emotions Difficult to compare the descriptions Not useful for understanding experiential aspects of emotions
EmotionPrism	To understand the relationship between emotion and behaviour To specify interaction effects that should be addressed To translate the intended positive emotions into interaction qualities	Provide a repertoire of various interaction qualities Demonstrate what product properties could be effective to incite an interaction that expresses a certain emotion	Unclear expressions of some emotions Does not explain the causes of emotions
Emotion raconteur	To facilitate empathy with users To help stakeholders understand the intended emotions for a design	Vivid expression of emotions Stimulate to imagine actively what the user and situation would look like	Takes a long time to go through all anecdotes Emotions are not comparable Does not give an overview of emotions
Emotion carousel	To provide education material for students To inspire designers (as a collection of examples that show how design evokes a particular emotion)	Give a visceral sense of differences between emotions	Does not give an overview of emotions Difficult to remember the emotions experienced while using the tool Difficult to communicate the nuances of the feelings Less applicable in a professional context

Table 8.1. An overview of the suggested design activities and the tools' strengths and weaknesses

8.5.1. Positive emotional granularity cards

It helps me describe how I actually feel. I would never come up with 'admiration' or 'love,' and likewise, people have a lot of trouble expressing their emotions. People just say "that's good" or "I am happy with it" (Participant 2).

The provision of a broad palette of emotion labels, combined with pictures and descriptions, appeared to have the potential to deepen knowledge of emotions and minimise the risk of misleading interpretations. The participants pointed out that the emotion labels would ensure there was no ambiguity and would support the articulation of emotional states with fine-grained terms, which would provide designers with a shared language of emotions, facilitating clear communication. The card format was particularly appreciated, as it was effective for sharing and arranging content with others. The participants found the pictures useful: (1) the

pictures would give designers a quick overview of positive emotions and help them decide to look at the detailed information; and (2) the elements illustrated in the pictures, such as context, product, and people, could support designers in understanding when and how particular emotions arise.

While useful, the descriptions of the emotions were considered to be a bit abstract and difficult to compare. Most of the participants agreed that the textual information would not be read because designers tend to be more attracted to visual stimuli in their creative processes. The card format was seen to be limiting in helping designers to understand the experiential aspects of emotion, such as the behavioural and physiological influences of an emotion. The selection of the pictures was considered critical: some cards included culture-sensitive pictures, leaving room for wrong interpretations, and there needed to be a diversity of examples illustrating emotion-eliciting situations.

8.5.2. EmotionPrism

This tool can be used for an interaction design course. It helps students understand... how I can translate an interaction quality into a movement of or with an object. Then, the emotion words don't matter that much (Participant 6).

The participants stated that the tool demonstrated clearly the expression of differentiated usage in relation to emotions and agreed that it could be used to show the repertoire of various interaction qualities. They mentioned that the various videos could support designers in identifying and explaining the specific feelings that the interaction with a product should bring for the user. The participants particularly favoured the abstract representation for this purpose. This could also guide the translation of the intended positive emotions into interaction qualities and the physical form of a product, because the videos could give a hint of which product properties could be effective to allow an interaction that expressed a certain emotion.

The weaknesses of the EmotionPrism were that some positive emotions cannot be appropriately expressed with the hands alone. The participants suggested that some emotions, such as euphoria and excitement, might be better expressed by showing a person's full body. To enact some emotions, such as hope or dreaminess, narratives seemed indispensable. Since the videos only demonstrated how emotions influence interactions with an object, when and how those emotions arise remained unclear.

This appeared to be problematic, as the tool therefore only gives partial information about an emotional experience.

8.5.3. Emotion raconteur

> *From the story, I discovered different types of love – not only love between two people but love for an ugly object from a grandfather. It shows you can also design for that kind of experience* (Participant 6).

The participants regarded the voice recordings as one of the strengths of the tool; the voices in the narrations clearly conveyed the user's emotional state and seemed to facilitate empathy. All the participants agreed that the professional actors' recordings made the anecdotes credible and lively, stimulating the hearers to imagine what the user and situation would look like. The concrete product examples were particularly appreciated, in that they helped to give an easy understanding of how a product could play a role in eliciting particular emotions. Given these advantages, the participants mentioned that this tool would be effective in helping the stakeholders of a design project, such as the client, understand the intended emotional experience that needed to be facilitated by the design, and to empathise with their target users.

Since it takes a long time to go through all the anecdotes and they cannot easily be compared, the participants responded that this tool would not be helpful when a designer wanted to have a quick overview of the positive emotions; the tool is more useful when a few positive emotions have already been chosen for the focus. The participants noted that extra care should be paid to the creation of the recordings. Some recordings sounded too polished and stereotyped, which made them less authentic and less inspirational.

8.5.4. Emotion carousel

> *Sometimes we realise something when we actually do it. How I feel through my body – I can't get it from reading a book. Reading '30 degrees of temperature' is different from actually being in a warm room (*Participant 5).

The strength of the emotion carousel reported by the participants was that first-hand experiences of particular positive emotions through interactions with artefacts could give an intuitive sense of the differences between them. The direct experience would enable designers to reflect on their feelings, on the qualities of the interactions, and on the conditions in which the interactions were enabled. This tool was seen to be a major

advantage for those who study emotion-driven design. One participant mentioned that the experiential quality of the tool would enable design students to learn and open up their minds to the idea that various emotions can be experienced in the interactions with a product. Moreover, the tool itself could serve as a collection of examples that showed how product properties (such as shape, size, behaviour and colour) can be manipulated to evoke a particular emotion.

However, the participants pointed out that some people might be unaware of or might not clearly remember the emotions they experienced while using the tool, and would find it difficult to communicate the nuances of their feelings. Besides, people's emotional responses may differ widely as a result of different attributions of meaning or current mood. The participants criticised the tool, arguing that its context seemed less applicable in a professional design context.

8.5.5. Additional findings

The participants reported that the given tools would play a role as a resource in particular activities, but said that there would be alternative ways of supporting designers to be aware of the distinctiveness of positive emotions. They suggested two approaches: (1) making 'making' a part of the tool and (2) contemplating. The participants noted that the iterative process of designing for particular positive emotions may lead designers to ponder upon the conditions that evoke those emotions, how users perceive the conditions, and how product properties could be manipulated to facilitate those conditions. In addition, the participants suggested that designers could grasp subtle differences between positive emotions by discussing their real-life memories.

The four tools were perceived to be limited in providing a comparative overview of positive emotions. The participants found this issue critical; they suggested that, on the basis of a certain criterion, the similarity between positive emotions could be differently arranged, and that ensuring multiple entry points for exploring and comparing the emotions could be advantageous. Some examples given by the participants were classifications based on interpersonal versus non-interpersonal emotions, eliciting conditions, effects on behaviour, and the duration of emotions.

8.6.   Discussion and conclusion

This paper sheds light on the topic of designing for nuanced positive emotions, with a focus on how a differentiated understanding of positive emotions can be facilitated by using design tools. The focus group study with design experts examined when and how the four types of design tools would be of use in design processes, and their strengths and weaknesses were discussed. In general, the purpose of developing the tools was well understood, and the participants could recognise the practical benefits of applying the tools in various design activities such as communicating emotional intentions, envisioning the effects of emotions on behaviour, and increasing an empathic understanding of specific emotional experiences.

All four of the tools were considered to be useful for gaining an understanding of the differences between positive emotions in a fine-grained manner, yet they were perceived to be different in terms of their application possibilities, strengths, and weaknesses. No single tool was considered to be effective for all of the suggested design activities. Each tool appeared to have various strengths and weaknesses, and their usefulness depended on the type of design activity. From this observation, we believe that the comparative overview of the four tools that emerged from the study (see Table 8.1) could give an insight into what kind of tool would be appropriate to apply in design processes; a designer could choose an appropriate one by referring to the specific design activities and strengths associated with each tool. In addition, the advantageous (and disadvantageous) aspects of the four tools that were identified could serve as design considerations for developing a future tool. A new tool could be developed to avoid certain disadvantageous aspects of these four tools or to integrate several advantageous aspects that may work together in supporting a particular design activity.

The focus group study comes with some limitations. The study aimed to clarify when and why the developed tools could be used, but the scope of the design activities that were discussed was somewhat narrow. Although designers can benefit from a nuanced understanding of positive emotions across all stages of a product development process (Yoon et al., 2014), most of the activities referred to during the study would occur in the early stage of a design process. This might be due to the way the study was set up; if the participants had been provided with a model of a design process, such as a human-centred design process (ISO, 2010), and had been directed to use this as a reference during the discussion, the results would have been more comprehensive and specific. Although the 'emotion

carousel' is an experiential tool, meant to evoke certain positive emotions through physical interactions, it was only reviewed on the basis of a demonstration movie. One participant mentioned that it was hard, without direct experience, to conceive how designers could benefit from using it.

We expect that real applications of the developed tools in various design projects will allow us to gain a better understanding of how designers perceive and experience the tools, which will help us to improve the tools and the findings reported in this paper. In particular, within the suggested applications of the tools, there were some activities that involve non-designers such as a client and end-users. Although the participating design experts suggested that the tools could be effectively used in these collaborative activities, it is not clear whether other stakeholders in a design project would value the tools as highly or be willing to use them. Therefore, other stakeholders' views on tool applications should be studied, and they should be involved in devising new tools and techniques.

While exploratory, this study provides the first insights into how designers can be supported in working with a differentiated understanding of positive emotions with the help of design tools. We will refine the current tools based on the suggestions that were collected, and continue to explore ways to support designers in their efforts to create positive experiences deliberately.

8.7.   References

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9. General discussion

Central to the present research has been the question of how designers can be supported in developing and applying a systematic understanding of positive emotions. The previous chapters have shown when and how designers can benefit from making fine-grained distinctions between positive emotions in design processes. The barriers that they encounter when designing for nuanced positive emotions, and how they could be overcome, have also been examined. Design tools that support designers in broadening their repertoire of positive emotions have been iteratively developed, evaluated and refined. Having brought together the key findings gained from these studies, this chapter looks back at the findings and discusses important issues for further research. The implications of the research are discussed, followed by directions for future research.

9.1. Discussion of the research findings

The aim of this thesis is to develop an understanding of how designers' nuanced understanding of positive emotions can be harnessed. To achieve this eight studies were conducted, each resulting in a set of new findings. In this section, I discuss some overarching issues related to those findings, focusing on the development of design tools and ethical issues in designing for positive emotions. This will offer broader insights into the research topic and opportunities for further investigations.

9.1.1. Development of PEG tools

Less differentiated positive emotions in the developed tools

In the studies of the PEG cards and the EmotionPrism, some positive emotions were observed to be less differentiated than others. In the case of the PEG cards, while most of the images were unambiguously recognised as representing the emotions intended, some were not clearly distinguishable and were instead perceived as being similar to others (see the validation study in Chapter 5). For example, the pictures of 'being energetic' were often perceived to portray 'joy' or 'amusement'. Likewise, in the validation of the movie-clips generated for the EmotionPrism, several positive emotions were not clearly discernible (see the validation

study in Chapter 7). For example, the movie-clips of 'sympathy' were frequently perceived as representing 'respect' or 'kindness', while the movie-clips of 'courage' were at times associated with 'fascination'.

An interesting finding was that the observed level of emotion differentiation varied between the different tools, depending on how they represented the positive emotions. In particular, the emotions perceived to be similar differed between the tools. In accordance with this observation, correspondence analysis of participants' responses to the EmotionPrism movie-clips revealed a different pattern of similarity between positive emotions from that observed for Desmet's typology (Desmet, 2012). The top image in Figure 9.1 is the two-dimensional solution computed with two factors: 25 movie-sets and 25 emotions. The solution visualises the similarity between positive emotions based on reported emotion ratings towards the movie-sets, i.e., similarity viewed through the lens of expressive interaction qualities. The distances between emotions plotted in the space reflect their degree of similarity: an emotion plotted close to another emotion was seen as being less differentiated. On the bottom side of Figure 9.1 is the two-dimensional solution of Desmet's typology (Desmet, 2012) based on similarity ratings. The ratings reflected the appraisal, thought–action tendency and subjective feelings of the emotions combined. In the top visualisation confidence and satisfaction are viewed as being similar, whereas they are considered relatively different in the bottom visualisation. Likewise, love and relaxation are considered similar in the left visualisation but considerably different in the bottom.

Differences in the levels of similarity found can potentially be explained by the multi-componential nature of emotions. Depending on how the emotions are represented (verbal description versus dynamic expression), respondents may focus on different components of the emotion. Some emotions may be similar on some components while different on others. The finding that relief and enchantment were more similar in the study of expressive interaction qualities may imply that they share some expressive qualities, whereas on the basis of verbal description they are perceived to be very different.

Figure 9.1. Two-dimensional scaling solutions (top: based on responses to the movie-clips of the EmotionPrism, bottom: the typology of positive emotions (Desmet, 2012))

Optimisation of the granularity level

In this research I found that having an awareness of a broad spectrum of positive emotions can be useful in constructing systematic and creative design processes. As reported in Chapter 3, PEG can be of value in various design activities depending on the stage of the design process, e.g., in formulating the design goal, stimulating to diverge design directions in terms of emotional impact and supporting communication within design teams, with clients and with users. While this supports the assumption that PEG is useful in design, it also poses new questions. For example, is there an optimal level of PEG? In other words, would it always be advantageous for designers to consider as many positive emotions as possible? Perhaps there is a ceiling effect or counter-effect of increasing PEG. In the evaluations of the tools developed, some participating designers pointed out that the level of granularity should be adapted to suit the needs of the design project at hand. In some situations, a heightened PEG could be counter-effective; one could get bogged down in too many nuances. Situations mentioned by participants included, for example, when meeting a client or when involving end-users. In those situations, using a reduced set of emotions (i.e., superordinate categories of positive emotions) might be more appropriate. Obviously, it is possible to have both 'too many' and 'too few' scenarios, but to my knowledge neither the optimal level of PEG nor the undesired counter-effects of PEG has been studied in psychology or design research. While emotion researchers agree on the benefits of stimulating emotional granularity, they have not addressed the questions of how many emotions should be taught and what these should be (Brackett, Rivers, Reyes, & Salovey, 2012). It would be interesting to explore whether and how a suitable balance can be found for design research and practice. At the same time, design tools should be developed that are sufficiently flexible to enable designers to adjust the level of granularity. This will help them to set appropriate levels of granularity, and in turn, consider positive emotions effectively.

Usefulness of PEG in creative processes

It was found that PEG could be beneficial for designers in creative processes (the interview study in Chapter 3). More specifically, the study results indicated that PEG could be useful in two design activities: (1) convergent thinking when determining what positive emotions to address, and (2) divergent thinking when exploring product ideas. Both the case study in Chapter 4 and the design workshop in Chapter 7 showed how PEG could help designers considering a range of positive emotions to converge

on relevant ones, by enabling them to imagine what would happen depending on the choices made and the emotions' experiential values. It was also consistently observed from the results of the studies in Chapters 4, 6 and 7, that having a broad repertoire of positive emotions enabled designers to diverge in their views in order to explore an array of design directions when generating product ideas, i.e., divergent thinking. Taken together, the results of these studies support the notion that PEG contributes to creative design processes.

Given the usefulness of PEG for converging on the most pertinent emotions, PEG supports the design of products that are appropriate to use. However, more research is needed to know whether PEG also supports the design of products that are more innovative or original. The present research did not examine whether creative processes facilitated by PEG also increased the innovativeness of the design results. In this research, the focus remained on how designers might benefit from PEG during the design process. Accordingly, its contribution to creative processes was measured in terms of indicators such as the number of product ideas generated using the PEG tool; the degree to which these ideas were perceived to be innovative was not assessed. Many other sophisticated factors influence the innovativeness of design, such as the ability to synthesise ideas into a final concept. Thus, the impact of PEG on the innovativeness of design outcomes themselves is debatable.

PEG tools to increase designers' PEG level

The focus of the tool development was on helping designers to consider nuances between positive emotions during certain activities in a general design process, e.g., specifying and communicating the positive emotions to be designed for. Thus, evaluations of the tools were based on their usefulness in these particular design activities. Related studies (in Chapters 6, 7 and 8) indicated that the developed tools and techniques are effective in supporting designers to consider a broad range of positive emotions during these design activities. While the tools were found to be useful, the studies raise a new question regarding their effect on designers' PEG: can the tools be used to train designers' PEG and ultimately increase their PEG level beyond that temporarily supported by the tools? Reservations might arise if using the tools rapidly increased the level of a designer's PEG, because PEG develops over time as an individual grows, is exposed to more emotional experiences and learns how to express them using the proper terms (Lindquist & Barrett, 2008).

More research is needed to explore how a designer's PEG might be

heightened using a tool. Recent studies in psychology have started exploring interventions targeting emotion differentiation. One example is the study of Brackett et al. (2012), which showed the effectiveness of long-term training in which school-aged children and young adults were taught to extend their use of emotion words and link descriptions of the physical changes occurring in their bodies to emotions (20-30 minutes per week for 30 weeks). The training was found to be effective in helping them to use differentiated emotion words in a flexible and contextualised manner, improving their academic performance and social behaviour. This indicates that with a long-term intervention, people's PEG can be improved. Given this possibility it would be worthwhile further refining the PEG tools and their usage guidelines so that they are suitable for the long-term training of designers' PEG, and subsequently examining whether and how they affect designers' performance. Doing so may also provide an opportunity to explore the impact of PEG on designers' performance from a broader perspective than that investigated in the present research, e.g., its impact on leadership, social skills and study skills.

Applicability of the developed tools to different design domains

Although the PEG tools were developed to support product design, they may also be useful in other types of design activities. Indeed, several studies in this thesis have pointed to application possibilities that extend beyond designing tangible, physical things. For example, in the case study reported in Chapter 4 the PEG cards were used to create diverse design interventions encompassing products, services, campaigns, education programmes and interactive installations. The same was true of the design workshop in which the EmotionPrism was employed (see Chapter 7). The focus group study in Chapter 8 also showed that participants from different design domains could relate the application of the tools to their practices, such as service design, product design and human–computer interaction. While not reported on in this thesis the PEG tools were also employed in several spin-off design projects, ranging from a museum experience design to a mobile phone marketing tool (e.g., Vermeeren, Shih, & Yoon, 2016). These observations suggest that the PEG tools can be more generally useful in design activities that are user-centred, empathy-based and aspire to generate positive emotional experiences.

It should be noted that to ensure the successful application of the tools, they must be integrated in user-centred and participatory design approaches. The case study in Chapter 4 showed that broadening designers' repertoire of positive emotions did not always guarantee a satisfactory design. Given the subjectivity of emotional experiences, there

is always a chance that a design evokes unforeseen emotions because the way people appraise it can differ. Hence, the tools should be applied in such a way that they help to ground design decisions in a solid understanding of users and their possible emotional responses towards the design.

Cultural dependency of the developed PEG tools

The PEG tools developed have been used on a variety of occasions across both design education and practice. In particular, since their introduction in 2013 the PEG cards have been used in several countries including the Netherlands, Finland, Germany, Luxemburg and Colombia. While the cards were generally well-received, the feedback indicated that a few contents, e.g., some emotion words and pictures, needed to be optimised in order to better convey the conceptual distinctions of certain emotions in different cultures. This finding raised the question: How can the tools developed be made applicable across different cultures? This question entails issues about not only the appropriateness of the contents of the tools but also the cultural nuances of positive emotions. The contents of the tools, such as the appraisals, visual representations of behaviours and expressive interaction qualities (see Chapters 5 and 7), have not been cross-culturally validated. Although the validation processes did involve participants from numerous countries, it is acknowledged that when used in different cultures there is a possibility that the emotions in the tools would be perceived differently.

While this was not within the focus of the current research, it is recommended that further research be undertaken to cross-culturally validate and fine-tune the tools to make them reliably applicable in international contexts. The fundamental challenge in doing so is that apart from studies of basic emotions that have included one or two positive emotions (e.g., joy and surprise), there has been no empirical study of the distinct positive emotions that are universal across different cultures (Sauter, 2010). This means that some of the 25 positive emotions described in the tools may not be perceived as positive in certain cultures, precisely because the categorisation of emotions as positive or negative depends on cultural differences (Kitayama, Mesquita, & Karasawa, 2006). For instance, pride is perceived less positively in Eastern than in Western cultures, while its antecedents and behavioural expressions differ across cultures (van Osch, Breugelmans, Zeelenberg, & Fontaine, 2013). Thus, the cross-cultural validity of the 25 positive emotions needs to be examined. There are, moreover, subtle differences in the interpretation of emotion terms across different languages and cultures (Goddard, 2002). It

is also important to bear in mind that there are a number of untranslatable positive emotions in different cultures that have no direct or easy equivalent English term that captures their subtleties (Lomas, 2015b). For example, 'Uitwaaien' is a Dutch expression that encapsulates the revitalising effects of going out into nature (e.g., taking a walk in the wind) and 'Jeong', a Korean expression, refers to a deep affinity and connectedness that may or may not be romantic (Lomas, 2015a). These emotion terms often depend on very particular circumstances shaped by their own culture. These issues suggest that the development of culturally nuanced PEG tools should accompany studies on positive emotions in different cultures, and should be addressed by future research.

9.1.2. Ethics of designing for positive emotions

Is designing for emotions manipulative? Is it ethical to influence people's emotions and behaviours intentionally? Many questions arise regarding the ethics of designing for emotions. Indeed, emotion evoked by a product is not value-neutral. Design that sets out to influence user emotion has unavoidable ethical ramifications for both short- and long-term user experience, and this applies to designing for positive emotions too. It is important to note that all products inevitably influence the emotions of users. As Gaver (1999, p. 51) stated, 'There is no such thing as a neutral interface. Any design will elicit emotions from users, or convey emotions from its designer, whether or not the designer intends this or is even conscious of it.' Therefore, I believe that designers should be sensitive to the ethical implications of their actions when designing for emotion. Designing for positive emotions is not meant as a call for, as Hassenzahl (2010) puts it, 'infinite jest' or 'shallow amusement.' Even if the design is intended to generate positive emotional experiences, the consequences for user experience may not necessarily be favourable and therefore designers should explicitly take potential moral considerations into account in their practices. With this concern in mind this section discusses some ethical issues relevant to those who want to design for positive emotions, accompanied by suggestions and issues for further work.

Potentially problematic effects of positive emotions on user well-being

The beneficial effects of positive emotions on users have been the main motivation behind designing for positive emotions (for a detailed discussion, see Chapter 2). But it is important to note that eliciting positive emotions is not always inherently positive with desirable consequences. In certain situations, positive emotions can produce

adverse effects (Fredrickson & Losada, 2005). Cummins, Nadorff, and Kelly (2009), for example, showed that initial positive emotions in combination with winning increases the risk of reckless and poorly informed decisions in gambling. Similarly, positive emotions are known to be associated with optimism bias, in which awareness of a risky situation is skewed to unrealistic expectations (Chambers & Windschitl, 2004). Moreover, the appropriateness of positive emotions is highly dependent on social context (Lazarus, 2003). Think of a portable speaker that generates immersive and rich sound, providing you with joy. And yet using the same speaker, playing music out loud in public might make others frown. Put simply, a product made to provide someone with pleasure could lead to another's displeasure. Stimulation of positive emotions is not without risk; aiming only at facilitating positive emotions, without holistically considering the impact on users, can potentially hinder their well-being or the well-being of others who are present at the time.

These considerations suggest that intentions to design for positive emotions should be formulated with ethical sensitivity, responsibility and an awareness of possible unwanted side-effects. So how can ethical issues be taken into account in the design process? In fact, there are no general rules or specific procedures for how to act. It is more a matter of establishing ethical awareness (Löwgren & Stolterman, 2004). It is important to carry out ongoing and iterative critical examinations of how the emotional impact can be seen as ethically legitimate. One strategy for this could be to include recurring cycles of ethical reflection in the design process, in which the emotional and ethical concerns (e.g., autonomy and self-esteem) of users and other stakeholders are made explicit, thereby anticipating possible risks and what needs to be done to minimise them. Specifically, user behaviours that certain positive emotions might lead to, or vice versa, should be discussed in both the short and long term, as well as from individual and collective perspectives.

In design research and engineering, several methods have been introduced to encourage reflection on design (Boenink, Swierstra, & Stemerding, 2010; Lacewing, 2005). These methods typically use narratives that describe situations in which product use gives rise to moral considerations. While useful for considering the ethical acceptability of a product, they appear to be limited in terms of helping designers take a nuanced view of user emotions and their possible experiential impact. Taking this as an additional opportunity for PEG in design, it is suggested that further research be undertaken to develop design supports (e.g., methods and tools) that can aid designers and users

in reflecting on the emotional implications of a product in a forward-looking sense, collaboratively. This could help to create a morally responsible approach to emotion-driven design.

Paradox in the contribution of positive emotions to well-being

Positive emotions have emerged as a key variable in design, driven by two main motives: economic value and user well-being (Desmet & Hekkert, 2009). In the former, emotions are viewed as a source of competitive advantage that can bring about economic profits (Magids, Zorfas, & Leemon, 2015). Hence, design activities are focused on the elicitation of positive emotions that influence purchasing decisions, and by extension, market success. In line with this aim, certain specific positive emotions, such as surprise, anticipation, curiosity and admiration, have been deliberately used in combination with marketing strategies to promote product uptake (Libert & Tynski, 2013; Nunes & Drèze, 2006).

The latter motive considers positive emotions as a means of improving people's quality of life. Here, the sum of enjoyable moments is seen as contributing to one's well-being. While similar to the former motive, its emphasis is on the extent to which positive emotional experiences are balanced with other factors related to well-being, e.g., virtuous living and personal meaningfulness (Desmet & Pohlmeyer, 2013). A body of research has shown that material possession and accumulation do not ultimately make people happy, but instead can potentially lead to deconstructive consumption behaviour (Burroughs & Rindfleisch, 2002). In this view, researchers assert that positive emotions should not be commoditised as a manipulative marketing tool because it could endanger user well-being in the long run (Patterson & Biswas-Diener, 2012).

It seems that there is a paradox in the contribution of positive emotions to well-being: on the one hand, they contribute to well-being because positive emotions are a key ingredient of well-being; on the other, they can lead to 'deconstructive consumption behaviour', and thus contribute to ill-being. Given this paradox, one may ask: 'Is it appropriate to design for positive emotions at the risk of hindering people's well-being?' Researchers suggest that the contradictory effects can be resolved if a stronger emphasis in the design is placed on evoking positive emotions that facilitate meaningful experiences beyond sensory delight. In particular, as was proposed by Desmet and Hassenzahl (2012), experiences need to be more about the 'doing' and 'being' (e.g., social interactions and personal goal achievement) than the 'having'. Several studies in consumer research have shown that spending money on

experiences (e.g., travel) as opposed to material possessions provides more long-lasting happiness (e.g., Nicolao, Irwin, & Goodman, 2009). Likewise, many companies are currently adapting to the emerging realisation that narrowly focusing on the moment of purchase does not guarantee market success. Products that can provide positive emotional experiences in the entire cycle of the user–product relationship can have greater and longer-lasting economic impact (Magids et al., 2015). I expect that considering every life activity that involves the product (e.g., commuting to work, dropping children off at school and shopping for groceries by car), and making those activities or practices meaningful by means of positive emotions, could help designers resolve the paradox. While short-lived, the positive emotions embodied in meaningful experiences would build up, leading users to improved well-being (Pohlmeyer & Desmet, 2017). Most importantly, as discussed in the previous section, the design process needs to consider how willing and able users are to undergo the 'intended' experiences from an ethical point of view.

9.2.   Implications of the research

In addition to its key findings, this research also extends our knowledge of positive emotions in the context of design practice as well as emotion research. In the following section, some implications of the research are discussed and speculated upon with a focus on design supports for experience-driven design and the differentiation of positive emotions.

9.2.1. Implications for positive emotion research

Development of interventions to facilitate PEG

The phenomenon of PEG has been studied primarily by focusing on its impact on well-being in the domains of sociology, psychology and clinical research (Kashdan, Barrett, & McKnight, 2015). Most reported studies used methods and tools that measure the level of PEG—such as the experience sampling method (Tugade, Fredrickson, & Feldman Barrett, 2004) and the Differentiation of Positive Emotion Scale (DOPES) (Kirby, Tugade, Morrow, Ahrens, & Smith, 2014)—in order to investigate the relationship between PEG and well-being. Prompted by the evidence for the efficacy of PEG, researchers have recently started to develop interventions that can help people distinguish and describe emotions, e.g., RULER feeling words curriculum (Brackett et al., 2012). While promising, the research on interventions to facilitate PEG is still at an early stage. Interventions tend to include six to eight positive emotions

and are generally based on the provision of emotion terms.

I believe that the present research can contribute to the research on the facilitation of PEG. It has demonstrated several ways to distinguish, internalise and communicate nuances of positive emotions, ranging from appraisal themes, suggestive narratives, behavioural manifestations and expressive qualities of hands interacting with an object, to actual experiences (see Chapter 8 for an overview). The study findings could be useful for design researchers who want to develop PEG tools, as well as for researchers in emotion research. Although the tools' uses are meant to serve specific design activities, their underlying approaches to differentiating positive emotions could nonetheless be relevant for emotion researchers. Researchers can explore the strengths and weaknesses of each tool, and, based on their findings, gain a sense of what kind of approach or approaches they need to take or combine for their studies.

Research into signals of positive emotions

Recent studies looking at the communication of positive emotions have generated insights into how positive emotions can be distinguished through various signals, such as vocalisation, postures and touch (Sauter, McDonald, Gangi, & Messinger, 2014). However, these studies have tended to focus on a single cue in isolation, and because of this it remains unclear whether some positive emotions are more effectively communicated using certain cues (or combinations of cues). For example, pride is reliably recognised from postural cues, but not from touch, which has been found to be effective for communicating other positive emotions such as love and sympathy (App, McIntosh, Reed, & Hertenstein, 2011). To address this issue, Sauter (2010) argued that it is necessary to include multiple signals when examining the communication of positive emotions. The present research has shown that expressive qualities of hands interacting with an object could be used as a cue to communicate distinct positive emotions. An implication of this is the possibility that expressive qualities of human–object interactions can add another layer to the cues considered in previous studies. This could serve as an additional cue for future inquiries into how different cues interact in communicating nuanced positive emotions.

9.2.2. Implications for design practice

Development of design tools for experience-driven design

Human emotion is a holistic experience that involves a wide range of behavioural, psychological and physiological elements. We cannot fully appreciate its diversity when reducing such a sophisticated phenomenon to simplified emotion terms or pictures. When user emotions are communicated overly simplistically in a design process, design decisions may inadvertently overlook their dynamics and subtleties of these emotions. One implication of the current research is that future design tools that incorporate emotions should acknowledge the diversity and distinctiveness of emotions. I observed that most design tools available in experience-driven design deal with user emotions in terms of valence or intensity. For instance, a customer journey map is widely used because of its efficiency in creating a concise overview of the dynamics of general experiences (e.g., Adaptive-path, 2013). The tool typically represents positive and negative emotions and their changes over time based on a bipolar, up-and-down pattern. I believe the findings of this research can contribute by adding nuances to the experiences represented in existing design tools. This, in turn, can open up additional design opportunities when using the tools. Designers and project stakeholders, for instance, would be better able to describe and interpret the variety of user emotions, and ultimately create more emotionally innovative design solutions.

In design research, a multitude of design tools and methods have been introduced. Although design researchers have aimed to improve design processes through these new tools, their overall uptake in both design practice and education is disappointingly low (Andreasen, 2011; Dorst, 2008). One of the reasons is that in many cases the emphasis when developing the tools has been primarily on their systematic and scientific nature. This is because researchers wanted them to be independent of product type and design context, in order to make them more widely applicable (Jensen & Andreasen, 2010). Consequently, the resulting tools often became irrelevant to the situational needs of designers and the design context, thereby hindering their uptake (Dorst, 2008). In this research, the process of developing the tools involved designers at all stages, which enabled me to methodically address their needs and expectations. In particular, the development of usage guidelines for the PEG cards (in Chapter 6) showed the advantage of learning how designers use and creatively appropriate a tool rather than relying on the vision of the design researcher. Taken together, I believe this approach can

considerably enhance the development of design tools that designers are compelled to use. A tool and its related techniques, developed from the perspective of the designers for whom they are intended, will hopefully have a higher chance of being accepted and enable designers to realise the value of using it.

Design for well-being with heightened PEG

Having demonstrated the design case studies and concrete design tools, the present research offers designers insights into how positive emotions can be purposely designed for. Given the relationship between positive emotions and well-being, this research also contributes to the practice of designing for well-being. A considerable amount of the literature on positive psychology has proven that positive emotions are inherently associated with people's well-being (Seligman, 2011; Sirgy & Wu, 2007). In line with this, positive emotions are also considered an important factor when designing for users' well-being. According to the Positive Design framework (Desmet & Pohlmeyer, 2013), pleasure (including all positive emotions) serves as one of the key ingredients for addressing user well-being, being tied in with virtue and personal significance.

There is substantial evidence that less intense but more frequent positive emotions are more strongly associated with well-being than are more intense but less frequent positive emotions (Diener, Larsen, Levine, & Emmons, 1985; Lyubomirsky, King, & Diener, 2005). This suggests that the frequent evocation of pleasant experiences by a product would lead to users' increased well-being. However, if the focus of the design is on eliciting only one (or a small set of) positive emotion(s) and increasing its (or their) frequency, users' appreciation of the design would soon fade with time. When users quickly become accustomed to the pleasure elicited by a design they eventually find it mundane, an occurrence that is often referred to as 'hedonic adaptation' (see Lyubomirsky, 2011 for an overview). To reduce the chance of hedonic adaptation occurring, eliciting a diversity of positive emotions has been suggested. Various empirical studies have shown that elicitation of several positive emotions can help to forestall the diminution of positivity and enhance people's well-being (e.g., Sheldon, Boehm, & Lyubomirsky, 2013). It is expected that by designing for a wide diversity of positive emotions, as opposed to one single emotion, users' emotional experiences may become more dynamic and richer. I propose that it would be interesting to explore whether and how designers' PEG can be used to create products that evoke a series of positive emotions during an unfolding usage (or ownership) episode. If this is possible, it may help to produce design that is not only pleasurable in

its own right, but also contributes to users' well-being.

9.3. Future research direction

Emotion terms have formed the backbone of the PEG tools developed, i.e., the use of emotion words and corresponding definitions. Other emotion components were selectively used to fit the purpose of each tool. It might be interesting to consider alternative ways to convey nuances between emotions when developing future tools. For instance, figurative expressions that make use of metaphors (e.g., 'on cloud nine' and 'over the moon' to express euphoria; 'fired up' to express enthusiasm) could be used to express subtle nuances of emotional states. Figurative expression has been found to be effective in contextualising and clarifying experiences (Fussell, 2002). While promising, whether this advantage would be compatible with differentiating positive emotions has not yet been studied. When developing future PEG tools it is recommended that new ways of differentiating positive emotions are explored, and their practical benefits to the design process investigated.

Making use of both positive and negative emotions, and understanding their different impact, is crucial because different situations demand different emotions. It is probable that the ability to differentiate negative emotions in a design process is as relevant as PEG. This research explored the opportunities for PEG. These same opportunities would also hold true for negative emotional granularity (NEG), and would increase if negative emotions were also included in the design repertoire. Given the functions of negative emotions in enriching user experience and their diversity (Fokkinga, 2015), developing design tools for NEG would greatly benefit emotion-focused design processes. It is expected that NEG tools would help not only to generate rich experiences but also to accurately diagnose unwanted negative experiences evoked by existing products. In future investigations the further study of the roles of NEG in a design process, and the development of NEG tools, would be worthwhile.

The importance of Emotional Intelligence (EI) has been extensively discussed and tested in various studies, providing compelling evidence of the advantages of higher EI for leadership, productive work behaviours, satisfying relationships and general well-being. The designers who participated in the research generally agreed that highly developed EI could make them more competent in their functions as it could help them sense, articulate and adapt to the emotional needs of users. Accordingly, they showed interest in enhancing their EI. The focus of this thesis has

been on 'understanding emotions', one of the four facets of EI (see Chapter 3), but the remaining facets of EI also deserve further study. They too could be of great value to designers, conferring benefits on them that differ from those supported by PEG. For example, opportunities for 'managing emotions' might help designers to successfully regulate user emotions, e.g., prolonging the positive experience, or to cultivate emotionally fulfilling work environments for product development teams. Designers' interest and potential benefits aside, the added value of EI in design has been largely untapped. Future research on what opportunities there may be for EI in design, as well as design supports for increasing EI, could help designers take a more holistic view of emotions and thereby significantly improve their performance.

In this thesis, I have contributed to our understanding of the usefulness of PEG in design activities. Starting from the proposition that a developed PEG would bring benefits to designers, I have answered the question of how a designer's PEG can be harnessed. A set of design tools has also been developed that can support designers in generating design solutions that are emotionally relevant to the users. Now that the research project is complete, I hope that it provides inspiration and practical knowledge to design researchers and practitioners, as well as students, who want to become more emotionally adept in their efforts to create positive user experiences.

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Summary

In human–product interactions, pleasure has many different shades. We can, for example, be proud of using an eco-friendly detergent, be all aflutter in anticipation of a planned trip when looking at a calendar application or experience a feeling of cathartic relief when playing a mobile phone game. Although these experiences are all pleasurable, each is different from the other in terms of the feelings they engender, the conditions that evoke them and how they influence people's thoughts and actions. Some people are more aware of these nuances and better able than others to articulate positive emotional states. This difference is called 'Positive Emotional Granularity' (PEG) (Tugade, Fredrickson, & Feldman Barrett, 2004). PEG reflects the degree to which a person is able to represent positive emotions with precision and specificity.

This thesis focuses on designers' PEG, and proposes that having an awareness of nuances between positive emotions can be advantageous for designers in their endeavour to generate positive emotional experiences. Design research has traditionally focused on generalised pleasure or liking, paying little attention to nuances in positive emotions. Consequently, little is known of either the implications of differentiating positive emotions in design processes or ways to support designers in this endeavour. The aim of this thesis is to develop an understanding of how designers' nuanced understanding of positive emotions can be harnessed and how doing so can contribute to design processes. The research question was, 'how can designers be supported in developing and applying a systematic understanding of nuanced positive emotions?' The overarching approach encompassing the research activities was 'research through design', in which the act of designing new solutions and reflecting on the processes is regarded as a means of generating knowledge (Stappers, 2007). A series of design tools and techniques that explained the distinctiveness of positive emotions was conceptualised for the purpose of this research and tested by designers. This research contributes to the field of experience design by elucidating how PEG can add value to design processes, and by providing tools that support designers in developing their understanding of positive emotions and their abilities to select and design for nuanced and distinct positive emotions.

Eight studies were conducted, each resulting in a set of new findings. The studies reported in each chapter are summarised below.

Chapter 2 introduces some of the key literature on the phenomenon of positive emotions. It addresses the questions of how a distinction between a positive and a negative emotion can be made, how positive emotions differ from similar positive affective states, how positive emotions can be classified, what the functions of positive emotions are and what process underlies positive emotional responses towards a product. Based on this, implications for the current research were discussed and relevant theoretical models and approaches were chosen, which served as a starting point for the theoretical and empirical work of this thesis.

Chapter 3 explores the added value of PEG in design. An interview study with design professionals was undertaken to obtain an overview of when and how PEG becomes useful in design processes. The study revealed seven key opportunities for PEG across all stages in a design process. The ability to precisely recognise and describe emotions could contribute to facilitating (1) a deep understanding of users. Having a structured overview of positive emotions could support (2) designers' precise determination of design intentions, which would increase the chances that a design outcome will have the appropriate emotional impact. Furthermore, considering a broad array of users' emotional responses can be useful in (3) stimulating creativity in the design process. Additional opportunities include (4) maintaining the continuity of a design's emotional impact across design process communications and (5) increasing organisational support by being able to demonstrate the added value of an emotion-focused design process, as well as (6) strengthening emotional coherency in communications targeting users. From an organisational perspective, PEG can also be beneficial when (7) managing emotions within a product development team. In the chapter, implications for research into each of these opportunities are also discussed. The findings support the contention that it is valuable to have a nuanced understanding of positive emotions, and that emotional granularity in design processes can enhance the management of the process and key design decisions in emotion-driven design. The study results served as a reference for specifying the foci of tool development in this research and provided insights into what kinds of design supports (e.g., tools, techniques, guidelines) might be of relevance in the design process.

Chapter 4 investigates the challenges that underlie designing for nuanced

positive emotions and ways of overcoming them, through a case study. The design project aimed to evoke ten different positive emotions to improve cabin crews' flight preparation procedure. Through interviews, observations and creative workshops, designers explored when and why flight attendants experience each of the ten emotions and how these emotions contribute to their professional activities. The insights gained were translated into a collection of designed interventions. Based on observations during the design process, the concepts generated and a focus group with designers, nine lessons for supporting design activities were identified. The lessons were associated with four design activities: determining emotional intentions, identifying concerns that underlie appraisals of the target emotions, formulating product characteristics that connote specific emotions and generating product concepts that evoke the emotions. The lessons cover the challenges presented by these design activities and how designers can be supported to carry them out. The design case study generated early insights into how designers can be supported to deliberately elicit specific positive emotional experiences, how nuances between positive emotions can be conveyed to designers and how knowledge of positive emotions can be applied in a design process.

Chapters 5, 6 and 7 explore ways in which designers can be supported in PEG, through the development and evaluation of PEG tools. **Chapter 5** describes the process of developing a design tool, 'Positive Emotional Granularity cards' (PEG cards), and its application possibilities in a design process. The cards were created as a versatile research tool; they served as a stimulus to probe designers' expectations and needs in PEG tool use. There were 25 cards in all, each depicting an emotion definition, underlying causes and visual representations of the behavioural manifestation of the emotion. For each emotion four different images were used, chosen through an online survey, in order to minimise ambiguity. The chosen images were validated to ensure that they effectively characterised the target emotions and were distinct from other similar positive emotions. In addition, a description of the conditions that evoke the emotion, drawn from emotion theory, was included, i.e., core relational theme. A workshop exploring possible applications of the PEG cards showed that they can be used for communication (e.g., to enable design teams to determine and communicate target emotions to design for, and to enable users to report their emotions in the context of product testing) and as a source of inspiration (e.g., to facilitate lateral thinking in design conceptualisation).

Chapter 6 reports on three design workshops, each exploring how designers made use of the PEG cards in one of three design activities: assimilating nuances of positive emotions, specifying emotional intentions and generating product ideas. The workshops focused on understanding designers' situational needs regarding tool applications and ways in which they could be supported to make full use of the tool. The results showed that there were individual differences in designers' ability to make use of the PEG cards. Although the cards can be used in many different ways, without guidance most designers were unable to make full use of them. Some were able to creatively appropriate the cards to fit the purpose of the workshops, while others failed to grasp their value. Most explored ways of using the cards, but at the same time felt unconfident about getting the most out of them without guidance. A creative session was run in which design researchers came up with specific usage guidelines covering three sets of instructions: how to gain a structured overview of positive emotions, how to select the most appropriate emotions to address and how to stimulate consideration of diverse emotions when generating product ideas. The results of the workshops and creative session indicated that clear methods and usage guidelines should be devised, even when the tool is intended to be versatile and more widely applicable, and there is value for design researchers to look at how designers use a tool and to learn from them when developing usage guidelines. Based on the findings, an approach to developing new provisional usage guidelines of card-based design tools was proposed.

Chapter 7 reports on the development and evaluation of EmotionPrism, a tool that communicates expressive interaction qualities of positive emotions. The tool's conceptualisation was inspired by the insight that positive emotions are characterised by distinct behavioural tendencies. Through an exploratory study with professional theatre actors, movie-sets were generated that manifest 25 different positive emotions by way of hands interacting with an object, considering that most human–product interactions involve hands. The movie-sets were validated through an online survey in which participants rated the extent to which each movie-set portrayed each of the 25 emotions. Evaluation of the movie-sets suggests that expressive interaction qualities represented by hands interacting with an object can be potentially used to communicate positive emotions. The tool was developed into an online database that includes the movie-sets, descriptions of thought–action tendencies and appraisal themes. The practical use of the tool was tested in a design workshop in which designers discussed interaction qualities appropriate

to stimulate, and selected positive emotions accordingly by using the tool as a repertoire to choose from. The designers generated product ideas that evoked the chosen positive emotions. The test results indicated that the tool supported the conscious determination and explicit communication of interaction qualities by means of particular positive emotions, facilitating divergent thinking in generating product ideas.

Chapter 8 investigates the strengths and weaknesses of the developed PEG tools: PEG cards, EmotionPrism, interactive installations and an audio library of users' anecdotes. Each tool employed a different strategy to represent the distinctiveness of positive emotions, ranging from pictorial and verbal descriptions on cards, audio recordings of narratives and videos of hands interacting with an object to installations that invite people to experience a range of positive emotions themselves. A focus group study was conducted in which a panel of expert design professionals and educators reviewed the PEG tools, focusing on identifying how they could help designers to discern a variety of positive emotions and when their use would be effective in design processes. The results indicated that the tools can mainly support three design activities: specifying emotions to design for, communicating emotional intentions with stakeholders and generating product ideas. Because each tool is designed around a different motive for differentiation, their perceived usefulness differed according to the type of design activity involved and the context in which the tool would be used. The results were consolidated into a comparative overview of the tools based on their usefulness in the design activities. The study suggests that there is no single tool that could serve all PEG-related design activities, and that the applicability of a tool is determined by how well it can address designers' specific needs in a certain design activity.

In the final chapter, I discuss the key findings from the research as a whole and their implications in terms of providing broader insights into the research topic and identifying opportunities for further investigation. The first section discusses the development of the PEG tools and presents some overarching issues such as different levels of differentiation of positive emotions observed with the tools, the optimisation of granularity level and the cultural relativism of the tools. In the second section, ethical aspects of designing for positive emotions are discussed alongside suggestions to resolve related issues. In addition to the key research findings, the research extends knowledge of positive emotions in the context of design practice as well as emotion research. The following section discusses the research implications, ranging from interventions to

facilitate PEG, communication of positive emotions and design tools for experience-driven design, to designing for well-being. The thesis ends with a discussion on future research directions: alternative ways of differentiating positive emotions, the added value of design tools for negative emotional granularity and a further design support for emotional intelligence.

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Samenvatting

In mens–product interacties heeft 'plezier' veel verschillende kanten. We kunnen bijvoorbeeld trots zijn op het gebruik van een milieuvriendelijk schoonmaakmiddel, enthousiast over het vooruitzicht op een geplande reis wanneer we naar onze kalender kijken, of opluchting tijdens het spelen van een gezelschapsspel. Hoewel deze ervaringen allemaal prettig zijn, verschillen ze van elkaar wat betreft de sensaties die ze veroorzaken, de omstandigheden waarin ze opgeroepen worden, en hoe ze onze gedachten en handelingen beïnvloeden. Sommige mensen zijn zich meer bewust van deze nuances, en zijn beter in staat dan anderen om hun positieve emoties te uiten. Dit verschil wordt 'Positieve Emotionele Granulariteit' (PEG) genoemd (Tugade, Fredrickson, & Feldman Barrett, 2004). PEG weerspiegelt de mate waarin een persoon in staat is om positieve emoties precies en specifiek te beschrijven.

Dit proefschrift richt zich op de PEG van ontwerpers en stelt dat kennis over genuanceerde verschillen tussen positieve emoties ontwerpers kan helpen bij hun streven om positieve emotionele ervaringen op te wekken. Belevingsonderzoek in het ontwerp domein is van oudsher gericht op algemeen plezier of genoegen, waarbij weinig aandacht wordt besteed aan emotionele nuances. Er is daarom weinig bekend over de gevolgen van het onderscheiden van positieve emoties in ontwerpprocessen en over hoe ontwerpers hierbij ondersteund kunnen worden. Het doel van dit proefschrift is om inzicht te krijgen in hoe genuanceerde kennis van ontwerpers omtrent positieve emoties gebruikt kan worden en hoe dit kan bijdragen aan ontwerpprocessen. De onderzoeksvraag was: 'hoe kunnen ontwerpers worden ondersteund bij het ontwikkelen en toepassen van een systematisch begrip van genuanceerde positieve emoties?' De overkoepelende benadering was 'onderzoek door ontwerp' (*research through design*), waarbij het ontwerpen van nieuwe oplossingen en het nadenken over ontwerp processen wordt beschouwd als een middel om kennis te genereren (Stappers, 2007). Een reeks ontwerpmiddelen en -technieken die het onderscheidend vermogen van positieve emoties hebben verklaard, is ontwikkeld en getest door ontwerpers. Dit onderzoek draagt bij tot het gebied van belevingsgericht ontwerpen door op te helderen hoe PEG waarde kan toevoegen aan ontwerpprocessen.

Daarnaast worden hulpmiddelen geïntroduceerd die ontwerpers ondersteunen bij het ontwikkelen van hun PEG en hun mogelijkheden om te selecteren en ontwerpen voor genuanceerde en verschillende positieve emoties. Acht studies werden uitgevoerd, elk resulterend in een reeks nieuwe bevindingen. De studies, gerapporteerd in het proefschrift, zijn hieronder samengevat.

Hoofdstuk 2 introduceert relevante literatuur over het fenomeen van positieve emoties. Het gaat in op de vraag hoe onderscheid kan worden gemaakt tussen een positieve en een negatieve emotie, hoe positieve emoties verschillen van vergelijkbare positieve stemmingen, hoe positieve emoties kunnen worden geclassificeerd, wat de functies van positieve emoties zijn en welk proces ten grondslag ligt aan positieve emotionele reacties op een product. Op basis hiervan werden de implicaties voor het huidige onderzoek besproken en werden relevante theoretische modellen en benaderingen gekozen, die als vertrekpunt dienden voor het theoretische en op ervaring gebaseerde werk van dit proefschrift.

Hoofdstuk 3 onderzoekt de toegevoegde waarde van PEG in design. Er werd een interviewstudie met professionele ontwerpers uitgevoerd om een overzicht te krijgen van wanneer en hoe PEG nuttig kan zijn in ontwerpprocessen. De studie onthulde zeven relevante kansen voor PEG in verschillende fasen van een ontwerpproces. Het vermogen om emoties juist te herkennen en te beschrijven, zorgt voor (1) een diep inzicht in gebruikers. Een gestructureerd overzicht van positieve emoties ondersteunt (2) de precieze bepaling van ontwerpintenties van ontwerpers, waardoor de kans groter wordt dat een ontwerpresultaat de juiste emotionele impact heeft. Bovendien kan de creativiteit in het ontwerpproces gestimuleerd (3) worden door een breed scala aan emotionele reacties van gebruikers. Bijkomende mogelijkheden zijn onder andere (4) het handhaven van de continuïteit van de emotionele intenties van een ontwerp in de communicatie in ontwerpprocessen en (5) het vergroten van de organisatorische ondersteuning door de toegevoegde waarde van een op emoties gericht ontwerpproces te kunnen aantonen, evenals (6) het versterken van emotionele coherentie in communicatie gericht op gebruikers. Vanuit een organisatorisch perspectief kan PEG ook gunstig zijn bij (7) het managen van emoties binnen een productontwikkelingsteam. In het hoofdstuk worden ook de resultaten van onderzoek naar elk van deze kansen besproken. De bevindingen ondersteunen de stelling dat het waardevol is om een genuanceerd inzicht te hebben van positieve emoties, en dat emotionele details in ontwerpprocessen het managen van het proces en de belangrijkste

ontwerpbeslissingen in emotie-gedreven ontwerpen kan verbeteren. De onderzoeksresultaten dienden als een referentie voor het specificeren van doelstellingen ten aanzien van gereedschapsontwikkeling in dit onderzoek, en gaven inzicht in welke soorten ontwerpondersteuning (bijv. gereedschappen, technieken, richtlijnen) kunnen bijdragen aan het ontwerpproces.

Hoofdstuk 4 onderzoekt de uitdagingen die ten grondslag liggen aan het ontwerpen van genuanceerde positieve emoties en manieren om deze te overwinnen, door middel van een *case study*. Het ontwerpproject had als doel om tien verschillende positieve emoties op te wekken om voor cabinepersoneel de voorbereidingsprocedure voor de vlucht te verbeteren. Via interviews, observaties en creatieve workshops hebben ontwerpers onderzocht wanneer en waarom stewardessen elk van de tien emoties ervaren, en hoe deze emoties bijdragen aan hun professionele activiteiten. De verkregen inzichten werden vertaald in een verzameling van ontworpen interventies. Er werden negen stappen voor ondersteunende ontwerpactiviteiten geïdentificeerd, op basis van observaties tijdens het ontwerpproces, de gegenereerde concepten en een focusgroep met ontwerpers. De stappen hadden betrekking op vier ontwerpactiviteiten: het bepalen van emotionele intensiteit, het identificeren van belangen die ten grondslag ligt aan de doelemoties, het formuleren van producteigenschappen die specifieke emoties opwekken, en het genereren van productconcepten die de emoties oproepen. De stappen behandelen de uitdagingen die deze ontwerpactiviteiten bieden en hoe ontwerpers kunnen worden ondersteund bij de uitvoering. De *case study* genereerde inzichten in een vroeg stadium over hoe ontwerpers kunnen worden ondersteund bij het gericht ontwerpen voor specifieke positieve emoties , hoe nuances tussen positieve emoties kunnen worden gecommuniceerd aan ontwerpers en hoe kennis van positieve emoties kan worden toegepast in een ontwerpproces.

Hoofdstukken 5, 6 en 7 verkennen manieren waarop ontwerpers kunnen worden ondersteund in PEG, door de ontwikkeling en evaluatie van PEG-tools. **Hoofdstuk 5** beschrijft het proces van het ontwikkelen van een ontwerptool, 'Positieve Emotionele Granulariteit kaarten' (PEG-kaarten), en de toepassingsmogelijkheden ervan in een ontwerpproces. De kaarten zijn ontworpen als een veelzijdige onderzoekstool; ze dienden als een stimulans om de verwachtingen en behoeften van ontwerpers in het gebruik van PEG-tools te peilen. Er waren in totaal 25 kaarten, elk met een definitie van de emotie, onderliggende oorzaken en visualisaties van de gedragsmatige manifestatie van de emotie. Voor elke emotie werden vier

verschillende afbeeldingen gebruikt, gekozen door middel van een online onderzoek, om ambiguïteit te minimaliseren. De gekozen afbeeldingen werden gevalideerd om er zeker van te zijn dat ze de doelemoties effectief communiceren en verschillen van andere soortgelijke positieve emoties. Daarnaast is er een beschrijving opgenomen van de condities die de emotie opwekken, ontleend aan emotietheorie, d.w.z. het belangrijkste relationele thema. Een workshop die mogelijke toepassingen van de PEG-kaarten onderzocht, liet zien dat ze kunnen worden gebruikt voor communicatie (bijv. om ontwerpteams in staat te stellen om doelemoties te bepalen en te communiceren, en om gebruikers in staat te stellen hun emoties te communiceren in de context van producttests) en als bron van inspiratie (bijv. om lateraal denken in ontwerpconcepten te faciliteren).

Hoofdstuk 6 rapporteert drie ontwerpworkshops die elk onderzochten hoe ontwerpers gebruik maken van de PEG-kaarten in een van drie ontwerpactiviteiten: het assimileren van nuances van positieve emoties, het specificeren van emotionele intensiteit, en het genereren van productideeën. De workshops waren gericht op het begrijpen van de behoeften per situatie van ontwerpers met betrekking tot hulpmiddelen en manieren waarop ze zouden kunnen worden ondersteund om volledig gebruik te maken van het hulpmiddel. De resultaten toonden aan dat er individuele verschillen waren in het vermogen van ontwerpers om gebruik te maken van de PEG-kaarten. Hoewel de kaarten op veel verschillende manieren gebruikt kunnen worden, waren de meeste ontwerpers zonder begeleiding niet in staat om er volledig gebruik van te maken. Sommigen konden de kaarten op een creatieve manier gebruiken conform het doel van de workshops, terwijl anderen er niet in slaagden hun waarde te begrijpen. Velen onderzochten manieren om de kaarten te gebruiken, maar tegelijkertijd voelden ze zich onzeker om zonder begeleiding het maximale eruit te halen. Er werd een creatieve sessie gehouden waarin ontwerponderzoekers met specifieke gebruiksrichtlijnen kwamen voor een drietal sets instructies: hoe een gestructureerd overzicht van positieve emoties te krijgen, hoe de meest geschikte emoties te selecteren en hoe aandacht te besteden aan verschillende emoties bij het genereren van productideeën. De resultaten van de workshops en de creatieve sessie wezen erop dat duidelijke methoden en gebruiksrichtlijnen moeten worden bedacht, zelfs wanneer de tool bedoeld is om veelzijdig en breder toepasbaar te zijn, en het is van waarde voor ontwerponderzoekers om te kijken hoe ontwerpers een hulpmiddel gebruiken en om van hen te leren bij het ontwikkelen van gebruiksrichtlijnen. Op basis van de bevindingen werd een aanpak voorgesteld voor het ontwikkelen van nieuwe voorlopige

gebruiksrichtlijnen van op kaarten gebaseerde ontwerphulpmiddelen.

Hoofdstuk 7 rapporteert over de ontwikkeling en evaluatie van EmotionPrism, een hulpmiddel dat expressieve interactiekwaliteiten van positieve emoties communiceert. De conceptualisering van de tool is geïnspireerd door het inzicht dat positieve emoties worden gekenmerkt door verschillende gedragstendensen. Door middel van een verkennend onderzoek met professionele theateracteurs werden filmpjes gegenereerd die 25 verschillende positieve emoties tonen door middel van handen die in contact staan met een voorwerp, overwegende dat bij de meeste mens-product interacties handen worden gebruikt. De filmsets werden gewaardeerd door middel van een online enquête waarin de deelnemers beoordeelden in hoeverre elk filmpje elk van de 25 emoties weergaf. Evaluatie van de filmsets suggereerde dat expressieve interactie-eigenschappen, vertegenwoordigd door handen die een interactie aangaan met een voorwerp, gebruikt kunnen worden om positieve emoties te communiceren. De tool is ontwikkeld tot een online database met de filmpjes, beschrijvingen van gedachte-tendensen—en beoordelingsthema's. Het praktische gebruik van de tool werd getest in een ontwerpworkshop waarin ontwerpers interactie-eigenschappen bespraken die geschikt waren om te stimuleren, en selecteerde vervolgens positieve emoties door de tool te gebruiken als een repertoire om uit te kiezen. De ontwerpers genereerden productideeën die de gekozen positieve emoties opwekten. De testresultaten wezen uit dat de tool de bewuste vastberadenheid en expliciete communicatie van interactie-eigenschappen ondersteunde door middel van specifieke positieve emoties, waardoor verschillend denken bij het genereren van productideeën werd ondersteund.

Hoofdstuk 8 onderzoekt de sterke en zwakke punten van de ontwikkelde PEG-tools: PEG-kaarten, EmotionPrism, interactieve installaties en een audiobibliotheek met anekdotes van gebruikers. Elke tool gebruikte een andere strategie om de differentiatie tussen positieve emoties weer te geven, variërend van visuele en verbale beschrijvingen op kaarten, geluidsopnames van verhalen en video's van handen die in contact staan met een voorwerp, tot installaties die mensen uitnodigen om zelf een reeks positieve emoties te ervaren. Er is een focus groep studie uitgevoerd waarin een panel van deskundige ontwerpprofessionals en onderzoekers de PEG-tools hebben beoordeeld, met de nadruk op het identificeren van hoe zij ontwerpers kunnen helpen verschillende positieve emoties te onderscheiden en wanneer hun gebruik effectief zou zijn in ontwerpprocessen. De resultaten wezen uit dat de tools hoofdzakelijk drie

ontwerpactiviteiten kunnen ondersteunen: het specificeren van emoties om voor te ontwerpen, het communiceren van emotionele intensiteit met belanghebbenden, en het genereren van productideeën. Omdat elk hulpmiddel rond een ander motief voor differentiatie is ontworpen, was hun waargenomen bruikbaarheid afhankelijk van het type ontwerpactiviteit en de context waarin het hulpmiddel zou worden gebruikt. De resultaten werden samengevoegd in een vergelijkend overzicht van de tools op basis van hun bruikbaarheid in de ontwerpactiviteiten. De studie suggereert dat geen enkele tool alle PEG-gerelateerde ontwerpactiviteiten zou kunnen ondersteunen, en dat de toepasbaarheid van een tool wordt bepaald door hoe goed het kan voldoen aan de specifieke behoeften van ontwerpers in een bepaalde ontwerpactiviteit.

In het laatste hoofdstuk bespreek ik de belangrijkste bevindingen van het onderzoek als geheel en hun implicaties in termen van bredere inzichten in de onderzoeksopzet en het identificeren van mogelijkheden voor verder onderzoek. De eerste sectie bespreekt de ontwikkeling van de PEG-tools en presenteert enkele overkoepelende kwesties zoals verschillende differentiatieniveaus van positieve emoties, die waargenomen zijn met de tools, de optimalisatie van granulariteits-niveau en de culturele nuances van de tools. In het tweede deel worden ethische aspecten van ontwerpen voor positieve emoties besproken, samen met suggesties om gerelateerde problemen op te lossen. Naast de belangrijkste onderzoeksresultaten levert het onderzoek kennis over positieve emoties in de context van de ontwerppraktijk en het onderzoek naar emotie. De volgende sectie bespreekt de implicaties van het onderzoek, variërend van interventies om PEG te vergemakkelijken, communicatie van positieve emoties en ontwerphulpmiddelen voor ervaringsgericht ontwerpen, tot ontwerpen voor welzijn. Het proefschrift eindigt met een discussie over richtingen voor toekomstig onderzoek: alternatieve manieren om positieve emoties te differentiëren, de toegevoegde waarde van ontwerphulpmiddelen voor negatieve emotionele granulariteit en een verdere ontwerpondersteuning voor emotionele intelligentie.

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I would like to dedicate this thesis to the memory of my father whose presence has always resonated. I hope he would have been proud.

About the author

Jay (JungKyoon) Yoon has a background in industrial design and computer science (BA and BE from Handong University, South Korea). He previously worked as an interaction designer at Naver Corporation where he supported the development of an Internet search service, social media and product simulations. He earned a MSc degree from the programme 'Design for Interaction' at the faculty of Industrial Design Engineering of Delft University of Technology, the Netherlands with the thesis 'Interest in Human-Product Interactions' in 2010 (with cum laude). The thesis won 'Gert van der Veer prijs', the best master thesis of the year in Human-Computer Interactions in the Netherlands (awarded by the Dutch HCI community).

His research focuses on experience design, mainly concerning how the differentiated nature of emotions can be leveraged in design processes. He has developed design tools and techniques to support designers to purposefully create positive emotional experiences. The research findings have been applied to and iteratively improved through several industry projects that covered multiple design contexts and business domains, e.g., a smart home service, an airport crew-centre, a museum tour and a brand loyalty programme. The prototypes developed along the research have been presented at exhibitions like Dutch Design Week and the Design and Emotion Conference and featured in the news of the Dutch Ergonomics Society.

He is a member of Delft Institute of Positive Design, a research group that focuses on the contribution of design to well-being. Since December 2016, he has continued his research and teaching as a lecturer in Industrial Design division, the University of Liverpool, the United Kingdom.

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