DESIGN −|+

Negative emotions for positive experiences

Steven Fokkinga

Design −I+

Negative emotions for positive experiences

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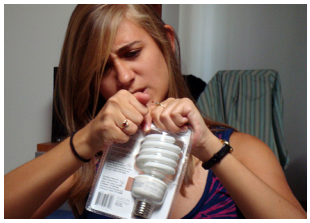
1.

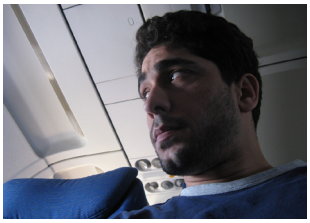
INTRODUCTION

The difficulty lies not so much in developing new ideas as in escaping from old ones.

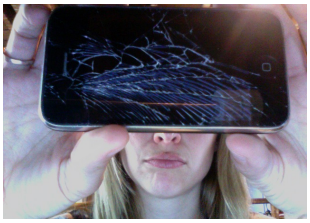
— John Maynard Keynes



"Honestly, getting the contents out of this "cut your hands to pieces" plastic packaging is an exercise in frustration and pain. I can't stand these things!!"



"I'm afraid the engines will fail and we'll plummet to the ground. Or that the turbulence will be so strong that we'll drop. (...) Physically, the anxiety makes me nauseous and tearful and I find it hard to breathe."



"Didn't even have it a week. Never even made a single call. It's dead. I killed it. I've never dropped a phone. This was a small drop and I had it in a really good case. Should not have broken and died. But alas, it did."

Figure 1: A frustrating, scary and sad product and service experience

Experience-driven design considers all aspects of a product – its appearance, cultural meaning, functionality, interaction, usability, technology, and indirect consequences of use – with the aim to optimize and orchestrate all these aspects and create the best possible user experience. Since the late 1990s, designers and design researchers have started to explicitly consider emotions in the analysis and design of products (see Desmet & Hekkert, 2009). An awareness of the different emotional implications of their design decisions enabled designers to deliberately evoke positive emotions and prevent negative emotions in product experiences. The importance of the latter is illustrated by the three vignettes in Figure 1.

Clearly, the user situations would improve if design could alleviate the frustration in the package opening experience, remove the anxiety from the air travel experience, and prevent the saddening loss of the precious phone[1]. Indeed, the awareness of these experiences has led to 'tear-tapes' for packages, anti-aviophobia apps and bumper cases for smartphones. Designing products that remove or avoid such negative emotions seems one of the most self-evident goals for a designer.

However, consider the three activities described and depicted in Figure 2: playing a video game, watching a horror movie, and listening to a downbeat song. These activities have two things in common. First, these are activities that people have deliberately sought out for enjoyment. Second, they all evoke a negative emotion in their interaction. In fact, they seem to evoke the same emotions as described in the negative product experiences. Furthermore, the vignettes suggest that people do not

1 *The three product experience vignettes come from the following weblogs and forums: Package frustration: http://arstechnica.com/civis/viewtopic.php?f=20&t=489547, flying fear: http://www.telegraph.co.uk/travel/738489/An-end-to-being-plane-terrified.html, phone sadness: http://www.localsearchforum.com/break-room/9191-dropped-my-new-galaxy-s4-phone-killed-$600-mistake.html*

"When I'm playing a game and I get stuck, it drives me crazy, but at the same time, when I finish the game it makes it that much better because I feel like it was a little more of a challenge to finish. (...) Looking back I realize the frustrating parts of a game are often what I remember the most."

"I think I love horror because it's an immensely human thing. A primal thing. (...) They take the things that you're comfortable with and scare you with them, or they take the things we all feel uncomfortable about and use them to scare us in ways we weren't expecting. They push boundaries and tell us things about ourselves that we didn't know."

"When I hear the lyrics in sad songs, it feels like they have been written for me and I can sink deeper into my lonely, sad emotion. Sad songs have a marvelous effect on us. (...) There is always an end to every beginning and happiness is always followed by sadness, so we should keep our doors open for sadness as well."

Figure 2: A frustrating, scary and sad experience that people have deliberately sought out

just enjoy these activities despite these emotions, but *because* of them[2]. The resulting experiences have an emotional complexity that goes beyond a simple positive-negative distinction.

This thesis focuses on such experiences and investigates how these can be systematically designed into products and services. The subtitle of the thesis, 'Negative emotions for positive experiences' highlights the central, paradoxical proposition of using 'negative' emotional building blocks to create 'positive' experiential outcomes. To avoid the recurring use of such a longwinded phrase, the term 'emotionally rich product experience', or simply 'rich experience', is used to refer to this phenomenon throughout the text.

This introduction chapter first surveys other initiatives that intend to involve rich experiences in design. The subsequent section outlines the aim, approach, context and outcomes of the research described in this thesis. Next, four assumptions about emotions are discussed, which are based on a deliberate choice for certain theoretical paradigms. The last section gives a per-chapter outline of the thesis.

2 *The three vignettes of enjoyable activities come from the following weblogs:*
Frustrating video games: https://www.cheapassgamer.com/blog/2185/entry-14805-video-game-frustration-problem-or-part-of-the-experience/
Horror movies: http://chrisbrosnahan.blogspot.nl/2014/08/why-i-love-horror.html
Sad songs: https://www.wattpad.com/41353745-why-i-love-sad-songs.

1.1 Design for emotionally rich experiences

Recently, several designers and researchers have similarly proposed that products and services can be deliberately designed to evoke emotionally richer user experiences. Dunne and Raby (2001) proposed 'design noir', a new genre of design that offers a darker and richer experience than common products. As an example of a noir product, they describe the 'truth phone'. This phone has a voice stress analyzer that indicates when the person on the other side is lying. Dunne and Raby describe how the addition of such a relatively small feature can completely change the experience with the phone and the relationship between the people involved.

Benford and colleagues (2012) discussed the possibility of deliberately designing 'uncomfortable interactions' for the purposes of entertainment, enlightenment and sociality. They use this perspective to analyze a number of experience installations and performance artworks that involve this kind of interaction. For example, they describe the performance piece "Ulrike and Eamon compliant", in which the participant walks around the city and follows the story of a historical terrorist through a series of phone calls. The piece ends with the participant being interviewed about their how they think they would act in a similar situation, which other participants can witness through a one-way mirror. With a similar intention, Marsh and Costello (2013) wrote how persuasive technology and digital games could offer 'serious experiences' alongside more traditional 'fun experiences', with the aim to raise awareness for important issues. For example, they describe a digital game that lets players experience the fragility of the Great Barrier Reef.

Hassenzahl and Laschke (2015) discuss the development of a series of products that they call 'pleasurable troublemakers'. These products are intended to let users reflect on their behavior by shaping the interaction in a certain way and having an implicit 'opinion' about the user's behavior built in. For example, they describe 'Forget me not', a reading lamp with an enclosure that resembles flower petals. These petals are open when the light is switched on, but slowly close after some time of use, leave decreasingly little light through. By tapping the lamp, the user can reopen them and continue reading. By shaping the interaction in this way, the user is more likely to reflect on his energy use.

Lastly, Katrin Baumgarten designed a series of hypothetical products that evoke disgust, to explore the paradoxical aesthetic that is connected to that emotion. For example, she designed a series of light switches that evoke disgust in different ways, among which a switch that oozes a snot-like substance after being pressed, and a switch with hairs that stand up when it is approached by a hand[3].

These initiatives have made a great contribution to the understanding of rich product experiences by exploring and discussing the phenomenon from different perspectives. Furthermore, they have gener-

3 *See: http://katrinbaumgarten.de/disgusting-light-switches*

ated or analyzed a number of design examples that designers can use for inspiration and researchers can use for further analysis and hypothesis generation.

At the same time, the research has left some important questions unanswered and has not yet generated the necessary tools that designers need to apply the learnings in their own work. First of all, most existing research provides an intuitive understanding of the phenomenon through discussion and examples, but has not provided a framework that makes clear what rich experiences are, and how they could be deliberately induced through design. Relatedly, although some general guidelines for design have been provided, no one had proposed an explicit design approach to systematically evoke rich product experiences. Thirdly, most initiatives lack differentiation: they discuss rich experience (under varying terms) as if it were a monomorphic concept, although the examples seem to show that it can comprise many different emotions and types of experiences. Lastly, apart from the work of Hassenzahl and Laschke (2015), most initiatives have not focused on the design of mainstream, commercially offered products, but instead on game design (e.g., Marsh & Costello, 2013), critical design (e.g., Dunne & Raby, 2001), interactive installations (e.g., Baumgarten's light switches), or performance art (e.g., Benford et al., 2012).

1.2 Current research

Research aim

The aim of this research is to obtain insight into the conditions that create emotionally rich experiences, both in general and through product interaction in particular, to provide designers with a wide repertoire of rich user experiences, and a systematic approach[4] to design these experiences into functional and commercially offered products and services.

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4 *In the design field, the terms 'design method', 'design approach', and 'design strategy' are sometimes used with nearly interchangeable meanings; sometimes in a specific contrast to each other. By lack of a universally shared set of definitions, I have adopted a certain nomenclature for these terms in this thesis, which is roughly based on how I most typically see them being used in the subset of design literature that I am familiar with. In this naming system, 'design method' refers to the most comprehensive and systematic procedure, which can span the entire design process, and is often explicitly tested against other methods. In contrast, a 'design approach' is a more specialized and flexible set of steps, guidelines or principles that is typically intended for a specific part or focal area of the design process. Lastly, a design approach (or method) can comprise various 'design strategies', which are specific sub-approaches that fit within the overall philosophy and procedure of its parent approach.*

Research questions

The research aim was broken down into the following research questions:

R1. What kinds of events or conditions elicit emotionally rich experiences?
R2. How can rich experiences be evoked through product interaction?
R3. What different types of rich experiences are possible?
R4. How can designers create functional products and services that evoke rich user experiences?
R5. How can products reverse existing negative emotions into rich experiences?

Research approach

As the phenomenon of emotionally rich experiences is a relatively new concept in the context of product design, many relevant variables have not yet been identified and solid hypotheses have yet to be formulated. Given this context, the research in this thesis had an exploratory character that approached the topic with a mix of methods.

The study of chapter two employed a phenomenological inquiry method: for a week participants described emotional episodes in a diary and subsequently engaged in an in-depth interview about these episodes. The phenomenological method was found most appropriate given the focus on the experiential qualia of the captured episodes. The research in chapter four comprised several methods from emotion psychology that were used for the collection, selection, generation, and validation of a set of different representations of negative emotions. In addition to the insights gained in preceding studies, the creation of the framework in chapter three and the design approach in chapter five were supported by literature research in the domains of emotion psychology and the humanities. Chapter six and eight describe workshops in which designer participants engaged in assignments to evaluate the process and outcomes of different design strategies. Lastly, chapter seven describes a study using the research through design study approach, in which the author reflects on his own experiences of designing and evaluating a prototype of a rich experience product.

The project combined design research with knowledge from the affective sciences about the characteristics, mechanisms and qualities of specific emotions – in particular, the positive contribution of specific negative emotions. The conception of emotion, subjective experience, and human behavior in this project has been largely based on knowledge and frameworks from emotion psychology.

Research context

The research described in this thesis was part of the Creative Industry Scientific Program (CRISP), a program sponsored by the Dutch government that focused on the design of product-service systems as a means to stimulate the continuing growth of the Dutch Design Sector and Creative Industries.

Research outcomes

Apart from generating frameworks and insights on designing for rich experience, the research project has produced a number of concrete deliverables. Firstly, an online database of 36 distinct negative emotions was developed, which includes detailed information and different narrative representations of each emotion. Secondly, a design approach was developed that guides designers to deliberately and systematically involve emotionally rich experiences in the user experience of products and services, as well as ten 'rich experience qualities', which are types of rich experiences based on specific negative emotions. This approach was tested with sixty design students and a professional designer, who used the approach to generate an additional fifteen rich experience qualities and a number of product concepts. Lastly, three design strategies have been developed that aim to improve the experience of a user situation that involves an irremovable negative emotion. These strategies have been tested by 24 novice designers.

1.3 Theoretical assumptions about emotions

Over the course of millennia, philosophers such as Aristotle, Hume, Spinoza, and Sartre have reflected extensively on the nature and functions of emotions. In more recent times, emotion has been studied in a multitude of scientific fields, including psychology, neuroscience, anthropology, computer science, economics, linguistics, and art studies (see Gross & Barrett, 2013), which together have produced a vast body of knowledge. It is unsurprising that this rich scholarly tradition has resulted in a number of different views and standpoints on the characteristics of emotions, some of which are mutually incongruous. The theoretical and empirical work in this thesis has been based on a number of assumptions about emotions, four of which are made explicit in the following sections.

Emotions are functional and lawful

The treatment of emotions in this thesis follows the functionalist tradition. This tradition, which comprises most contemporary theories of emotion, advances that emotions are specific and instrumental responses to relevant changes in the environment of the individual (e.g., Lazarus, 1991). In other words, whenever something happens that is relevant to a person, a specific emotion is evoked that helps that person deal with this event in various ways. Secondly, the tradition supposes that by studying and mapping the different functions that emotions serve, we can uncover the laws that govern them and make them more predictable (Frijda, 2007). The functionalist view argues against the idea that emotions are an irrational disturbance of rational processing, which was popular in past centuries, up until the origin of appraisal theories (Schorr, 2001), and is still present today in some fields, such as behavioral economics (see Lerner, Small, & Loewenstein, 2004) or policy making (see Roeser, 2012).

The following section gives a very brief overview of some important functions of emotions that have been studied in the last decades. First of all, emotions provide us with information about our situa-

tion (Lazarus, 1991; Schwarz, 1990). For example, fear tells a person that she is in danger, pride that she has done something admirable, and sadness that she has lost something important. Secondly, emotions contain *action tendencies* that help people to get in the right motivation and physical state to deal with the situation that has caused it (Frijda, 1986). For example, a person experiencing fear will be physically activated and have an urge to back away from the threat. Conversely, a person who feels interest in an object will have the urge to approach and explore it (Fredrickson, 1998). Emotions also influence our behavior in more indirect ways, by leading us to reflect on our actions and make adjustments when necessary (this is often called the feedback model, see Baumeister, Vohs, DeWall, & Zhang, 2007). For example, a person that feels regret over finishing an entire box of cookies by himself may stop buying those cookies to prevent it from happening again. Fourthly, emotions serve social functions: they help people manage relationships and establish their social position relative to others (Fischer & Manstead, 2008). For example, expressing genuine guilt after an inconsiderate remark can (partly) repair the damage that it has done to the relationship. In addition, the collective contempt or hate that a social group feels against a rival group can function as social glue that brings the group closer together. Lastly, emotions have a communicative function, which is in part related to its social function. Emotions are accompanied with facial and bodily expressions, which signal the emotional state to others (Ekman, 1993). Knowing what other people are feeling is useful in social interactions. For example, someone with an angry expression may be temporarily avoided by others, while someone who expresses sadness may be approached and comforted.

The positive-negative classification of emotions is a simplistic, yet pragmatic heuristic

When regular people are asked to categorize emotions according to any criterion they see fit, the primary distinction they make is almost invariably between positive and negative emotions (e.g., see Shaver et al., 1987). Most scientific theories of emotion also explicitly or implicitly assume that valence is one of the primary components of every emotion (see Colombetti, 2005). At the same time, several scholars have criticized or even rejected valence as a dichotomous variable that can classify every emotion in one of two groups (e.g., Frijda, 2007; Lazarus, 2003; Solomon, 2001; Solomon & Stone, 2002).

There are a number of criteria on which an emotion can be classified as either positive or negative. Some have proposed four (Averill, 1980), others as much as eighteen (Solomon & Stone, 2002). For reasons of conciseness, the three basic criteria of Lazarus (Lazarus, 2003, p. 98) are used here: 1) negative emotions feel subjectively unpleasant, whereas positive emotions feel pleasant; 2) negative emotions result in undesirable social outcomes, while positive emotions result in desirable social outcome; 3) negative emotions are brought about by unfavorable life events, whereas positive emotions are brought about by favorable life events;. Although at first glance these criteria seem to hold for most emotions, upon scrutiny, counterexamples can be given of emotions that are supposedly negative, yet violate one or more of these criteria.

The first criterion refers to the commonly shared experience that emotions like fear, sadness, and envy feel unpleasant, while emotions like admiration, joy and relief feel pleasant. If a person could hook himself up to a machine that can artificially induce the sensation of any emotion, such as the 'mood organ' in the short story 'Do androids dream of electric sheep' by Philip K. Dick, he would probably select pride or hope over loneliness or fear[5]. However, several scholars have argued that the experiential qualities of different emotions far exceed a simple positive-negative division. For instance, righteous anger can feel delightful (Frijda, 2007, p. 87), sadness can feel purgative and comforting (Morreall, 1985), and fear can feel exhilarating (Andrade & Cohen, 2007). Reversal theory[6] even proposes that every negative emotion has a 'parapathic', or enjoyable, version – for example, there is both a pleasant "anger" and "anxiety" (Apter, 2007, p. 53). Similarly, positive emotions can at times feel unpleasant. Love can be one of the most positive emotions when it is mutual, but one of the most painful ones when it is unanswered.

The second criterion points to the observation that negative emotions have led to much harm and destruction in the world. For example, hatred between nations has been known to start wars, jealousy has broken up relationships, and fear-of-otherness has alienated neighbors from each other. However, to attribute these effects to negative emotions as such would be a mistake. Rather, these effects occur when emotions are misplaced (e.g., based on wrong information) or badly calibrated (e.g., triggered too easily). The hatred people feel for another country may have been fuelled by years of deliberate state propaganda, and is thus misplaced. If a woman feels intense jealousy the moment another woman looks at her husband, this should be attributed to a dysfunctionally sensitive jealousy system, rather than to the emotion of jealousy itself. In moderate forms, jealousy represents that a person is passionate about a relationship and willing to fight for it, which is considered functional (Baker, McNulty, & Overall, 2014) or even virtuous (Kristjánsson, 1996). In the same vein, positive emotions can just as well be misplaced – such as when a young boy feels admiration for a notorious gangster and wishes to emulate him – or poorly calibrated – such as when someone is too quickly too proud about his own achievements.

The third criterion is most congruous with modern cognitive emotion theories like appraisal theory. It is an important component of most variants of appraisal theory that negative emotions are a response to events or conditions that are unfavorable for the individual, whereas positive emotions are evoked by favorable events or conditions (e.g., Arnold, 1960; Ortony, Clore, & Collins, 1988). However, other researchers in this tradition have argued that an important achievement of appraisal theory is its ability to explain a multitude of emotions as adaptations to specific situations, and that collapsing

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5 *Then again, the main character's wife subjects herself to a bi-monthly session of despair to keep her sense of reality in check.*

6 *Reversal theory is a theory about the dynamic structure of human experience, motivation, and emotion. It proposes that a 'protective frame' determines the difference between a negative and a parapathic emotion, which is discussed in chapters three and five. For a more wide-ranging discussion about the use of reversal theory in design, see Fokkinga and Desmet (2014).*

these to any single polarity is reductive (Solomon & Stone, 2002, pp. 427-430) or even harmful to the progression of ideas (Lazarus, 2003, pp. 98-101). Consequently, negative emotions do not always have to represent an unequivocally negative situation for the individual. For example, someone who feels contempt for another person evaluates that person as somehow inferior (negative), but consequently evaluates himself as superior in comparison (positive). Clearly, there is an unfavorable evaluation of the object of the emotion (the other person), but the overall situation does not necessarily appear negative to the contemptuous person. The same duality can be observed in the positive emotion admiration, which involves a positive evaluation of the object of admiration, but consequently also a recognition from the admiring person that he or she does not possess the admirable quality.

These issues show that the debate about the validity of a dichotomous valence distinction is complex and as yet unresolved. This thesis takes a pragmatic stance on the issue. Although I wholeheartedly agree with the critics who favor a nuanced and emotion-specific approach over a reduction of emotions to a few dimensions or categories, the reality is that virtually all people employ the positive-negative distinction in their personal lives and professional practice. It is exactly this distinction that has led designers to embrace one set of emotions in their work (the positive) and to shy away from another set (the negative). Thus, I adopt the distinction, but at the same time use it to argue against some of the inferences for which it was created in the first place.

Although none of the three criteria can unambiguously cut the emotion pie in two consistent pieces, I believe that the third criterion comes closest. Following a functionalist paradigm, it seems to make most sense to propose that what we (pragmatically) call negative emotions are in principle objects and events that are somehow judged as bad, unfavorable or inferior. In the design approach outlined in chapter six, which demonstrates how designers can enrich user experiences by eliciting negative emotions, the specific experiences start from different negative stimuli, such as threats (fear) or losses (sadness). In contrast, the second criterion makes the least sense from a (social) functionalist perspective: if every emotion is in principle an adaptive response to the situation that evoked it, it should on some level produce desirable outcomes[7]. Since this thesis deals with subjective experience – in particular the positive contribution of negative emotions to subjective experience – it seems that the first criterion is of key importance. However, the exceptions that have been presented against this criterion can still be explained within a positive-negative dichotomy, if one supposes that emotions of opposite valence can co-occur, which will be the argument of the next assumption.

People can experience mixed emotions, some of which constitute 'rich experiences'

The first day on a new job can feel both anxious and exciting. These emotions of opposing valence are evoked because the new workplace, boss and colleagues hold both a risk and a possibility: the job can

7 *It could be argued that emotions are primarily adaptive for individuals, i.e., that they only serve self-interested goals. However, as Fischer & Manstead (2008) discussed, emotions are also functional from a social perspective.*

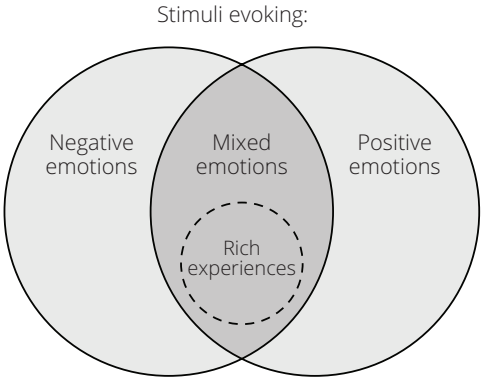

Figure 3: The place of rich emotion experiences in a framework of positive, negative and mixed emotions

turn out to be anywhere from terrible to terrific. Imagine (or remember) the moment you walk into your new office for the first time. I would argue that you feel both emotions at the same time: they are mixed.

This interpretation is not uncontroversial. Some researchers have argued that positive and negative affects are opposite ends of a single scale, on which a person's momentary feeling can only occupy a single point (Green, Goldman, & Salovey, 1993; Russell & Carroll, 1999). This can be compared with the feeling of body temperature: a person feels either hot or cold, or something in between, but not both hot and cold at the same time. Other researchers see positive and negative feelings as separate dimensions that can be activated independently. This means that a situation can evoke only positive or negative feelings, but also both at the same time, like hunger and thirst (Cacioppo & Berntson, 1994; Larsen, Mcgraw, & Cacioppo, 2001; Schimmack, 2001). Since the debate got ignited in the 1990s, numerous experimental studies have been published that study the possibility of eliciting mixed emotions. These studies expose participants to stimuli are supposed to evoke mixed emotions, such as pictures, ads, movie clips or music, and ask them to rate their feelings. Recently, Berrios and colleagues (2015) carried out a meta-analysis of 63 of these studies and found a relatively large positive effect: people do indeed report feeling both positive and negative emotions in response to such stimuli. Similarly, Norman and colleagues (2011) discuss recent neurobiological evidence for the existence of mixed emotions.

This thesis is based on the assumption that people can indeed feel positive and negative emotions at the same time. Furthermore, it proposes that some cases of mixed emotional experiences can be considered 'rich experiences', meaning that the individual regards the overall experience as enjoyable, meaningful, or worthwhile, and the negative emotion as instrumental in the formation of this experience. In other cases of mixed emotions, the negative part does not contribute anything and the experience would be better without it. This simple relationship can be depicted as the Venn-diagram

of Figure 3. Chapter two discusses a study that investigated in which cases of mixed emotional can be called rich (the dotted circle), and which cannot.

Negative emotions have beneficial effects

Negative emotions can contribute to the richness of experience because they have numerous beneficial effects on a person's functioning and wellbeing. Although there have always been authors who studied and argued for the value of negative emotions, the last decades have witnessed a relative upsurge of publications with this perspective. This recent interest can in part be understood as a countermovement against a postwar, Western trend to overvalue optimism, positive thinking and positive emotions, especially in the United States.

This is for instance the viewpoint of Barbara Ehrenreich, who wrote a book titled 'Bright-Sided: How the relentless promotion of positive thinking has undermined America' (Ehrenreich, 2009). In the book she observed how the positive thinking ideology has been attempting to ban the expression and experience of negative emotions from American daily life. She argues that this trend has harmful consequences for individuals, whom it pushes to exercise denial and self-blame, and society, by leading companies and institutions to take irresponsible risks. With a similar view, Oliver Burkeman promotes a 'negative path to happiness', in his book 'The antidote' (Burkeman, 2012). Through a series of personal explorations, he follows and discusses life methods that promote embracing uncertainty, failure, pessimism, detachment and mortality, and observes the positive effects is has on him.

The value of negative emotions has also been studied by psychologists and other emotion researchers. In 2014, a book was published under the title 'The positive side of negative emotions', in which two dozen scholars survey the value and benefits of specific negative emotions (Parrott, 2014). To name only a few specific examples: sad people are more accurate when remembering details of an event (Forgas, 2014), angry people do better at negotiations (Van Kleef & Cote, 2014), and envious people work harder to achieve something desired (Henniger & Harris, 2014). These found effects are directly in line with the first-discussed assumption, which states that all emotions are in principle functional.

This thesis similarly adopts the view that negative emotions, when evoked under the right conditions, are beneficial and have an important place in people's lives. Consequently, I argue that if designers only aim to elicit positive emotions in product interactions, they miss the opportunity to tap into the beneficial sources that a long line of scholars have found in negative emotions.

1.4 Outline of the thesis

This thesis contains nine chapters that are divided in two parts. The first part, which consists of chapters two, three and four, discusses some fundamental concepts of emotionally rich design that are referred to in later chapters. The second part, consisting of chapters five to eight, applies these

concepts and presents design strategies to create rich product experiences. The last chapter provides an overall discussion of the findings and its implications.

Chapters two, three and five were previously published in papers that have been reproduced verbatim in this thesis. In addition, chapter seven was written based on a previously published conference paper. Using papers as chapters has the advantage that the chapters can be read separately, according to the reader's interest. To extend this advantage, the remaining chapters (except the general discussion chapter) have been written with a similarly independent structure. A drawback of this approach is that some chapters repeat the explanation of certain concepts, especially in the introduction sections. Furthermore, some chapters discuss opportunities for future research, without acknowledging that other chapters elaborate on these directions[8].

Chapter two discusses a phenomenological study that investigated what kind of life situations evoke mixed emotions, and in which cases those emotions constitute rich experiences. 124 mixed emotional experiences were clustered into eleven groups, of which five were considered rich experiences.

Chapter three starts with an account of what rich experience design aims to be, and why. Next, it discusses the possible reasons why people seek out negative emotions and the condition under which these emotions can be enjoyed. The insights lead to a framework of the formation of rich experiences, which is used to analyze six product examples.

One of the main points of chapter three is that specific negative emotions lead to different rich experiences, which necessitates the understanding of the characteristics of a wide range of negative emotions. Chapter four discusses a series of studies that lead to the creation of an online database that offers designers knowledge about a highly differentiated set of negative emotions through different textual and audiovisual means.

Based on the concepts and finding of the previous chapters, chapter five introduces a methodical design approach to emotionally enrich user experiences. In addition to the overall approach, it also discusses ten 'rich experience qualities' that designers could use right away in their projects. These rich qualities are pre-researched types of experiences that have been constructed with the design approach. Six design concepts generated with the approach are discussed.

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8 *The system of using previously published papers as chapter has resulted in a few additional artifacts. For example, chapters two, three and five refer to themselves as 'papers' in their text. Chapter five deserves particular mention. The discussion section of chapter five (from page 111) states that the negative emotions that make up the rich qualities were drawn from an emotion typology that is still under development. This refers to the (now finished) typology presented in chapter four. Furthermore, some emotions that are the basis of the rich qualities in chapter five have changed names since the publication of the paper: 'fright' changed to 'fear', 'maliciousness' to 'anger', and 'poignancy' to 'sadness'. Lastly, the emotion definitions used in Table 7 of chapter five have since been updated – the definitions in chapter four are the final ones.*

Chapter six further examines the design approach, by reflecting on the results and processes of nearly sixty design students and a professional designer. The chapter discusses the rich experience qualities and the design concepts that the designers generated using the approach. One of the findings is that the rich experience approach (and experience design approaches in general) are helpful in the conceptual phase of design, but not in the materialization phase.

Chapter seven describes a research through design study that investigated how the rich experience approach can be employed in the materialization stage of design. It focuses on the design and testing of an interactive wristband that aimed to add engagement to the activity of running, and discusses the emerging insights and recommendations.

Chapter eight slightly extends the scope of the thesis. Whereas the preceding chapters focused primarily on adding enjoyment, engagement and meaning to generally boring or empty situations, chapter eight investigates whether a similar approach can be used to design for user situations that already involve a strong negative emotion. Four of such situations were designed for in a workshop that evaluated three different design strategies.

The final chapter reviews the findings of the thesis to formulate answers for the research questions. In addition, it discusses implications of the findings and possibilities for future research.

2 : RICH MIX OR TRICKY CONFLICT? A PHENOMENOLOGICAL STUDY

Pleasure and pain, though directly opposite, are contrived to be constant companions.

— Pierre Charron

In the introduction, I argued that rich emotional experiences occur as a subset of mixed emotions. This chapter discusses a phenomenological study that investigated which kinds of life situations evoke mixed emotions, how these emotions influence and transform people's subjective experience, and what the underlying differences are between mixed emotions that constitute rich experiences and those that do not. A diary study and in-depth interviews were carried out with ten participants, which produced 124 captured experiences. An analysis categorized the experiences into four main clusters, comprising eleven types of mixed emotional experiences. We found that the five mixed emotion types of two main clusters lead to a rich experience, while the types in the other two clusters do not. Early suggestions are made on how these mixed emotions can be applied in design to create richer product experiences.

This chapter was previously published as: Fokkinga, S. F., & Desmet, P. M. A. (2012). Meaningful mix or tricky conflict? A categorization of mixed emotional experiences and their usefulness for design. In J. Brassett, J. McDonnell, & M. Malpass (Eds.), Proceedings of the 8th international conference on Design and Emotion: Out of Control. Central Saint Martins, University of the Arts, London, UK. 11-14 september 2012.

2.1 Introduction

Many of life's most unique and interesting events are defined by mixed emotions. For instance, the experience of seeing one's child grow up and move out of the house (happiness and sadness), getting a promotion in favor of other co-workers (pride and guilt), or starting a new career (anticipation and anxiety) all involve both positive and negative emotions. In these examples, the emotional complexity is an important part of the richness of the experience. For parents seeing their child move out, the sadness signals the significance of the event and the loss of something valued, while the happiness is evoked by the realization that their kid has become an adult and is progressing in life. Analogously, the experience of starting a new job is vibrant and engaging because not knowing what lies ahead elicits both hopeful anticipation and jittery nervousness.

Life events evoke mixed emotions; so do designed objects. For example, someone can admire a car for its innovative design, yet be disappointed by its lack of luggage space; one can feel contempt towards the cruelty of a fur coat, yet be delighted by its soft touch. In fact, it is probably difficult to conceive examples of products that do not evoke some level of mixed emotions. We have seen this observation confirmed in studies that measured emotional responses evoked by a variety of product categories, such as car design (Desmet, Hekkert, & Jacobs, 2000), wheelchair design (Desmet & Dijkhuis, 2003) and mobile phones (Desmet, Porcelijn, & Van Dijk, 2007). In some cases, objects are designed to deliberately evoke mixed emotions. An example is modern art, which deliberately evokes mixed emotions to temporarily shift people's perspective on the world and give food for thought. For instance, Damien Hirst's 'Mother and Child Divided', an installation of a dissected cow and calf exhibited in a series of separate vitrines, evokes negative emotions of disgust and eeriness, and at the same time positive emotions of fascination and amazement.

In mainstream design, however, mixed emotions are scarcely used as an intentional design strategy. There is a good reason for that: mixed emotions do not always contribute to richer experiences. The negative part of the mixed emotion can be just plain unpleasant, and harm rather than contribute to the overall experience. For instance, the experience with the car from the previous example is not particularly rich - the user would probably wish for a car that has both an innovative design *and* ample luggage space. Furthermore, mixed emotions can even cause unpleasant confusion and insecurity (e.g., see Cacioppo, Gardner, & Berntson, 1999), when people feel torn between two options in an important decision, or when they have a love-hate relationship with a person that has made them both happy and unhappy in the past.

These cases show that mixed emotions are a delicate matter - sometimes contributing to the richness of an experience, sometimes doing nothing, and sometimes even detracting from it. This might be one of the reasons why emotional designers often prefer to target a single (positive) emotion in their product experiences, like pride, trust or happiness. This is a pity in our view, because when

used appropriately, mixed emotions can be employed to provide users with very unique and engaging product experiences.

In this paper, we want to address the questions of what mixed emotions are, what the differences are between mixed emotions that contribute to richness of experience and those that are superfluous or even harmful, and what the implications are for emotional product design. First, we discuss the definitions and models we have used to frame the phenomenon of mixed emotions, which guided the setup of the study and the data analysis. The chief part of the chapter discusses the phenomenological study that was carried out to collect a number of life events that evoked mixed emotions. These events were analyzed and categorized to find out what the commonalities and differences are between the mixed emotions that are beneficial and those that are harmful to subjective experience. The conclusions of these data were then used to draw some implications for the application of mixed emotions to product design.

2.2 A phenomenological approach to mixed emotions

In this study, we defined a mixed emotion as an affective episode in which a person feels one or more emotions of both valences (positive and negative) at the same time, which are phenomenally still distinguishable, and in reaction to the same situation or object. The idea that the emotions are felt simultaneously but separately distinguishable means that, although a person has a mixed emotion as 'one' feeling, he can still discern and identify the emotions of which it is made up, like when one eats a single dish but is still able to identify the individual ingredients from which it was composed.

It is also necessary to clarify what is meant by the term 'rich experience'. It implies an experience that is somehow a-typical and therefore notable or memorable, which people are more likely to share with others than a non-rich experience. Secondly, it implies to contain an intellectual or emotional complexity that makes it intriguing, like a dish with dissonant, but ultimately matching flavors. Thirdly, one could make a normative statement about rich experiences, by defining them as experiences that are somehow valuable or worthwhile in life. In this study, we have focused on this last definition, by asking respondents for every experience if and how it had yielded them something on a meta-level. For instance, whether they had learned something from it, whether they felt closer to someone or something after it, whether it had led to a (more) desirable situation, and so forth.

To obtain a detailed overview of the different episodes of mixed emotions that people experience in daily life, we adopted a phenomenological approach. The phenomenological inquiry is a qualitative approach to explicate people's subjective experience of a certain situation or around a certain theme (Moustakas, 1994). It is based on the philosophical writings of Edmund Husserl (early 20th century),

who argued that experimental psychology was successful in finding out facts about people's mental life, but, as an empirical science, it was unable to discover the 'essence' of human experience. For instance, experimental psychology might find out different facts about angry people - that they are likely to display certain behavior, to have certain thoughts, memories, preferences, and so forth - but these facts do not tell us what it 'feels like' to be angry. It is this essence of subjective experience that phenomenological methods hope to uncover. Because our investigation deals with the subjective experience of 'richness' in different emotional episodes, phenomenology is a suitable mode of inquiry.

A phenomenological exposition of mixed emotions is facilitated by first introducing some key distinctions in human emotions. Firstly, it is important to make a distinction between the object or event eliciting an emotion, and the actual stimulus of the emotion. For products, the stimulus that causes an emotion is rarely the entire product (Desmet, 2012). It is rather a certain aspect of the product that evokes an emotion, be it the product appearance (e.g., the looks of a mobile phone evoke admiration), the interaction with a product feature (e.g., an incomprehensible television menu evokes frustration), or the inferred meaning of a product (e.g., driving in a hybrid car evokes pride). Thus, a single product can easily evoke mixed emotions because it 'contains' multiple stimuli.

Secondly, the conception of emotion that underlies this study is grounded in the tradition of appraisal theory. This theory understands emotions as cognitive, but non-deliberate evaluations of stimuli and events that help people cope with the situations that elicit them (Roseman & Smith, 2001, pp. 3-5). Simply said, emotions are automatic bodily processes that help an individual distinguish between the beneficial and harmful events in the world, and act appropriately upon them.

Thirdly, we should distinguish between two manifestations of emotions: emotions are experienced (i.e., someone feels angry) and have behavioral manifestations (i.e., someone who is angry will have the tendency to confront, or even hit someone). The behavioral manifestation of the emotion is often referred to as the 'action tendency': an urge to act in a particular way in reaction to the situation that evokes the emotion (Frijda, 1986). An example is 'the urge to explore' in the case of fascination, or 'the urge to flee' in the case of fear. Fredrickson (1998) argued that these tendencies are not necessarily only present in physical action, but can also arise in cognitive activity (e.g., the urge to be open to new ideas or the urge to concentrate). To express the combined behavioral and cognitive effects of emotion, Fredrickson introduced the term "thought-action tendencies". Each distinct emotion has a unique thought action tendency and, in general, negative emotions serve to narrow an individual's momentary thought-action repertoire, whereas positive emotions serve to broaden this repertoire.

Fourthly, time is an important factor in analysis – is there a difference between mixed emotions in which the emotions are truly simultaneous, and mixed emotions that start with one emotion and are joined later by the other? Obviously, experiences are never static, and small changes in the stimuli or the way they are appraised can significantly change emotions over time. The object of the emotion can also reside in different times: when someone moves to another city, she can be simultaneously

sad for ending a nice time with friends and neighbors (the past), while excited about the good times she will have in her new environment (the future).

2.3 Method

Phenomenological method

Phenomenological methods often use semi-structured, in-depth interviews to acquire data. There are a number of key aspects in a phenomenological interview that a researcher has to take into account (Moustakas, 1994). First of all, the interviewer should try to rid himself of the prejudgments and preconceptions he might have about the topic of inquiry - for instance acquired in previous research or from everyday experience - so he can approach the respondent with an unbiased, receptive presence. This is particularly important for phenomenological topics, as subjective experiences are quite ephemeral and impressionable to outside comments, in contrast to, for instance, facts and opinions. Secondly, the experience should be 'bracketed', which means that the interview should only be about the subjective experience 'in the moment', and not about the interviewer's or respondent's social, cultural or psychological explanation of the phenomenon. Thirdly, the interviewer should apply a process called horizonalization, meaning that a respondent can go from one 'horizon' (topic) to the other, while the interviewer treats each statement of the respondent as equally valuable. Anything that came into consciousness during the experience of the event is worthwhile to talk about: including but not limited to perceptions, feelings, thoughts, felt bodily changes, memories, judgments, imaginations, own behavior, perceived reactions or behavior of others, real or imagined consequences, expectations and preferences.

Participants

Ten participants from different backgrounds were recruited to participate in the study. In the selection of participants, an effort was made to recruit participants that a) were likely to encounter mixed-emotion situations, because of their occupation or their lifestyle; b) easily reflected and talked about their emotions; and c) were reasonably different from each other in terms of age, gender and background. The participants were recruited through our social networks, but none of the participants knew the interviewer prior to the study. The participants had the following occupations: emergency-room doctor, theatre actor, art critic, user insights researcher, dancer, entrepreneur and employer at a medium-sized design agency, psychology student, industrial design student, psychotherapist, and student councilor for children with learning and behavioral disorders. All participants spoke Dutch. Five of the participants were women, five were men.

Procedure

For each participant, the study consisted of two parts: a diary study and an in-depth interview. In the diary study, participants were asked to fill in thirteen experiences of mixed emotions over the course

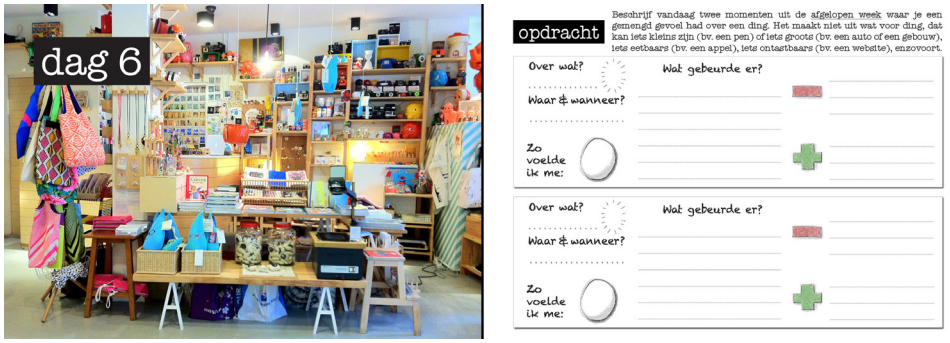


Figure 4: Two pages of the mixed-emotion diary (in Dutch)

of seven days into a booklet (see Figure 4). These thirteen experiences formed the basis of the interview, which was conducted immediately after the seven-day period of the diary-study. The diary gave participants a slightly different assignment every day, but always with the same structure of questions: "What was the event?", "Where and when did it take place?", "Which negative feeling(s) was/were evoked by the event?", and "Which positive feeling(s)?" The assignments asked about different objects of emotions (e.g., oneself, another person, an object) and were meant to stimulate participants to explore the breadth of different mixed emotion experiences, without presenting any specific combination of emotions as more or less appropriate. In fact, care was given that no examples of mixed emotions were provided anywhere in the diary or in communications to participants, to prevent a bias in the type of experiences participants would come up with. Participants were supposed to only use the given definition of a mixed emotion and their own judgment to determine which personal experience would be suitable. The given definition was: an event that is positive, nice, beautiful or pleasant on the one hand, while also negative, uncomfortable, bitter or unpleasant on the other hand - in which both feelings have to be about the same situation, object or event.

Even though the study was conducted as part of a design research project, the diary did not exclusively ask about product experiences. This was done to capture a broader spectrum of mixed emotions than current products elicit, so that mixed emotions that are currently unused in design might also be considered for application in product experiences.

The purpose of conducting a diary-study before the interview was to give participants more time to come up with good examples of mixed emotions than just an interview setup would allow. Furthermore, the diary was meant to 'sensitize' participants over the course of a week to think about the subjective experience of different emotional situations, so that they would be more prepared for the interview (e.g., see Sleeswijk Visser, Stappers, Van der Lugt, & Sanders, 2005). Lastly, it allowed more time during the interview to directly go in-depth about the nature of the different experiences, without spending time to first come up with experiences.

The interviews, which were audio-recorded and lasted for about two hours, started with a run-through of the diary to shortly discuss all experiences. Each experience was discussed until the interviewer had a good understanding of what had happened in the event, and which emotions were involved. After all experiences were discussed, the researcher took some time to evaluate which of them would be worthwhile to discuss in more detail (ranging from two to five experiences). In the in-depth treatment, participants were asked to relive the event in the first person as if it took place here and now, and recall several sensorial details of the situation (i.e., what the respondent saw, heard, smelled, and touched during the event). This process of recalling details was supposed to a) put the respondent in the moment of the event again, so he or she would more easily recall the emotions; and to b) have the respondent focus on their body and bodily reactions, to get descriptions of emotions that were more about direct feelings and less about psychologized explanations. Next, respondents were asked to give a detailed account of their emotions at the time, and how different feelings interacted with each other. Lastly, the effect of the emotions was discussed. Central was the question if and how the experience had yielded something. This last question was meant to get a sense of whether a mixed emotion had somehow enriched the experience, or had been beneficial in any other way.

Data analysis

All the experiences were summarized and formatted on the basis of the diaries, the audio data and the notes of the interviewer, as much in the words of the respondent, and with as little interpretation from the researcher as possible. Next, for each experience the researchers considered which kind of mechanism had brought about this particular mixed emotion, paying careful attention to the described effects of the different emotion, the relation between the emotions and the sequence and timing of the emotions. When a mechanism was found that did not apply to any of the previous experiences, a new cluster was made. At the end, these clusters were again categorized in main clusters, when they appeared to share some obvious commonalities.

2.4 Results

The study yielded 124 mixed emotion experiences from ten participants (not every participant completed all thirteen assignments). The experiences were categorized into four main clusters, each consisting of several sub-clusters. All clusters were created on the basis of the inferred interactions between the positive and negative emotions in the experiences. The first main cluster consists of experiences in which there is no interaction between the positive and the negative emotions. The experiences in the second main cluster were characterized by positive and negative emotions having a mutually intensifying effect. In the experiences of the third main cluster, the negative emotion brought about a transformation of attitude or behavior in the participant, which in turn produced or helped to produce the positive emotion. The different sub-clusters all fit the descriptions of the main cluster to which they belong, but also have differences that set them apart. Table 1 shows an overview of all clusters. In this section, each cluster is discussed briefly with examples and respondent quotes

Table 1: An overview of all clusters of mixed emotional experiences

Cluster	Sub-cluster	Example
1. Unrelated emotions	1a. Different stimuli	I am happy for my friend because she is moving to another country, but jealous that I am not going on such an adventure.
	1b. Inability to fully experience something positive	I am happy that the sun is finally out again, but sad that I have to work indoors all day.
	1c. A negative event turned out better	I am envious of the beautiful teacups my partner received, but I am relieved that they turned out to be quite impractical.
	1d. Putting something negative into perspective	I am angry that my friend is being so difficult, but I feel affection because I know it will be all right in the end.
	1e. Ambivalence	I feel frustrated but happy over my decision to not finish my paper and going to my family instead.
2. Ambiguous emotions	2a. Ambiguous appraisals	I feel both anxiety and anticipation over the prospect of starting a new job.
	2b. Negative and positive emotions resonate and intensify the experience	I feel an intense mix of disgust and fascination over a program depicting open-body surgery.
3. Positive effect of negative emotion	3a. Using the action tendency of the negative emotion	I am angry because I received an unfair evaluation, but it also makes me pugnacious and determined, which I enjoy.
	3b. A negative emotion helps to realize the importance of something	I feel sad over leaving my grandparents after a nice weekend, but it makes me realize how important they are to me.
	3c. Feeling good about overcoming a negative emotion	I feel guilty over telling a co-worker that she is not suitable for a job, but I feel proud that I told her despite my reluctance.
4. Negative effect of positive emotion	4a. Feeling bad about an inappropriate positive emotion	I feel desire over a beautiful but very expensive cup, but that emotion also makes me feel greedy and guilty.

(translated from Dutch). The diagrams give a visual representation of the emotion mechanism of the experience in the intended cluster.

1. Unrelated emotions

The experiences in this cluster involved positive and negative emotions that had no mutual relationship or interdependence, other than the fact that they were evoked by the same situation or object.

1a. Different stimuli (Figure 5)

Although the emotions that made up the experiences in this sub-cluster were elicited by the same situation or object, closer inspection revealed that they were evoked by different stimuli. An example was the experience of one participant with his son's baby stroller: he felt happy that the stroller was so sturdy and convenient in everyday use, yet he felt frustrated and annoyed that the process of folding it up for transport was tedious and complicated. Although both emotions are elicited by the same product, it is clear that they are aimed at different aspects of the product. Another example was when a woman heard her friend announce over drinks that she was going to move to Australia. This made

the respondent feel simultaneously happy for her friend for setting off on adventure (stimulus 1), jealous that her friend was doing this while she was staying home (stimulus 2), and pity that her friend was not going to be around any longer (stimulus 3). In this case, the emotions were all evoked at the same time and by the same announcement, but the actual stimuli were the different implications of the announcement.

1b. Inability to fully experience something positive (Figure 6)

The main stimulus in these experiences was positive, but because the respondent was in some way unable to fully benefit from or enjoy the positive stimulus, they experienced an additional negative emotion. For instance, one respondent was very excited that it was finally sunny outside after weeks of bad weather, but disappointed that she had to stay inside to work. The mixed emotion arose because she was happy with the sunshine coming in through the window, but she would have been even happier if she had been able to go outside.

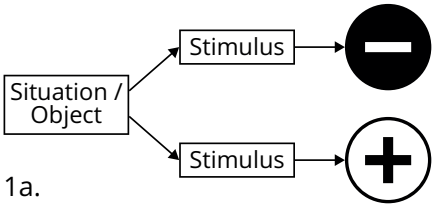


Figure 5: Different stimuli

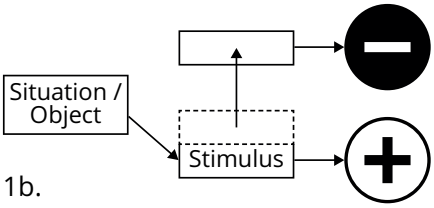


Figure 6: Inability to fully experience something positive

1c. A negative event turned out better (Figure 7)

This sub-cluster is a mirrored version of the previous one: the primary stimulus was negative, but mitigating circumstances subsequently introduced a relieving, positive emotion. For instance, the partner of one respondent received teacups as a present, which the respondent found very beautiful, evoking jealousy. However, later he discovered that they were not very well designed: they had no handle and became very hot with tea inside, making it difficult to drink from them comfortably. This imperfection in the product evoked relief in the respondent, which dispelled some (but not all) of his initial jealousy.

1d. Putting something negative into perspective (Figure 8)

Emotions can also become mixed when someone actively tries to find a silver lining to a negative event, or attempts to put the implications of an event into perspective. This is also an experience of initial negative emotions and a relief afterwards, but instead of a change in the situation or the stimuli, the relief is brought forth by a reappraisal of the situation. For example, a respondent told that she had treated a friend unfairly at one occasion, which resulted in her friend not responding to her text messages anymore. The respondent inferred that her friend was angry with her, which she found exaggerated and unreasonable of her, given the mild indiscretion that she had committed. This idea

made her become angry herself. However, she calmed down after a little while, because she realized that they had been friends for a long time and this incident would not jeopardize their friendship. She forgave her friend for being a bit unreasonable. Finally, she ended up feeling still a bit angry, but also feeling acceptance and affection for her friend.

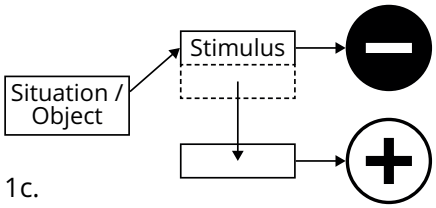


Figure 7: A negative event turned out better

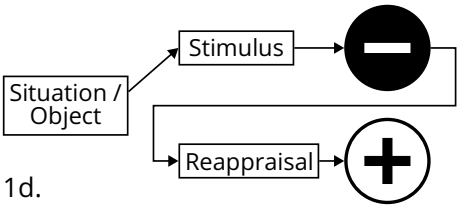


Figure 8: Putting something negative into perspective

1e. Ambivalence (Figure 9)

When people make a decision about something, they consciously or unconsciously weigh the pros and cons of each option. In the simplest situation, there are two choices (1 and 2) and two factors (A and B) that set these choices apart. If A and B are both things that a person wants, but cannot have simultaneously, the choice is between a situation 1 that consists of A and not-B, and a situation 2 that consists of B and not-A. From an emotional viewpoint, people either have a mixed emotion that consists of a reaction to A (positive) and not-B (negative), or a reaction to B (positive) and not-A (negative). One example came from a respondent that was working on an article that should have been finished that day. However, he had agreed to pick up his girlfriend and spend Christmas with her family in two hours, which was not enough time to finish the paper. He decided to keep his agreement (A) and not finish his paper (not-B), which left him with the positive emotion of anticipation of a nice and peaceful time with his in-laws, but also with frustration and anxiety of not meeting his professional deadline.

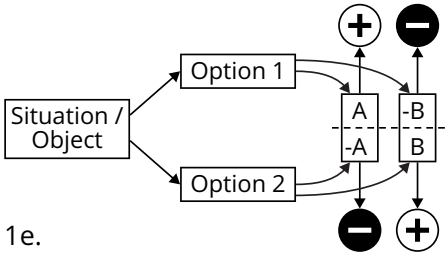


Figure 9: Ambivalence

In all of the above categories of mixed emotion experiences, the emotions are evoked by different stimuli. This has an important implication: the negative emotion and the aspect causing it are simply unwanted elements of the experience, and if they could somehow be extracted from the experience,

the remaining positive emotion would be enjoyed more fully. Thus, in these cases the mixed nature of the emotions does not enrich the situation.

2. Ambiguous emotions

2a. Ambiguous appraisals (Figure 10)

The emotions in the experiences of cluster 1 were elicited by different stimuli. However, it is also possible that different emotions are elicited by the same stimulus. For instance, one participant described how he was looking for a new job, after he was notified that the contract of his former job would soon expire. This situation created a void, which he experienced as simultaneously scary and exciting. It was scary, because he was not sure if he was able to find something interesting in time. However, it was also exciting, because as long as his future job was still undetermined, he could fantasize with anticipation about all the different things he could be doing. The stimulus in this case could be described as 'unknown future' – which can be appraised as an opportunity or as a threat. An important implication is that it is not possible to just remove the negative aspect from such stimuli, as the positive and negative aspects are intertwined. In these cases, it is more important how a person mentally approaches such a stimulus – as a threat or an opportunity, which determines the experiential outcome. However, apart from the most fervent optimists and pessimists in the world, the majority of people will always experience both sides to a certain extent. Some other examples of ambiguous appraisals were: remembering a lost relative (sad over the loss, but simultaneously happy with the good memories); starting a big project (eager to work on it, but simultaneously daunted by all the effort it would be going to take); and taking strong measures against a problem (proud that you dealt with the problem sturdily, but simultaneously feeling troubled that you may have been too severe).

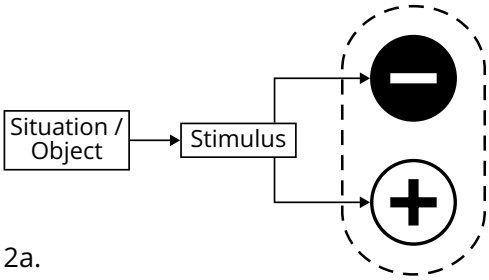


Figure 10: Ambiguous appraisals

2b. Negative and positive emotions resonate and intensify the experience (Figure 11)

An interesting variant within this cluster are the experiences in which emotions with opposing action tendencies, evoked by the different sides of the stimulus, start to 'resonate' with each other. If the action tendencies of the two emotions 'push' a person in opposite directions (sometimes even literally), the emotions can start to build up against each other in an upward spiral, thus intensifying the overall experience. A straightforward example is the description of a respondent seeing a surgical pro-

cedure on television. He described how the graphic images repulsed and captivated him at the same time. He stated: *"It is a bit that feeling of pleasant shivers, you know, so enjoying something that looks nasty. (...) I am seeing that image, and then I see how it is cut open and parts, and I find it very dismal to see, so from that emotion you would want to look away, but at the same time I was very curious, you know, how it would work. So yes, I did not want to look away."* The underlying emotions of this experience, disgust and fascination, pushed him in opposite directions – the disgust demanded him to look away, while the fascination compelled him to keep looking. On a behavioral level, he ended up somewhere halfway – intermittently looking and not looking, or looking through his fingers. This could be conceptualized with the metaphor of two equally large forces pushing against each other. As a net result, they appear to stand still, but between them is a great deal of pressure. This pressure is what makes the experience unique, and what sets it apart from an experience of interest that is evoked by a less controversial program. Another example of this phenomenon was when a respondent was celebrating 'Sinterklaas' (a Dutch tradition resembling Christmas), in which family members anonymously give presents to each other. When the respondent's sister was unwrapping the present he bought for her, he felt a great suspense toward her possible reaction. This suspense consisted of anxiety that she might be disappointed by the present, and anticipation of seeing a positive reaction. This gave him a jittery, nervous energy in which he looked at her unwrapping the present with "pricked-up eyes" and experienced "an alertness kick", which made the whole event more lively and interesting.

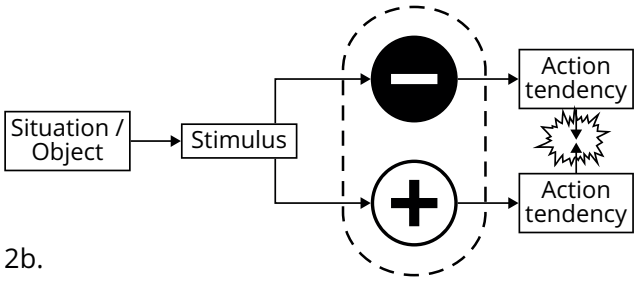


Figure 11: Negative and positive emotions resonate together and intensify the experience

3. Positive effect of negative emotion

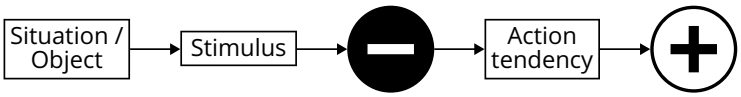
In the third cluster, the negative emotion has a certain positive effect on either the person's experience of the situation, their attitude towards the situation, or their behavior, which in turn leads to a positive emotion.

3a. Using the action tendency of a negative emotion (Figure 12)

Negative emotions have a clear function; they signal us that there is something wrong or harmful in the situation, which we should somehow fix or get away from (e.g., Frijda, 1986). It seems that if a person can effectively use the resulting action tendency of a negative emotion, this can directly or indirectly lead to a positive emotion. Although different negative emotions (e.g., frustration, sadness,

anxiety) have very different action tendencies, this mechanism seems to work in some way for most or all negative emotions. For example, a respondent had to hand in a full paper for his university course within a few hours, but he had almost nothing on paper yet. Even a few hours before his deadline he found it hard to concentrate, and spend most of the time procrastinating. Suddenly, he felt extremely frustrated and fed up with his inability to work properly, which lead him to a surge of rapid and dedicated writing. According to the respondent: *"That frustration lead to a sort of hyperconcentration like 'and now it is going to happen', and then I was really typing like a madman. (...) The focus that sprang from that, it is just, everything falls away from it, like, 'if I want to finish this paper it has to be now', that feeling of that aggressive undercurrent in frustration helps me, a sort of straightforwardly looking only at that [issue]."* After this, he managed to finish the paper just in time.

Another respondent experienced the beneficial effect of a different emotion. He was having dinner with an old friend, who had obtained her Master's degree three years earlier. However, because of the difficult job market, she had not yet found suitable employment and was still working her student job. The sadness and compassion that he felt for her situation caused him to see her as 'helpless' and 'child-like', which made him consequently feel more mature and responsible. This put him in a position where he could comfort her and give her advice, even though he himself was still a student. This resulted in positive feelings of affection towards her, which had been 'dormant until then'.



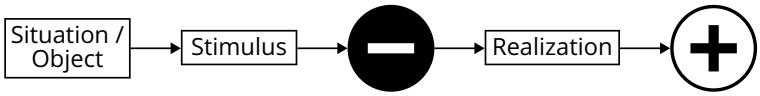
3a.

Figure 12: Using the action tendency of a negative emotion

A third respondent experienced constructive effects of anger. The school where she worked, which was generally considered a very good school by its employees, was being visited by an inspector. On the first day this inspector gave her initial impressions of the school, which were quite negative. This did not go down well with the respondent, who was expecting a positive review. She felt the evaluation was extremely unjust, and felt unapproved in her work. In her reply to the inspector, she could suddenly express very clearly why her school deserved a better judgment: *"At that moment I could very well formulate it, what I thought we are doing well. That went really automatically, I didn't have to think about that. Right now, for instance, I would have a much harder time to do that, yes, because you are in a certain flow then, or something, because it really affects you. At that time, I could really express well why I found it so unfair."* During her speech to the inspector she was very focused, she felt a surge of adrenaline going through her body, and felt very pugnacious and righteous about her cause. All these effects contributed to a thrilling, positive emotion.

3b. A negative emotion helps to realize the gravity or importance of something (Figure 13)

In addition to the action tendency, negative emotions also have an impact on conscious thought. Through the intensity of a negative emotion, a person can gauge how difficult, grave or important a situation is. For instance, one respondent was coming back from a nice weekend with her grandparents, who she does not see often as they live abroad. She felt sad about saying goodbye to them again, but this emotion made her realize how much her grandparents meant to her. On her way back in the car, she talked for a long time to her friend, who had accompanied her on the visit, about the importance of keeping contact with your grandparents, and she resolved to visit them more frequently than she had before.

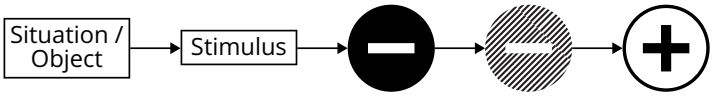


3b.

Figure 13: A negative emotion helps to realize the gravity or importance of something

3c. Feeling good about overcoming a negative emotion (Figure 14)

Mixed emotions can also arise when overcoming a negative emotion. This experience is related to the one in the previous sub-cluster, because the initial negativity of the situation signals how grave or difficult the situation is, thus adding to the feeling of achievement for overcoming it. For example, a respondent was asked by the school to sit in on a meeting to give advice about the employment of a co-worker. This co-worker had been working for the school part-time, but now that another employee was leaving, she wanted to apply to the full-time position. The co-worker sat in the meeting cheerfully, thinking that the meeting was a formality and the job was practically hers. However, the respondent did not think that her co-worker would be suitable to fill the position by herself. When the director asked her for her opinion during the meeting, she felt resistance and guilt to speak truthfully and shatter her co-worker's expectations. Nevertheless, she felt it was her obligation, so she honestly expressed her opinion. After the meeting, her feeling of guilt was mixed with feelings of pride about herself, for being able to be honest and putting the school's interests first. If she had not felt so much reluctance to speak her mind, it would not have felt as an achievement to her. Another respondent made a statement about the satisfaction of physical workout: *"Good, hard exercising and going through that fear or pain threshold, that is really Prozac to me. (...) That cannot fail, mentally, when I go exercising and encounter that threshold, and I persevere, then that will make me happy."* The difference between the experiences in this cluster and those of 1c and 1d, is that here the negative stimulus is faced and dealt with, rather than changing by itself (1c) or being put in perspective as something not important or serious (1d).



3c.

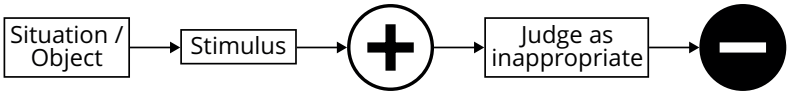
Figure 14: Feeling good about overcoming a negative emotion

4. Negative effect of positive emotion

Negative emotions sometimes have positive outcomes, the opposite is also true: sometimes positive emotions are misplaced and have a negative consequence.

4a. Feeling bad about an inappropriate positive emotion (Figure 15)

People can have a positive emotion, but then regard that emotion as inappropriate and feel bad. For instance, one participant was doing a wall-climbing competition with her friend, and had performed quite well on the particular route. Then, while observing her friend's climb, she felt anticipation and hope that her friend would make a mistake and fall, so that she would win the competition. But soon after, she felt guilty about having these unfriendly thoughts. Another example was from a respondent who saw a beautiful, but very expensive cup in a kitchenware store. He felt an enormous desire to buy the cup, but at the same time felt guilty and greedy, for desiring something that he did not really need.



4a.

Figure 15: Feeling bad about an inappropriate positive emotion

2.5 Discussion and implications for design

The apparently clear-cut distinction between positive and negative emotions is deceptive. Negative is not always unwanted or superfluous. In the analysis we saw cases in which negative emotions actually even feel good. Moreover, there may be aspects of positive emotions that are unpleasant. For instance, after the termination of a relationship, people often express that they do not want to be cheered up right away - they sometimes want to feel the significance of their loss as part of the grieving process. We should also be careful when analyzing emotions outside of the context of the situated experience. Emotions are most of the time experienced in an episode involving multiple and interrelated emotions that evolve and interact with each other, with the events at hand, and with our responses to these events. The positive-negative distinction may be useful as a rudimentary

distinction in everyday conversation, but relying on it in the design discourse obscures opportunities for designing products that evoke rich and, in a way, realistic experiences.

There were some limitations to the choice of research method and its execution in this study. Although a substantial number of experiences were collected, the set of clusters that it produced is probably not exhaustive. For instance, the fourth cluster could have featured a second sub-cluster that is the opposite of 3a: a person feels bad about his own inappropriate behavior, following the action tendency of a positive emotion. For example, a person in a social situation could, encouraged by other people's laughter and general cheerfulness, make a joke that crosses the line and subsequently feel ashamed. Similarly, there could be other sub-clusters (or even clusters) that did not emerge in the current study. Secondly, although care was given that participants were relatively different in terms of background and lifestyle, they were all Dutch natives. This was decided to ensure that the in-depth interviews would not be hindered by a lack of vocabulary or understanding from the participant or the interviewer. Additionally, for practical reasons all respondents were interviewed by the same researcher. These decisions may have introduced cultural and personal bias, which could be solved by carrying out a study in several countries and cultures, with different (native) interviewers. Thirdly, although all ten participants were very cooperative and insightful in recalling their experiences, at some point most of them ran into the limits of their introspective and descriptive power. Some even expressed frustration over their inability to exactly describe the dynamics of their feelings, and were puzzled by the fact that their own feelings were, upon scrutiny, so difficult to describe. However, in general the quality of the results mostly depended on the willingness of participants to openly explore the different sides of their inner life, more than on their intellectual capacities. If a researcher would plan a study that involves a long-term analysis of subjective feelings, perhaps they could adopt a panel of 'phenomenological experts', who are selected for their ability and willingness to analyze and describe their inner life.

We can summarize some key findings about qualities of mixed emotions. First of all, a negative emotion can have a beneficial effect on our thoughts and actions, which in turn can create a positive experience (3a). This means that a designer could attempt to design a product that evokes a negative emotion in the user, while making sure that the beneficial effects of the negative emotion are appropriate and that the overall experience is pleasant. A strategy to achieve this is proposed in (Fokkinga & Desmet, 2012a)[1]. Secondly, certain negative emotions can help people to realize the importance of something (3b), which can be useful in design for behavioral change. Issues, such as environmental responsibility, which are otherwise 'cold' concerns to many people, might become more poignant through the right emotional cues. Thirdly, there are certain life experiences that are emotionally mixed on a fundamental level, such as unknown futures (2a). These kind of ambiguous stimuli can feel more unique and 'realistic' than those that evoke only (moderately) positive emotions. Ersner-Hershfield and colleagues (2009) investigated the ambiguous appraisal of a 'meaningful ending', which they

1 *Chapter three of this thesis*

called a phenomenon with a 'bi-valenced nature'. They found meaningful endings to evoke a mix of sadness and happiness. Fourthly, a negative emotion and positive emotion can be intertwined in such a way that their opposing thought-action tendencies clash, thus creating invigorating experiences (2b). The same phenomenon has been observed in art: "*Few, if any, pleasurable experiences match the intensity of our reactions to painful art*" (Smuts, 2007, p. 72). Apparently, stimuli that are partly 'painful' evoke a reaction of an intensity that neutral or positive stimuli simply cannot attain. This can be useful for products that have to attract a lot of attention, or in a situation where it is appropriate that people become energized for action. Fifthly, a negative emotion can be seen as an obstacle to overcome, after which the resulting experience is more positive than it was before (3c). It is clear that in this experience, as well as in some others (1c, 1d and 4a), the dimension of time is crucial. When designing such product experiences, it is important that the designer is conscious of and has control over the progression of events in time, like the storyteller of a narrative. One requisite is probably that the final or concluding feeling in the experience should be positive, as is the case in sub-clusters 1c and 1d, and in clusters 2 and 3 (but not in cluster 4). The emotional design of product narratives might prove to be a very interesting and worthwhile new direction of research. Examples of narratives that were deliberately designed with mixed emotions are scarce, but some activities have evolved in a way to make use of them. For instance, the many mixed emotional experiences people go through in military initiation rites, like shared hardship and humiliation, can lead to a much greater sense of bonding and togetherness. In movies, a similar mechanism compels audiences to empathize with the main character after 'together' going through hardships with him or her (Tan, 1996).

Another design-relevant issue is that cultural and personal differences influence the tendency of an individual to enjoy mixed emotions. For instance, Williams and Aaker (2002) showed that both older people and people from an Asian background (as opposed to younger people and people with an Anglo-Saxon background) had a preference for an ad that evoked a mixed emotion (of a type that we would put in category 2a) over one that was purely positive. Hong and Lee (2010) found that the abstraction level at which people mentally represent information determines for a large part their liking for mixed emotions. Comparing higher-level abstraction thinking (e.g., thinking of vacation as having a good time and enjoying life) with lower-level abstraction thinking (e.g., thinking of vacation as lying on the beach with a cold drink), people in a higher level responded equally or more favorably to mixed emotion appeals than to positive appeals, whereas the obverse was true for people in a lower level. The rationale behind it is that abstraction introduces a psychological distance, which moderates the conflict of the mixed stimulus. Importantly, a person's abstraction level is partly a personal trait, but can also partly be influenced by certain triggers, for instance asking someone to imagine what life will be like a year from now (rather than tomorrow, see Foerster, Friedman, & Liberman, 2004). Apter's (2007) concept of the protective frame proposes a related mechanism – enjoying negative emotions by introducing psychological distance. In (Fokkinga & Desmet, 2013)[2], we discuss how protective frames can be used in design.

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2 Chapter five of this thesis

Summing up, we think that there are several ways in which mixed emotions are interesting and worthwhile for designers and design researchers to explore, each creating product experiences that are interesting and unique in their own way. Rich emotional experiences are experiences that feature both a positive and a negative emotion, which are either causally related (cluster 3) or mutually dependent (cluster 2).

The (sub-)clusters should bring some clarification in the forest of emotional experiences, so that designers have a better idea which type of mixed emotion works best for their purpose.

3 :.

A FRAMEWORK OF EMOTIONALLY RICH PRODUCT EXPERIENCE

All art is immortal. For emotion for the sake of emotion is the aim of art, and emotion for the sake of action is the aim of life.

— Oscar Wilde

The previous chapter discussed what types of life experiences can be called rich, and how they originate from different constellations of mixed emotions. However, this discussion did not yet uncover how rich experiences could be deliberately induced – in general or through design in particular. Furthermore, the previous chapter did not investigate what the influence of different specific emotions is on the type of rich experience. The current chapter intends to shed light on these questions, by analyzing product examples and explicitly considering the contribution of negative emotions to rich experience. First, a number of existing products that evoke rich experiences are discussed, under the observation that they are part of 'critical design'. Different existing explanations of why people seek out negative emotions are discussed, and a new explanation is proposed, based on insights of emotion psychology. The concept of the protective frame is introduced, which explains under what condition negative emotions can be enjoyed, and elaborates four types for application in product interaction. Based on these concepts, a framework is introduced that proposes how rich experiences can be created. This framework is subsequently used to analyze six product examples.

This chapter was previously published as: Fokkinga, S. F., & Desmet, P. M. A. (2012). Darker Shades of Joy: The Role of Negative Emotion in Rich Product Experiences. Design Issues, 28(4), 42-56.

3.1 Introduction

Imagine you are moving to a new city. What emotions would you experience? You might feel sad about leaving your family and friends. At the same time, you might also feel hopeful about the opportunities awaiting your new life, joy over the prospect of exploring your new city and meeting new people, and anxiety about not knowing anyone yet. The combination of all these different emotions makes the transition a complex but rich experience that you will long remember.

Several authors in the field of user experience and interaction design have expressed the opinion that product experiences should mirror the richness of these kinds of real-life experiences. Hassenzahl (2010, p. 31) recently suggested that product experiences should be *"worthwhile"* or *"valuable"* to avoid the pitfall of shallow amusement in experience design. Likewise, Arrasvuori, Boberg, & Korhonen (2010) investigated the possibilities of translating the wide range of emotions in video games to create more engaging consumer products. With their concept of "design noir," Dunne and Raby even proposed a new genre of design to complement the prevailing "Hollywood" tradition of products that offer a limited experience. They proposed that design noir "could enrich and expand our experience of everyday life rather than closing it down"(Dunne & Raby, 2001, p. 45). Although working in different research traditions, these authors share the underlying view that engaging product experiences should go beyond simplified assumptions about people, acknowledging the complexity of their desires and behavior.

This view is illustrated by a number of interesting design examples. Dunne and Raby (2001, p. 63) discussed the "Life counter" by Ippei Matsumoto (Figure 16). This digital clock-like product lets users decide how many years they would like to live and then starts counting back. Once activated, the different sides of the product display the number of years, days, hours, and seconds they have left,

Figure 16: Life Counter (Photo by Hidetoyo Sasaki)

Figure 17: The Tyrant

respectively, which forces the user to choose whether to see the years of their lifetime dragging on, or the seconds flashing before their eyes. Another example is Alice Wang's "The Tyrant" (Figure 17), as described by Hassenzahl (2010, p. 29). This alarm clock wakes the user, not by sounding an alarm, but by calling random people from the user's address book every three minutes after the wake-up time. The daunting prospect of bothering random acquaintances is expected to motivate users to get out of bed. Gaver et al. (2004) designed "The Drift Table" (Figure 18), a coffee table with a small hole in the middle that reveals a satellite view of England's countryside. This view floats in a certain direction, corresponding to the arrangement of physical objects on the table. Thus, as more weight is put on a certain side of the table, the image shifts more quickly in that direction. The idea is that the interaction with a product that lacks both clear functionality and direct controls enables the user to have a more open and exploratory experience.

These products clearly illustrate the aim to avoid the pitfall of shallow amusement mentioned by Hassenzahl (2010, p. 29). We believe they do so because they evoke a larger spectrum of emotions than more conventional products. In particular, besides evoking positive emotions, they also elicit several negative emotions. For instance, the "Life Counter" has a pleasantly sinister or morbid quality, provoking emotions of mild horror, anxiety, and sadness. "The Tyrant" clearly tries to evoke shame in users for bothering random acquaintances with their problems in getting up. Furthermore, the anticipatory fear that the product will actually do this is a strong incentive for users to get up. Lastly, "The Drift Table" was purposefully designed to conceal a clear intention of use, and to restrict users in the way they could control the table. Both these design decisions can elicit frustration and annoyance in users, as the researchers also encountered with testers of the device (Gaver et al., 2004, pp. 897-898).

Regarding negative emotions as a key element of rich product experiences, instead of an unwanted side effect of product interaction, may seem unconventional. However, in the domains of art and entertainment, which offer rich experience par excellence, this idea is commonly accepted. Creators

Figure 18: The Drift table (Photo by Interaction Research Studio, University of London)

of novels, plays, films, and music have always used negative emotions to delight their audiences. This intent may be most obvious in the enjoyment of extreme experiences, such as horror movies (anxiety, disgust), shock art (indignation, embarrassment), or rollercoasters (fright), but the effect should not by any means be regarded as a peripheral phenomenon. In fact, any narrative construct—be it written fiction, theatre, or film—contains setbacks and hardship for the protagonists to overcome. A story without any antagonists or dramatic tension is considered "emotionally flat" and will not be very enjoyable (Zillmann, 1995, p. 48). Similarly, video games can be regarded as a series of obstacles that elicit frustration and aggression in the player, which have to be resolved in succession. Lastly, people enjoy listening to gloomy music that makes them sad, and in fact regularly prefer it over cheerful music (Vorderer & Schramm, 2004, pp. 392-393). In other words, negative emotions are a principal part of all these cultural products.

In this paper, we focus on the questions of whether and how the experience of mainstream consumer products—like chairs, smartphones, and copy machines—can also be enriched with negative emotions. The three examples already described are interesting, but they are not intended to become mainstream products; they are part of "critical design," as Dunne and Raby (2001, p. 58) termed it. This "haute couture" type of design mainly aims to comment on the way people use and co-exist with products in our society, in order to inspire other designers in the process. Thus, although critical design offers designers an incentive to create rich experiences for product users, it does not offer an explicit approach to achieve this effect in "non-critical," everyday products. We are especially interested in understanding why, when, and how negative emotions can contribute to richness in everyday product experiences.

In contrast, the design and emotion research domain has produced several practical, experience-driven design approaches, mostly based on psychological and sociological theory[1]. These approaches have supported designers in creating pleasurable product experiences. However, they do not help us in understanding how negative emotions can enrich these experiences: They detail the nuances on the product side of the interaction, but mostly ignore the nuances on the user side—the question of which emotional experiences are actually enjoyable in the specific context of use. As a consequence, designers still rely primarily on the basic assumption that all positive emotions are pleasant, and thus suitable for product experiences, while all negative emotions are unpleasant and thus unsuitable for design.

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1 *For an overview of such design approaches, see Desmet and Hekkert (2009). Examples of approaches based on psychological and sociological theory include the following: Jordan (2000) used the pleasure framework of Tiger (1992) to suggest four sources of product pleasure; Desmet (2008) used the appraisal theory of Ortony, Clore, and Collins (1988) to propose nine sources of product appeal; and Norman (2004) proposed three layers of pleasurable product experiences on the basis of a neurobiological framework.*

Clearly, we challenge this assumption and propose that designers can enrich product experiences by explicitly involving negative emotions in the user–product interaction. To explore this proposition, we examine what motivates people to willfully engage in activities that evoke negative emotions, and the conditions under which these negative emotions are enjoyable[2]. We first discuss three existing explanations. Although these theories explain why people seek out negative stimuli in some cases, they cannot explain all such cases, nor do they explain why the resulting negative emotions are sometimes pleasurable. We therefore propose an alternative view that consists of two ingredients. The first is that people seek out negative emotions because such emotions transform their perception of and attitude toward a situation. The second is that people can actually enjoy this transformation if they experience it through a protective frame. With these two ingredients in place, we propose a framework of rich experience that explains the conditions under which negative product experiences can be enjoyable. Finally, we explain how this framework can explicate the richness of "critical design" experiences and enable designers to apply this kind of thinking in a systematic way, in mainstream products. In the last section, we discuss some implications of creating rich experiences with negative emotions, as well as some limitations of the framework.

3.2 Existing explanations of why people seek out negative emotions

Psychologists have long debated why people willingly expose themselves to negative emotions, like those experienced in art and entertainment, but also in activities like physical exercise or parachuting. This debate has generated three main explanations: the utilitarian explanation, the aftermath explanation, and the intensity explanation.

The utilitarian viewpoint is probably the most obvious explanation: People engage in activities that evoke negative emotions not because they enjoy them, but because they expect these activities to be beneficial in the long run. For instance, people who have a fear of flying may still board an airplane, in spite of their fear. They suppress their fear because they want to reach their destination as quickly as possible. Similarly, people overcome their reluctance to engage in physical exercise because they hope to become healthier and slimmer. This view enables us to explain why people buy clock radios with shrill alarms: Although the alarm sounds unpleasant, the sensation of distress is the only reliable means to awaken them. However, the important limitation of this view is that it fails to explain activities or experiences that have no other purpose than to entertain. How would someone expect to be better off riding rollercoasters or watching horror movies?

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2 *Although we see subtle differences between the words "enjoyable" and "pleasant" (e.g., enjoyable has a connotation of something actively entertaining, whereas pleasant seems to refer to stimuli that are more passively agreeable to the senses), these terms are used interchangeably throughout this paper for purposes of readability.*

The aftermath explanation proposes that negative emotions in experiences are taken for granted because they make the ensuing positive emotions more enjoyable. For instance, it proposes that a parachute jumper only enjoys the moment after the jump, because it compares pleasantly to the fear she experienced before jumping and while in the air[3]. This logic also can explain why we willfully spend our Sunday afternoon mowing the lawn: The mowing itself is not what we enjoy, but the satisfaction of having the job done. In fact, the taller the grass, the more tedious and thus satisfying the job will be. Although plausible, this view also has limited explanatory power. Parachutists and horror movie viewers do not seem happy only when the activity is over; they also express enjoyment in the activity itself. This observation is supported by the experiments of Andrade and Cohen (2007), who measured the amount of positive and negative affect in people before, during, and after watching a horror movie. The results showed that fans of horror movies experience negative emotions throughout the movie, together with positive emotions. Furthermore, Andrade and Cohen detected no aftermath effect in this group; they showed neither a decrease in negative emotions, nor an increase in positive emotions directly after the movie.

The intensity explanation, put forward by Zuckerman (1996, pp. 157-159), states that certain people are able to enjoy activities like parachuting because they can successfully inhibit the accompanying fear. To these so-called sensation seekers, the activity is not really frightening anymore—just pleasantly arousing. This effect explains why some people are interested in products like racing bikes: They have learned to ignore the dangers that would deter other people from using them. The same mechanism is proposed to play a role in the enjoyment of horror movies: Fans of the genre have learned to inhibit their disgust and anxiety and simply enjoy their arousing effects. Andrade and Cohen (2007, p. 285) point out a flaw in this line of thinking: If people enjoy parachuting only after learning to inhibit their fear, they argue, why do they begin doing it in the first place? Their experiments show no difference in the amount of fear experienced between fans and non-fans of horror movies— only that the fans experienced more joy while watching. In fact, Andrade and Cohen (2007, p. 292) observed a positive correlation between the negative and the positive emotions: "*[Horror fans] not only experienced "opposite" affective states at the same time, but the most fearful scenes were clearly perceived to be the most pleasant ones*". This conclusion is particularly noteworthy for our current investigation because it highlights a key limitation of all three existing explanations: They all start from the false assumption that negative emotions are fundamentally and therefore always, unpleasant.

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3 For instance, this line of reasoning can be found in theories of Soloman and Corbit (1974) and of Zillman (1980, pp. 146-150); or in the "Law of Affective Contrast" from Frijda (2007, p. 11), which states that "[l]oss of misery yields not a sense of normality but positive happiness."

3.3 Alternative explanation of why people seek out negative emotions

We propose an alternative explanation that in contrast is based on the assumption that negative emotions can also be enjoyable. The key concept in our explanation is "subjective transformation." People seek out negative emotions because they produce specific bodily and mental effects, which together transform their perception of, and attitude toward, the situation. This concept of transformation is inspired by Sartre's phenomenological conception of emotions, but it is also grounded in contemporary psychological understanding of emotion. We explain the proposition step-by-step through its four main components: (1) bodily and mental effects of negative emotions, which are (2) emotion-specific, lead to (3) transformations of perception and (4) transformations of attitude.

Bodily and Mental Effects of Negative Emotions

The idea that emotions have bodily effects is undisputed. For example, fear increases the heart rate, which helps the individual to move and act more quickly in case of danger. Recent research has also uncovered mental effects of different emotions: Negative emotions change people's attention, thoughts, memory, imagination, judgment, needs, and behavior. For example, fear not only increases arousal, it also has been shown to have other effects:

- It gives people a narrower field of attention (Derryberry & Reed, 1998).
- It improves visual contrast sensitivity (Phelps, Ling, & Carrasco, 2006).
- It causes people to experience time as passing more slowly (Tipples, 2011).
- It influences people's ability to estimate sizes of objects and distances (Teachman, Stefanucci, Clerkin, Cody, & Proffitt, 2008).
- It brings back memories of previous dangerous situations (Bower, 1981).

Emotion-Specific

Negative emotions have different sets of bodily and mental effects. The effects of sadness, for instance, differ strongly from those of anger[4]. Several studies have shown that certain negative emotions even have opposing effects. For example, Lerner and Keltner (2000) demonstrated that whereas fear caused people to estimate that real-life risks (e.g., natural disasters or brain cancer) are more likely to occur than they are in reality, anger caused them to assess the same risks as less likely to occur than they actually are. Another study showed that participants who experienced disgust became much sterner

4 *This distinction may seem self-evident, but the common practice in empirical studies for many years was to look at the effects of all negative emotions together, under the umbrella term of "negative affect." A number of researchers have recently started to study the differentiated effects of negative emotions in experiments and found widely diverging results. For a discussion, see Lerner and Keltner (2000, pp. 474-476).*

in their moral judgments of other people's bad behavior in stories, compared to the neutral control group (Schnall, Haidt, Clore, & Jordan, 2008). Sad participants became slightly less judgmental than the neutral group. Different negative emotions also can have opposing effects on which activities people prefer: When presented with ads for holiday resorts, sad people (i.e., those who had previously read a magazine article inducing sadness) preferred an ad that highlighted the relaxing nature of a particular resort, while angry people (i.e., those who read a story inducing anger) preferred the ad that promoted the active aspects of the same resort (Rucker & Petty, 2004). These examples illustrate just a few effects of a few specific emotions. A complete overview of all such effects for every emotion does not yet exist, as this area of research is just emerging. Future studies eventually could map the whole range of effects that each emotion produces.

Transformation of Perception

From a functional point of view, the effects previously discussed can be understood as useful responses that help people to survive (e.g., see Lazarus, 1991, p. 84). In case of fear, the narrowed field of attention helps the frightened individual to single out the actual threat from the side issues; the memories of previous dangerous situations help the individual to find a solution for the current predicament; and the experience of time moving more slowly increases the individual's ability to identify and process a solution. However, from a phenomenological point of view, these effects also have a significant effect on a person's subjective experience of the situation. Consider fear again: The sudden focus of attention, the memories of past frights, and the feeling that time is standing still are all significant deviations from neutral, everyday experiences. Moreover, this change is not experienced as a set of separate or sequential effects, but rather as a holistic transformation that makes perceived objects, people, and events take on a different meaning. This view is inspired by Sartre's phenomenological conception of emotion, which he described as magical transformations of the deterministic and factual world into subjective reality (Sartre, 1939/1962, pp. 39-40). To grasp how this "magical transformation" can be described, consider the following metaphor of a frightening event. If subjective perception is like a theatre stage, fear would abruptly change the arrangements and stage lighting so that only a few crucial objects or actors are illuminated, in a way that reveals a new side of them in vivid detail. These objects and actors would seem to stand still for a moment, although they are all turned toward the person experiencing the fear because she plays the pivotal role in this arrangement. Other emotions could be described by different arrangements of the same metaphor.

Transformation of Attitude

These specific changes of attention, expectations, judgments, and preferences also influence a person's attitude toward the situation. The word "attitude" here means one's subjectively experienced disposition toward events, people, and objects (summarized as "the world"). For instance, a person who becomes angry has an increasingly assertive, empowered, and risk-taking attitude toward the world. Sadness, on the other hand, results in a more calm, sensitive, and reflective attitude toward the world. This idea of transformed attitudes is similar to Frijda's concept of the action tendency, which is people's tendency to behave in a certain way under the influence of an emotion (Frijda, 1986). The

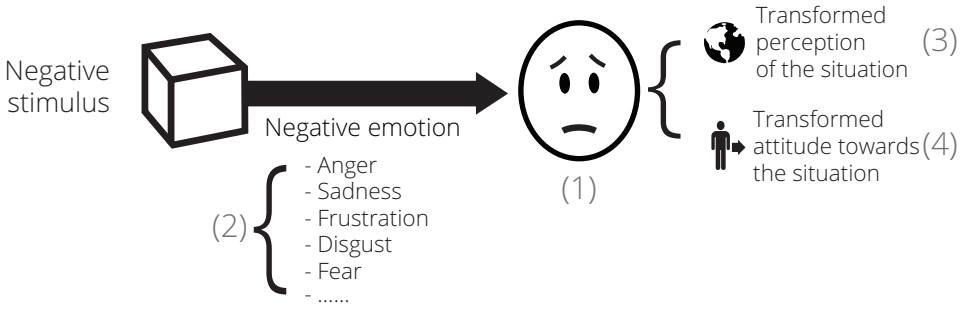

Figure 19: Process of subjective transformation

difference between attitude and action tendency is that the latter is a behavioral concept, described with objective terms such as "approach," "avoidance," "inhibition," and "activation." Attitude, on the other hand, refers primarily to individuals' subjective account of their disposition to the world, and transformations of attitude are first and foremost felt changes. Tamir and Ford (2009) used action tendency to explain why people performed better in certain games when emotions were induced beforehand that corresponded to the type of game. For instance, angry people performed better in a confrontational game, while frightened people performed better in a threat-avoidance game. This improvement in performance did not occur when participants had a non-corresponding or neutral emotion before the game.

To summarize, we propose that every negative emotion has a different combination of bodily and mental effects, which holistically generate a unique transformation of subjective perception and attitude (see Figure 19). In our view, this transformation is what makes the negative emotion potentially refreshing, enchanting, empowering, exciting, or profound—and thus worth experiencing. The transformation is either a welcome change from the status quo—for an agreeable person to get angry once in a while is refreshing—or the right attitude at the right moment can help deal with a situation—someone who has to undergo an intimidating job interview feels more assertive and focused if she is a little angry.

3.4 The enjoyment condition

The question remains as to whether negative emotions can also be pleasant, and if so, under which circumstances. For instance, when someone with a fear of heights looks down from a tall building, he might also have a lively experience and a highly focused and energized attitude, but he is not necessarily enjoying himself.

Figure 20: Representation of the safety-zone frame

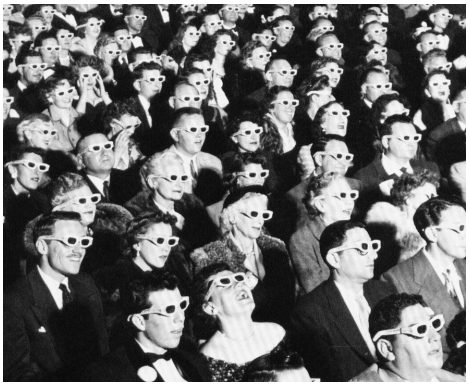

Figure 21: Representation of the detachment frame

Michael Apter (2007) was one of the first authors in psychology to theorize that negative emotions have pleasant counterparts, which he called "parapathic emotions"[5]. Apter proposed that one of the most important factors that causes people to enjoy negative emotion is the presence of a "protective frame." This frame is the mental construct that enables people to create a certain psychological distance between themselves and the object of their emotion. For example, consider an encounter with a hungry lion. If the lion is unrestrained, it will arguably elicit only fear in the unfortunate person encountering it; on the other hand, if the lion is in a cage (but still clearly visible and audible), the encounter can elicit an enjoyable thrill. This example can be used to highlight two important features of the protective frame. First, the protective frame (the cage) converts the negative experience (fear) into an enjoyable experience (thrill), but it does not diminish or take away the negative emotion itself. The fear is necessary for the situation to be enjoyable; a cage without a lion would just be dull. Second, the protective frame is not a physical but a psychological construct, which means that the determining factor is not whether the person is, in reality, safe but whether she believes that she is safe[6]. Apter originally proposed three different types of protective frames: the detachment frame, the safety-zone frame, and the confidence frame (Apter, 2007, pp. 50-53). After considering how these frames might apply to product design, we recognized that the confidence frame is better termed the "control frame" to make it more suitable for product interaction[7]. In addition, we added a fourth frame to account for a wider range of applications: the "perspective frame". We explain these four protective frames in the following paragraphs.

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5 *For example, he proposed that, apart from the well-known unpleasant anger, "anger" (in quotation marks) can also be "the kind of devilish glee one might experience while being objectionable in some social setting, or the mischievousness one might feel in getting one's own back in some underhand way, or the joyous hate one experiences towards the villain in a cowboy film." See Apter (2007, p. 119).*

6 *For instance, if the lion is in an enclosure that is imperceptible, a person standing next to it will not be enjoying the situation, even if she is actually safe*

7 *We revised this terminology because "confidence" is a psychological state that cannot directly be manipulated by design, whereas the amount of control that the user has over a certain interaction is a designable aspect.*

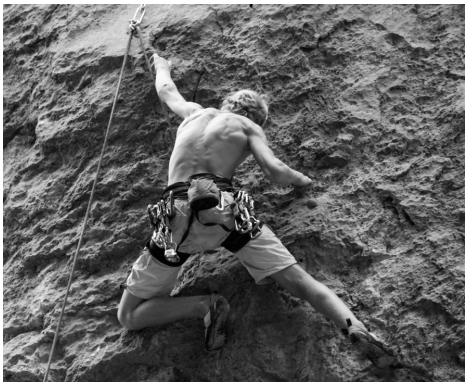

Figure 22: Representation of the control frame

Figure 23: Representation of the perspective frame

The safety-zone frame (Figure 20) arises when a person perceives a negative stimulus in her direct environment but feels protected from it. The lion in the cage is a typical example; people can enjoy the awe and terror of being close to a lion if they believe they are safe at the same time[8]. Note that this protecting barrier does not have to be a fixed enclosure. A child who finds a dead bird might be reluctant to touch it with her hands, but poking it with a stick can elicit the right mix of horror and safety. Wearing rubber gloves can provide a similar protective frame. A safety-zone frame can also be achieved through spatial distance. For instance, someone can enjoy the thrill of standing on a cliff as long as he is far enough from the edge.

A detachment frame (Figure 21) lets people observe an event without participating in it, as occurs in the experience of novels, films, and plays. Through this frame, people are dealing with a representation of a negative stimulus rather than the stimulus itself. For instance, watching a movie scene about a fighting couple might be an entertaining experience, whereas it would be unpleasant to witness in real life. A detachment frame can manifest in different forms, including abstraction (e.g., reading about the number of victims of a disaster rather than seeing photographs of them), simplification (e.g., a line drawing of a wound rather than a photograph), stylization (e.g., a beautiful picture of a collapsed building), and exaggeration (e.g., violence ad absurdum in a slasher film).

With a control frame (Figure 22), people have a certain amount of control over the interaction with the negative stimulus. Although they are actually in the danger zone, they trust they have the skills to keep themselves from trauma. For instance, a first-time driver might feel terrified when driving on the highway, but a skilled driver, who is running comparable risks, is much more at ease. Types of control that people potentially have in a challenging situation include physical skills (e.g., the user is strong/

8 *This example also shows that the feeling of trust is often a necessary aspect in the experience of a safety-zone frame. People can only feel safe from a lion behind a barrier if they can trust the barrier was well-constructed.*

fast/agile enough to deal with the situation) and mental skills (e.g., the user is smart/ knowledgeable/ skilled/creative enough to deal with the situation).

The perspective frame (Figure 23) changes the meaning of the experienced emotion by providing a window to the wider implications of the situation. This frame connects the negative stimulus to a universal human theme. For example, people who participate in a charity run might experience fatigue and pain, but the realization that they are doing it for a good cause can convert these sensations into feelings of benevolence. Other examples of such universal human themes are loyalty (e.g., "taking one for the team"), self-actualization (e.g., observing one's own progress in mastering a difficult skill), patriotism (e.g., standing in the rain to raise the flag), or diligence (e.g., giving up free time to finish work).

3.5 Rich experience framework

With the addition of the protective frame model, the process of subjective transformation (see Figure 19) can be completed to create a "rich experience" framework (see Figure 24). In this framework, the negative emotion produces the subjective transformation, while the protective frame makes the experience enjoyable. The complete process can be described as follows: Something happens (negative stimulus), which causes a person to have a specific negative emotion (e.g., anger, sadness, etc.). This emotion transforms both that person's perception of the situation, and her attitude toward the situation. Finally, a protective frame around this negative stimulus must manifest in one of four different forms for the person to enjoy the experience.

By distinguishing three components of rich experiences (negative stimulus, protective frame, and subjective transformation), the framework enables us to explain a wide variety of product experiences that are enjoyable while involving negative emotions. Six examples follow that illustrate some of this variety of experience.

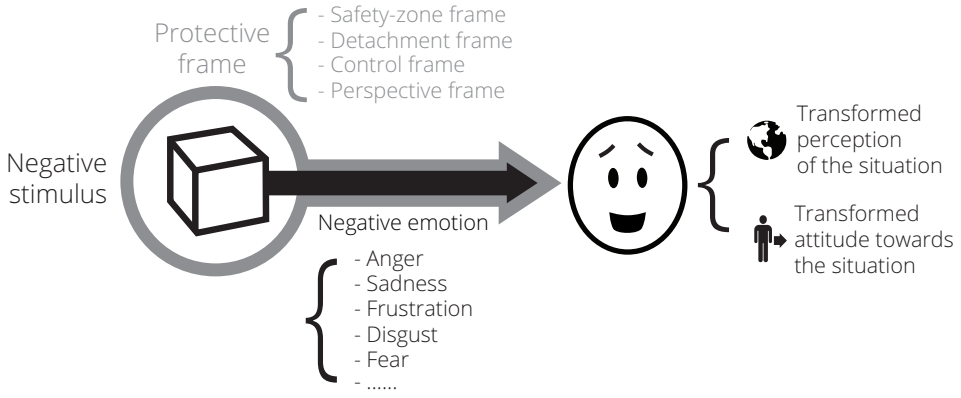

Figure 24: The Rich Experience framework

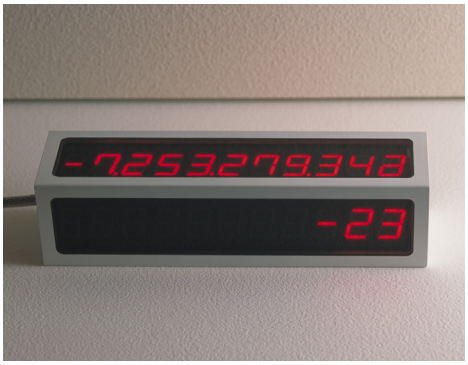

Figure 25: Life Counter (Photo: Hidetoyo Sasaki)

Figure 26: Motorcycle

Life Counter

The framework can be used to analyze the previously discussed life counter, which counts back the time its user still has to live (Figure 25). This product can potentially evoke a mix of horror, anxiety, and sadness, which pulls people out of their everyday flow of thoughts and adds a sense of mystery and contemplation. The main protective frame for this product is the perspective frame: The sad or anxious feelings are accepted because they lead the user to reflect on his or her mortality. Secondarily, the user's choice between different time displays (years, days, hours, and seconds) provides a control frame because the user has control over the type or level of negative emotion experienced. The relatively static display of time-in-years may evoke mild feelings of sadness and resignation, while the display that shows the user's life shorten every second might primarily evoke anxiety or distress.

Motorcycling

Although all forms of road use come with a certain risk, motorcycling is considered particularly dangerous (Figure 26)[9]. This fact does not seem to deter people from riding motorcycles. On the contrary, the design and marketing of most motorcycles emphasize thrill, power, and speed, rather than safety. The main emotion in these aspects of motorcycle riding is fright. This form of immediate fear is highly stimulating, allowing people to feel that they live in the here and now, as an enjoyable alternative to the everyday tedium or routine. The main protective frame in the enjoyment of riding a motorcycle is the control frame. Motorcyclists need to feel that they are under control of the situation, which is expressed in product characteristics like maneuverability, braking response, and physical feedback. In a second protective frame, safety accessories such as helmets and crash bars provide a safety-zone frame by limiting the consequences of a possible crash.

9 *The NHTSA Traffic fact sheet 2008 states: "Per vehicle mile traveled in 2007, motorcyclists were about 37 times more likely than passenger car occupants to die in a motor vehicle traffic crash and nine times more likely to be injured [in the United States]." http://www.nrd.nhtsa.dot.gov/Pubs/811159.pdf (accessed August 16, 2011).*

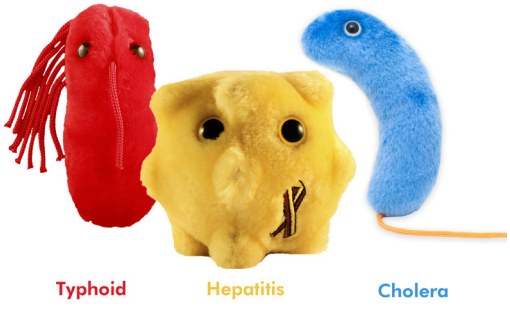

Figure 27: Giant Microbes: Typhoid, Hepatitis and Cholera Dolls (© Giantmicrobes, Inc.)

Figure 28: Spicy food

Giant Microbes

The company Giantmicrobes, Inc. makes cuddly plush toys that are representations of microbial diseases like cholera, hepatitis, and herpes (Figure 27). These toys evoke an inherent contradiction of attraction and repulsion, which makes them stand out in a large and saturated market. By evoking disgust, they manage to draw attention and spark children's imagination. In this case, a detachment frame makes the experience enjoyable, as the children are only playing with representations of harmful diseases.

Spicy Foods

Negative emotions can also be enjoyed on a basic, sensory level, in the experience of pain. Even though the sensation of eating very spicy chilies can be very distressing and uncomfortable (Figure 28), some people enjoy this experience and even try to push the limits of how much pungency they can withstand. This behavior is paradoxical because the pungent substance that is excreted by chili plants is actually meant to prevent mammals from eating them (Tewksbury & Nabhan, 2001). Two protective frames play a role in the enjoyment of spicy foods: the control frame and the perspective frame. The control frame is relevant because the person has control over the speed and amount of food intake. The perspective frame comes into play whenever the person eating the spicy food can connect the pain he is enduring to ideas of personal perseverance and resistance.

Glass Balcony

The Willis Tower in Chicago features three glass balconies at the one-hundred-third floor that offer visitors a unique experience (Figure 29). Part of this experience is the panoramic view of the city, but the more intense anxiety stems from the sensation of standing on "thin air," which certainly adds suspense and novelty. The protective frame is a safety-zone frame. Visitors trust that the people who are responsible for the balcony have ensured the safety of the experience.

Figure 29: Glass balcony at the Willis tower

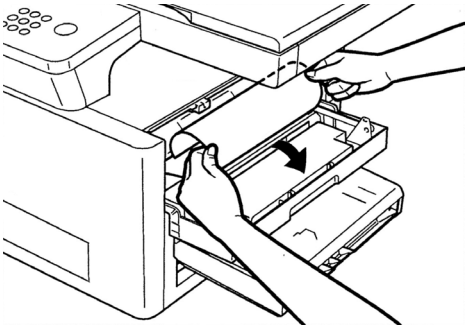

Figure 30: Printer problems

Printer Problems

Sometimes products can provide rich experiences through interactions that are unintentional or even unwanted by the manufacturer. Consider a user who sends a digital document to a printer but discovers that the printer has a paper jam (Figure 30). The subsequent scavenger hunt to find the stuck piece of paper can evoke frustration. However, if the user is not in a terrible hurry and has an idea about how to resolve this issue, the experience can actually be enjoyable. The frustration has the ability to make the person more determined and focused on resolution, and it adds a sense of accomplishment afterward. The enjoyment condition is a version of the control frame: The user must believe that she still has options to try or steps to follow. When the user feels that she has tried everything and the printer is still unresponsive, the protective frame fails and the enjoyment will cease.

These examples illustrate that different rich experiences involve different constellations of the three key components described in the framework. They also illustrate that the substantial differences in people's experiences of situations that involve negative emotions are explained by the subjective nature of the protective frame. For some people, the thick glass bottom of the Willis Tower's balcony provides a safety-zone frame; for others it does not. The first group is excited, and the second is plain fearful. A mild chili sauce is boring for some and exciting for others.

3.6 Discussion

We are interested in understanding how design can provide users with rich product experiences – experiences that go beyond one-dimensional pleasure. Our ultimate goal is to offer designers tools to compose rich palettes of emotions for their product experiences, drawing from the large set of potentially enjoyable positive and negative emotions. This paper represents a first step by introducing a framework that describes the conditions under which negative emotions are pleasurable. The next steps are to formulate practical design strategies and to extend the framework to enable more

fine-grained distinctions. For example, for design applications, more information must be generated about the specific transformations (of both perception and attitude) of different negative emotions. Because product experiences are, in essence, dynamic, the framework should ideally also include the element of time (Hassenzahl, 2010, p. 31). Rich experiences are not just for people with an eccentric taste or for thrill-seekers; just as everyone enjoys some form of art and entertainment, everyone can enjoy rich product experiences. However, exploring cultural and individual differences in the level of engagement and acceptance of rich experience products might also generate valuable insights. For instance, initial indications are that both elderly people and people of eastern descent are more appreciative of mixed emotions, at least for an experience that includes sadness (Williams & Aaker, 2002). In addition, young people may be more inclined to engage in thrilling activities that involve emotions like fear and disgust. Ideally, as more details and the element of time are incorporated, the framework can expand to become a tool that enables designers to create rich experiences in a way that is similar to writing stories: They can carefully plan different emotional narrative elements through time to compose a holistic and meaningful experience.

Rich experience design potentially offers at least three benefits. First, it can add engagement, refreshment, or meaning to situations that are generally boring or void of meaning. Second, it can make use of the specific effects of negative emotions on attitude to stimulate people toward engagement in activities in which they otherwise would not engage. Note that this effect also has a dark side: Products that are designed to make use of protective frames (e.g., cars with many airbags) might induce reckless use or behavior because they provide a sense of safety that overshadows the actual risk. Third, and perhaps most important, it can result in strategies for situations that will always have some negative aspect, including hospital visits, waiting in line, traffic jams, and air travel. For example, consider the printer situation already described. Printer designers most likely do not intend to evoke negative emotions. However, even in this case, understanding how to use the concepts of protective frame and transformation offers opportunities: If taking away the negative stimulus is not possible (i.e., occasional paper jams are unavoidable), clever design might help transform this negative stimulus into a rich rather than an unpleasant experience. In fact, in these kinds of situations, trying to add positive emotions is counterproductive because they form a dissonant with the reality of the situation. Instead, it is better to acknowledge that the situation is (partly) negative and to design something that either redirects this negativity or makes it enjoyable.

4 ::

DIFFERENTIATING NEGATIVE EMOTIONS

Emotions, in my experience, aren't covered by single words. I don't believe in "sadness," "joy," or "regret." Maybe the best proof that the language is patriarchal is that it oversimplifies feeling. I'd like to have at my disposal complicated hybrid emotions, Germanic train-car constructions like, say, "the happiness that attends disaster." Or: "the disappointment of sleeping with one's fantasy." I'd like to show how "intimations of mortality brought on by aging family members" connects with "the hatred of mirrors that begins in middle age." I'd like to have a word for "the sadness inspired by failing restaurants" as well as for "the excitement of getting a room with a minibar." I've never had the right words to describe my life.

— Jeffrey Eugenides, "Middlesex"

The framework introduced in the last chapter demonstrated how rich experiences can be elicited in product interaction. The framework proposed that the type of rich experience depends for an important part on the specific negative emotion on which it is based. This suggests that if designers want to be able to design for a wide variety of rich experiences, they need to have a differentiated understanding of negative emotions. This chapter looks in detail at the characteristics of a set of highly differentiated negative emotions.

From a large collection of emotions, 36 were selected and comprehensively studied. Definitions were formulated for each emotion and systematically validated with emotion experts. In addition, movie clips were collected for each emotion, and validated in an online study. An online database was created to help designers understand and differentiate the 36 negative emotions. This database contained the validated material and additional descriptions and visual representations.

4.1 Introduction

Being able to precisely identify and understand the unique characteristics of emotions is known as emotional granularity (Barrett, 2004; Lindquist & Barrett, 2008). Prototype theory proposes that emotions can be categorized in a tree-structure with three levels of differentiation, superordinate (top), basic (middle), and subordinate (bottom) (Shaver, Schwartz, Kirson, & O'connor, 1987). At the superordinate level, only a distinction is made between pleasant feelings and unpleasant feelings. At the basic level, a number of discrete emotions are distinguished, such as anger, sadness, joy and surprise. Such emotions are sometimes called 'emotion families' (e.g., Ekman, 1992), 'basic emotions' (Izard, 1992), or, more recently, 'ur-emotions' (Frijda & Parrott, 2011). At the subordinate level, these emotion families in turn consist of more finely-detailed emotion concepts, such as resentment, annoyance, fury, and indignation (in the anger family), or anxiety, worry, and nervousness (in the fear family). An understanding of emotions at the subordinate level – i.e., a highly differentiated understanding of emotions – does not just involve awareness of the existence of such emotions, but also an understanding of the characteristics that set these emotions apart.

Emotion-driven design approaches aim to improve the experience that people have with and through products based on a systematic understanding of the causes and effects of emotions. If emotion-driven design is compared to a craft, specific emotions are the materials of the trade. Just as a craftsman creating physical products benefits from knowing not only the differences between general types of materials, such as wood, metal and plastic, but also between more specific kinds such as oak, birch, aluminum, stainless steel, and polypropylene, so too does the emotion-driven designer benefit from knowledge about specific emotions.

Desmet (2012) identified the need for emotional granularity in design for positive emotions. He argued that designers benefit from knowing different possible ways to provide an enjoyable experience that transcends the simplified idea of a pleasurable experience. A similar argument can be made for negative emotions. Firstly, designers benefit from the ability to analyze in greater detail what kinds of negative emotions are involved in a user situation or product interaction to better understand how it is deficient. For example, an analysis of a train station experience that finds that passengers are frustrated with the cumbersome ticket machine, annoyed by the lack of wayfinding information, resentful about the uncooperative station personnel, and dissatisfied with the lack of refreshment options, provides a more detailed picture of these issues, and thus, a better starting point for improvement, than an analysis that just points out that passengers feel 'angry' throughout the experience. Secondly, and in line with the premise of this dissertation, negative emotions can also be building blocks for enjoyable or engaging experience. The necessity to differentiate negative emotions might be even greater than for positive emotions. Successfully evoking a positive emotion in a usage situation that is not the intended emotion (e.g., fascination instead of admiration) may be undesirable, but most likely not disastrous. In contrast, there is a certain delicacy and risk involved with evoking negative

emotions as part of a rich user experience, as a different negative emotion than the intended one may end up providing a very unpleasant experience.

To facilitate the knowledge about specific negative emotions in the design field, this chapter describes the development of a database containing information about 36 negative emotions in textual, graphical and audiovisual formats, and two studies that evaluated the validity of certain aspects of this database.

Desmet (2012) posed, after Averill (1980) and Fredrickson (2004), that a challenge in differentiating positive emotions is the relative lack of attention for this topic in emotion research. Negative emotions, in contrast, have not had this problem[1]. Especially since the emotion revival in psychology in the 1980s, and the argument for more research on specific (negative) emotions in the 1990s (e.g., see DeSteno, Petty, Wegener, & Rucker, 2000; Keltner, Ellsworth, & Edwards, 1993; Lerner & Keltner, 2000; Raghunathan & Pham, 1999), there has been an abundance of scientific publications about the causes, experience, expressions, and behavioral effects of specific negative emotions.

So what is the benefit of an emotion database? Why could designers not rely on the information in its current form and availability? I propose two main reasons. Firstly, the available information is overwhelming in amount, and scattered across thousands of publications. There are certain natural starting points, such as the Handbook of emotions (Lewis, Haviland-Jones, & Barrett, 2008) or books that integrate a great number of insights into comprehensive frameworks of emotions, such as Frijda (1986), Ortony, Clore, and Collins (1988) or Lazarus (1991). However, the main aim of these works is to show the current understanding of the processes underlying emotions (e.g., from a cognitive, neurological, biological, or developmental point of view) and perspectives on the role of emotions in certain anthropological domains (e.g., personality, health, or social groups). The information these sources provide about specific emotions is often in service of expounding a theory, or as an example to illustrate a certain point, but not to provide detailed information about specific emotions for practitioners. Secondly, the information is almost exclusively analytical in nature, and textual in form. Design integrates analytical and creative practices (Roozenburg & Eekels, 1995) and benefits from input that stimulates visual thinking (Sleeswijk Visser et al., 2005). This is related to an observation that may be the proverbial elephant in the room: designers are not universally known for their eagerness to read long texts on theoretical subjects. Although characterized by a profound interest for

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1 *To illustrate this: a Web of Science search for emotion words in the titles of academic publications resulted in a total of 3,834 hits for eight common positive emotion words, and a total of 12,906 hits for eight common negative emotion words. The list of emotions comprised happiness, joy, fascination, hope, admiration, compassion, pride, and relief for the positive emotions, and anger, fear, worry, sadness, disgust, shame, guilt, and envy for the negative ones. Only a title-search was done to identify publications that are likely to contain substantial information about that emotion, rather than just mentioning it in passing. Certain emotion words such as interest, trust, anxiety, and frustration were deliberately omitted, because they have additional meanings beyond their designation of a specific emotion. Although this is hardly a conclusive test, it does demonstrate a general difference.*

anything relevant to their field, designers often lack the time and attention to read long treatments on any single topic.

The aim for the database of negative emotions described in this chapter was to contain elaborate, but accessible and well-structured information in different forms that could facilitate and further stimulate the interest designers have in the topic. This database had three specific goals:

1. To provide an overview of a highly differentiated, but manageable number of emotions that can be easily compared.
2. To provide in-depth information about the characteristics of each specific emotion, including its possible causes and experiential and behavioral effects.
3. To provide rich representations in different forms that increase the intuitive familiarity with specific emotions.

To return to the metaphor of the craftsman: a good materials library could be characterized by containing 1) a complete overview of materials that are easily comparable, 2) detailed information for each material about properties like tensile strength, melting point, and transparency, and 3) interactive samples that provide an intuitive feel of what the material is and what it can do.

In the first part of this chapter, the process of gathering and selecting a few dozen negative emotions for the database is described, based on the aim to cover the negative emotional spectrum with as much detail as possible, given the available information about discrete emotions. The second part describes the efforts to formulate clear definitions for these emotions, which were subsequently validated by emotion experts. The definitions made it possible to precisely create and collect narrative representations (comic strips and movie clips) that illustrate each emotion, which is described in part three. This part also discusses an online study in which the movie clips were evaluated. In the fourth part, the development of an online database is described, in which the 36 emotions, the definitions, the representations, and some other elements were included.

4.2 Part I - composing the negative emotion typology

The first step in creating the database was to compose a typology of emotions, a clustered tree-structure containing a certain number of negative emotions. The first question in this step was how many emotions would be appropriate. The amount had to be large enough to provide the desired granularity, but not so large that it would become difficult to offer an overview, and that the differences between emotions would become so nuanced that they would only be interesting to experts on the topic. The balance was assumed to lie somewhere in the low double digits: more than twenty, less than fifty (by comparison, the typology of Desmet (2012) consisted of 25 positive emotions). However,

a precise number was not determined beforehand, as it was expected to logically emerge from the process of collecting and selecting emotion words.

Several psychologists and other scholars have presented lists of emotions. However, these lists are either detailed but short, or very long but without much information for each entry.

An additional issue with the short lists is they usually serve to illustrate how emotions can be classified from a certain theoretical perspective. For instance, Frijda (1986, p. 88) provides a list of sixteen emotions based on how they differ in action tendencies, Lazarus (1991, p. 122) gives a list of fifteen emotions based on their core relation themes. As a consequence, these lists are not intended to be exhaustive in all respects. For example, emotions that do not have a clear action tendency (e.g., confusion) or core relational theme (e.g., boredom) would not be included in these lists[2].

Long lists, on the other hand, are usually the result of semantic research into emotion vocabulary, such as that of Storm & Storm (1987) with 525 terms, or Averill (1975) with 558 terms. The most extensive list was found in 'Wordnet-affect', a lexicon containing 2904 affective words (Strapparava & Valitutti, 2004). This lexicon is a subset of 'Multiwordnet', a database comprising over 100,000 semantically categorized words (Miller, 1995). The issue with these lists is, apart from the fact that they are much too extensive for our purposes, that they do not provide detailed information about each emotion.

Instead of choosing one of these lists as the single starting point, we aggregated all available lists of emotions and created our own typology.

Procedure

The negative emotion typology was created in three stages: 1) emotion word collection, 2) emotion word elimination, and 3) emotion word clustering. This process was modeled after the one Desmet (2012) followed for positive emotions.

Stage 1: Emotion word collection

The aim of the first stage was to collect an extensive and exhaustive set of negative-emotion words. Two types of sources were used in this process. The first type consisted of the aforementioned available lists of emotion words, such as the Wordnet-affect and the Storm & Storm (1987), from which the emotion words could simply be extracted. The second source was a collection of peer-reviewed publications that discuss a large number of emotions. These publications comprised linguistic typologies of emotion and affect words, emotion sets used by appraisal psychologists, and emotion typologies

2 *More recently, Fontaine, Soriano, and Scherer (2013) published a book in which they integrate knowledge from five aspects of emotion (appraisals, bodily reactions, expressions, action tendencies, and feelings) that resulted in a list of 24 emotions (of which 15 negative). We did not use this in our research because it was published after the work on the typology described in this chapter had been concluded. Moreover, the resulting list contained fewer emotions than we aimed for.*

from applied fields, such as advertising and product design. A research assistant scanned and noted each publication for emotion words included in tables, figures, or the main text. In total, 7829 word instances (including duplicates) were extracted from 30 sources – see appendix A (p.227) for the list of sources used in this process. The work in stage 1 was predominantly carried out by a research assistant.

Stage 2: Emotion word elimination

In the second stage, this set was reduced from 7829 to 333 words in a number of steps. The work in this stage was carried out by three researchers; the author, another PhD-candidate in emotion-driven design, and a full professor of emotion-driven design. In each step, they individually assessed whether a word referred to a negative emotion. In case of disagreement, the word was left in. In the first step, all non-emotions were eliminated, using the principled approach of Ortony, Clore, and Foss (1987). The published typologies and the Wordnet database contain many affective words that we did not consider emotions, but, for instance, attitudes (e.g., 'disrespectful'), behavioral descriptions (e.g., 'violent') or purely bodily states (such as 'sleepy' or 'aroused'). Any positive emotion words were omitted, but words of unclear valence (e.g., nostalgia) were left in. For the remaining set of words, semantic word groups were homogenized to the same canonical form. For example, the words 'annoying, 'annoyance' and 'annoyed' were all converted to 'annoyance'; the noun form. For some words this was not possible, for instance, there is not an unambiguous noun version for the word 'afraid'[3]. In the fourth step, the frequencies of the remaining words were counted. Some words occurred very frequently (e.g., 37 times for sadness), whereas other words only occurred once (e.g., schadenfreude and poignancy). Words that were mentioned by three or more sources were left in; words mentioned only two times or less were eliminated.

Stage 3: Emotion word clustering

The 333 remaining emotion words were subsequently clustered and further eliminated over the course of several sessions with the same three researchers, which ultimately resulted in 36 emotions. The aim was to consider for each emotion how different or similar it was to the other emotions, in order to create a tree-structure of emotion words (similar to Shaver et al., 1987). For each emotion, several psychological and philosophical sources were used to elaborate on the characteristics of one or several of the emotions. See appendix B (p.229) for an overview of books and papers that were consulted in this process. In the case information was incomplete or unavailable, it was supplemented by personal insights. Three criteria were used to judge similarity: the cause of the emotion, the emotion experience, and the emotion outcome.

The principal model for judging the cause of the emotion was the concept of ***appraisal***, both in 'molar form' (e.g., core relational themes, see Lazarus, 1991, pp. 121-123) and 'molecular form' (Frijda, 1986, pp. 218-219). For instance, if the kind of events that trigger 'annoyance' are different than those that

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3 One could argue that 'fear' is the noun version of afraid, however, a closer adjective for that noun would be 'fearful'.

trigger 'frustration', than that is one criterion on which these emotions can be distinguished. For the *emotion experience*, the concept of 'cognitive scenarios' was used – short first-person descriptions written in an elementary, culture-independent language that aim to express the essence of what a person experiences ('thinks') when undergoing an emotion (Wierzbicka, 1999). For instance, if 'annoyance' feels different from 'frustration', this sets them apart. At times, it proved difficult to compare emotion experiences across emotions, as it is to some extent a subjective process that is only observable through direct inner experience. However, the cognitive scenarios were found to be a very resourceful tool to capture emotion experiences in an explicit and debatable format, which made it possible to compare and triangulate different personal emotion experiences. See appendix C (p.232) for a few examples of emotion experiences in the form of cognitive scenarios. Lastly, the main concepts for comparing *emotion outcomes* were emotion behavior, facial expression, and action tendency (Arnold, 1960; Frijda, 1986). For instance, if 'frustration' and 'annoyance' lead to different behavior (tendencies), or different emotional expressions, this was another criterion to set them apart. In the course of the process, the first criterion (the cause of the emotion) turned out to be the most dominant clustering feature, as it was more often possible to determine and agree on the type of circumstance that evokes an emotion, than on its experiential and behavioral components.

After the 36 emotion words were identified and given a place in the typology, several dozen words remained. These words were considered equally valid emotions, but too close to one of the 36 to be granted their own place in the typology. For example, the emotion 'concern' was considered very similar to the emotion 'worry' (which was one of the 36 typology emotions). Both involve the possibility of something bad happening in the future, which the person cannot do much about, and which is very much on his or her mind. There are also a few differences. For example, 'worry' usually signifies a slightly more personal relation to the object of emotion (e.g., when a parent is worried about her child's school results), whereas the word 'concern' is more often used in relation to objects to which one is more of an outsider (e.g., when a school teacher is concerned about the school results of one of her pupils). However, this difference is much more nuanced than, for instance, the difference between fear and worry, and for most practical purposes expected to be of lesser importance. The choice to include 'worry' in the typology, and make 'concern' a variant, instead of the other way around, was motivated by the observation that 'worry' is a more salient emotion word, which is more often considered and discussed in psychological literature than the word 'concern'. Similar judgments were made for other emotion variants. In some cases it was unclear whether one emotion word was more prominent than its alternatives, for example, for the emotion words 'dissatisfaction, 'discontentment', 'displeasure', and 'disgruntlement', which all signify someone is not satisfied with a situation. For such cases, a word-frequency analysis was done to find out which word is more commonly used in the

English language, using the online tool Google Ngram Viewer[4]. For example, this analysis pointed out that 'dissatisfaction' is the most frequently used word of the four, so that was used in the typology while the other words became variants.

Outcome

The final typology consisted of 36 emotions in eight clusters and fifteen subclusters. Table 2 shows an overview of the typology. The clusters were intended to provide structure and show the degree of similarity between the 36 emotions. For instance, we consider anger to be very different from sadness (different clusters), more similar to frustration (same cluster), and even more similar to indignation (same subcluster). The fifteen subclusters were given short names that referred to the common attribute of the emotions that it contained, which was most often the emotion cause (e.g., concrete threat or misfortune), but sometimes other defining features (e.g., helplessness or demotivation). Moving to the 'top level', the eight clusters have a degree of granularity that is similar to that of emotion families, such as 'anger emotions' or 'fear emotions' (Ekman, 1992). These clusters were given intuitive names that made them easy to distinguish during the process, which often meant that they were given the name of its most prominent member (e.g., anger-emotions). However, in the database these eight clusters were only designated by different colors, to avoid confusion with the 36 emotions. For instance, the cluster 'anger emotions' contains an emotion called 'anger', and explicitly mentioning the cluster would give that emotion an unintentional special status among other emotions, like 'indignation' and 'resentment' (see Parrott, 2009, p. 17). These colors are shown in Table 2.

4.3 Part II – defining the emotions

If one imagines the total spectrum of negative emotions laid out on a finite surface, the goal in this project was to divide the entire surface into a few dozen pieces of roughly equal size, each of which is considered a separate emotion concept. After the first part of the process, each of these emotion concepts was represented by an emotion word. However, emotion words are labels that not always unequivocally cover an emotion concept. In general, words are used differently by different people, cultures, and evolve over time, especially if they represent abstract constructs such as emotions. For example, envy and jealousy were once words used for different emotion concepts, but in the last decades the word jealousy also started being used to refer to the concept of envy. A similar process can be observed for the words embarrassment and shame (Wierzbicka, 1999).

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4 *The online tool Google nGram viewer (https://books.google.com/ngrams/) shows how frequently one or more words occur in a database of over 5 million books (Michel et al., 2011). Our procedure involved a comparison of the occurrences of the different emotion word variants in English books between 1960 and 2008. The word that occurred most often became the main emotion, and the other words emotion variants to that emotion.*

Table 2: Overview of the 8 clusters, 15 subclusters, 36 emotion words, and 76 emotion variants

Cluster	Subcluster	Emotion	Emotion variants
	Personal provocation	Anger	Fury, mad, rage, cross
		Indignation	Outrage
		Resentment	Rancor, bitterness
	Agitation	Annoyance	Irritation, bothered, irked, exasperation
		Dissatisfaction	Discontentment, displeasure, disgruntlement
		Frustration	
	Antipathy	Contempt	Disdain, despisal
		Hate	Enmity, vengefulness, animosity
	Repulsion	Disgust	Repugnance, abhorrence, revolt, loathing,
	Demotivation	Boredom	Listlessness
		Reluctance	Unwillingness, disinclination
	Misfortune	Sadness	Sorrow, grief, woe, bereft
		Disappointment	Feel let down, disheartenment, demoralization
		Pity	Compassion, self-pity
	Social hurt	Loneliness	Lonesome
		Rejection	Disregarded, ignored
		Humiliation	Abused
	Painful desire	Longing	Yearning, craving, wistful
		Envy	Covetousness
		Jealousy	
	Self-blame	Guilt	Remorse, repentance, self-reproach
		Regret	
	Social failing	Shame	Ashamed, self-degradation
		Embarrassment	Abashment
	Concrete threat	Fear	Afraid, scared, dread, terrified
		Startle	Fright, alarmed
		Worry	Concern, solicitude
	Ambiguous threat	Anxiety	Apprehension
		Distrust	Mistrust
	Uncertainty of action	Insecurity	Intimidated, meekness
		Doubt	Hesitation
		Nervousness	Tenseness
	Helplessness	Distress	Upset, agony, panic, anguish
		Desperation*	Despair, hopelessness, despondency
	Overwhelm	Confusion	Puzzlement
		Shock	Bafflement, astonishment, perplexity, appalled

Note: For the emotion words, the noun form was always preferred, unless it did not exist or had a different meaning than the adjective form. Originally this emotion was named 'despair', but it was changed to 'desperation' after the results of the definitions study (see part II).

The 36 emotions had been selected and clustered on the basis of a collection of sources from emotion psychology and philosophy. The next step was to use the same knowledge to create definitions for each emotion: concise descriptions that convey the core characteristics of each emotion, which can be used to quickly recognize and compare emotions. In the final database, the emotion words helped to facilitate fast recognition of emotion concepts, but the definitions made sure that the emotion concept was understood in its entirety. In addition, the process of formulating the definitions helped to obtain additional clarity and consensus among the researchers about the emotion concepts, which was beneficial in the subsequent phases of finding narrative representations and writing elaborate descriptions.

The process of formulating emotion definitions was done by four researchers, consisting of two of the three researchers who had been involved in the first process (the author and the full professor), and two external emotion experts (a full professor and an assistant professor from a Dutch university).

Process of formulating emotion definitions

The initial starting point for formulating definition was to take the dictionary definition for each emotion word from the English-language online dictionary Merriam-Webster and the Dutch-language dictionary Van Dale (Den Boon & Geeraerts, 2005). However, it soon became clear that these definitions were low in detail and, more problematically, circular with other definitions. For example, Merriam-Webster's definition of fear is 'to be afraid of something or someone', and the definition for 'afraid' is 'filled with fear or apprehension' (for an elaborate treatment of this problem, see Wierzbicka, 1996, pp. 237-286). However, not all dictionary definitions were problematic, and some were a good starting point for subsequent steps.

The next strategy was to formulate the definition based on the three ingredients that has also driven the selection and clustering phase: the cause of the emotion, the experience of the emotion, and the resulting behavioral or expressive effects of the emotion[5]. Although this format worked well for a few emotions, like disgust, it was ultimately abandoned in favor of a more liberal and bespoke definition system. This system only included ingredients that are both necessary for the definition and can be unambiguously attributed to the emotion concept. This excluded experiential descriptions as they are typically subjective and difficult to characterize in a few words. The effect of the emotion ended up being included in several of the definitions, although it was not always a behavioral or other externally observable effect[6]. For example, effects can also comprise intentions (e.g., for contempt), judgments

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5 *The working format for these definitions was: The [experiential adjective] feeling when [cause] that results in [effect]. The idea behind this structure for each emotion was that it would provide consistency and equality in the amount of information each definition carried. For example, for disgust this version of the definition became: "The nauseating feeling when you encounter something that you don't want to get into contact with, because you think it is bad for you. You have the urge to get it away from you."*

6 *This is actually consistent with the idea of action tendencies, if thoughts are also considered actions, see Fredrickson (1998).*

(e.g., for shame), or thoughts (e.g., jealousy)[7]. Thus, the only element that was consistently included in the definition was the cause of the emotion. Besides being more accurate, this system also resulted in shorter definitions.

For some emotions, it was more difficult to formulate a satisfactory definition based on literature. For example, resentment was challenging because different scholars describe and classify it in conflicting ways. For example, some sources describes it as a kind of suppressed form of anger (e.g., Goldie, 2000; Wierzbicka, 1994), while another posits that its central feature is 'not getting what you deserve' (Apter, 2007). Yet another source agrees that deservingness is the central aspect of resentment, but states that it is a person's reaction to seeing someone else getting something they do not deserve (Ortony et al., 1988). Sometimes certain sources were favored over others, other times, an attempt was made to unite viewpoints. For example, it was decided that both 'not getting what you deserve', and 'someone else getting something they do not deserve' are valid causes for resentment and thus included in the definition, but that elements of regulation (e.g., bottling up) would not be included in any emotion definition, as it is a construct that is thought to operate independently from any specific emotion. Other emotions were simply underrepresented in scientific literature, although they are fairly common concepts in everyday experience. For example, emotion concepts such as nervousness, reluctance, and rejection can be explained and personally related to as emotions with a clear cause, experience and effect. The definitions of such emotions relied more on personal insight than on existing literature.

Outcome

The 36 resulting emotion definitions were all formulated in one or two sentences and an average of 24.75 words. The shortest definitions were for reluctance and loneliness (both 13 words), the longest definitions were for jealousy (41 words) and disgust (42 words). The complete overview of the definitions can be found in Table 4 and Table 5.

Study on emotion definitions – first iteration

A study was set up to test whether these relatively short definitions would be recognized as belonging to the right emotions. Because this process would require some in-depth, technical knowledge of emotions, this study was done with emotion experts as participants. The setup was to offer them each of the definitions blindly, and ask them to choose which of 36 emotion words best represented this definition. The plan was then to flag the definitions that did not pass this test, use participant's answers and comments to improve them, and to test the changed definitions again with a different group of participants.

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7 See Table 4 for the definitions of these examples.

Method

Participants

Participants were nineteen emotion experts that were recruited from ISRE, an international society of academics working in the affective sciences. When asked how important a part emotion research was in their work or studies, six indicated it was the most important part, seven that it was an important part, and six that is was occasionally part of their work (no one chose the fourth and final option, which stated that it was not part of their work). On average, participants had 5.5 years of experience in studying emotions (minimum 1 year, maximum 20 years, SD=5.1 years). All participants were native English speakers or fluent in the language.

Procedure

The definitions were validated in an online questionnaire that contained 36 screens; one for each emotion. Each screen showed the definition and 37 items: the 36 emotions words and a 'none of the above'-option. The order of screens was randomized. The order of the 37 answer choices was randomized between participants, but kept in the same order for the same participant between questions, to make it easier to retrieve words. Participants could optionally leave a comment on each screen. At the end, participants were given the option to review their choices against the intended emotion for each definition.

Analysis

The analysis followed a similar approach as Haidt and Keltner (1999), who investigated the level of recognition of photographed facial expressions of emotions for different cultural groups. This is a testing situation similar to the one in this study, as they also offered participants a single stimulus each round, asking to choose the most appropriate emotion label. Haidt and Keltner used three tests to assess the level of recognition: magnitude, discreteness, and similarity of magnitude between cultural groups. The last test was specifically to find the difference between two cultural groups, and was not relevant to this study.

Magnitude is a measure of how well the intended correct answer fared, in comparison with all the other answers. The magnitude ratio is the choice frequency of the intended answer divided by the total amount of answers (e.g., if 6 out of 10 respondents chose the intended answer, the ratio is 0.6). Based on this ratio, a magnitude score is calculated following the algorithm in Table 3.

Discreteness is a measure of how well the intended answer did in comparison with the second most chosen option. This measure is necessary in addition to the magnitude score to identify whether another emotion label is a strong contender for the given definition, which would be problematic. For example, compare two hypothetical answer patterns for the definition of indignation:

Pattern 1: Indignation: 55%, Anger: 20%, Resentment: 15%, Frustration: 10%.

Pattern 2: Indignation: 55%, Anger: 45%.

Table 3: The scoring algorithm for Magnitude and Discreteness, as used in the validation of the emotion definitions and the movie clips (see p.72 for the latter)

Score	Magnitude	Discreteness	Result
1	The intended emotion was not the most often chosen answer	The intended emotion was not the most often chosen answer	Fail
2	The intended emotion was chosen most often, but less than 40% of total responses	The intended emotion was chosen less than twice as often as the second most chosen answer	
3	The intended emotion was chosen between 40% and 60% of total responses	The intended emotion was chosen between two and three times as often as the second most chosen answer	Pass
4	The intended emotion was chosen between 60% and 80% of total responses	The intended emotion was chosen between three and four times as often as the second most chosen answer	
5	The intended emotion was chosen more than 80% of total responses	The intended emotion was chosen more than four times as often as the second most chosen answer	

The magnitude ratio will be the same in both cases: 0.55 (leading to a score of 3). However, this score does not reflect that pattern 1 shows a better result than pattern 2. In pattern 1, the answers are more likely the result of noise and random mistakes, whereas pattern 2 shows that the definition is almost as likely to be attributed to anger. The discreteness score is calculated as the ratio between the intended answer and the second most chosen option (e.g., 2.75 in pattern 1, and 1.22 in pattern 2). Based on this ratio, a discreteness score is calculated following the algorithm in Table 3.

An emotion definition passed if the average of magnitude and discreteness was at least 3.0. In addition to the scores, participant's (optional) comments for each emotion definition were analyzed for suggestions to improve the definitions.

Results & Discussion

Table 4 shows the results for each emotion definition. The fourth column shows the percentage of participants that chose the 'correct' emotion word (the emotion word for which that definition was written). The columns next to it show the corresponding scores for magnitude, discreteness and the average between the two. The last column shows the percentages of other answers that were given by more than ten per cent of participants. The table shows that out of 36 emotion definitions, 29 passed the test by scoring an average of 3.0 or higher. Seven emotion definitions scored lower than 3.0: envy and worry scored 2.5, dissatisfaction, doubt and distress scored 2.0, and resentment and nervousness scored 1.0. These seven were reformulated and retested in the second iteration of the study. In addition, four definitions that did pass the test (humiliation, rejection, pity, and despair) were reformulated and retested based on the comments they received.

Table 4: The results of the first iteration of the emotion definitions study

#	Emotion	Definition	Freq. correct	M	D	Avg.	Other answers given > 10%
1	Anger	The feeling when someone did something bad that harmed or offended you. You want to go against this person to stop them or prevent them from doing it again.	63%	4	5	4.5	Hate: 16% Resentment: 11%
2	Indignation	The feeling when someone's action goes against your moral values. You can't believe that a person could do something like this. You have the urge to speak out about what this person did.	42%	3	3	3	Anger: 21% Resentment: 11%
3	Resentment	The feeling when you are treated unfairly. You are worse off than you deserve, or someone else is better off than they deserve.	11%	1	1	**1.0***	Anger: 37% Frustration: 21% Indignation: 11%
4	Annoyance	The feeling when something is happening that bothers you. You have the urge to say or do something to change it or make it stop.	47%	3	4	3.5	Dissatisfaction: 16% Frustration: 11%
5	Dissatisfaction	The feeling of being unfulfilled when something happens that is different from what you expected. You feel that it should be changed to meet your expectations.	32%	2	2	**2.0***	Disappointment: 26% Frustration: 16%
6	Frustration	The feeling when you want to achieve something, but find your action blocked. Nevertheless, you keep trying.	63%	4	5	4.5	Annoyance: 11% None o/t above: 11%
7	Contempt	The feeling when you look down on someone. You don't want to have anything to do with a person like this.	79%	4	5	4.5	Resentment: 11%
8	Hate	The intense feeling when you think about a bad person who is doing very bad things. You would want something bad to happen to this person.	58%	3	4	3.5	Contempt: 16% Resentment: 16% Anger: 11%
9	Disgust	The feeling when you encounter something that you don't want to get into contact with in any way (neither see, hear, feel, smell, or taste it), because you expect it is bad for you. You want to get it away from you.	95%	5	5	5	
10	Reluctance	The feeling when you know that you should do something that you do not feel like doing.	74%	4	5	4.5	
11	Boredom	The feeling when there is nothing interesting or engaging for you to do.	95%	5	5	5	
12	Sadness	The feeling when you lost something that was important to you. You have the urge to withdraw and to seek comfort.	74%	4	5	4.5	Despair: 11%
13	Disappointment	The feeling when you find out that something you had hoped for has not happened.	79%	4	5	4.5	
14	Pity	The feeling when you witness someone else's misfortune or suffering. You would like to do something to help them.	63%	4	4	4	None o/t above: 21%
15	Loneliness	The feeling when you think there is no one who cares about you.	84%	5	5	5	
16	Rejection	The feeling when someone, who you thought liked you, has done something that makes you think they don't like you at all.	53%	3	4	3.5	Sadness: 16% Disappointment: 11% Startle: 11%
17	Humiliation	The feeling when someone has deliberately done something to put you down or make you look bad in the eyes of others.	58%	3	3	3	Anger: 26%
18	Longing	The feeling when you want something that you cannot have (now). You keep thinking how good it would be if you had it.	79%	4	5	4.5	
19	Envy	The feeling when you know that something good has happened to someone else, but not to you. You keep wishing that good thing had happened to you instead.	58%	3	2	**2.5***	Jealousy: 42%

#	Emotion	Definition	Freq. correct	M	D	Avg.	Other answers given > 10%
20	Jealousy	The feeling when you think that a special relationship that you have with someone is threatened because a third person is trying to have a similar relationship. You really don't want that to happen and you cannot think of much else.	68%	4	5	4.5	
21	Guilt	The feeling when you think you have done harm to someone. You blame yourself and cannot stop thinking about this.	79%	4	5	4.5	Regret: 11%
22	Regret	The feeling when you think that something you didn't want to happen could have been prevented if you had acted differently.	89%	5	5	5	
23	Shame	The feeling when you think that other people know something bad about you. What they know is true, so you also feel bad about yourself.	47%	3	5	4	Guilt: 11% Embarrassment: 11% Insecurity: 11%
24	Embarrassment	The feeling when people suddenly focus unwanted attention on you in a situation that is not in your control. You have the urge to get away from the attention.	68%	4	5	4.5	Humiliation: 11% Shame: 11%
25	Fear	The feeling when you encounter or think about a thing or person that can harm you. You have the urge to avoid or get away from the threat.	68%	4	5	4.5	Anxiety: 11% Distress: 11%
26	Startle	The feeling when suddenly something unexpected happens, which could be something bad. You have the immediate urge to find out what is going on.	47%	3	3	3	Nervous: 21% Shock: 11%
27	Worry	The feeling when you are continuously thinking about something bad that could happen to you or someone else. You think you cannot do something to prevent it.	42%	3	2	**2.5***	Anxiety: 32% Fear: 11% Distress: 11%
28	Anxiety	The feeling when you think about bad things that could happen to you. You are on guard, because you don't know what the threat is.	68%	4	5	4.5	Nervous: 16% Insecurity: 11%
29	Distrust	The feeling when you think that someone is not truthful and does not have good intentions. You feel the need to be very careful what you do or say to this person.	68%	4	5	4.5	Reluctance: 16%
30	Insecurity	The feeling when you are uncertain about your ability to do something or to measure up to a certain standard. This uncertainty has a negative effect on your self-esteem.	74%	4	5	4.5	Worry: 11% Anxiety: 11%
31	Doubt	The feeling when you have to do something, but there is more than one course of action to choose from. You don't know which option is the best so you feel the need to get more certainty.	32%	2	2	**2.0***	Insecurity: 26% Confusion: 16% Worry: 11%
32	Nervousness	The feeling when you have to do something, but you think that something might go wrong that prevents you from succeeding. You don't feel in control of the situation.	16%	1	1	**1.0***	Insecurity: 26% Worry: 16% Doubt: 16%
33	Distress	The intense feeling when something bad is happening to you at this moment. You feel that you need help.	37%	2	2	**2.0***	Despair: 32% Anxiety: 11%
34	Despair	The feeling when you have lost the hope or ability to reach a goal. You are willing to try anything to achieve it.	68%	4	5	4.5	None o/t above: 16% Frustration: 11%
35	Shock	The feeling when you realize that something very bad just happened. You didn't think something like this was possible, and you don't know what to think or do.	58%	3	4	3.5	Despair: 16%
36	Confusion	The feeling when you get information that does not make sense to you, leaving you uncertain what to do with it.	68%	4	5	4.5	Doubt: 11%

*M: Magnitude score of correct response, D: Discreteness score of correct response, Avg: Average between magnitude and discreteness score. * Falls below validation score.*

The following sections briefly discuss the eleven definitions that were changed for the second iteration of the definitions study. The reformulated definitions can be found in Table 5.

Resentment

The definition for resentment was the worst-scoring in the sample. It received a score of 1.0 on both criteria because its correct answer was not the most frequently chosen. The bad score could (in part) be explained by the earlier observation that its meaning is interpreted differently by different emotion researchers. Participants attributed eight different emotion words to it (four of which by more than 10%). The resentment definition especially led a lot of participants to choose the word anger. We attributed this to the use of the phrase 'you are treated unfairly' in the definition, which makes it sound very close to a personal offence. For the reformulation, this was changed to 'someone did something unfair'. Furthermore, a sentence was added to highlight the inability to express one's feelings that characterizes resentment.

Nervousness

The definition for nervousness also scored a low 1.0. This definition was mostly attributed to the word 'insecurity'. Interestingly, insecurity was the most-often chosen emotion word in the entire study (36x), beating arguably more common emotion words like anger (32x), frustration (30x), or anxiety (28x). Although we did not have a conclusive evidence to back this up, our explanation was that participants might have had a broader concept of insecurity in mind than the emotion we intended it to represent in this study, more along the lines of 'uncertainty' – which is not an emotion but an appraisal component that is present in every 'fear'-emotion. In the reformulation, the word 'succeeding' was removed in the hope that it would eliminate the confusion with insecurity.

Doubt

The definition for doubt scored a 2.0, and like nervousness, it was mainly confused with insecurity. In this case, the inclusion of the phrase 'you feel the need to get more certainty' was thought to trigger associations with insecurity (interpreted as uncertainty). This part of the definition was removed for the reformulation.

Dissatisfaction

The definition for dissatisfaction scored a 2.0, mainly because people mistook it for disappointment. To put the difference between these two emotions in an (over-)simplified way: disappointment is the 'sad' version of being unfulfilled, while dissatisfaction is the 'angry' version of being unfulfilled. We considered dissatisfaction and disappointment as a typical example of an emotion pair that is easily confused when comparing short analytical descriptions (like the definitions), but not when experiencing it, or seeing someone else experiencing it. Furthermore, we found an order effect: none of the people who had first seen the definition for disappointment later attributed the disappointment word to the dissatisfaction definition (while almost all of the participants who saw the two definitions in the reverse order did make this mistake). This may indicate that disappointment is a more top-of-

mind word when evaluating definitions, but that in a direct comparison with the two emotions, the attribution would improve.

Distress

The definition for distress scored a 2.0 and was mainly confused with despair. First of all, we expected the score to improve if we changed the label of 'despair' to 'desperation' (see below). Secondly, the definition of distress was reformulated to include a focus on the inability to cope, which is more characteristic of distress than desperation.

Worry

The definition for worry scored a 2.5, mainly because it was confused with anxiety. Upon scrutiny, the definition of worry was too close to the concept of anxiety. An important difference with anxiety is that worry starts from a concrete event that leads someone to think things may go wrong in the future. This was more clearly included in the reformulation.

Envy

The definition for envy scored a 2.5, which was entirely caused by people attributing the label jealousy to it. This is in line with the development that jealousy is seen as meaning both the concepts we defined as envy and jealousy. We expected that if offered together, these emotions would be more easily distinguished. We did not see a way to reformulate envy's definition to better distinguish it from jealousy, so the formulation was left (virtually) the same.

Humiliation

The definition for humiliation scored adequately at 3.0, but it was surprisingly confused with anger, which we had not considered a close emotion. However, upon reviewing the definitions, the confusion became clearer. Put in a simplified way, humiliation and anger can both be caused by a similar type of event, but it is the subsequent appraisal of power that determines which emotion one experiences. If someone puts you down and you feel you have a certain amount of power, you will likely get angry and retaliate. If you feel you do not have any power, you will be more likely to feel humiliated. The power dimension was added in the reformulation of the definition for humiliation.

Rejection

The definition for rejection scored adequately with a 3.5, but received a suggestion in the comments that we agreed with: to change the phrase from 'who you thought liked you' to 'whom you want to like you', as it is indeed possible to feel rejected by someone of whom you have no prior idea of whether they like you or not.

Pity

The definition for pity scored a good 4.0, but received a lot of 'none of the above' choices, which indicated that its definition could be improved. Mainly, participants commented that compassion would

be a better label (which was not in the list). Compassion is often regarded as the more positive variant of pity (e.g., see Ben-Ze'ev, 2000; Wierzbicka, 1999), which could mean that our definition of pity was 'too positive'. In the reformulation, the mention of wanting to help was removed, and a reference was added to the comparison that is made between the person experiencing the pity and the object of pity: 'someone who is worse off than you'.

Despair

The definition for despair did well on the test with a 4.5, but also received several 'none of the above' choices and comments. The comments mainly referred to a contradiction between the phrases 'you have lost the hope' and 'you are willing to try anything'. In the reformulation, this led us to change the first phrase to 'you have lost almost all hope'. Furthermore, we found that the word 'desperation' was a better label for this concept, as 'despair' indeed means that someone has lost all hope and has given up. In the second round, the label was changed to 'desperation'.

Although the study results indicated problems with some emotion definitions, it revealed an overall positive evaluation of the set. The answers and comments helped to make improvements to the definitions for a re-evaluation. Furthermore, the seven definitions that did not pass the test were in almost all cases mistaken for emotions that were assigned to the same (sub)cluster in our typology, which was an indirect indication that the clustering was generally agreed on. The reformulations for the eleven emotion definitions were evaluated in a second iteration of the test.

Study on emotion definitions – second iteration

Method

Participants

Participants were ten emotion experts that were recruited from professional networks. None of the respondents had participated in the previous questionnaire. When asked how important a part emotion research was in their work or studies, one indicated it was the most important part, eight that it was an important part, and one that is was occasionally part of their work (no one chose the option that it was not part of their work). On average, participants had 9.6 years of experience in studying emotions (minimum 1 year, maximum 20 years, SD=6.6 years). All participants stated to be fluent in English. One participant did not finish the entire questionnaire, but because of the difficulty to recruit more participants, the given answers were used in the analysis.

Procedure

The procedure was identical to the previous iteration of the study, except that eleven items were presented instead of 36.

Table 5: The results of the second iteration of the emotion definitions study

#	Emotion	Definition	Freq. corr.	M	D	Avg	Chng.	Other answers given > 10%
3	Resentment	The feeling when someone did something unfair. You got less than you deserve, or someone else got more than they deserve. You want to set it right, but you cannot do much (at the moment).	22%	1	1	**1.0***	0	Indignation: 56% Annoyance: 11% Frustration: 11%
5	Dissatisfaction	The feeling of being unfulfilled when something happens that does not meet your expected standards.	44%	1	1	**1.0***	0	Disappointment: 56%
14	Pity	The feeling when you witness the misfortune or suffering of someone who is worse off than you.	100%	5	5	5.0	+1.0	
16	Rejection	The feeling when someone, who you want to like you, has done something that makes you think they don't like you at all.	90%	5	5	5.0	+1.5	Disappointment: 10%
17	Humiliation	The feeling when someone has deliberately done something to put you down or make you look bad in the eyes of others. You feel you have no power over the situation.	78%	4	5	4.5	+1.5	Anger: 11% Indignation: 11%
19	Envy	The feeling when something good has happened to someone else, but not to you. You keep wishing that the good thing had happened to you instead.	44%	1	1	**1.0***	-1.5	Jealousy: 56%
27	Worry	The feeling when something happened that could mean something bad will happen to you or someone else. You cannot stop thinking about this.	60%	4	4	4.0	+1.5	Anxiety: 20% Fear: 10% Insecurity: 10%
31	Doubt	The feeling when you have to do something, but there is more than one course of action to choose from. You don't know which option you should choose.	67%	4	4	4.0	+2.0	Insecurity: 22% Confusion: 11%
32	Nervousness	The feeling when you have to do something, but you think that something might go wrong. You don't feel in control of the situation.	20%	1	1	**1.0***	0	Anxiety: 30% Worry: 20% Insecurity: 20% Reluctance: 10%
33	Distress	The intense feeling when something bad is happening to you at this moment. You feel that you need help, because you cannot cope.	60%	4	3	3.5	+1.5	Desperation: 30% Anxiety: 10%
34	Desperation*	The feeling when you have lost almost all hope or ability to reach a goal. You will do anything to still achieve it.	89%	5	5	5.0	+0.5	Distress: 11%

*Note: M: Magnitude score of correct response, D: Discreteness score of correct response, Avg: Average between magnitude and discreteness score, Chng: Change of average score compared to result in first iteration. * Falls below validation score.*

Analysis

The analysis was also identical to the previous study, except for an additional comparison of the results between studies. The new definition was only adopted if it scored better than the previous one. If it scored the same or worse, the previous definition was adopted instead.

Results & discussion

Table 5 shows the results for each emotion definition. The table has the same structure as Table 4, but includes an extra column that compares the scores obtained in this study to the ones in the previous iteration. Overall, the results showed an improvement: seven definitions improved their score, two stayed the same, and two got worse results. Of the seven definitions that improved, three had now passed the mark of scoring at least a 3.0: Worry, doubt, and distress. The other four were the definitions that had already scored a passing grade in the previous iteration, but each of them further improved their score: Pity, humiliation, rejection, and desperation (formerly despair).

The definitions that scored the same were the two emotions that had also scored lowest in the previous iterations: resentment and nervousness. The definitions of these two emotions were restored to the versions used in the first iteration.

Two definitions scored worse: envy and dissatisfaction. For envy, the difference in score could not really be attributed to a change in the definition, as it had hardly changed between the iterations. For dissatisfaction, the simpler description had apparently not made it easier to distinguish from disappointment, and the previous definition was adopted instead.

Overall, 32 emotions now had a definition that had scored a 3.0 or higher. Envy, dissatisfaction, resentment and nervousness had not passed either of the tests. This can mean that there are either better definitions possible for these emotion concepts that we had not come up with, or that there are more fundamental problems with these emotions. For instance, they may not be proper emotions or not different enough from other emotions. This question was revisited in the study described on page 72, which evaluated a set of movie clips for each emotion.

4.4 Part III – the narrative representations

The typology and the definitions form the core structure of the database, and largely fulfill its first goal: to provide overview and compare emotions (see introduction). The next step was to find and generate representations that would exemplify each of the 36 emotions. These representations were expected to fulfill the third goal (creating intuitive familiarity with the specific emotions), as well as providing examples to support the second goal (providing in-depth information for analysis of each emotion). The ambition was to include representations that could depict the different emotions as clearly as possible, to support the emotion word and definition in the database. However, we did not expect the representations to be able to fully convey an emotion to a layperson without this information[8]. Secondly, the process of finding, creating, and evaluating narrative representations was found to be useful in itself, because it encouraged a deeper examination of different possible manifestations of the emotions.

Two types of representations were developed for each emotion: three short movie clips (between 20-50 seconds each) extracted from narrative movies, and one three-panel comic strip. These two types were chosen for a number of reasons. Firstly, both forms are narrative, involving a progression of events over time. This gives them the ability to depict the cause, expression and possible behavior effects of the emotions in a single representation, which would be more difficult to achieve with a photograph or a single drawing. Secondly, both formats involve relatable characters who experience the emotion, which has the advantage that people not only understand the emotion but can also

8 *This was, however, how the validation study of the movie clips was set up – see page 72*

empathize with it. Thirdly, both movies and comic strips are visual formats, which draw more attention and have a lower threshold to engage with compared to, for instance, written stories.

The two types of representations also had advantages over each other, which is why they were both included in the database. Movie clips have the advantage of being closest to real life, by showing actual people experiencing and expressing emotions in realistic situations. This makes movie clips arguably the best format to make viewers intuitively familiar with emotions. Secondly, narrative films are very immersive by nature because they involve visuals, sound and movement. Thirdly, thousands of movies were readily available to extract clips from, which simplified the process.

Comic strips, on the other hand, consist of simplified line drawings and have the advantage of drawing attention to the key elements of the emotion episode while leaving out irrelevant details. Secondly, because they depict events over time in a single image, comic strips are easier to compare side-by-side and are also usable in a non-digital environment (e.g., during a design workshop). Thirdly, they can both be offered separately, illustrating a single emotion, or as a longer, coherent story, which allows readers to go through the entire story of 36 emotions in less than ten minutes. Lastly, comic strips are a format that we were able to create ourselves, instead of relying on existing material.

Process of collecting the movie clips

For each main emotion, three movie clips were collected from commercially available fictional films, resulting in a total of 108 clips. Each movie clip was edited to be around 20 to 50 seconds in length and showed a character experiencing the emotion in a comprehensible situation[9]. For example, for the emotion pity a clip was extracted from the movie 'About Schmidt' (Figure 31). The clip shows a man confessing to a woman, whom he just met, that he is very lonely and that he feels she understands him better than his wife did after 42 years of marriage. She responds with great pity to his confession, and lets him rest his head on her shoulder while saying what a sad man he is. Appendix D (p.233) shows still images of each movie clips from the moment that the character experiences the emotion.

To find 108 suitable movie clips, between 800-1000 movie scenes were collected and considered (more than 20 per emotion, on average). The collection was partly done by two researchers (the author and a PhD-candidate in emotion-driven design) going through a large number of movies, and partly through crowdsourcing. For the crowdsourcing process, requests for scenes were posted on several forums of websites for movie aficionados, including a short description of each requested emotion. The collected movie clips were subsequently judged for appropriateness by four researchers (the two

9 *This type of clip should be discriminated from movie clips that aim to elicit a certain emotion in the viewer (e.g., see Rottenberg, Ray, & Gross, 2007). Although the empathy mechanism may create significant overlap in movie clips that show a character experiencing an emotion and clips that elicit that same emotion in the viewer, the purposes of both types of stimuli are distinct and may lead to different movie clips choices.*

Figure 31: Stills from one of the movie clips for the emotion pity

researchers who had collected the clips, and two professors in emotion psychology). There were four main criteria for the suitability of a clip:

1. The character in the movie clip had to clearly and uniquely experience the designated emotion – so not combined or in quick succession with any other emotion;
2. The clip had to clearly show the cause of the emotion – the event or series of events that elicited the emotion in the character;
3. The clip had to clearly show an effect of the emotion on the character – the facial expression and/or a behavioral effect;
4. The clip had to comprehensibly show the situation in 50 seconds or less (with the possibility of editing out certain irrelevant segments).

Especially the first criterion proved challenging to fulfill, as movies tend to show a multitude of emotions, and often do not limit a character from experiencing a single emotion in a given scene. Furthermore, for certain emotions it was difficult to satisfy both the second and fourth criteria: sometimes the cause of an emotion was only clear in the larger context of the story. For instance, a character that loses a loved one in the beginning of the film may have a very clear sadness scene later on, but this scene would not comprehensible without showing extensive parts of the earlier scenes.

Process of creating the comic strips

The comic strips were created for the typology by an illustrator. Two researchers (the author and a PhD-candidate in emotion-driven design) first wrote the script, which was elaborated in several sessions with the artist. The 36 comic strips (one for each emotion) each consisted of three panels, and showed the main character Murphy experiencing one of the emotions. Together, the 36 strips formed a story of one day of Murphy's life at work. Figure 32 shows one example; see appendix E (p.238) for the full set of comic strips, in the order of the story. Murphy enters the office in the first strip and leaves it in the last strip, so all the 36 emotions take place at his office. This setting was chosen because it is a recognizable and everyday environment, while it also has ample opportunity to experience the full range of negative emotions. The order of emotions throughout the story was chosen according to the logic of the narration, and did not follow the order in which they are featured in the typology. When writing the scenario for the strips, the first three criteria for the movie clips (depicting only the

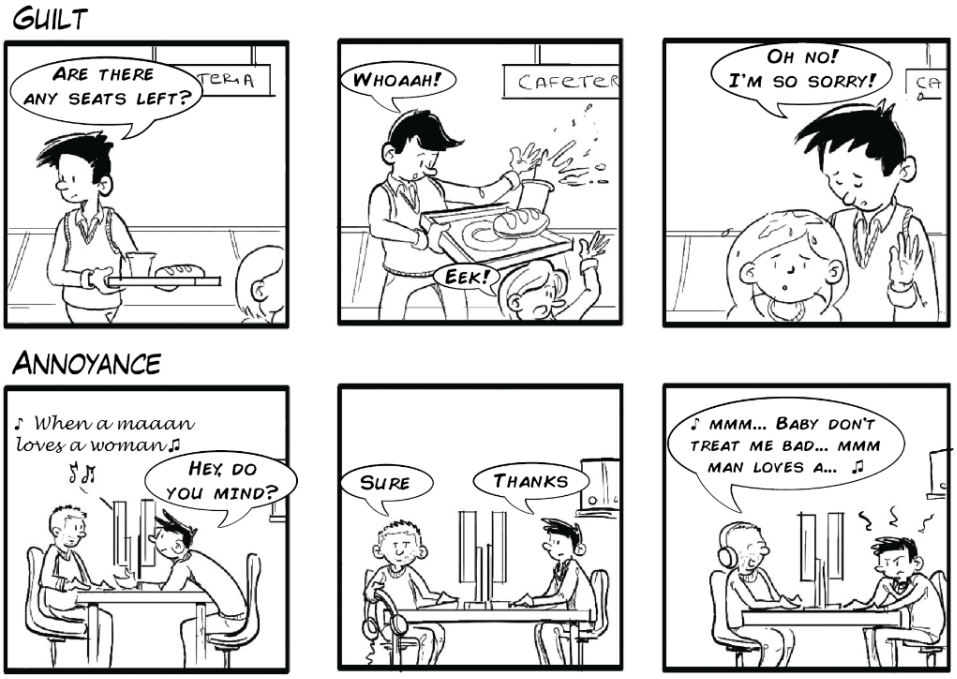

Figure 32: Two examples of comic strips, representing the emotions guilt and annoyance

designated emotion; showing the cause of the emotion; and showing the effect of the emotion) also applied to the comic strips. In addition, there were three other criteria for each individual comic strip:

1. Each comic strip had to fit in the larger story. This posed restrictions in terms of the setting in which the strip took place (the story could not abruptly take place with different people and location between two strips), and the fact that events in earlier strips had to logically connect to events in later strips.
2. At the same time, each comic strip had to be completely comprehensible on its own. People who do not read the entire comic, but just encounter a single strip when looking up an emotion, also had to understand the events in the strip.
3. The strips had to be pleasurable and slightly funny to read. For each strip, the aim was to add some kind of irony, twist or punch line to keep the reader engaged.

Fulfilling the first and second criteria simultaneously proved challenging, because it required that the strips were connected to each other in the larger story, but at the same time none of them could rely on information in earlier strips to be able to understand it.

Validation study of the movie clips

The 108 movie clips were tested to evaluate if they clearly and unequivocally expressed the emotion they were attributed to. This test was done with non-emotion experts, as it was expected that including the definitions into the answer choices would facilitate a deep enough understanding of the emotions to judge the movie clips.

Method

Participants

Ninety individuals from the United States (37 females) participated in an online questionnaire via Mechanical Turk[10]. Participants had been selected on the criteria that they had finished at least a thousand 'HITs' and that they had an overall approval rating of 98% on the platform[11]. Participants were each paid $4.50 in exchange for their participation. All participants indicated that they were native or fluent in English. Before the main questionnaire started, the setup of the participant's computer was checked through a test question, to ensure that the videos could be properly seen and heard.

Procedure

The 108 movie clips were divided into three tracks of 36 movie clips. Each participant finished one track, which contained one movie clip for every emotion. Every movie clip had English subtitles to support the understanding of important lines. The beginning of every movie clip showed a still frame of the target character with a red circle around him or her. After a few seconds, this circle would disappear, and the clip would start playing seamlessly from the still image.

Each movie clip was first shown on a screen without any questions. It would start playing automatically without the ability to skip a part of the video or continue to the next screen, until the clip had finished playing. This was done to ensure participants had watched the entire clip before seeing the answer options. Then, a screen would show the question asking which emotion the circled character was experiencing by the end of the clip. The last comment was added for clarity, because sometimes the character would also experience other emotions, which were in our judgment less intense or noticeable, but the emotion would always end just after the target emotion.

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10 Mechanical Turk is an online crowdsourcing platform on which one group of people (called 'requesters') posts tasks, called 'HITs', and another group (called 'workers') carries out these HITs for compensation. HITs are typically simple to perform and short (anywhere from a few seconds to an hour). Increasingly, this platform is used by academic researchers to recruit representative and well-performing participants for questionnaires and online experiments (Berinsky, Huber, & Lenz, 2012; Buhrmester, Kwang, & Gosling, 2011).

11 Mechanical Turk offers several options for criteria to admit workers for a task. A minimum of at least 500 HITs performed and an approval rating of 95% is the default. The criteria used in this study would be considered quite strict.

The answer type was a fixed choice with four options: the target emotion, two distractor emotions, and a random emotion. The distractor emotions were chosen based on the definition study: these were the emotions that were most frequently attributed to the definition, apart from the target emotion. For example, for the anger-definition the most frequently chosen answers (apart from anger) were resentment and hate, so these became the two distractor choices in the movie clips study. The 'random choice' for each emotion was chosen semi-randomly with the intention that a participant would typically not confuse it with the target emotion. For example, the movie clips for anger would not have indignation, annoyance, or frustration as the random choice, because these emotions are judged to be relatively close to anger. The inclusion of the random emotion choices were thought to help detect certain problems with certain clips or participants. Firstly, if the random emotion choice would be chosen frequently for a certain clip, this would indicate that the clip was especially unclear. Secondly, if a participant would chose the random emotion option for a relatively large amount of clips, this could be an indication that this participant had not followed instructions and had to be excluded from the sample. Lastly, the random emotions helped to have a more balanced distribution of emotion choices in the questionnaire, because certain emotions occurred more frequently as distractor emotions than others. In the entire questionnaire, every emotion choice occurred at least three times. For an overview of the distractor choices and the random choice, see Table 6 in the results section.

The answer choices included the emotion and the definition. Participants were asked to take both into account in their answer. If they had the feeling that more than one answer was applicable, they were instructed to choose the one they felt most specifically described the character's emotion.

A second question for each movie clip asked if participants recalled having seen the movie or TV show from which the clip was extracted. This was asked to check whether familiarity with the source material would influence the emotion attribution. Lastly, the question screen featured the movie clip again in case participants wanted to re-watch it, but it did not play automatically.

Analysis

The movie clips were evaluated with the same scoring procedure as was used in the definition studies. Again, clips would pass if they scored at least an average of 3.0 for magnitude and discreteness. In addition, the larger number of participants and the smaller amount of answer choices made it possible to run a few statistical test to see if the results were significant. For the magnitude ratio, a binomial test was carried out for the answers of each movie clip, to test the probability that the frequency of the modal answer was the result of chance. Instead of using a probability of 1/4 (for the four answer choices), a more strict probability of 1/3 was used, to accommodate for the expectation that the random emotion choice would usually not be considered. For the discreteness ratio, a chi-square was run that tested whether the frequency of the most-chosen and the second-to-most-chosen answers differed significantly. Lastly, a Bonferroni-correction tested whether results were still significant at $p<.00046$ (0.05 / 108), to correct for the 108 tests.

Results and discussion

Table 6 shows the results of the study for each movie clip. The last three columns show the magnitude score, the discreteness scores, and the average between the two scores. The plus signs next to the magnitude and discreteness scores indicate significance according to the binomial tests and the chi-square tests, respectively. A double plus sign indicates that a test was also significant after the Bonferroni-correction.

Overall, the movie clips seemed to have done a good job portraying the emotions: out of 108 clips, 100 scored a 3.0 or higher. All of the 100 passing clips scored significant on the binomial test with Bonferroni-correction (at $p<.00046$). The chi-square test found that the two most-chosen answers for 94 out of 100 clips were significantly different (at $p<.05$), of which 72 were still significantly different after the Bonferroni-correction (at $p<.00046$).

Looking at the failing eight movie clips post hoc, we agreed that most of these had not been the strongest examples, and found the emotions that participants had chosen instead understandable. For example, the failed movie clip of resentment shows a teenage girl and her father in his car, with the girl asking if she can drive it, after the father refuses, the girl exits the car, slamming the door. We had found this an interesting example of resentment, but most participants identified it as frustration. Upon rewatching the clip, we agreed that this emotion was also clearly present.

The only emotion that had more than one unsuccessful movie clip was shame. This was also found to be a difficult emotion in the process of collecting movie scenes. Often, we found that potentially fitting scenes of shame in English-language movies tended to go into the direction of embarrassment. However, the third movie clip, which scored a 5 on both criteria, shows that it is indeed possible to find scenes that unambiguously depict shame.

Two of the three movie clips for guilt passed, but just barely, at a score of 3.0. For all guilt clips, regret was the most often chosen 'incorrect' answer. At the same time, guilt was not a frequently chosen answer for the regret clips. This is in line with the finding that regret is a broader emotion than guilt, because 'guilt' is only used for situations of interpersonal harm, whereas 'regret' can be used both for situations of intrapersonal harm and interpersonal harm (Zeelenberg & Breugelmans, 2008)[12]. Thus, the movie clips for regret all showed a situations of intrapersonal harm, and were not confused with guilt, but the movie clips for guilt showed situations of interpersonal harm, to which both labels could apply. However, the fact that two guilt clips passed the test indicates that participants found 'guilt' was the more specific emotion word for this situation.

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12 'Interpersonal harm' means something bad for another person; 'Intrapersonal harm' means something that is bad for oneself

Out of the 100 clips that passed, six were not found significantly different from the second choice with the chi-square test, and an additional 22 were not significantly different after the Bonferroni-correction. The six that did not pass the before the correction all scored a 3 or lower on the discreteness test, and these clips might also be considered for replacement. However, we attribute the failure of the 22 clips that did not pass after the correction to the relatively low number of participants. For example, for the first clip of hate, 23 participants selected 'hate', and five participants selected 'contempt'. Although this produced a discreteness score of 5, these two numbers are not significantly different after the correction. However, had the study been run with twice as many participants and produced the same answer pattern, 46 participants would have chosen 'hate', against 10 for 'contempt', which would easily pass the test of significance.

A possible limitation of the study was that each movie clip only included four option choices, of which two were serious contenders for the correct answer. It could be argued that some movie clips passed the test because the alternatives were an even worse fit, but that other, non-available options would have been preferred. However, the decision to include four choices was to keep the questionnaire manageable to participants, as the answers were quite lengthy at an average of about 27 words (emotion word plus definition).

Both the emotion word and definition were included in the answer choices because it seemed a better alternative over having only the emotion word or description. Offering only the emotion word was expected to introduce a number of problems. First of all, there was the possibility that respondents would not know the precise meaning of each emotion word. Secondly, even if they did know all the meanings, participants would be more likely to select an emotion that occurs more frequently in everyday language (e.g., anger) over an emotion that occurs less frequently (e.g., indignation). For this reason, the initial plan was to offer only the definitions to eliminate the familiarity bias entirely. However, a pilot study found that participants found the task very difficult and cumbersome, because they had to read and internalize each definition for every question. Once they reached the last definition, they had sometimes already forgotten the first one. Offering both the emotion word and definition was found to strike a good balance: the emotion word served as an anchor, while the definitions helped to make a more informed choice.

A follow-up study could find replacements for the eight unsuccessful movie clips and, optionally, the six clips that did not pass the chi-square test. This study should be run with more participants (e.g., 60 per track), to make sure the effect size is large enough to pass the statistical tests.

Table 6: Overview of the results of the movie clip validation study

#	Target emotion	Other emotion choices	Tr.	movie name	Freq. correct	Freq. highest incorrect	M	D	Avg
		1: Resentment	a	Good Will Hunting	100%	0%	5++	5++	5.0
01	Anger	2: Hate	b	Indecent Proposal	67%	23% [2]	4++	3+	3.5
		3: Fear	c	Top Gun	90%	7% [1]	5++	5++	5.0
		1: Anger	a	Downton abbey S.4 Ep.3	67%	30% [1]	4++	3+	3.5
02	Indignation	2: Resentment	b	Father of the bride	60%	30% [1]	4++	3	3.5
		3: Regret	c	Pleasantville	73%	23% [1]	4++	4+	4.0
		1: Anger	a	American Psycho	73%	13% [2]	4++	5++	4.5
03	Resentment	2: Frustration	b	Dan in Real Life	33%	63% [2]	1	1	**1.0***
		3: Boredom	c	Election	73%	13% [1,2]	4++	5++	4.5
		1: Frustration	a	A Serious Man	73%	27% [1]	4++	3+	3.5
04	Annoyance	2: Dissatisfaction	b	Ghost World	93%	3% [1,2]	5++	5++	5.0
		3: Fear	c	When Harry met Sally	97%	3% [1]	5++	5++	5.0
		1: Disappointment	a	Kindergarten Cop	93%	7% [1]	5++	5++	5.0
05	Dissatisfaction	2: Frustration	b	Louie S.1 Ep.7	87%	7% [2]	5++	5++	5.0
		3: Humiliation	c	Mad Men S.4 Ep.7	87%	7% [1,2]	5++	5++	5.0
		1: Annoyance	a	Dirty Rotten Scoundrels	100%	0%	5++	5++	5.0
06	Frustration	2: Anger	b	Cast Away	87%	13% [2]	5++	5++	5.0
		3: Envy	c	Little Miss Sunshine	97%	3% [2]	5++	5++	5.0
		1: Resentment	a	Gran Torino	83%	10% [1]	5++	5++	5.0
07	Contempt	2: Hate	b	Happiness	87%	7% [1]	5++	5++	5.0
		3: Loneliness	c	Pretty Woman	93%	7% [1]	5++	5++	5.0
		1: Resentment	a	A Time to Kill	77%	17% [2]	4++	5+	4.5
08	Hate	2: Contempt	b	Mean Girls	73%	13% [1,2]	4++	5++	4.5
		3: Embarrassment	c	V for Vendetta	67%	30% [1]	4++	3+	3.5
		1: Reluctance	a	50/50	97%	3% [1]	5++	5++	5.0
09	Disgust	2: Hate	b	Ghostbusters	93%	7% [1]	5++	5++	5.0
		3: Pity	c	Trainspotting	100%	0%	5++	5++	5.0
		1: Reluctance	a	Breaking Bad	93%	7% [1]	5++	5++	5.0
10	Boredom	2: Confusion	b	Ferris Bueller's Day Off	100%	0%	5++	5++	5.0
		3: Jealousy	c	Happiness	93%	7% [1]	5++	5++	5.0
		1: Annoyance	a	Bruce Almighty	93%	3% [1,2]	5++	5++	5.0
11	Reluctance	2: Dissatisfaction	b	Midnight in Paris	73%	27% [1]	4++	3+	3.5
		3: Rejection	c	The Ice Storm	57%	37% [1]	3++	2	**2.5***
		1: Desperation	a	Blow	97%	3% [3]	5++	5++	5.0
12	Sadness	2: Rejection	b	About Schmidt	93%	7% [2]	5++	5++	5.0
		3: Distrust	c	Leon	90%	10% [1]	5++	5++	5.0
		1: Sadness	a	Working Girl	90%	7% [3]	5++	5++	5.0
13	Disappointment	2: Desperation	b	Ghost World	90%	7% [1]	5++	5++	5.0
		3: Doubt	c	Big	97%	3% [2]	5++	5++	5.0
		1: Sadness	a	About Schmidt	100%	0%	5++	5++	5.0
14	Pity	2: Worry	b	Carrie	87%	10% [3]	5++	5++	5.0
		3: Embarrassment	c	Good Will Hunting	97%	3% [2]	5++	5++	5.0

#	Target emotion	Other emotion choices		Tr.	movie name	Freq. correct	Freq. highest incorrect	M	D	Avg
		1:	Sadness	a	when Harry met Sally	100%	0%	5++	5++	5.0
15	Loneliness	2:	Rejection	b	One hour photo	93%	7% [1]	5++	5++	5.0
		3:	Shock	c	About Schmidt	100%	0%	5++	5++	5.0
		1:	Sadness	a	Ghost World	77%	20% [1]	4++	4+	4.0
16	Rejection	2:	Disappointment	b	Parenthood	60%	30% [2]	4++	3	3.5
		3:	Contempt	c	Take This Waltz	87%	7% [1,2]	5++	5++	5.0
		1:	Anger	a	Full metal jacket	97%	3% [2]	5++	5++	5.0
17	Humiliation	2:	Resentment	b	Man on the moon	73%	13% [1]	4++	5++	4.5
		3:	Distrust	c	Weird Science	100%	0%	5++	5++	5.0
		1:	Loneliness	a	Art School Confidential	90%	10% [1]	5++	5++	5.0
18	Longing	2:	Envy	b	Munich	100%	0%	5++	5++	5.0
		3:	Indignation	c	The Truman Show	93%	7% [1]	5++	5++	5.0
		1:	Jealousy	a	Black swan	67%	13% [2]	4++	5+	4.5
19	Envy	2:	Resentment	b	Mad Men	87%	10% [2]	5++	5++	5.0
		3:	Annoyance	c	The Prestige	73%	17% [1]	4++	5+	4.5
		1:	Envy	a	Moulin Rouge	90%	7% [2]	5++	5++	5.0
20	Jealousy	2:	Worry	b	My Best Friend's Wedding	80%	10% [1]	5++	5++	5.0
		3:	Startle	c	The Office S.2 Ep.4	50%	27% [1]	3+	2	**2.5***
		1:	Regret	a	Amour	47%	40% [1]	3+	2	**2.5***
21	Guilt	2:	Shame	b	In Bruges	63%	33% [1]	4++	2	3.0
		3:	Disgust	c	The Company Men	57%	23% [1]	3++	3+	3.0
		1:	Guilt	a	Cast Away	90%	3% [1,2,3]	5++	5++	5.0
22	Regret	2:	Shame	b	The social network	73%	13% [2]	4++	5++	4.5
		3:	Indignation	c	Mighty Aphrodite	73%	20% [1]	4++	4+	4.0
		1:	Embarrassment	a	Real Genius	13%	83% [1]	1	1++	**1.0***
23	Shame	2:	Insecurity	b	Working Girl	80%	17% [1]	5++	5++	5.0
		3:	Boredom	c	The King's Speech	23%	57% [2]	1	1+	**1.0***
		1:	Shame	a	Closer	70%	23% [1]	4++	4+	4.0
24	Embarrassment	2:	Nervousness	b	When Harry met Sally	90%	7% [2]	5++	5++	5.0
		3:	Longing	c	A Fish Called Wanda	93%	7% [1]	5++	5++	5.0
		1:	Anxiety	a	Scent of a woman	67%	23% [1]	4++	3+	3.5
25	Fear	2:	Distress	b	A Serious Man	93%	7% [1]	5++	5++	5.0
		3:	Contempt	c	The Usual Suspects	87%	13% [2]	5++	5++	5.0
		1:	Nervousness	a	Falling Down	70%	13% [2]	4++	5+	4.5
26	Startle	2:	Shock	b	The Cabin in the Woods	87%	10% [2]	5++	5++	5.0
		3:	Dissatisfaction	c	Ghost World	67%	20% [1]	4++	4+	4.0
		1:	Anxiety	a	Parenthood	23%	63% [2]	1	1+	**1.0***
27	Worry	2:	Insecurity	b	Apollo 13	83%	17% [1]	5++	5++	5.0
		3:	Jealousy	c	The Perfect Storm	97%	3% [1]	5++	5++	5.0
		1:	Nervousness	a	Ghost	57%	27% [2]	3++	3	3.0
28	Anxiety	2:	Worry	b	The Hurt Locker	50%	30% [1]	3+	2	**2.5***
		3:	Longing	c	The Cabin in the Woods	67%	17% [1,2]	4++	5+	4.5

#	Target emotion	Other emotion choices		Tr.	movie name	Freq. correct	Freq. highest incorrect	M	D	Avg
		1:	Reluctance	a	Indecent Proposal	93%	7% [2]	5++	5++	5.0
29	Distrust	2:	Worry	b	The road	97%	3% [1]	5++	5++	5.0
		3:	Humiliation	c	Working Girl	83%	13% [1]	5++	5++	5.0
		1:	Anxiety	a	Carrie	77%	20% [2]	4++	4+	4.0
30	Insecurity	2:	Nervousness	b	Back to the future	93%	7% [2]	5++	5++	5.0
		3:	Startle	c	Art School Confidential	63%	23% [2]	4++	3+	3.5
		1:	Insecurity	a	Master and Commander	63%	20% [1]	4++	4+	4.0
31	Doubt	2:	Confusion	b	Parenthood	80%	13% [2]	5++	5++	5.0
		3:	Disgust	c	Pulp Fiction	80%	13% [3]	5++	5++	5.0
		1:	Insecurity	a	Little Miss Sunshine	100%	0%	5++	5++	5.0
32	Nervousness	2:	Doubt	b	Scent of a woman	63%	37% [1]	4++	2	3.0
		3:	Loneliness	c	The Cutting Edge	70%	27% [1]	4++	3+	3.5
		1:	Desperation	a	Bad Santa	100%	0%	5++	5++	5.0
33	Distress	2:	Anxiety	b	Eternal Sunsh. o/t Sp. M.	83%	13% [1]	5++	5++	5.0
		3:	Boredom	c	Full metal jacket 2	97%	3% [1]	5++	5++	5.0
		1:	Distress	a	A Serious Man	67%	33% [1]	4++	3	3.5
34	Desperation	2:	Frustration	b	It's A Wonderful Life	93%	7% [1]	5++	5++	5.0
		3:	Pity	c	Parenthood	90%	10% [1]	5++	5++	5.0
		1:	Doubt	a	Social network	87%	10% [1]	5++	5++	5.0
35	Confusion	2:	Shock	b	A Fish Called Wanda	93%	3% [3]	5++	5++	5.0
		3:	Indignation	c	Take this waltz	97%	3% [2]	5++	5++	5.0
		1:	Desperation	a	Working Girl	73%	27% [2]	4++	3+	3.5
36	Shock	2:	Confusion	b	Forrest Gump	87%	10% [2]	5++	5++	5.0
		3:	Guilt	c	A Serious Man	70%	30% [2]	4++	3+	3.5

*Note: M: Magnitude score of correct response, D: Discreteness score of correct response, Avg: Average between magnitude and discreteness score. The numbers in front of the other emotion choices represent: 1,2: Distractor emotions, 3:Random emotion. The superscripts next to the frequency percentage of the highest incorrect number indicated which of the three emotions was chosen most often. In the magnitude and discreteness columns, + means significant at p<.05 (without Bonferroni-correction) and ++ means significant at p<.00046 (with Bonferroni-correction). * Falls below validation score.*

4.5 Part IV – creating the database website

The emotion typology, definitions, comic strips, and movie clips formed the basis of the negative emotion database. This database was published on a website that was intended to make all its elements accessible in an intuitive and engaging way (www.emotiontypology.com). The website was developed by the author, in collaboration with a digital designer from the Dutch design agency Reframing Studio, and a technical developer from the Dutch company De Wortel van Drie.

The website was designed so that people would start from the overview of 36 emotions. These emotions were arranged in blocks, of which the colors and arrangement represented the emotion clusters

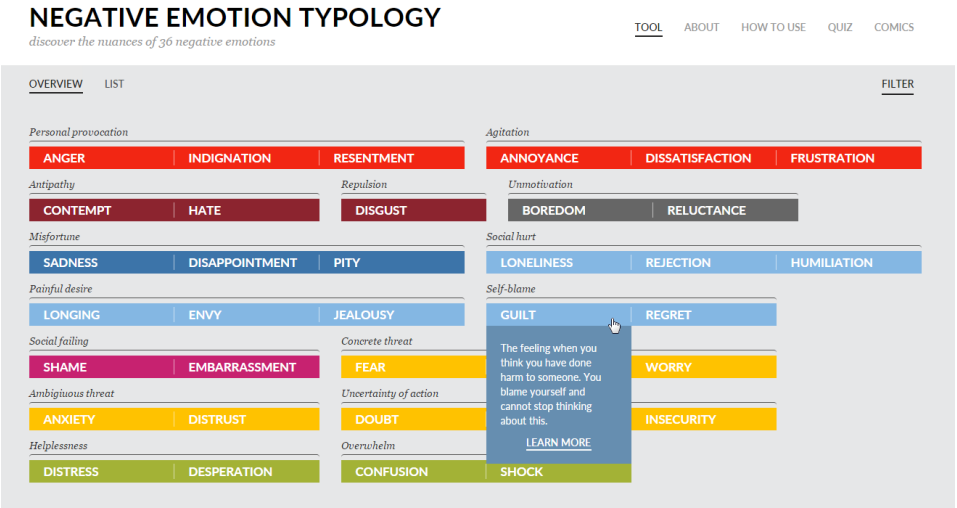

Figure 33: The homepage of the online database

and subclusters (Figure 33). To reduce visual clutter, the definitions of the emotion words were not immediately visible, but shown for a specific emotion if the user hovered their cursor over the corresponding block. Subsequently clicking on the definition would bring the user to the detail page of that emotion.

The detail page features the following elements: The emotion, the definition, a general description text, the three movie clips, two typical expressions, the comic strip, and a number of comparisons between the emotion and other emotions that are likely confused (see Figure 34).

The description texts were written based on the same literature sources used for the clustering and definition formulation. The descriptions are an average of 350 words per emotion, with a total of over 12,500 words. The movie clips play individually if the user clicks on them. While not playing, they show a still frame, taken at a moment in the clip when the character is expressing the emotion. In this way, the still frames serve as illustrative images even if users are not watching the videos.

The emotion expressions are two sentences that have been written as prototypical sayings or thought lines for someone experiencing the emotion. For example, the expressions for disappointment are "*Oh, that's too bad...*", and "*I really hoped it was possible.*" Expressions also include exclamations or bodily sounds, such as "*Yuck!*" for disgust, or **yawn** for boredom.

The comic strips have the option to 'read the whole story', which brings users to a separate page on which they could read the comic in the order of the story.

NEGATIVE EMOTION TYPOLOGY

discover the nuances of 36 negative emotions

TOOL ABOUT HOW TO USE QUIZ COMICS

OVERVIEW LIST

- ANGER
- INDIGNATION
- RESENTMENT
- ANNOYANCE
- DISSATISFACTION
- FRUSTRATION
- CONTEMPT
- HATE
- DISGUST
- BOREDOM
- RELUCTANCE
- SADNESS
- DISAPPOINTMENT
- PITY
- LONELINESS
- REJECTION
- HUMILIATION
- LONGING
- ENVY
- JEALOUSY
- GUILT
- REGRET
- SHAME
- EMBARRASSMENT
- FEAR
- STARTLE
- WORRY
- ANXIETY
- DISTRUST
- INSECURITY
- DOUBT
- NERVOUSNESS
- DISTRESS
- DESPERATION
- CONFUSION
- SHOCK

INDIGNATION

personal provocation

The feeling when someone's action goes against your moral values. You can't believe that a person could do something like this. You have the urge to speak out about what this person did.

You feel indignation when someone crosses the line of what you think is morally right or acceptable. For example, if you see a car driver speeding in a residential area, when you read a tabloid article about the adultery of a celebrity, or when you find out that company managers have fired many employees while increasing their own bonus. In each of these cases, you witness other people doing something that is harmful, disrespectful, or unfair to others.

Unlike other anger-emotions, indignation can also be evoked by events that have nothing to do with you or anyone you know. For instance, you may become indignant when you read in the paper that thousands of people in another country were injured in a chemical spill by a negligent company, even if you don't know anyone involved.

Researchers identified five themes that are relevant in moral judgment: Harm (e.g., you see someone hitting a child), fairness (e.g., you see someone being ripped off in a store), in-group loyalty (e.g., you hear a colleague speak badly about your company to people from outside), repect for authority (e.g., you find out students regularly degrade and make fun of a teacher), and purity (e.g., you learn that someone has slept with a great number of people). How people prioritize these values – which violation evokes indignation most quickly and intensely – depends on their personal worldview and political inclination.

Because the person experiencing it is often not directly involved in the matter, indignation often gives people the urge to tell others about the wrongdoing. By letting more people know, they hope – at least implicitly – that the news will reach people that can do something about it (e.g., politicians), or that it can mobilize enough people to reach a critical mass (e.g., forming an activist group).

In the comic, Murphy passes the copy room where a colleague is stocking up on an unusual amount of print supplies. It is clear that this colleague is getting them for his own use, and that he does not feel the slightest bit of remorse over this.

MOVIE CLIPS

TYPICAL EXPRESSIONS

"How could you do something like that?!"

"I can't believe he is getting away with this."

MURPHY'S BAD DAY

READ THE WHOLE STORY

COMPARISONS WITH OTHER EMOTIONS

Indignation & Anger

Anger and indignation both include a moral dimension – someone did something bad. The difference is that for anger the action is personal (you did something bad to me), whereas indignation is bad in a more general sense, for instance, for society. Often, indignation is about violating a social rule or harming standard (e.g., you should not steal). For instance, if you read a story about a manager who stole millions from his company, you could experience indignation, but not anger, because it had nothing to do with you. On the other hand, if someone is not paying attention and smashes their car into yours, you can become angry, but probably not indignant, because there was no social rule violated.

Indignation & Contempt

Indignation and contempt often seem to go hand in hand: if you hear about a politician stealing public money, you are likely to feel both emotions. The most important difference is that indignation is triggered by specific actions (e.g., hurting, stealing), whereas contempt is triggered by knowing about a characteristic (e.g., greediness, ruthlessness). As such, you can feel contempt for someone just for which group they belong to or who they are, without knowing about anything specific they have done. Additionally, when you get indignant about something someone did, you do not automatically feel contempt for them. If you believe that the action was a one-time incident, and not an overall

Figure 34: The detail page for indignation in the online database

Anger and annoyance can both occur when someone does something that you didn't want. However, whereas annoyance is reaction against an action that is against your current wishes, you can only become angry when you think there is a bad motivation behind it. For example, when students are talking in class, a teacher may just be annoyed. However, if she believes that they are purposefully trying to undermine her, she would become angry. People can be annoyed if something disturbs them, even if they see it in general as something positive. For example, a mother may be annoyed, but not angry, when her son is practicing violin at home, even if she supports his efforts to learn to play it. She could only get angry if she would see his playing as something 'bad', for instance, if she had earlier forbidden him from playing because it distracts from his schoolwork. This shows that anger has a certain moral dimension that annoyance lacks. In anger, you feel that the other person should not do things like this, because they are bad. In annoyance, you simply feel that the other person should not do this, because it disturbs you.

Sample database comparison text, discussing the differences between anger and annoyance

The comparison texts were written to help users explicitly compare and distinguish two easily confused emotions with each other (see an example text above). In total, 45 pieces were written, which means that each emotion features on average 2.5 comparison texts (2 x 45/36). These texts contained in total 6,000 words, which is an average of about 135 words per piece.

Lastly, the website features a movie quiz that users can take to test their own emotion knowledge. This quiz shows five screens with a movie clip that asks them to choose the right emotion from four options (a setup identical to the movie study). At the end, the users receive a score and can review their answers.

The website is intended to fulfill the three goals outlined in the beginning of the project. The first goal, providing a structured overview, was covered by the overview page and the concise definitions. If a user wants to explicitly compare two emotions, they can read the comparison text. The second goal is covered by the in-depth descriptions of each emotion, and to some extent, by the comic strips and the movie clips. Lastly, the third goal, offering intuitive familiarity with the specific emotions was covered by the comic strips, the movie clips and the typical expressions. Although the website was designed and written with experience-driven designers in mind, it was not made exclusively suitable for this group. Although quite a few of the given examples show the role of products, the website was made as a resource that could be used by a broader group of users.

Earlier versions of the database and website were used in education and in several projects described in this thesis. It was a guiding force in the research-through-design project described in chapter seven and it was used as preparation for the design workshop described in chapter eight. These applications gave the indication that the website was both insightful and effective for use in projects, as well as intrinsically engaging to use. However, the website has not been formally tested for these benefits. A future plan is to evaluate whether the database can be used to help people in general increase their

personal emotional granularity. This is an application that could be very interesting, as emotional granularity has been correlated to the ability to regulate emotions more effectively (Barrett, Gross, Christensen, & Benvenuto, 2001), and was recently found to be positively related to wellbeing (Erbas, Ceulemans, Lee Pe, Koval, & Kuppens, 2014). An experiment could make a within-subjects comparison of emotional granularity before and after using the database for a certain amount of time.

4.6 General discussion

This chapter discussed the compilation of an emotion typology with 36 emotions, the formulation of definitions for each emotion, the validation of these definitions, the collection and creation of narrative representations for each emotion, the validation of these representations, and finally, the composition of these elements in an online database that aims to increase the emotional granularity of designers.

A main finding in this project was that people seem able to distinguish at least 36 different negative emotions. The definitions studies found that 32 definitions were reliably attributed to the right emotion word, which is only possible if these emotions are distinguished in the first place. Furthermore, the movie clip study found that every emotion was successfully recognized in one movie clip (and for most, in three clips).

Another important finding is that emotions that were problematic in the definitions study, performed well in the movie clips study, and vice versa. The four emotions that had failed to pass the definitions study, envy, dissatisfaction, resentment and nervousness, all had two or more movie clips correctly identified. Conversely, the two emotions that were problematic in the movie studies, guilt and shame, both did well in the definitions study. This shows the importance of offering more than one type of information in the database: the combination of definition, descriptions, and representations should have a much better chance of clearly conveying an emotion concept than any one of these elements has on its own.

The decision to make our own typology instead of using an existing one was based on the observation that existing ones were not well suited to our aim, which was to start from a workable and, within reasonable criteria, exhaustive list of emotions that would help practitioners to understand, analyze and evoke emotions. Although we have been as rigorous as possible in the composition of the typology, we do not think that the list of emotions forms a definitive, unchangeable set. We believe that the final outcome is a good starting point for both practical and theoretical projects, but we welcome any additions or improvements that others may propose in the future.

There are 36 negative emotions in the typology, which is eleven more than the 25 positive emotions that Desmet (2012) identified through a similar process. Although we subscribe to the viewpoint that

positive emotions have not been differentiated enough in most literature (at least, until recently), we still think that there are more distinguishable variants of negative emotions than positive ones. This was also the finding of Smith, Tong, and Ellsworth (2014), who reviewed the differentiation of ten positive emotions through appraisal theory, but concluded that there are more negative emotions to distinguish. An explanation for this imbalance may be that, from an evolutionary standpoint, situations of harm or threat require greater precision in identification and response than situations of benefit and opportunity (e.g., see Lazarus, 1991).

The different parts that make up the project are described in a linear fashion in this chapter, for purposes of readability and comprehension. In reality, the processes ran partly sequential, partly parallel. For example, the process of formulating the emotion definitions led to some changes in the composition and amount of emotions in the typology. The selection process had initially produced 39 different emotions, but 3 of those were eliminated after it was found impossible to formulate a good definition for them that was clearly distinct from that of other emotions. Similarly, the process of identifying suitable movie clips sometimes led to changes in the emotion definitions, because a movie clip illuminated a crucial aspect of the emotion that we had not considered before. Thus, rather than considering the lack of clearly defined, sequential stages as carelessness or a lack in rigor, we regard it as an example of how different approaches and perspectives can reinforce each other.

5 ::.

AN APPROACH TO DESIGN FOR RICH EXPERIENCE

Calvin: Let's find some slugs and worms.
Hobbes: Why do we want to find slugs and worms?
Calvin: Because they're gross.
Hobbes: That's why one avoids slugs and worms.
Calvin: If we avoid them, we can't dare each other to eat one.
Hobbes: Toodle-oo.
Calvin: What's the matter with you?! Don't you like fun?!

— Bill Watterson

Chapter three introduced a framework for rich product experience and the study in chapter four collected, clustered, and generated information about specific negative emotions. Using these ingredients, the current chapter introduces a design approach to enrich user experiences by methodically involving negative emotions in user-product interaction. The approach consists of three steps, where the designer decides 1) which negative emotion is most appropriate for the user context; 2) how and when this emotion is best elicited; and 3) which protective frame is most appropriate to use and in what way it is applied to the product concept. Ten rich experience qualities were developed that offer prefabricated combinations of these steps, which are intended to lower the threshold of using the approach. The steps for these qualities are described, and each is briefly discussed. Lastly, the applicability of the approach in design is demonstrated by showing six examples of how the qualities have been used to generate concrete product concepts.

This chapter was previously published as: Fokkinga, S. F., & Desmet, P. M. A. (2013). Ten ways to design for disgust, anxiety, and other enjoyments. International Journal of Design, 7(1).

5.1 Introduction

Consider the following new product concepts: a digital nutrition assistant that elicits disgust in people who are shopping for groceries, a thermometer that makes feverish children feel sad when it takes their temperature, and a digital exercise coach that makes running laps a frightening experience. These concepts may seem strange at first glance. Indeed, by eliciting negative emotions their purpose seems even contrary to that of experience design: to provide people with pleasurable product experiences. However, we believe that these concepts illuminate a promising new direction in experience design.

Several authors have published guidelines for experience-driven design. Although diverse, these existing approaches share the objective to provide guidance in designing products that stimulate positive emotions and experiences. For instance, Jordan (2000) suggested four sources of product pleasure, Norman (2004) discussed three cognitive levels of pleasurable product experiences, Desmet (2008) proposed nine sources of product appeal, and Arrasvuori, Boberg, and Korhonen (2010) surveyed and categorized 22 different ways for products to elicit playfulness. In this paper we outline an approach that is different in purpose and even opposite in its consideration of emotions. It is different in purpose because it aims to create *rich experiences* rather than pleasure, playfulness or positive appeal, and opposite in its consideration of emotions because it conceives negative emotions at the basis of these rich product experiences. Our aim is to show how product concepts eliciting negative emotions, like the ones proposed above, can be created to systematically enrich user experiences.

To show why and how negative emotions have a central role in rich experiences, it is necessary to define what is meant by these terms. Firstly, the English word 'experience' can refer to a momentary experience of a single event (in German: 'Erlebung'), such as the experience of pain, but also to an episode of multiple experiences that form a coherent whole (in German: 'Erlebnis'), such as the experience of traveling by airplane. Rich experiences are examples of such integrated 'Erlebnissen', whereas the specific emotions of which they are composed are mostly individual 'Erlebungen'. Secondly, to accurately define our notion of rich experiences, we will identify the key characteristics that set them apart from non-rich experiences, thus gradually narrowing the scope of definition. This definition-by-exclusion is visually represented in Figure 35, which also shows examples of the different types of experiences. First of all, rich experiences are somehow a-typical and therefore notable and memorable (2), setting them apart from ordinary or mundane experiences that involve neutral, mildly positive or mildly negative emotions (1). Secondly, rich experiences are differentiated from other notable experiences by being pleasant or by having some kind of beneficial effect on the experiencing individual (2.2). This criterion excludes experiences that are notable, yet unpleasant and without any value to the person experiencing (2.1). The remaining set of experiences can again be divided into two categories, yielding a set of experiences that only involve strongly positive emotions (2.2.1), and a set of experiences that involve a mix of negative and positive emotions (2.2.2). In brief, rich experiences

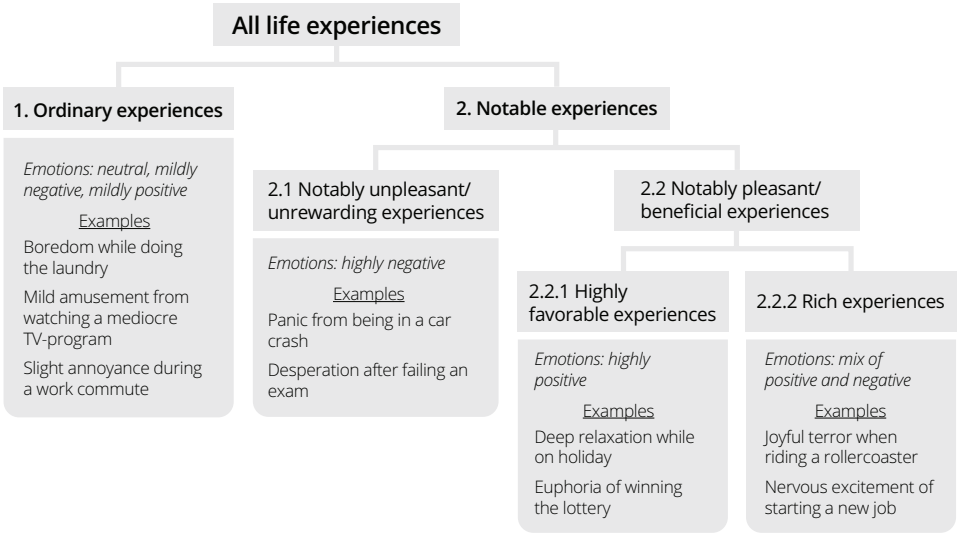

Figure 35: Rich experiences defined by comparison to other types of life experiences

are notable and memorable experiences that involve a mix of positive and negative emotions and are experienced as valuable, because they are pleasant, beneficial, or both.

Although both of the final categories (2.2.1 and 2.2.2) are highly interesting for design, there are a few reasons why we focus on rich experiences in this paper, instead of on highly favorable ones. First of all, it is difficult to durably elicit strong positive emotions with everyday products. Such emotions are usually only evoked by personal goal achievements or by highly favorable life events (e.g., Lazarus, 1991, pp. 265-269), in which products normally play a supportive role at best (Desmet, 2002). Products are in some cases able to elicit certain strong positive emotions, but those are either singular and short-lived (e.g., positive surprise, see Ludden, 2008) or unattainable to most people, such as the satisfaction evoked by flying first-class. However, apart from issues of feasibility, the use of rich experiences can be justified primarily by their ability to offer unique experiences that purely positive (or negative) experiences cannot provide. A phenomenological study uncovered two main types of rich experiences with mixed emotions (Fokkinga & Desmet, 2012b)[1]. Firstly, some of the most interesting and enjoyable things in life are not simply positive or negative. This is evident in the experience of art and entertainment: gloomy music makes listeners feel melancholic, shock art may disgust or outrage people, and movies even elicit a whole spectrum of negative and positive emotions over the course of their narrative (Tan, 1996, pp. 1-2). Secondly, negative emotions can have beneficial effects on the experiencing individual, which can lead to a positive overall experience. For example, one participant in the study stated that the rage she had over an unfair evaluation made her feel very energetic, focused, and righteous, which helped her to formulate an articulate reply to challenge the evaluation.

1 *(Later note) Chapter two of this thesis*

Another participant said that the sadness she felt when saying goodbye to her grandparents had a positive effect, because it made her realize their importance in her life (Fokkinga & Desmet, 2012b). The study also found two types of mixed emotional experiences that were not perceived as rich: experiences in which the causes of the emotions were mutually unrelated (e.g., someone is happy with the look of his car, but dissatisfied with its energy consumption), and experiences in which the positive emotion preceded and caused the negative emotion (e.g., someone hoped her friend would fall so she would win the wall-climbing competition, but felt ashamed about this afterwards). Thus, even though rich experiences involve mixed emotions, not all mixed emotion-experiences are necessarily rich. Another important observation was that it is simplest and most elegant to conceptualize the negative emotion as primary and the positive emotion as secondary in the formation of rich experiences. For instance, it is much easier to explain that shock art is fascinating because it is outrageous, or that roller coasters are fun because they are scary, than the other way around.

This last observation was at the basis of an explanatory framework that suggests how rich experiences can be formed in human-product interactions, which we proposed in another paper (Fokkinga & Desmet, 2012a)[2]. In this framework, rich experiences consist of three ingredients: a negative stimulus, subjective transformation and a protective frame (see Figure 36). The negative stimulus is the element of a product or product interaction that evokes the negative emotion. For instance, a certain product feature may seem threatening to the user, and elicit fear. Secondly, negative emotions enrich experiences because they bring about a perception transformation and attitude transformation in an individual, which constitute two sides of the same effect. A perception transformation changes what a person attends to in the world around him, how he experiences time and space, which meaning he derives from events, and how sensitive he is to certain information, among other things. For instance, a frightened person will momentarily perceive the world as more lively, urgent, and revolving around himself. Analogously, an attitude transformation changes a person's view on his own position in the world and his tendency to act upon it. For instance, an angry person tends to feel more impulsive, direct and assertive towards his surroundings. Every negative emotion produces a unique transformation of perception and attitude, so each of them enriches the user experience in a distinct way. The third ingredient of the framework is the protective frame, which takes away the unpleasant aspects of the negative emotions to allow the user to enjoy its beneficial aspects. Four different protective frames were identified for use in design: the safety-zone frame, the detachment frame, the control frame and the perspective frame, all of which can be applied separately or jointly. The framework was inspired by Sartre's conception of emotions as transformations of the world (Sartre, 1939/1962), but underpinned by insights of contemporary emotion psychology, particularly areas of appraisal theory that focus on bodily and mental effects of emotions (e.g., Fredrickson, 2004; Frijda, 1986) and the distinction in these effects across different emotions (e.g., Lerner & Keltner, 2000; Rucker & Petty, 2004). Lastly, the concept of the protective frame is derived from the work of Apter (2007).

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2 (Later note) Chapter three of this thesis

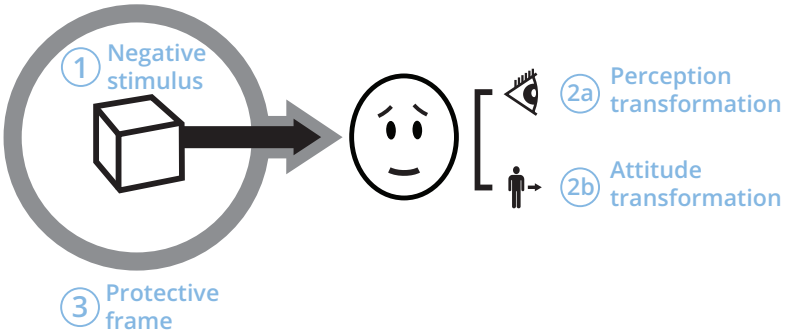


Figure 36: The rich experience explanatory framework (adapted from Fokkinga & Desmet, 2012a)[2]

The current paper shows how the three ingredients of the framework can be applied consecutively in a three-step design approach. This approach and the design steps are discussed in the first section. Next, the paper introduces ten rich experience qualities that follow specific 'prefabricated' combinations of these steps, each evoking a different combination of a negative and a positive emotion, and thus each enriching a product experience in a different way. The subsequent section offers a detailed description of the ten rich qualities, with examples of their occurrence in real life and product use, as well as a discussion of relevant literature. Several rich qualities are then exemplified with concept design cases, including the examples of the first paragraph of the introduction. Lastly, we reflect on the use of this approach and discuss some implications of this new way of constructing emotional product experiences.

5.2 Adapting the framework to a product experience design approach

With the proposed framework in Figure 36, the formation of emotionally rich experiences can be conceptualized. However, apart from analyzing and explaining rich product experiences, this framework can also guide designers in *creating* them. In a design process, the three ingredients can be applied consecutively in three steps (see Figure 37).

In the first step, the designer chooses which negative emotion to evoke in the product experience, based on an understanding of which transformation of perception or attitude might be desirable in the user's situation. Thus, the second ingredient of the framework is the first step in the approach, because the specific subjective transformation (produced by a specific negative emotion) determines what kind of rich experience the user will have. For instance, if the user context is a waiting room in which people are generally bored, the designer might opt to design something that makes the waiting

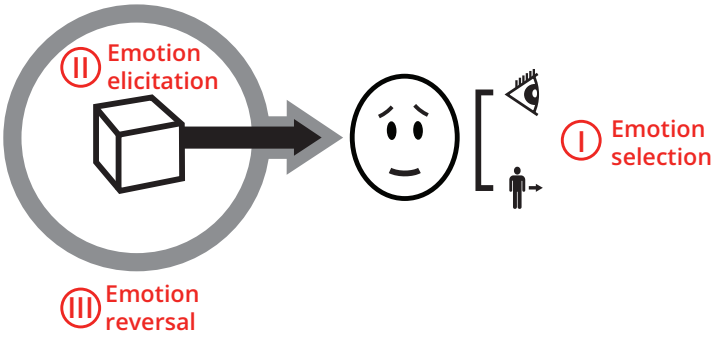


Figure 37: The rich experience design approach

experience more exciting and lively (transformation of perception), in which case fright would be an appropriate emotion. Or, if the brief is to design something that makes students calmer and feel more connected to their history lesson, the design could elicit sadness (transformation of attitude). The transformations are essentially two sides of the same effect, as they are both the result of the bodily and mental changes that occur with an emotion. However, they have been treated separately to make a distinction between two perspectives that designers can adopt when considering the effect they want to achieve in the user context. If a designer is mostly concerned with the user's subjective experience of a situation, transformation of perception might be the most relevant to consider. In contrast, if a designer is mainly interested in changing a user's behavior, a focus on attitude transformation might be more worthwhile. Unfortunately, when considering transformations as a guideline of emotion selection, there is one obvious challenge. Although there is much knowledge about specific bodily and mental effects of different negative emotions (for instance, Rucker and Petty (2004) found that sadness makes people prefer passive activities, whereas anger makes them prefer active ones), there are, to our knowledge, no clear and empirically rooted overviews of the integral transformations that different negative emotions produce. This problem will be addressed in the next section, in which ten pre-researched negative emotions are proposed for use in the approach.

In the second step, the designer needs to find an appropriate way to evoke the chosen emotion in the user. Several researchers have made overviews of the causes for specific emotions (e.g., Ellsworth & Scherer, 2003, p. 583; Frijda, 1986, p. 218; Lazarus, 1991, p. 122). For instance, fear is evoked when something threatens a person, whereas sadness is evoked by a loss (Lazarus, 1991, p. 122). Emotion researchers use such causes to explain why people have certain emotions in a given situation, but designers can use them the other way around – to create the circumstances that elicit the chosen emotion in the user. However, there is often a high level of abstraction in the description of these causes because they cover large themes. For example, a variety of situations evoke fear because they all represent different kinds of threats: e.g., looking down from a great height (threat of falling down), forgetting to lock one's car (threat of losing property), or suddenly having to speak for a large audience (threat of social embarrassment). Thus, the designer still has to decide on a concrete way to put the

abstract cause into the product experience. The role of the product in this can be both direct and indirect. In the direct role, the product evokes the emotion through sensory impression or through usage. In the indirect role, the product can motivate the user to undertake certain behavior, or reveal a certain quality in the world, which in turn evokes the emotion. In addition to introducing a new negative emotion in a product interaction, the designer can also use a negative emotion that is already present in the targeted user context. For instance, when designing a product for children in a hospital, the designer can use the anxiety or sadness that is intrinsic to such an environment, and redirect these emotions to a less unpleasant source.

In the last step, the designer creates a protective frame that reverses the negative emotion so that it can be enjoyable for the user. The protective frame is a mental construct that detracts the unpleasant aspects from the experience of a negative object or event (Apter, 2007), while leaving the transforming effects intact. For instance, when people interact with a caged lion, they will experience the same transformation of perception (stimulation and focus) and attitude (pumped up and energized), but without the subjective evaluation that their lives are in danger. Although the protective frame is a mental construct, it can be (and often is) induced by designable circumstances, as the case of the caged lion shows. To understand the different ways in which negative emotions can be enjoyable in product experience, four protective frames were proposed (Fokkinga & Desmet, 2012a). Each of these four frames can be employed by designers to make the negative emotion enjoyable.

The *detachment frame* (Figure 38) is constructed by altering the stimulus of the negative emotion in such a way that users are only confronted with a representation of it. For instance, instead of interacting with a real-life lion, users can interact with a graphic, movie, story, audio recording or even a symbolic representation of a lion. The use of this frame is common in the experience of negative emotions in art and entertainment. There are several sub-strategies that lead to a detachment frame, some of which are stronger than others. For instance, the negative stimulus can be represented by abstraction –e.g., reading about the number of victims of a disaster rather than seeing photographs of them; by simplification – e.g., a line drawing of a wound rather than a photograph; by stylization – e.g., a beautiful picture of a collapsed building; or by overemphasis – e.g., the exaggeration of violence ad absurdum in slasher movies.

The *safety-zone frame* (Figure 39) is constructed by physically distancing users from the negative stimulus, so they are literally or figuratively in the 'safe zone'. Unlike the detachment frame, the safety-zone frame still lets the user interact with the actual negative stimulus. This frame can be constructed by creating a distance between the user and the stimulus (e.g., designating seats that are outside of the splash zone at a dolphin show), or by creating a barrier between the user and the negative stimulus (e.g., a fence that prevents people from falling from a rooftop). Not all barriers are necessarily solid and static – a child can use a twig as a safety-zone frame to probe a dead bird without having to touch it, while still feeling fascinatingly disgusted.

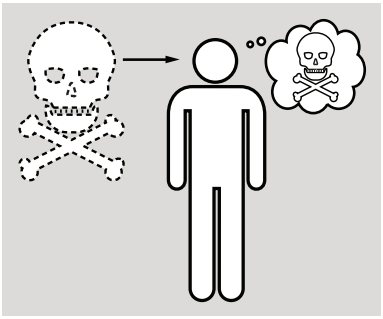


Figure 38: The detachment frame

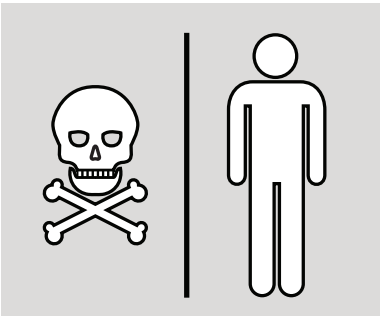


Figure 39: The safety-zone frame

The *control frame* (Figure 40) is constructed by increasing the amount of control that a user has over the interaction with the negative stimulus, taking into account any skills and abilities that the user already possesses. This control can relate to physical skills (e.g., the user is fast, strong or agile enough to avoid or deal with the negative stimulus) and mental abilities (e.g., the user is smart, knowledgeable, perceptive or creative enough to avoid or deal with the negative stimulus). Design can support or improve skills of both categories. For instance, a product (feature) could temporarily increase a person's load capacity (e.g., anchoring rope in rock climbing), it could increase a user's perceptiveness by alerting him to impending danger (e.g., proximity sensors in car bumpers) or it could increase a user's creative problem solving by providing hints (e.g., the suggestion function in printers with a paper jam). Sometimes a control frame is as simple as giving users the ability to 'opt out' of the experience of a negative stimulus. Even though they may never use the option, the knowledge that it is possible at any time can provide a sufficiently strong frame for the user to enjoy the experience.

The *perspective frame* (Figure 41) can be constructed by providing a perspective on the wider implications of the negative stimulus or the user's reaction towards it. For instance, a person may feel reluctance toward getting up early in the morning, but if she is able to see the beneficial implications of her early awakening (e.g., being able to get more work done, being ahead of other commuters in traffic), she can feel proud about her own behavior. A good way to approach the creation of a perspective frame through design is by connecting the negative situation to specific *virtues*. Virtues, such as those promoted by Aristotle (2009), are character qualities that are considered morally good and socially beneficial. For instance, getting up early (eliciting reluctance) can be connected to the virtue of *diligence*, whereas getting close to a lion (eliciting fear) can be connected to *courage*. Other examples of virtues are *loyalty* (e.g., 'taking one for the team'), *self-actualization* (e.g., observing one's own progress in mastering a difficult skill), *altruism* (e.g., participating in a charity run), *modesty* (e.g., declining an expensive present), and *sincerity* (e.g., telling the truth against one's own interest). The connection between the situation and one of these virtues will depend heavily on the specific context. In the case of the early riser, for example, the virtue of diligence could be introduced through an alarm clock that

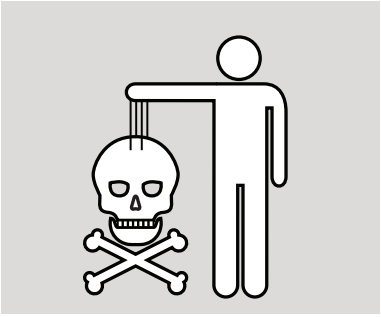


Figure 40: The control frame

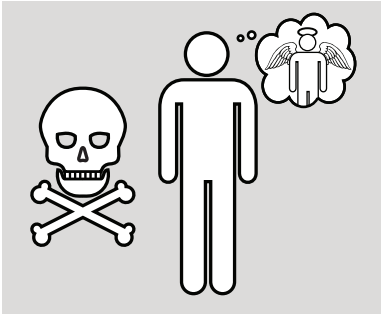


Figure 41: The perspective frame

shows how many other people have already gotten up at that time, so the user can immediately see she is one of the first and feel good about herself.

By following these three steps, designers can come up with conceptual ideas for a product or product feature that afford rich experiences. However, it should not be considered a 'cookbook' for the creation of rich product concepts. The steps are rather guidelines that can help to structure the designer's thought process and facilitate discussion among different team members working on a project.

5.3 Ten rich experience qualities

In this approach, any negative emotion, combined with a protective frame, can be the basis for a rich experience, provided that it is elicited in an appropriate user context. This means that the number of possible rich product experiences is in principle at least as extensive as the number of negative emotions. However, to get a more tangible impression of the possibilities of the approach, we elaborated ten specific rich experience qualities that we believe are worthwhile in user-product contexts. 'Experience qualities' (or just 'qualities') in general are a concept used by designers to specify the type of experience the user should have with a product, without yet establishing functional properties or even the type of product. It is akin to what Hassenzahl (2010, pp. 17-19) calls an 'experience pattern': the essence of an experience that can be manifested differently in different situations. The rich experience qualities specifically were developed by elaborating the three steps of the approach for ten different negative emotions. Table 7 shows an overview of the ten rich qualities with a short description and the three elaborated steps[3]. Designers can use this overview as a guideline for experimenting with the different emotions and rich experiences.

3 *(Later note) The names of three negative emotions in Table 7 and the following sections were changed since the paper, which has been reproduced verbatim in this chapter, was published. 'Fright' changed to 'fear', 'maliciousness' to 'anger', and 'poignancy' to 'sadness'. Furthermore, the emotion definitions used in Table 7 have since been updated – the definitions provided in chapter four are the final ones.*

Table 7: Three-step application of ten rich experience qualities

			Step 1 – Emotion selection
Rich quality	**Description of quality**	**Negative and positive emotion**	**Transformation of perception**
 **The sadistic**	Using a mental or physical advantage to harm a person or object in a playful way	**Maliciousness:** To experience an urge to trouble or harm someone **Amusement:** To enjoy a playful state of humour or entertainment	*Invitingly opportunistic* People perceive the world full of attractive opportunities that beg to be tried out.
 **The thrilling**	An immediate, exciting rush that makes people feel alive and very in-the-moment.	**Fright:** A feeling of strong, sudden agitation caused by the presence or imminence of danger **Joy:** To be actively pleased about something	*Stimulating Intensity* People perceive their world as very stimulating and intense, and momentarily revolving around themselves.
 **The challenging**	The experience of a frustrating, yet engaging problem that people are determined to solve.	**Frustration:** To experience an arousing dissatisfaction from dealing with an obstacle to reach a goal **Satisfaction:** To enjoy the recent fulfilment of a need or desire	*Straightforwardly demanding* People feel an irresistible lure to solve a certain problem: it might not be an easy task, but they have an idea how to deal with it
 **The eerie**	Something that gives people the creeps but is also enchanting.	**Anxiety:** To experience uneasiness from the anticipation of an uncertain or unclear threat **Fascination:** To experience an urge to explore, investigate, or to understand something	*Suspensefully mysterious* People briefly perceive their environment as a mysterious yet suspenseful place, and feel they have to be careful in their acts.
 **The scandalous**	An outrageous, yet fascinating violation of social norms or values.	**Indignation:** To experience arousal from witnessing something morally unjust, mean, or unworthy **Fascination:** To experience an urge to explore, investigate, or to understand something	*Straightforwardly controversial* People subjectively perceive an increased clarity and simplicity in the world: it is clear someone has been wrong.
 **The grotesque**	Being simultaneously repulsed and attracted by something physically or morally disgusting.	**Disgust:** To experience intense physical dislike for an object or situation **Fascination:** To experience an urge to explore, investigate, or to understand something	*Intriguing directness* Something disgusting gives a very direct, in-your-face experience that can be intriguing.
 **The self-sacrificing**	Giving up current, temporary comfort or safety and being proud about it.	**Reluctance:** To experiencing a lack of motivation or willingness to engage in a certain activity **Pride:** To experience an enjoyable sense of self-worth or achievement	*Harsh realness* Reluctance makes people perceive the world as a little harsher, but also as more 'real' and honest.
 **The indulging**	A liberation from ethics and conventions that makes people seek out pleasure.	**Shame:** To experience painful awareness that one has violated a cultural or social norm or value **Desire:** To experience a strong attraction to enjoy or own something	*Irresistibly seductive* People perceive the world as irresistible, seducing them to do something they actually shouldn't.
 **The unreachable**	A bittersweet longing for something that is currently or permanently out of reach.	**Longing:** To experience a strong and painful desire for someone or something that is out of reach **Dreaminess:** To enjoy a calm state of introspection and thoughtfulness	*Profoundly desirable* People perceive an object or event as more deeply desirable and significant - as something worth investing time in.
 **The sentimental**	A touching experience that makes people perceive the world as a bit more beautiful.	**Poignancy:** To experience a painful excess of tender feelings towards an event or object **Enchantment:** To be captivated by something that is experienced as delightful or extraordinary	*Beautifully connected* People perceive a sense of warmness and beauty in the world, and feel closer connected to the world and other people.

	Step 2 – Emotion elicitation	Step 3 – Reversal
Transformation of attitude	**Emotion cause**	**Protective frame**
Assertive playfulness This emotion brings people to do things they normally wouldn't do, because they are more assertive and playful, and less serious.	*Advantage (over someone or something)* e.g. physical advantage (making the user stronger, faster, etc.), material advantage (being better equipped), skill advantage, or cognitive advantage (helping the user outsmart the other).	Detachment frame (or) Safety-zone frame
Focused Energetic Panic is engaging because it focuses and energizes people to either avoid or control the source of danger.	*Danger* e.g. physical danger (fast approaching objects, fear of falling, etc.), psychological danger (being chased, being threatened, etc.), or social danger (performance fear, fear of attracting attention, etc.).	Control frame (and/or) Safety-zone frame (or) Detachment frame
Undisturbed determination Frustrated people become focused, directed and determined to solve the problem at hand.	*Obstacle* e.g. physical (lifting a heavy object, outrunning something fast), psychological (e.g. a difficult puzzle), social (e.g. convincing someone) or skill-related (learning an instrument).	Control frame
Suggestible vigilance People briefly halt their routine to get passively vigilant towards their surroundings and become more suggestible to new information	*Uncertain or uncanny threats* Different possible themes: e.g. uncertainty (e.g. darkness, unknown environments), simultaneous familiarity and strangeness (e.g. a humanoid robot, an aged childhood home), or seemingly inexplicable events (e.g. paranormal events, strange sounds).	Detachment frame (or) Safety-zone frame
Confidently judgmental Indignation brings out uneasiness in people, which they are eager to discuss with others.	*Violation of a rule or code* e.g. violations of an actual law, violation of a social rule (e.g. etiquette), violation of trust, violation of purpose (e.g. a squandering charity fund), or violation of rights (e.g. impeding freedom of speech).	Detachment frame (or) Safety-zone frame
Cautiously curious Disgust is a good way to grab someone's attention and make them curious. People will feel a simultaneous attraction and repulsion.	*Repulsive object or concept* e.g. physically disgusting things (filth, bodily things, morbid things, etc.), or morally disgusting things (violent behavior, perverse behavior, etc.)	Detachment frame (or) Safety-zone frame
Disciplined responsibility People becomes sterner and more disciplined, and it is a way to improve someone's self-respect.	*Sacrifice* Motivating the user to engage in an activity that is unpleasant, but somehow good (e.g. a chore, physical labor, jogging), to give up something pleasant (e.g., sitting comfortably, a sensorial pleasure), or to 'punish' himself (e.g. with a loud noise, with an unpleasant task)	(in any case) Perspective frame (possibly in addition) Detachment frame Control frame
Liberated impulsiveness People get a more impulsive and liberated attitude towards a situation, and makes them ignore personal or social restrictions.	*'Forbidden' temptation* Motivating the user to engage in an activity that is pleasant but bad for them (e.g. smoking, overeating), or pleasant but violating a rule or code (e.g. breaking something, going against etiquette)	Detachment frame (or) Safety-zone frame (or) Control frame
Dreamily passionate People become more passionate about an object or event, but in a passive, dreamy way.	*Inaccessible object or concept* e.g. an inaccessible object (e.g. an expensive sports car, the unobtainable piece of a collection), environment (e.g. home, an exotic place), event (e.g. being with a certain person, longing back to one's own childhood), a missed opportunity, etc.	Control frame (and/or) Detachment frame
Reflectively sensitive People become more reflective about which things matter in their life, and are more likely to act kind-heartedly.	Virtue against the odds or expectations e.g. bravery, real friendship, loyalty, modesty, diligence, honesty. Each of these against the odds (under difficult circumstances) or against expectations.	(Inherently has a) Perspective frame (possibly in addition) Detachment frame

The following sub-sections elaborate the nature and background of the ten qualities in more detail, by showing examples of their occurrence in real life and references to literature from psychology and the humanities. Most of the qualities also feature a product example. Since rich qualities are (still) very scarcely used in mainstream products, most examples were derived from 'critical design' or from products designed for entertainment. For purposes of structure and efficiency, we clustered the qualities into four categories, as some have similarities between them that can be discussed jointly.

Negative emotions stimulate and focus

This category contains qualities that use the stimulating and arousing effects of negative emotions like fear, anger and frustration. These emotions have in common that they direct the attention of the user at a specific problem, and energize him or her to avoid or deal with a problem.

The Sadistic (Maliciousness + Amusement)

a. b. c.

Figure 42: Examples of the Sadistic quality

The sadistic is the enjoyment that people draw from taking revenge, putting somebody back in their place, or playing a prank. The governing condition in all these cases is that people have the opportunity to exploit an advantage they have over another person or object. This might sound extreme, but in nuanced forms this experience is relatively harmless and socially accepted. For example, office workers can exploit their colleague's trust and unsuspecting nature by playing a practical joke (Figure 42a). However, a harmful act can also be socially useful, if it is directed at institutions or ideas that are thought to have a lot of power. In that case, the perpetrator is seen as the underdog and the harmful act as an expression of rebellion. For instance, making a joke about religion, mocking a person of authority (Figure 42b) or disproving a powerful scientific theory can all be enjoyable for this reason. This quality also manifests itself in the feeling of *sweet revenge*, when the act is meant as punishment for someone else's unacceptable behavior (see Knutson, 2004). De Quervain et al. (2004) demonstrated that taking revenge activates a part of the brain that is associated with mental satisfaction and reward. Pain Station is an art installation in the form of an arcade video game that utilizes the sadistic quality (Figure 42c). Two users play a game of pong, while holding one hand on the so-called pain execution unit[4]. Through different playing styles, the users have the opportunity

4 *See: http://www.painstation.de/*

to inflict different types and intensities of pain in their opponent, thus raising the stakes and the enjoyment in the game.

The Thrilling (Fright + Joy)

a.


b.

c.

Figure 43: Examples of the Thrilling quality

Fright is at the basis of the kind of thrill that people feel when they undertake activities that carry a certain risk – either real or imagined. For instance, many people feel a thrill when they suddenly have to speak for a large audience (Figure 43a), which is instigated by fear of social failure. A clear example of an imagined risk occurs when someone rides a rollercoaster (Figure 43b) – he knows the amusement park will make sure he is safe, but his body tells him otherwise. Fright can even play a role when there is a 'positive risk' involved, such as when people watch the lottery results in anticipation of winning. Fright is engaging because it focuses and energizes people to either avoid or control the source of danger. This transformation of attitude can be useful and pleasant when users have to engage in an uninspiring activity, or when they have to finish a task within a certain time. Furthermore, fright makes people experience their immediate situation as eventful and overpowering, which can be refreshing when they feel generally disinterested or bored. There are several thrilling children's outdoor games on the market that feature a water-filled object, which is passed around between players. When the internal timer runs out, the person holding the device at that moment will get soaked (Figure 43c).


a.


b.


c.

Figure 44: Examples of the Challenging quality

An obstacle elicits frustration – it is something standing in the way of achievement. On the other hand, without any obstacles to overcome, there would be no sense of achievement whatsoever. This paradoxical relation is central to mastering any skill, puzzle or game: people try to get rid of an obstacle and immediately look for a new one. For instance, the guitar pupil must perform endless exercises to learn new chords, which are, as soon as he has mastered them, succeeded by even more difficult ones (Figure 44a). A similar experience is offered by video games (Figure 44b), where the player has to test her agility, intelligence and creativity when going through increasingly difficult levels. An important design feature of challenging interactions is that people should always have an idea how to come closer to the end result – otherwise the experience will turn into sheer frustration. A case in point is the Rubik's cube –people who are familiar with it might feel an irresistible urge to solve it, but those who have no clue what steps to take may twist it a few times fruitlessly and become disinterested. Frustrated people become focused and determined to solve the issue at hand, which is refreshing and useful when they are otherwise unmotivated or undirected towards a certain task. The Nekura Scramble LED Watch purposefully confronts users with an obstacle to make the activity of telling time more interesting (Figure 44c). By using a cryptic and unconventional way to display the time, the watch stands out in a saturated market.

Negative emotions signify intriguing boundaries

People have the basic need to understand the social and material world, themselves, and their relationship with the world (Frijda, 1986). Individuals are attracted to new, odd, or strange things because these situations can tell them something about the world or about themselves. The emotions in this category all notify the user that they are witnessing events that push the boundaries of what is acceptable physically, morally, or existentially.

The Eerie (Anxiety + Fascination)

a.

b.

c.

Figure 45: Examples of the Eerie quality

Whereas fright (the thrilling) is a reaction to a clear danger in the here and now, anxiety is directed to ambiguous or intangible phenomena. Sometimes these anxieties have a functional basis, like being cautious of catching a disease in a contaminated area (Figure 45a), but they can also be considered 'irrational', like being afraid of the dark in a safe environment (Figure 45b). In both these experiences the whole surroundings can take on a mysterious and suspenseful quality. Another instance of this quality can be found in what Freud (1919) called 'das Unheimliche', or the uncanny: the feeling that one is observing something that is familiar, yet strange. Roboticist Masahiro Mori (1970) famously applied this phenomenon to describe the 'uncanny valley', which is the effect of objects resembling human beings almost, but not completely, which makes them very eerie (Figure 45c). People who experience anxiety become hyper vigilant towards themselves and their surroundings (Rhudy & Meagher, 2000), and become more suggestible to different explanations of their feelings, up to the point where they can even use superstition to explain the event. This effect can be helpful in design to make users more sensitive to events and information that they normally take for granted.

The Scandalous (Indignation + Fascination)

a.

b.

c.

Figure 46: Examples of the Scandalous quality

People love scandals. This is apparent in the popularity of sensation journalism (Figure 46a), but not restricted to that domain – serious news can also open with a story about the transgressions of an influential person. Scandals amaze, shock or even outrage people, but they also have an attractive quality that makes people want to know all the details involved. A scandal starts when someone

violates a law or code of society, to which people react with indignation. This can be the violation of an actual law, marital rules, someone else's trust (e.g., being betrayed), or social codes (e.g., walking through the city nude). When a situation evokes enough indignation, it can even incite people to protest (Figure 46b). A scandal is enjoyable in part because it lets people experience an increased clarity and simplicity in the world: some moral issues may be ambiguous and multifaceted, but in a scandal it is clear who is right and wrong. However, because there is often not a direct way to deal with a scandal, it can bring out restlessness in people and an eagerness to discuss the case with others, which makes scandals a good conversation starter. Katrin Baumgarten showed with her teakettle 'Raging Roger' that products can also violate codes and act in a scandalous way (Figure 46c). Raging Roger rotates and squirts its contents at unsuspecting users[5].

The Grotesque (Disgust + Fascination)

a. b. c.

Figure 47: Examples of the Grotesque quality

The grotesque is about being fascinated by something disgusting. This fascination is observable in people's urge to slow down and get a glimpse of a car accident, or in the popularity of zombie movies (Figure 47a). Moreover, this quality can reveal itself in things that people regard as morally disgusting, which is part of the appeal of 'shockumentaries' and shock art (Figure 47b). The difference between indignation (the scandalous) and disgust (the grotesque) is that whereas social scandals harm a person's idea of *justice* and *harm/care*, disgust is evoked when a person feels *purity* is being impaired, which "*involves values and principles directed at protecting the sanctity of the body and soul*" (Horberg, Oveis, Keltner, & Cohen, 2009, p. 964). People witnessing something disgusting will experience their situation with a direct and intriguing novelty, which evokes a simultaneous attraction and repulsion. Hemenover and Schimmack (2007) found that disgusting stimuli, when pushed far enough, may even be perceived as humorous, for instance when something exaggeratedly disgusting is shown in a movie. Meatbook was an interactive product installation with a grotesque character. The product had the form of a book with pages made from slices of real meat, which could sense the user and react by quivering, twitching, stretching and throbbing (Figure 47c). The installation was meant to evoke simultaneous revulsion and attraction that confronted the user with the contrast between the human body and technology (Levisohn, Cochrane, Gromala, & Seo, 2007).

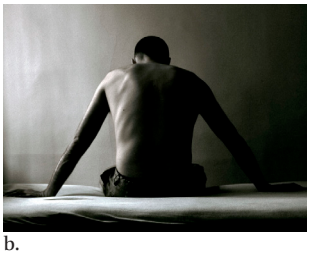
5 *See: http://katrinbaumgarten.de/raging-roger*

Negative emotions emphasize the morality of our actions

Emotions are not always reactions to something that happens in the outside world – sometimes they are reactions to our own actions. Emotions like shame and pride are intuitive evaluations of a person's own failure and success. These emotions can become rich if they include a paradox: a pleasure can become indulging if it is socially disapproved of, and an unpleasantness can give pride if it is clear that it will lead to greater good. In this sense, the following two qualities are each other's opposites.

The Self-sacrificing (Reluctance + Pride)

a.



b.

c.

Figure 48: Examples of the Self-sacrificing quality

Many activities in life, like doing household chores (Figure 48a) or tedious workouts can be unpleasant because people feel averse to engaging in them. However, the experience will become rich if it provides, in addition to the reluctance, the opportunity for people to realize that what they are doing is somehow good for them in the long run. In fact, the more effort or sacrifice is needed to complete a task, the more self-satisfaction people get during the task and afterwards. For example, a person that gets up early despite the enjoyable comfort of his bed may feel proud for not giving in to the temptation of sleeping late (Figure 48b). The reluctance makes people experience the world as a little harsher, bleaker and more demanding environment. In addition, under the influence of the protective frame, a person's attitude transforms to become sterner, more determined and disciplined. If design can facilitate this experience and attitude, it can be a useful motivator for people to engage in activities that are not necessarily pleasant, or as a means to improve someone's self-respect. Manufacturers of very spicy hot sauces have clearly tapped into the self-sacrificing quality. Instead of focusing on good taste or high-quality ingredients, these sauces are primarily marketed as giving a painful sensation, with product names like 'Sudden death', 'Beyond insanity', and '100% pain' (Figure 48c). The consumers of such products are obviously not repelled by the prospect of some pain, and even use them to feel better about themselves or to show off to others.

The Indulging (Shame + Desire)


a.


b.


c.

Figure 49: Examples of the Indulging quality

Indulgence is about giving in to one's forbidden desires. It occurs when someone engages in an activity that goes against a personal or social value, like overeating (against the value of moderation – Figure 49a) wallowing in laziness (against the value of diligence – Figure 49b) or loudly riding a motorbike in the morning (against the value of decency – Figure 49c). The negative emotion in this experience is shame, which people feel whenever they have violated a rule or custom. Paradoxically, it is the shame that determines whether an act is simply desirable or indulging. If the fruit is not forbidden, it is not half as seductive. For instance, people develop a strong preference for food that they have been prohibited to eat (Fisher & Birch, 1999; Mann & Ward, 2001). Thus, somehow the (expected) negative aspects of engaging in a certain activity will make the experience of the object or situation more seductive and attractive. This causes people to have a more impulsive and liberated attitude towards a situation, which can be interesting for design if the intention is to help people to ignore personal or social restrictions. The indulging is, just like the scandalous quality, about breaking rules. However, whereas the scandalous is about the user witnessing something or someone else breaking the rules, in the indulging it is the user himself who engages in the violation – and enjoys it.

Negative emotions enable connection and contemplation

In most literature, sadness is categorized as a prototypically negative emotion, and is often even thought to be the direct opposite of happiness (for example in the models of Plutchik, (2003) and Russell & Barrett (1999)). Evidently, deep feelings of sadness in reaction to misfortune in life, as well as sadness in depression are invariably unpleasant. Still, there are several emotional experiences related to sadness that are both rich and enjoyable. For instance, sadness is related to emotional experiences like longing and sympathy (Shaver et al., 1987), nostalgia (Barrett et al., 2010), sentimentality (Tan & Frijda, 1999) and poignancy (Ersner-Hershfield et al., 2009). Furthermore, there appear to be links between sadness and aesthetic experiences. Most notably, Panksepp (1995) showed that the sensation of getting 'chills' (or 'goose bumps') from music is, contrary to common assumption, more related to sadness than to any other emotion. In our view, sadness can add a depth and significance to a person's experience of the situation. For instance, feeling sad over the farewell of a good friend adds to the significance of the event. Ersner-Hershfield et al. (2009) demonstrated that people who were in a 'poignant' state of mind have "*an intensified desire for, and ultimate experience of more positive emo-*

tion", compared to people who were in a neutral state of mind. According to their theory, this leads people to pursue more emotionally meaningful goals in the here and now. Lastly, sadness promotes contemplation, as when people let their thoughts float while listening to overwhelming music. Studies on depression similarly link sadness to rumination (e.g., Nolen-Hoeksema, 1991), and even suggest it as the reason that artists with a tendency to depression are more creative (Verhaeghen, Joorman, & Khan, 2005). In addition, sadness has been shown to improve memory accuracy (Storbeck & Clore, 2005), which may indicate that it plays a conducive role in reflecting on one's past.

The Unreachable (Longing + Dreaminess)

a. b. c.

Figure 50: Examples of the Unreachable quality

Desired things that are out of reach elicit a kind of sadness in people that goes by names like nostalgia, homesickness, and melancholy. The out of reach 'things' can be physical objects (e.g., an unaffordable dream house –Figure 50a), people (e.g., a lover who is abroad), or experiences (e.g., one's own past childhood – Figure 50b). The experience becomes rich if the affected individual can somehow interact with the absent object, or a representation of it. Thus, people reminisce about the past by looking at photographs, exchange text messages with their distant lover and those dreaming of owning a sports car may collect posters and even miniature models of that car. Furthermore, the inherent sadness is not just negative - it also sets this experience apart from more trivial desires. Consider the opposite situation: if a person could buy or achieve everything she desires at any time, those things would arguably carry far less significance. Similarly, something that was once possessed but now lost can be cherished more than when it was still present, as expressed by the saying "*you don't know what you got 'til it's gone*". The emotional experience affects a person's attitude to become more connected to the object and it promotes 'daydreaming' and contemplating about the object or concept. 'Heirloom' is a product concept that stimulates people to get more attached to one of their possessions (Figure 50c). The user puts the chosen object inside a glass jar, out of reach, where it is preserved for generations to come. Every generation records their stories and memories related to the object, thus "*transforming (...) a miscellaneous item into a meaningful* object"[6].

6 *See: http://www.nikkigeorgeferguson.com/Design/The_Heirloom.html*

The Sentimental (Poignancy + Enchantment)


a.


b.

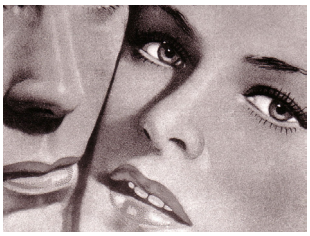

c.

Figure 51: Examples of the Sentimental quality

Poignancy is the feeling of being overwhelmed with sadness over something that seems purely positive. For instance, a person may be moved to tears at her friend's wedding (Figure 51a). This may seem strange at first consideration: why should there be any sadness involved in such a joyous experience? Tan and Frijda (1999) discuss this phenomenon, and argue that people feel overwhelmed by witnessing a certain goodness, grandeur or childlike purity in the world, which momentarily silences their cynical beliefs. This overwhelming feeling is accompanied by a sense of helplessness that triggers the tears and passive action tendency. Derived from their ideas, we think that the sentimental quality can be elicited by witnessing an act or event that symbolizes some greater virtue, like loyalty, bravery or diligence, especially if that act or event is against the odds or against expectation. The woman who is overwhelmed by her surprise party realizes that her friends have, against normal expectations, gone out of their way to make her happy, symbolizing the quality of their friendship. Witnessing acts of heroism, like a fireman sacrificing himself, can evoke a similar feeling because it involves virtues of altruism and bravery (Figure 51b). However, virtues do not always have to show themselves through people's actions – they can also seem to originate in the world itself. Movies often make use of this idea, for instance, by showing that two people are 'destined' to be together, in spite of being obstructed by circumstances (Figure 51c). If they do finally end up together, against all odds, and show that 'true love overcomes all obstacles', the viewer can temporarily perceive the world as a more beautiful and good-natured place.

5.4 The application of the approach

This section illustrates how the information in Table 7 can be used to design product concepts, by showing four short design cases that were carried out with several rich interaction qualities. The first four examples are part of a design session that was carried out by the first author to explore the usefulness and applicability of the different rich qualities, which yielded about 40 concepts in total. The last two examples are results of a two-week workshop that was carried out in London with Master degree students in Design for Interaction from the Technical University Delft (The Netherlands) and Master degree students in Industrial Design from Central Saint Martins School of Art and Design

(United Kingdom). In this workshop, students used the rich experience approach to come up with innovative solutions for wicked social problems.

Brief 1: Making jogging more engaging

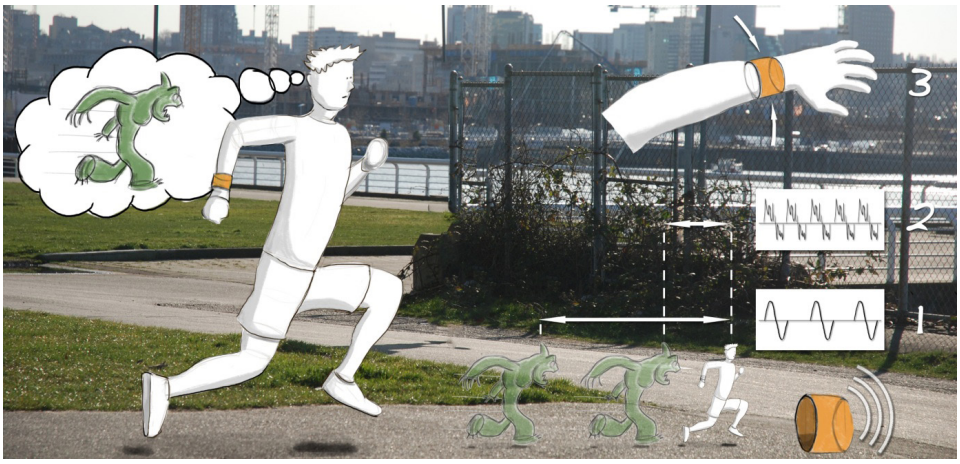


Figure 52: Product concept sketch of 'Pursuit' (the Thrilling quality)

Jogging is a popular activity because it is an accessible and inexpensive way to exercise. However, in spite of the low physical threshold, people may struggle to keep jogging regularly after a few weeks because they experience it as tedious and monotonous. One of the reasons for this is that running lacks the engaging emotions that are evoked in sports with game elements, like football or tennis. So the first step in the approach was to find a quality that adds engagement and excitement to the experience of jogging. In this case, the *thrilling* quality seemed suitable, because it adds excitement and stimulation (transformation of perception), and it gives the user more focus and energy (transformation of attitude). The next step was to find a specific way to elicit fright through a threat (Table 7). The threat can occur at different moments in the interaction, for example before, during or after the jogging, and it can manifest itself in different ways, for example as a social threat (e.g., telling the user's friends he has failed to go jogging), a psychological threat, or a physical threat. In this case, it was decided to manifest it as a psychological threat during the activity itself: the *experience of being chased.* This experience is one of the most frightening and activating experiences a person can have, and it is logically connected to the activity of running. The resulting concept was 'Pursuit' (Figure 52). This concept is a sweatband that people wear on their wrist, which uses a heart rate monitor to measure the user's activation, and accelerometers to measure their physical activity. The user is chased by an imaginary pursuer the moment he or she starts running. This creature cannot be observed directly, but is represented by sound and tactile feedback. If the user is running in their pre-assigned pace, the sweatband will respond with comfortable intervallic beeps (1). When the user is starting to fall behind, the beeps will get more frequent and unpleasant to represent the creature getting closer (2). When it is even closer, the band will gradually contract around the wrist of the user (3), up to the

point where the runner is 'caught', and the band will shut off completely. The fear of being chased and grabbed is intended to energize physically and stimulate mentally. To take the last step in the approach, the concept uses a *detachment frame* and a *control frame*: the source of danger is not real but represented through sound and touch, and the user is in control of the experience by managing their own speed.

Brief 2: Making people more aware of nutritional information

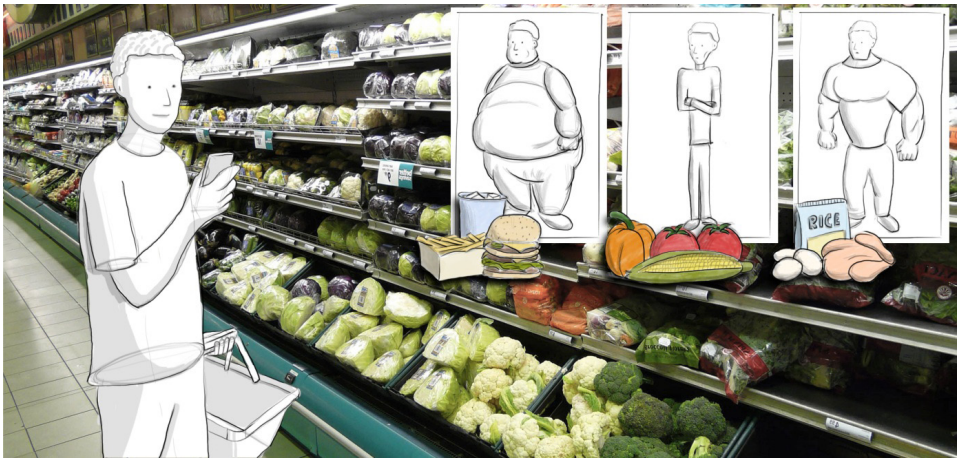


Figure 53: Product concept sketch of 'The direct dietitian' (the Grotesque quality)

In many countries, food companies are required by law to display the nutritional values of food products on the packaging, so customers can make a more informed purchase decision. However, few people will have the time or motivation to read the packaging of every food item, as the information is often numerical and dry. The experience can be made richer by presenting the information in a more confronting way than current solutions do. Based on their ability to grab attention, there are two qualities that seem to qualify: the eerie and the grotesque (Table 7). In this case *the grotesque* was chosen, because it has a more instantaneous impact, and because it is logically linked to the theme of food and eating. To elicit the disgust, a repulsive representation of the *impact of food on the human body* was chosen. The resulting concept, 'The direct dietitian' (Figure 53), is a digital nutrition assistant for smartphones that reacts directly to people's purchase decisions. When the user starts shopping in a supermarket or grocery store, a normal looking cartoon character is displayed, which changes shape and expression according to the type of products the user puts in their cart. For instance, selecting only fatty items will make the character look obese, picking items with many proteins and minerals will make the character look more muscular, and if the user chooses mostly low-calorie food the character will look slimmer. Through a number of purchase decisions these cartoon characters will quickly look like a terribly obese, very skinny or extremely muscular and lean person. For the third step, the experience is reversed through a *detachment frame*, which is constructed by two sub-strate-

gies: simplification (the screen shows cartoon figures rather than realistic people), and exaggeration (the exaggerated features of the characters can be taken less seriously than realistic bodily changes).

Brief 3: Design something that makes a restaurant experience more memorable

Figure 54: Product concept sketch of 'Fingerbite' (the Indulging quality)

Even though going out to a nice restaurant is an experience that people seek out to have an enjoyable experience with good food and company, some restaurants wish to distinguish themselves from the competition by making the eating experience more unique. As good restaurants are commonly a bastion of social codes and etiquette, it can be an interesting exercise to play with some of these conventions. The *indulging* quality was found appropriate in this context because of its liberating and pleasure-seeking transformation. For the second step of the approach, it was chosen to motivate users to *violate table manners* as the way to elicit shame. The resulting concept is Fingerbite (Figure 54). The product is a silicon glove that people wear to eat with their hands in a hygienic way. This tool is intended as a complete replacement for standard cutlery. The outside of the fourth finger is serrated and sharp to afford cutting, and the fingers are webbed to easily scoop up soups. The shame of going against dining etiquettes is intended to make the activity more seductive and inviting, and creates a more liberated and lively atmosphere in the restaurant. The shameful behavior - touching food with one's hands - is reversed by the physical barrier that the glove provides – a *safety-zone frame*. The interaction with the food and the resulting tactile sensation are equivalent to eating with bare hands, but the fact that the user is not in direct physical contact makes the experience acceptable.

Brief 4: Consoling feverish children

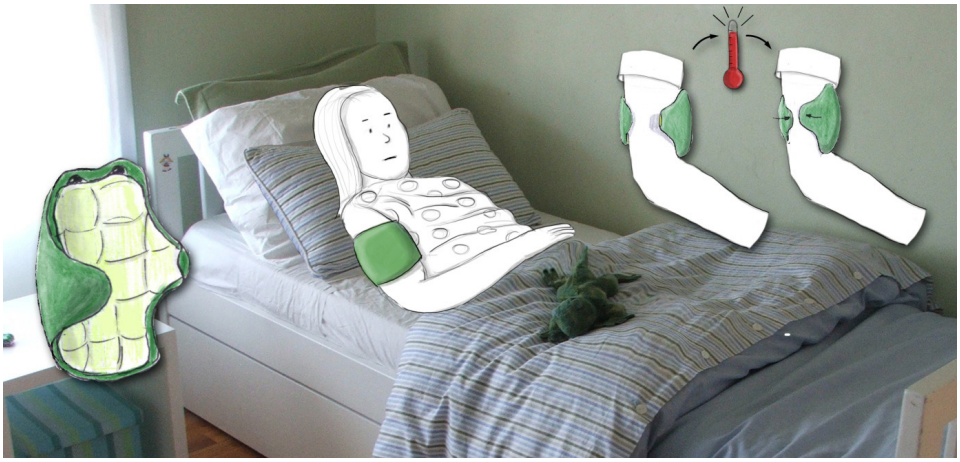


Figure 55: Product concept sketch of 'Clinger' (the Sentimental quality)

Having a fever can be an unpleasant experience for children, as they have to be in bed for longer periods without much contact or activity. To make this experience a bit nicer and less lonely, *the sentimental* quality was applied, because of its transformation of perception–experiencing warmth and connectedness. The concept, Clinger (Figure 55), is a special kind of body-temperature measuring device. This soft, animal-like device can be pressed against the child's arm to measure his or her temperature, and if the child has a fever, it will gently cling itself to the arm and stay there until the fever is over. In periods of high fever the device will softly purr to soothe the child. The product is intended to represent a little companion that stays with the child throughout the fever, regardless of any other 'concerns' the represented character might have. This touching idea is connected to virtues of companionship and loyalty, which elicits the poignancy. Furthermore, children who are ill in bed probably already have some sad feelings, which can now be partly redirected to the interaction with the product. The third step in the design approach is slightly different for the sentimental quality, as it inherently involves a *perspective* frame due to its involvement of virtues (see Table 7). In this case, there is an additional *detachment frame* present – because the product abstractly represents a loyal companion.

Student Project A: Encouraging legal downloading

Figure 56: Representation of concept 'Impulse' (the Thrilling and the Indulging quality)

Although illegal in most countries, media piracy (i.e., the illegal up- and download of software, videos and music) is considered by many people as a minor transgression rather than a crime. Countermeasures that aim to deter or scare people from downloading seem to have little effect, as the amount of illegal downloads increase every year with damages estimated in the billions. To make a positive change in this issue, the designers focused on a service that makes legally downloading music more attractive. The resulting concept, 'Impulse', is a smartphone application for users that have an account with existing channels like Spotify or iTunes, which promotes and gives away music to its users, if they are willing to do something in return (Figure 56). When the app senses that a number of people with similar music taste are in proximity of each other, a song starts playing simultaneously on each of their smartphones. Users are invited to react to this by dancing and singing to the song together – the more they engage in this assignment (measured by accelerometers and microphone), the more download credits they get. Users can choose to accept or reject the offer, but they have no influence over the type of song or its timing. The designers used the *indulging* and *thrilling* qualities to make the experience with the service seducing and stimulating, two effects that were found to work well with the young target group. The product evokes fright and shame by encouraging the user to stand out in a crowd and possibly look foolish to others. A safety-zone frame is provided by the fact that users are engaging in the activity together with others: a scare shared is a scare halved. A mockup version of the app was tested by students in a crowded London station. Most of the participants were at first reluctant to start dancing, but once a few people began, they all joined in voluntarily. Many passers-by stopped to look at the performance or take a picture. The participants noted afterwards that this outside attention motivate them to dance even more expressively. Most participants felt exhilarated after the event.

Student Project B: Increasing the amount of organ donors

Figure 57: Representation of concept 'Donor hero' (the Sentimental and the Eerie quality)

Worldwide, people who are in need of an organ donation exceed the number of organs available for transplants. Most countries only have a small percentage of the population registered as donors. The designers in the project 'Donor hero' wanted to enrich the experience of being and becoming an organ donor. The 'experience gap' that the project aimed to solve was that people who are registered as a donor do not feel heroic because they have not (yet) contributed a donor, whereas the people that donated are not around anymore to experience the results of their good deed. The concept is a street memorial for organ donors who were killed in an accident. The memorial, which is placed on the site of the accident, is the outline of the person with abstract representations and descriptions of the organs that were donated (Figure 57). Instead of focusing on details of their accident, it states, for example: Susan (28) saved 5 lives here on 20 June 2012. Two kinds of rich qualities are elicited in the interaction with the product. The slightly *eerie* quality of the human outline and the organs are meant to be mysterious and attract attention. For people who are registered as a donor, the memorial is meant to elicit the *sentimental* feeling that a fellow donor has deceased, who is now a hero. Because the memorial is a representation, it uses a detachment frame. The prototype was put in the street for a day and attracted considerable attention.

5.5 Discussion

In this paper we have introduced a design approach to develop rich experience concepts. Evaluating, it seems indeed possible to deliberately use negative emotions to enrich product experiences. Furthermore, because it is a process that can be applied systematically, it is potentially interesting to apply in mainstream product development and as a method in design education. Apart from a general approach that outlines how designers can combine negative emotions and protective frames to create rich experiences, this paper also introduced ten rich qualities. The qualities originated by using the perspective of the framework to look at insights from three sources: emotional constructs in cultural products (i.e., movies, novels, music, games, etc.), phenomenological descriptions of mixed emotional experiences (Fokkinga & Desmet, 2012b), and scientific literature from the field of psychology and the humanities. The intention of introducing the qualities was to lower the threshold of working with the rich experience approach, by offering certain combinations of negative emotions and protective frames which we think are interesting and useful for product experiences. Furthermore, the qualities and their resulting transformations have been 'pre-researched', which saves designers the effort of doing the same. However, this does not mean that applying a quality to a product experience is a straightforward, uncreative task. Apart from choosing a quality to work with, it is also completely up to the designer in what way the negative emotion is manifested and how the protective frame is constructed. The specific user context that is designed for will also imply unique boundaries and opportunities that will influence the end result. Furthermore, the ten proposed qualities are by no means considered to offer an exhaustive list of possible rich experiences. We would therefore like to encourage designers and design researchers to come up with new rich qualities or describe qualities they may have used implicitly in past projects, and share them with the community. We are currently setting up a web-based platform to facilitate this exchange[7]. The negative emotions that make up the rich qualities are all included in a typology that we are currently composing, which is based on thirty existing typologies, taxonomies and lists of emotion definitions[8]. The ten negative emotions in this paper are best defined and discussed in the following publications: The emotions fright (thrilling), frustration (challenging), anxiety (eerie), indignation (scandalous), shame (indulging), and disgust (grotesque) are all discussed by Frijda (1986, e.g., pp. 218-219). Maliciousness (sadistic) is a translation and interpretation of what Apter (2007, p. 119) describes as parapathic anger (Apter, 2007, p. 119). Reluctance (self-sacrificing), in the meaning of 'lacking enthusiasm', and longing (unreachable) are both discussed by Johnson-Laird and Oatley (1989, p. 118). Lastly, poignancy (the sentimental) is covered by Ersner-Hershfield et al. (2009) and Tan & Frijda (1999). The positive emotions in the rich experience are all derived from a typology of positive emotions, which was developed as a design tool (Desmet, 2012).

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7 See: http://studiolab.ide.tudelft.nl/diopd/library/tools/rich-experience-qualities/

8 (Later note) This refers to the emotion typology described in the previous chapter

Several components of the approach could be elaborated further to make the resulting product concepts better and more predictable. For instance, it seems that there should be some balance between the strength of the negative emotion and the protective frame. If the negative emotion is too strong and the protective frame too weak, the resulting experience will be predominantly negative. For example, if the wristband of the 'pursuit' concept would start to contract around the runner's arm so tightly that it causes pain, the detachment frame would fail and the runner could get genuinely scared of the sweatband, instead of the pursuer it represents. On the other hand, if a protective frame is too strong or a negative emotion too weak, the resulting experience can become boring or even laughable. For instance, if the gloves of the 'Fingerbite' concept would only be used to eat food that is not very daring to touch without gloves, like bread or snacks, the user might feel ridiculous for using them. More research on the intensity of negative emotions and protective frames could give additional guidelines to understand the construction of rich experiences.

Apart from the fact that rich experiences have different effects, and should thus be used for different design opportunities, we also found some overarching rules of applicability. In general, the qualities grotesque, scandalous, eerie, sentimental, and thrilling are easier to implement, because they only require the attention and perception of the user: the grotesque is, for instance, elicited as soon as the user perceives something disgusting. Conversely, the qualities challenging, self-sacrificing, unreachable, sadistic, and indulging require the user to engage in a certain activity before they manifest themselves: a product experience can only be self-sacrificing if the user is willing to engage in the aversive activity. Secondly, it seems that some qualities are more subject to cultural and personal differences than others. For instance, all people are hard-wired to find certain things disgusting or frightening, whereas what is considered indulging or sentimental may vary based on cultural and personal values: a movie that truly moves some people, might be regarded as tasteless by others.

When designing for emotion, there is always a subjective dimension that complicates a prediction of the resulting experience (Desmet, 2008). In one sense emotions are universal, because they are reliably evoked by the same relational causes – shame is for instance always evoked by a personal transgression. On the other hand emotions are subjective, because, by the same example, the actions that people consider to be personal transgressions can differ heavily between people and cultures. For example, the 'Fingerbite' concept would probably not evoke shame or a rich experience if it were introduced in a culture where it is already customary to eat with bare hands. Thus, the implementations of the steps of the approach should always be informed by a solid understanding of the culture and context that is designed for, and be followed by tests to make sure that the final result has the intended effect.

6 ⁝⁝⁝

REFLECTION ON RICH EXPERIENCE DESIGN

Creativity comes from a conflict of ideas.

— Donatella Versace

The previous chapter introduced an approach which designers can follow to methodically create products that evoke rich experiences in the user. This chapter reflects on four projects in which almost sixty design students and one professional designer engaged with the approach. The designers used the approach to generate new rich experiences qualities and to design product concepts. Based on observations and discussions with the designers, the chapter reflects on the processes they followed and the design results they produced.

6.1 Introduction

The previous chapter introduced the rich experience design approach, which supports designers to enrich product experiences with negative user emotions. The last section of that chapter showed six examples of design concepts, of which four were created by the author and two by design students. This chapter discusses in more detail how design students and a professional designer have engaged with the rich experience design approach in four different projects, and reflects on the strengths, weaknesses, and challenges they encountered in the approach. The section after the introduction first discusses the characteristics of the four design projects, which differed in terms of time frame, deliverables, and participants.

The subsequent reflection on these projects consists of two parts. The first section discusses how participants used the approach to generate their own rich experience qualities. The ten rich experience qualities introduced in the previous chapter are meant as a starting point, but an important aim for the approach is that designers can construct their own qualities, based on the needs of their project. This section also reflects on the iterative changes that were made on the format of the rich experience qualities, based on observations throughout the projects. These changes are discussed in an integral manner rather than a listing per project.

The second section focuses on how the participants used the approach to design new products and services that elicit an emotionally rich user experience. It reflects on the observations of the participants' design processes, discussions about the approach with the participants, and the design results they produced. These reflections are grouped under the headings of integral insights and framed using models of design methodology literature.

Lastly, the conclusion section briefly summarizes the findings and recommendations for the approach.

6.2 The four design projects

A total of 60 designers engaged with the rich experience approach over the course of four projects. The time frame of the projects varied considerably: the shortest consisted of a two-afternoon workshop, while the longest was a five-month engagement with a professional designer. Table 8 shows an overview of the four design projects.

Project A was a two-week workshop with twenty design students, of which the previous chapter already showed two design examples. This project had a mix of participants: ten MA students from Central Saint Martins in London, who relied more on personal intuition and design sensitivity, and ten MSc. students from Delft University, who are more accustomed to methodological design approaches.

Table 8: Characteristics of the four projects that worked with the rich experience approach

	Context of design work	Project aim	Deliverable	Participant(s)	Time frame	Year
A	Independently organized workshop	Rich experience concepts to address social issues	Concept with mockup	10 MSc. students and 10 MA students	Two weeks full-time	2012
B	Course on interactive technology design	Interactive prototypes of rich experience products	Interactive prototype of concept	20 MSc. students	Five months, 1.5 days a week	2013
C	Workshop as part of course on design for Alessi	Ideas for household products	Idea sketches and mockups	19 BSc. Students	Two afternoons	2014
D	Designer-in-residence program	Household products	Products ready for production	1 Freelance professional designer	Five months full-time	2014

The design brief was to use rich experience design to help combat certain social problems, like obesity, media piracy and lack of organ donation. The end deliverable was a design concept that contributed to solving the problem, illustrated and explained through a product mock-up and a short movie.

Project B was an assignment within a MSc. course on interactive technology design at Delft University, with four groups of five students. In this project, students had to design and build a working prototype of a product that made use of electronic and digital technology. The students were giving general product themes (e.g., 'a product that keeps time'; 'a product related to food'), and the instruction to involve two rich experience qualities in the product, but were otherwise free to formulate the function and type of product. The students worked on the project a day and a half per week for the duration of a semester (about 30 days in total).

Project C was a workshop of two afternoons as part of a BSc. Elective in which Delft University students designed products for Alessi, an Italian company of luxury household products (e.g., tableware, kitchen utensils, and office accessories). Students spent one afternoon exploring the rich experience approach, and another to sketch product ideas and create a quick paper mockup. The resulting products were open in how they involved a rich experience, but had to fit into the portfolio of Alessi.

Project D was different from the others because it only involved a single participant, because it was much more time-intensive, and because it was the only project that went through the entire design process up until manufacturing considerations. The participant was a freelance designer with seven years of experience working for various design companies. She did a five month 'designer-in-residence' project at the Delft University to engage with research and researchers in general, and the rich experience approach in particular. The designer had frequent discussions and co-working sessions with the author. In this period, she designed three household products (selected from a large number of ideas) with various companies in mind, which were developed up to the point where they were virtually ready for production.

6.3 Custom rich experience qualities

The rich experience approach essentially contains two levels of specificity: the overall rich experience approach, which shows how in principle any negative emotion could be evoked to create a rich experience, and the ten 'pre-fabricated' elaborations of the approach with ten different negative emotions: the 'rich experience qualities' (see chapter five). These rich qualities are meant to illustrate the application of the design approach and to give designers a number of concrete starting points to facilitate quick experimentation with rich user experiences. However, the set of ten qualities is not considered to exhaust all possible rich experiences. The aim is that designers could construct their own rich experience qualities using the approach, to suit the needs of their particular design brief.

In each of the four projects, the participants generated their own rich qualities. Several participants went on to use these qualities in the subsequent design process, although some reverted to one of the original ten when that better suited their project. The process of constructing rich qualities was found beneficial for four reasons. First of all, it helped designers to better understand the overall rich experience approach and its underlying human principles. The generation of possible benefits of negative emotions and retrieval of supporting examples from personal experience and literature were found to substantially add to participants' intuitive and practical understanding of the overall approach. Secondly, the construction of rich qualities was generally an engaging and enjoyable activity, which increased participants' enthusiasm for the subsequent design session. Thirdly, participants who already knew what product type or situation they would design for could generate rich qualities that were particularly relevant to their project. For example, a participant who wanted to design products that encouraged people to conserve resources explored rich qualities based on the emotion of guilt (see Antarctica shower mat, p.123). Lastly, the generated rich qualities that were considered viable and different from existing ones could be added to the collection to inspire future designers.

Prior to the rich quality generation process for each project, the overall rich experience approach was explained and the existing ten rich qualities were discussed as examples. A number of the existing qualities were explicitly shown because they exemplified how one could get from the approach to a specific quality, and to avoid that participants would come up with one of the previously generated qualities. Although participants found the existing qualities helpful to generate their own, some initially had difficulty coming up with qualities that were sufficiently different from these, as they felt that the demonstrated qualities already comprised some of the most salient examples of rich experience.

In project A, the rich qualities were still formulated as in the previous chapter: A combination of a specific negative and positive emotion was selected (e.g., disgust and fascination), and the quality was given a title that captured its duality in a single noun (e.g., 'the grotesque'). However, the experience with this project proved that participants had difficulty generating rich qualities in this format. First

of all, participants found it difficult to find a fitting positive emotion to go with the negative emotion that they had selected. This format necessitated that participants were immersed in the subtleties of both negative and positive emotions, which was challenging in the relatively short time frame of the generation sessions (typically one afternoon). Furthermore, the consideration of explicit positive emotions did not seem to broaden the scope of qualities that participants generated, because the selection of the negative emotion was almost always the guiding element in the construction of the quality. Thirdly, on some occasions participants came up with qualities that featured a negative emotion with a clear positive benefit (e.g., 'comfort', 'peace', or 'bonding') that was difficult to express in the form of a proper emotion label. Lastly, the participants often had trouble to phrase fitting titles for the qualities that emphasized both its negative origin and its positive nature. This process typically took a lot of time and frequently resulted in suboptimal titles.

To address these issues, the rich qualities were adjusted to a simpler and more liberal format. The starting point remained the identification of a specific negative emotion, which participants could select from the negative emotion database (see chapter four) or another source. Subsequently, they had to determine how this emotion could have a positive effect on the overall experience. This was called the 'benefit' of the emotion. Together, these elements formed the title of the rich quality in the format: the [benefit] of [negative emotion], which eliminated the need to come up with an additional title to describe the quality. The identification of the positive effect was more liberal because it could be a positive emotion (e.g., the *amusement* of embarrassment), but also a non-emotional pleasant feeling (e.g., the *comfort* of self-pity) a positive mental effect (the *focus* of distress), a motivational tendency (the *aspiration* of envy), or even a behavioral effect (the *bonding* of hate). In projects B, C, and D, this process proved to be more accessible and engaging for participants, especially under pressure of time.

Table 9 shows a selection of fifteen participants-generated rich qualities that were found suitable and interesting by both the participants and the author. After some effort, almost all participants were able to generate unique and interesting rich qualities in a relatively short amount of time. To illustrate, the BSc. design students of project C, divided in groups of three, were able to generate two or more rich qualities in half an hour, after being introduced to the rich experience approach for the first time an hour earlier, with minimal instructor guidance during the generation session. After this session, about three quarters of the produced rich qualities was considered appropriate, meaning that it had a specific negative emotion and positive benefit, and a clear story of how these were connected.

Certain generated qualities were judged unsuitable for a number of reasons. Some qualities had a positive effect on something outside of the emotional experience. For example, a participant formulated 'the protection of fear', which referred to the function of fear to elicit careful behavior. For example, a dangerous product could be designed to elicit more fear to decrease the chance that people hurt themselves. Although this could certainly be an interesting and prudent design strategy, it does not use the negative emotion to enrich the user experience. Other qualities were simply not found to be

very persuasive, for example, 'the value of doubt': People realize a decision is very important if it elicits a great deal of doubt.

Table 9: Rich experience qualities generated by the designer participants of four projects

Rich experience quality	Description	Example
The amusement of (vicarious) embarrassment	Gasping or feeling giggly when watching someone making a fool of themselves	Seeing someone starting to sing Happy birthday, without anyone else joining in
The inspiration of awe	The overwhelming experience of seeing something much greater or grander than yourself	Entering a magnificent cathedral
The security of dependence	The experience of placing your wellbeing in the hands of a trusted person	Completely relying on your partner when you have fallen ill
The enthrallment of confusion	The experience of mystery: not understanding how something works	Seeing an inexplicable magic trick
The comfort of self-pity	The partly painful, partly soothing experience of feeling sorry for oneself	Feeling like the whole world is against you after being turned down for a job
The peace of loneliness	The meditative experience of relying completely on yourself and your own thoughts	Getting a new perspective on life when making a long journey alone
The bonding of mutual hate	The feeling of connection to a person or group when you share the same opponent	Feeling a bond with fellow protesters when fighting the police
The liberation of (postponed) regret	The experience of knowing that you are doing something that you will regret, but doing it anyway	Flirting with someone else while you are in a relationship
The satisfaction of being abused	The experience of masochism: taking pleasure from pain or punishment	Doing athletic running and not stopping until you have passed the pain barrier
The aspiration of envy	The experience of wanting to do better (in work, in life, etc.) when seeing someone who is better off	Planning to start working harder when a colleague gets promoted
The fun of annoyance	The amusing experience when someone is deliberately trying to annoy you, in a well-meant way	Being the target of a practical joke by friends
The significance of guilt	Experiencing that you are harming others through your behavior, but also realizing that you have influence over it	Intending to only buy fair-trade after seeing a documentary about worker exploitation
The focus of distress	The experience of heightened concentration induced by a stressful situation	Only having a few hours left to finish important work
The indulgence of boredom	The gratifying experience of having time to waste and deliberately not spending it usefully	Being lazy on a Sunday afternoon
The anticipation of distress	The suspenseful experience of thinking that something will or may go wrong, but not knowing when or how	Watching a tightrope walker
The superiority of contempt	Feeling better about yourself by observing someone that you consider inferior	Watching a reality TV-show about people with bad manners

6.4 Reflection on design cases

The following section describes several insights obtained from discussing and evaluating the rich experience approach with the participants of the various projects. Many insights are particular to the rich experience approach, but some could be considered characteristics of experience-driven design in general. Rather than separately discussing each project, the results are presented under the headings of different types of insights. Throughout the section, a selection of the resulting design projects is described in separate textboxes, which are referred to and discussed in the main text. The reflection starts with a discussion of a framework of design problem solving that helps to explain several of the findings.

A framework of design problem equations

Dorst (2011) discussed a core equation to characterize different design problems.

What	+	How	→	Value	(1a)
(thing)		*(working principle)*		*(effect)*	

The 'value' refers to the problem that is addressed by the design, or more generally, the effect that the designer wants to achieve. The 'how' is the working principle or mechanism that is employed, and the 'what' is the specific manifestation of the solution, in the form of a product, service or system. To give a rough example: The value of transporting people from A to B can be realized with different working principles (e.g., a personally-owned, human-powered device, or a time-structured system of publicly offered vehicles) that manifest in even more possible concrete solutions (e.g., a racing bike or a bus system). For technical design challenges, the unknown 'how' elements tend to consist of engineering principles. However, when the design challenge involves the behavior and/or the experience of users, it will also involve psychological principles.

Different unknowns in the equation lead to different types of design problems. The most common and straightforward design brief will have known values for the 'value' and 'how', but the specific 'what' is missing:

???	+	How	→	Value	(1b)
(thing)		*(working principle)*		*(effect)*	

In this case, the designer has to create a product for a known goal and a known product type (e.g., a speedy yet comfortable racing bike). The design problem becomes more complex when also the working principle is unknown, in which case the designer has to find matching pairs of 'what's' and how's', without an evident optimal solution (Dorst, 2011).

???	+	???	→	Value	(1c)
(thing)		*(working principle)*		*(effect)*	

This situation is typical of briefs in conceptual design or design thinking, for which only the desired effect is given, but the specific solution and the working principle are unknown. For example, Dorst describes a case of night-time violence in an entertainment quarter of a metropolis. The desired effect was given: decreasing the violence, but both the approach to achieve this and the specific means involved were open-ended.

The rich experience approach as a 'how'

The framework of design problems helps to explain a characteristic of the rich experience projects that some participants experienced as an unusual challenge. Most real-life design cases have at least a certain desired effect or problem to be solved (i.e., equation 1c). However, because the projects were set up to test the rich experience approach, the 'how' was given, but both the 'what' and the 'value' were unknown.

???	+	[rich experience approach]	→	???
(thing)		*(working principle)*		*(effect)*

This meant that the design briefs were usually in the form of: 'find a problem that can be solved with a rich experience and design a product that delivers this experience'[1]. This reversed order was an artefact of the evaluation conditions that participants sometimes considered unnatural. For example, the principle behind Alla Goccia (Figure 58) – being unable to proceed until the container is emptied and can be turned over – had earlier been used in a different form for a different purpose: a plate that encouraged children to finish their meal. In a real-life project, a designer typically generates different solutions for the same problem, rather than coming up with different problems for the same kind of solution.

Functional value and experiential value

The framework of design problems represents the solution for each design as a single value or effect. The designer of project D and the author reflected on the distinction between the functionality and the experience that the product delivers. This distinction can be added to the design problem equation in the following way.

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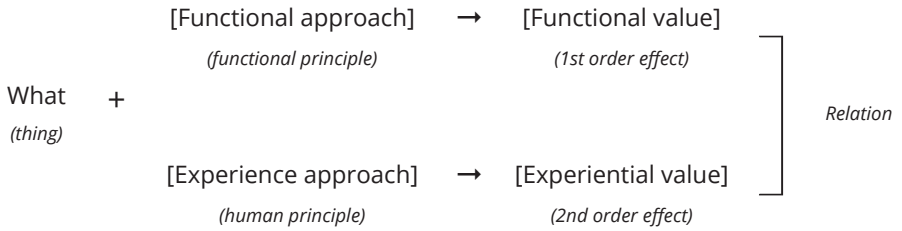
1 *In projects C and D the type of product was given (household products). This decreased the amount of unknowns in the leftmost part of the equation, but also constrained the options for designing something that delivers the experience.*



In this equation, there is not one but two types of desired effects: a functional value and an experiential value[2]. Both values are arrived at through different sets of principles, both of which have to be united in a single product. For example, the Antarctica shower mat (Figure 59) has the functional value of preventing people to slip and fall in the shower. In addition, it has the value of providing a rich experience about one's own water consumption. The functional value is called the first-order effect because it is what makes the object a product (e.g., a shower mat, a shot glass) and it is typically the reason why people obtain and use it.

However, the designer may want to consider these effects in the opposite order. If the primary intervention that a designer wants to make in a user context is an improved experience, it may be more effective to start by defining the details of the experience and only afterwards find the most suitable product type and functionality that matches it. For example, if the design brief is to improve the waiting experience at the dentist, the designer first defines the improved waiting experience (e.g., a more exciting, more relaxing, or more reflective experience), and subsequently determines which product or service this experience can be 'attached' to (e.g., the waiting chair, the turn call service, the waiting room lighting, or an entirely new product). This order of effects was at first particularly foreign to the professional designer of project D, who was used to starting a design brief with a given type of product and functionality and explore the possible experience and meaning from the object.

The distinction between functional and experiential value also foregrounds that products can differ in the strength of the relation between the two, which determines a part of their success or appeal. For example, the shower mat exhibits a moderately strong relation between the two values. There is not an inherent connection between slippage-prevention (functional value) and the experience of wasting water (experiential value). However, the values have some intuitively evident links in terms of their common theme (water), and logic in timing of the experience (showering is a good moment to think about conserving water).

Mr. Piggy (Figure 61) is an example of a product with a strong relation between the functional and experiential values: The experience effect is directly related to the main interaction with the product

2 *A similar equation can be formulated for other forms of effect-driven design (see Fokkinga et al., 2013). For example, products designed for social behavior change can be attributed with a functional value and a social value.*

Figure 58: Alla Goccia (Project D)
Alla Goccia (bottoms up) is a set of shot glasses with an upside-down design. Because of their round undersides, the glasses can only be put down when they are completely empty. This makes the ritual of drinking shots more socially involved; everyone observes the drinks being poured, and no one sets them down until they have finished. Each glass has a different metal coaster to help identify it and to collect the last drops of remaining liquid. Put down, the glasses have the appearance of different tower bells.

Rich experience quality: The fun of annoyance
The glasses are meant to be used in a social drinking ritual. The experience of such rituals often has two sides: People undertake them for fun and to bond with each other. On the other hand, the social pressure of needing to keep up with the others can be somewhat annoying. The inability to put down the glasses emphasizes the teasing character that drinking rituals can have. This feature, which in many situations would just be annoying, is intended to evoke fun in a social, non-serious setting.

and makes the interaction more engaging and meaningful. Secondly, the eventual destruction of the product fits the themes of value and transience that are relevant to the saving ritual.

If the order of values is reversed, and the functional value becomes subordinate to the experiential value, the product has the risk of becoming more akin to art or critical design. For example, the procrastination timer (Figure 62) intends to help people become aware of their procrastination behavior, to help them reduce it. However, the functionality that elicits the rich experience (deleting words from a working document) is so drastic, that the product would probably not be suitable for mainstream use.

The functional value of a product can also completely coincide with the experiential value, in which case the distinction between the two disappears. For example, the unique experience that the Sinsecret concept (Figure 60) provides to users *is* its main function. A challenge for such products is to convince potential customers of the value of the experience, as it cannot 'piggyback' on any additional functional values.

Several designers mentioned a useful exercise they had discovered, which was to first generate

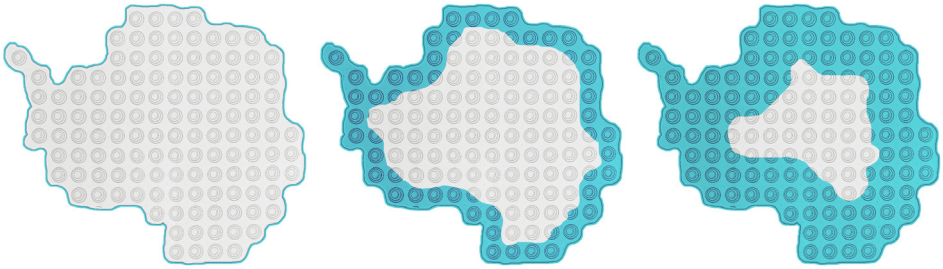


Figure 59: Antarctica shower mat (Project C)
The product is a non-slip shower mat in the shape of Antarctica. Before the user starts having a shower, the whole continent is displayed. As it comes into contact with water, the shape gradually shrinks, until it completely disappears after fifteen minutes in the shower. The shape returns as the mat dries.

Rich experience quality: The significance of guilt
The principle behind this mat is simple: the user is encouraged to preserve water and energy by making the effects of overuse explicit. The image of the melting continent is intended to evoke guilt, and make the user reflect on his behavior. The playful way in which the message is conveyed makes it a rich experience.

extreme design examples that deliver the rich experience, and subsequently using the same principle in a more moderate or acceptable form. For example, the designers of the Sinsecret concept had first generated a provocative idea for a translucent booth in a public place, in which overweight women could have sex with their spouses, to demonstrate that sexuality is not restricted to certain people. The same principle was then applied in the more moderate and viable Sinsecret concept.

Overall, creating a strong relation between the experience and function of the product was one of the most challenging aspects of the rich experience approach. Like any design process, this often required a considerable number of iterations to get right. The rich experience approach did not provide explicit tools or guidance to assist designers in this process.

Types of designers

Design typically deals with a great number of interdepending variables, many of which are unknown or uncertain. As such, design problems do not have an a-priori solution that can be arrived at in a linear manner (Gaver, 2012). Consequently, designers can differ extensively in their overall approach. Two differences in approach were found particularly relevant in the evaluation of the rich experience approach: the involvement of systematic methodology and the starting point of the process.

Gunther and Ehrlenspiel (1999) investigated the distinction between so-called p-designers (practice-based) and m-designers (methodology-based). M-designers have often been taught design methodology at university and typically follow a certain structured approach to arrive at a design solution. In contrast, p-designers typically draw from their experience and intuition when dealing with design

Figure 60: Sinsecret (Project A)
Sinsecret is product-service system that intends to help obese women gain self-confidence. The product is a garter that is worn around the upper leg, invisible to others. Occasionally, the device gets warm to indicate a new message is available. Once the user has found a private spot, a single earpiece whispers a task in her ear. The user has to submit to the provocative and slightly embarrassing task, such as singing loudly in a bathroom stall, walking down the supermarket aisle as if it were a catwalk, or staging a short pole dancing performance in the subway.

Rich experience quality: the indulgence of shame
The intention of the product is to increase the wearer's self-confidence by encouraging her to engage in activities that, paradoxically, evoke some shame and embarrassment. These activities are publicly regarded with a double standard: they are welcomed if they are undertaken by attractive women (in certain contexts), but frowned upon when done by a regular woman. The activities are both meant to help the user explore the sexual and feminine side of herself, and encourage her to be less concerned with what others think of her. The added self-confidence may even help her to lose weight.

problems and often adopt an idiosyncratic approach for each project. A second distinction is that m-designers start their process from the desired effect of the product, working their way back to the concrete solution (from right to left in the design equation), while p-designers often start from the object, exploring possible meanings and uses (from left to right in the design equation). Although these distinctions simplify the many differences between individual designers, it was found helpful in understanding the different responses to the rich experience approach from different participants.

The participants in projects B and C, and half of the participants of project A were typical m-designers. All these participants were students at Delft University, which is characterized by its methodical education (see Van Boeijen, Daalhuizen, Zijlstra, & Van Der Schoor, 2013, p. 5). In contrast, the freelance designer of project D and the other half of the participants in project A were more like p-designers.

Figure 61: Mr. Piggy (Project D)
Mr. Piggy is a piggy bank made of plaster. The user is asked to write an explicit spending goal on its bottom. When he receives his first few coins, Mr. Piggy is a stable and reliable piggy bank. However, because of his asymmetric shape, the fuller the bank gets, the more he becomes imbalanced and wobbly. Finally, the time comes when he is full enough and falls over, shattering into many pieces and exposing his contents to the user. The leftover pieces can be repurposed as crayons for a chalk board.

Rich experience quality: The anticipation of distress
Even with the increasing ubiquity of virtual money, many people still cherish the tradition of depositing their small change in a piggy bank. However, in terms of everyday experience, piggy banks do not offer much – the money disappears and reappears only at the moment people decide to appraise the contents. Mr. Piggy aims to create a rich experience out of the saving practice, both to make people more aware of the meaning of saving money and to encourage them to regularly perform this ritual. Because the user knows that the piggy bank will eventually tip over and break itself, but not when, the deposit of every coin evokes a combination of anticipation and fear that it may be the last one. When that finally happens, the user can feel a mix of shock that Mr. Piggy is gone, a destructive pleasure in the shattering spectacle, and delight that enough money has been saved for the intended goal.

In general, the m-designers were familiar with the methodical nature of the rich experience approach and were quickly able to work with it. The p-designers had a harder time to get started, or in some cases, to design anything with the approach. This was exemplified by the fact that more than half of the p-designers in project A dropped out a few days into the workshop. Some remarked that they were not interested in 'following steps'. However, the p-designers that did make a sustained effort to engage with the approach (co)produced some of the most interesting results of the projects, such as Mr. Piggy (Figure 61), Alla Goccia (Figure 58), Sinsecret (Figure 60), and Donor Hero (p.110, Figure 57).

There was also a difference in the type of information that designers derived inspiration from during their design process. M-designers tended to be fond of empirical sources and scientific descriptions of human principles and mechanisms. For example, they were interested to know as many possible experiential and behavioral effects of specific negative emotions that had been established by psycho-

Figure 62: Procrastination timer (Project B)
The procrastination timer is an electronic device that is connected to a person's working computer. Someone can use it to track their working hours and specifically, to keep their procrastination behavior in check. Every time the user engages in digital activities that are not work-related, such as going on Facebook or a news site, the hourglass automatically turns over and starts counting. Slowly, a receipt with seemingly random markings starts coming out from underneath the timer. When the user starts working again, he has to manually turn back the hourglass. The receipt is released and is found to contain the addresses of the websites the user has visited, mixed with words from the user's document. The same words turn out to be deleted from the document that the user was – or rather, should have been – working on.

Rich experience quality: The enchantment of anxiety and the salience of remorse
The device intends to make the (after-)experience of procrastination more salient, by specifically evoking feelings of remorse. The interaction with the device embodies the message that it is not a problem to procrastinate once in a while, as long as it does not become an unconscious habit. By removing words from his document and making the cost of procrastination more tangible in the symbolic receipt, the user is supposed to feel remorse and reflect on his behavior.

logical research. In contrast, the p-designer in project D called such sources 'hermetic', as they did not allow personal interpretation. She preferred sources that were more narrative or philosophical in nature, because they allowed her to develop a personal view on the matter. For example, she found much inspiration in 'The antidote', a book by Burkeman (2012) that describes a personal exploration of different aspects of 'negative happiness', which shares some of the fundamental views of the rich experience approach. What united m-designers and p-designers was their appreciation of examples of existing design that made use of rich experience.

Differences notwithstanding, all designers needed considerable time to understand the principles of the approach and find a way to apply it in their approach. If there was little time (such as in project C), the product solutions ideas tended to be quite 'gimmicky', i.e., obvious attempts to achieve an emotional effect without much subtlety. However, given more time, most participants were able to turn these ideas in more refined product concepts.

Figure 63: Horribly hungry (Project B)
Horribly hungry is an interactive dinner table for restaurants at which guests can influence each other's table manners and pace of eating. Inside the table are a number of tubes that run underneath each of the dinner plates. The tubes are connected to two reservoirs containing cold and hot liquid. When cold liquid flows through the tube underneath a plate, the warm food cools down; when hot liquid flows through the tube, it heats up. By placing their hands on the table, dinner guests can send each other hot or cold streams.

Rich experience quality: the pleasure of anger and the thrill of fear
With this product the designers intended to encourage social eating, meaning that people have their full attention on each other and eat at more or less the same pace. This product intends to evoke two types of rich experiences. The first is the kind of sadistic pleasure of being able to punish a table companion who is not behaving appropriately, for example, because she is checking her smartphone. The second is the thrill of fearing that others may send you a cold stream. In general, though, the product is intended to facilitate an atmosphere of fun and excitement.

Materialization

Projects A, B, and C did not go beyond the conceptual stage, mainly due to time constraints and the focus of the courses of which the projects were part. Project D was an exception, as there was more time and an explicit aim to produce products that would be (virtually) ready for production. The experiences in this project showed that the rich experience approach was helpful in the conceptual stage, but did not offer much guidance in the subsequent embodiment stage, in which the concept is elaborated into a materialized product. Although the rich experience with the product is mainly established in the conceptual phase, several design decisions in the materialization phase were found to have an important influence on the effectiveness of the experience. For example, initially the designer intended to make Mr. Piggy out of thin porcelain, emphasizing its fragility. However, this would make the piggy bank expensive and the eventual destruction quite a waste. Furthermore, users might prevent the piggy bank from falling over altogether. The designer explored other materials, and ultimately settled on plaster. This preserved the original idea; there was still a rich experience in destroying a functional and nice-looking object, but the destruction would not be so costly, and the remaining pieces would go on to serve a second purpose.

6.5 Conclusions

The first section discussed how participants used the rich experience approach to generate their own rich qualities, which most were able to do in a short amount of time. The novel rich qualities were added to the collection to support future projects. Evidently, as the collection grows, the chance that participants are able to come up with new qualities decreases. Nevertheless, even when designers did not manage to come up with a new quality, or when they did not go on to design with their generated rich quality, the exercise was found useful because it significantly added to their engagement and understanding of the overall approach.

The design sessions demonstrated that although participants at first found the rich experience approach challenging to work with, almost all of them could use it to create interesting product concepts after some exercise. At the same time, there were personal differences in the merit that designers ascribed to the methodical nature of the approach, which was found to correlate with their overall design profile (m-designers versus p-designers). However, the experiences in the later projects demonstrated that providing a variety in types of input – both scientific and more narrative-philosophical in nature – helped to optimally engage the different kinds of designers in the approach.

During the design sessions, several characteristics emerged that had not been explicitly part of the approach. The first was the difference between the experiential value and the functional value of the product, and the relation between the two. Making this relation more explicit in the approach, and showing how it can be made stronger and more meaningful could help designers to create rich experience products that are both engaging and marketable. Secondly, the participants that took their design beyond the conceptualization stage, particularly the designer of project D, sometimes missed guidance from the approach in bringing out the rich experience in the embodiment of the product. Observations during the creation of designs that reached this stage, such as Mr. Piggy, demonstrated that concrete design decisions can have a large impact on the ultimate ability of the product to deliver a rich user experience. This could be resolved with additional guidelines in the approach that help the designer make decisions on concrete interactions with the product.

7 :::.

RICH EXPERIENCE IN CONCRETE INTERACTIONS

Be true to your own act, and congratulate yourself if you have done something strange and extravagant, and broken the monotony of a decorous age. It was a high counsel that I once heard given to a young person: "Always do what you are afraid to do."

— Ralph Waldo Emerson

Chapter five introduced the rich experience design approach and chapter six evaluated how designers had used it to create several product concepts. These chapters showed some of the characteristics and usefulness of the approach, especially in the conceptual phase of designing. However, because these product concepts were only minimally and informally tested with users, they did not yet fully evaluate whether functional products developed with this approach can systematically evoke a specific and intended rich user experience. Secondly, the previous chapter raised some questions about the applicability of the rich experience approach beyond the conceptual stage of designing. This chapter discusses a 'research through design' study that evaluated whether the approach was useful in the entire design process, from conceptualization to user testing, and whether the final product produced the intended effects on the users' experience and attitude. The starting point was the 'Run for your life' wristband, a product that intends to add engagement to running by giving users the impression that they are being chased. Emotion theory guided the process of materializing the concept into a prototype and the subsequent participant testing. The evaluation of the prototype showed that most participants indeed had the intended rich user experience, although there were several notable obstacles. The reflection on the design process also led to several insights that are interesting for the design of concrete interactions with theory-driven design approaches in general.

This chapter is based on: Fokkinga, S. F., & Desmet, P. M. A. (2014). Run for your life! Using emotion theory in designing for concrete product interactions. In J. Salamanca, P. M. A. Desmet, A. Burbano, G. D. S. Ludden, & J. Maya (Eds.), 9th International conference on Design and Emotion: The colors of care (pp. 384-393). Bogota: Ediciones Uniandes.

7.1 Introduction

Imagine it is 9am on a Saturday; everything is still quiet outside. The birds are chirping, the sun is gently shining on your face, and you are running for your life. Just before the last corner you were able to shake off your pursuers for a minute, but they have redoubled their efforts and are at your throat again. The warning system on your wrist is counting back to ten meters; seven; four; two. You can hear the heavy breathing right behind you. You only need to get to the end of the street to be safe, but will you make it?

This is the user scenario of a product that was designed to enrich the experience of running. Through different types of feedback from a wearable device, runners get the experience of being chased by something. The initial concept for this product was described in chapter six (and Fokkinga & Desmet, 2013). In the conceptual phase of designing this product, the rich experience approach and the psychological theory behind it proved to be very helpful in answering design questions such as: What does the experience of running consist of? Which emotions are beneficial in this context? How could the product evoke such an experience?

However, the approach has yet to be extensively tested in the 'manifestation phase' of the design process: the phase in which the product is materialized, the specific product-user interactions are given shape, and the product is integrally evaluated with users. The relevant design questions in this phase relate to more concrete topics like: What shape should the product take? How often should it provide feedback? Which combination of visual, auditory and tactile feedback most successfully evokes the intended experience?

In general, we find that theory-driven experience design approaches are less supportive in the manifestation phase of design, as they typically involve abstract psychological concepts that are difficultly translatable to concrete design decisions. This means that designers are often left to their personal taste, design sensitivity and experimentation to make sure the intended experience is also expressed or evoked by its concrete manifestation. Although this is not necessarily problematic, we think that there is great potential for theory-driven approaches to expand the range of design activities in which they can be inspiring and useful.

In this chapter, we describe a project that attempted to use the theory-based rich experience approach in the concrete design and testing of a product for runners. By taking a reflective approach during the design and testing activities, we aimed to identify the factors and challenges involved in using psychological theory to make design decisions in the manifestation phase. The project particularly investigated if the prototype could systematically evoke a specific and intended rich experience in test users. In the following section, we briefly discuss fear emotions and the product concept that was the starting point for this project. Then, we explain how this project used the research through design method

Figure 64: Artist's impression of the 'Run for your life'-concept (drawing by Jort Nijhuis)

in a way that combined an explicit treatment of psychological and technological variables with a dynamically adjustable prototype. In the subsequent section, we describe the insights we drew from the design and research process. Lastly, we discuss some implications of these insights and the new questions that they raise.

7.2 Case study: design for fear emotions

Running is popular in many countries, because it is a sport with a high activity intensity, which at the same time requires little in terms of skills and material investments. However, many runners may experience a lack of enjoyment during running, and as a result have difficulty finding the motivation to run as regularly as they want. It was hypothesized that fear emotions could add thrill, adrenaline and focus to the running experience, which led to the idea of 'Run for your life'[1], a product that gives runners the experience of being chased by something (Figure 64).

Fear emotions come in different shapes and intensities. Although the extreme variants, like fear of spiders or fear of flying, might be most salient, fear emotions often occur in small, everyday moments.

1 *This was elaborated from the 'Pursuit' concept, described in chapter five (p.105)*

For example, you might experience them when you are unsure whether you locked the front door, or when you are afraid of getting your new shoes wet. When properly 'framed', fear emotions can have all sorts of pleasant varieties, like the exciting fright when riding a rollercoaster, the suspenseful anxiety when watching a thriller movie, or the invigorating nervousness before giving an important presentation.

Fear emotions can affect user experience in two main ways (see chapter three). Firstly, they can directly influence a person's experience of the world. Scientific studies have shown many such effects: fear causes people to adopt a narrower field of view (Derryberry & Reed, 1998), it makes people experience time as passing more slowly (Tipples, 2011) and people more easily retrieve memories of other times when they were afraid (Bower, 1981). There is also anecdotal evidence of the beneficial power of fear from the art world. For example, fiction writer Karen Thompson Walker devoted her 2012 TED talk to arguing that fear has the unique ability to spark people's imagination, which is apparent in the creative fantasies that people express when they think of their worst fears[2]. Secondly, fear emotions can change the way we behave and deal with situations, which in turn affects our experience. For example, fear increases adrenaline levels, which gives people more energy to perform physical tasks (Wise, 2009). Tamir and Ford (2009) found that fearful people performed better than people who were positively excited in a game which required them to avoid an enemy. Both the direct experience effect and the behavioral effects can be beneficial for the running context: fear can help people experience their run as more interesting and thrilling, and it might help motivate them to run faster, longer and/or more often.

Obviously, just evoking fear emotions does not necessarily lead to better experiences. After all, fear is often just plain unpleasant. Apter (2007) proposed that the difference between enjoyable fear and unpleasant fear is the presence of a protective frame. Protective frames are psychological constructs that determine whether a person perceives a situation as truly threatening, or as intriguing and exciting. A simple example is a lion in a cage: most people who encounter an uncaged lion would probably just experience terror. Conversely, encountering a caged lion from close by can change the experience into an enjoyable one. The most important idea is that the cage does not take away the arousal of encountering the lion, but that it makes that arousal enjoyable.

7.3 Method

Research through design

According to Zimmerman and colleagues (2010), design research can be grouped into three categories: 1) Research about Design, which investigates design activities and studies how designers work,

2 *See: http://new.ted.com/talks/karen_thompson_walker_what_fear_can_teach_us*

Figure 65: Three display types of the prototype

2) Research for Design, which aims to create knowledge for designers in the form of frameworks, guidelines and design methods, often by applying or translating knowledge from other disciplines like psychology, and 3) Research through Design, which uses the act of design to iteratively discover what potential future technologies, usage scenarios, and product experiences might look like. From the perspective of this categorization, our project followed a user experience-focused research through design approach, with the ultimate aim of contributing to theory for design (Zimmerman et al., 2010, p. 313).

The research through design process used here was intended to generate knowledge on different levels of specificity. Firstly, it was expected to gain insight into designing for the experience and motivation of running. Secondly, the project aimed to gain more understanding of how negative emotions, and specifically fear emotions, might be elicited during the interaction with a functional product, in such a way that the resulting experience would be more enjoyable and motivating. Lastly, by reflecting on this process in a systematic way, the aim was to generate knowledge on the use of theory in designing concrete product interactions.

Procedure

The design process and prototyping of the product consisted of two stages. In the first stage, the hardware prototype was designed and built. The prototype was intended to be a versatile 'platform' rather than a single product, in the sense that it afforded many different types of interaction, which could be altered by exchanging hardware components and adjusting the software. The aim of this approach was to create as large a 'canvas' of interaction options as possible, which were expected to influence the emotional experience, within the constraints of practical, technical and social feasibility. In the second design stage, these interaction options were explicitly documented as different 'variables'. One example of such a variable was the type of display that the user would carry on their wrist, which came in three varieties: a display with three numbers, a display with a row of bar lights, and a display with a translucent dome on top which could display any color in the red, green and blue spectrum (Figure 65).

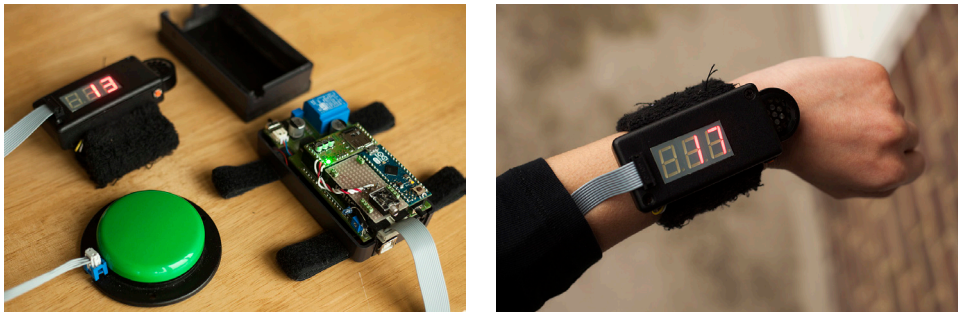


Figure 66: the Run for your life prototype

Examples of other variables included variants based on vibration, shock, and sound stimuli. The different variants of these variables could subsequently be combined into 'experience scenarios'. Each scenario represented a different way in which the product manifested the intended experience effect of the concept. These scenarios were subsequently programmed into the prototype and could be exchanged, and even altered, between testing sessions.

During this stage, iterations were made between several activities:

- Studying literature about the elicitation of different (fear) emotions
- Personal exploration into the possible ways of evoking (fear) emotions
- Design experimentation that explored possible ways of linking (combinations of) concrete interactions to psychological variables

The resulting prototype consisted of two parts (Figure 66). The first part was a small box that runners would put in their pockets, which contained an Arduino system, an accelerometer that measured the runner's speed, and a battery. All the interactions between the runner and the prototype took place through the second part, which runners wore on their wrists. This part gave the feedback to the runner through a display, a speaker or headphones, a vibration motor under the wrist, a shock element on top of the wrist (which could administer small electric shocks, far below safety limits), an mp3-module, a synthesizer module, and a button that could be placed against the runner's body.

Evaluation

This prototype was tested in two-hour sessions with individual participants. In total, the prototype was tested in 26 runs with 11 different participants (5 female, average age 25.7 years), who were recruited through the university network. In each session, the participant first filled in a short questionnaire about their running style and their motivation for running. After a brief explanation, participants ran with the prototype that was programmed with one of the available scenarios. In most sessions, participants tried multiple scenarios (7 participants tested 3 scenarios, 1 participant tested 2 scenarios, and 3 participants tested 1 scenario). The distance of the runs differed between 2 and 3 km;

Figure 67: The camera cap

Figure 68: Image captured by the cap during a run

runs lasted about 10 to 20 minutes, depending on the speed of the runner. During the run, participants wore a cap with an attached video camera (Figure 67) that recorded the video and audio of the run from a first-person-perspective (Figure 68). Directly after they had finished their last scenario, participants were interviewed about their experiences. During the interview, parts of the recorded videos were watched while the participants retold their experiences, helping them to recall their experiences and compare the different scenarios. This procedure was based on recommendations from the emotion measurement research of Laurans (2011), who found that this method of 'self-confrontation' offered the best compromise between capturing accurate and rich reports of experiences while intervening as little as possible in the experience itself.

7.4 Results and discussion

The following sections report findings and insights obtained from the research through design process, in which different combinations of interactions were designed and tested using the versatile prototype. Even though the process was iterative, the results are presented in a thematic rather than a chronological fashion, in which each theme represents a constellation of insights. Ten main insight themes are reported, in three loosely defined clusters: (1) lessons learned from the process of developing manifestations of experience; (2) lessons learned from the process of testing manifestations of experience; and (3) additional (general) lessons learned that are relevant for experience design approaches.

Lessons learned from the process of developing manifestations of experience

Emotional granularity

When designing specific emotional interactions for the prototype, one of the first findings was the importance of considering emotions at a high level of granularity. For example, the emotions that are evoked when thinking of a financial problem, when preparing for an exam, or when someone suddenly stands behind you, could all be called 'fear', but they could be described with more nuance as

Figure 69: The prototype in use (photos by Wetzer & Berends)

'worry', 'nervousness' and 'startle', respectively. The emotions used in the design case were all derived from the cluster of 'fear-emotions' in the emotion typology described in chapter four (see Table 2). Table 10 lists the emotions that were used in the design case, together with the definitions discussed in chapter four and an example of an eliciting event[3].

Working with the emotions in Table 10 was helpful in three ways. Firstly, their more specific nature was found to be a greater source of inspiration for coming up with concrete user-product interactions. Secondly, they offered a more focused evaluation of the different modes of interaction. For instance, it turned out that certain fear emotions were less effective than others in making the experience enjoyable and that the preference of one fear emotion over another depended on personal preferences. Thirdly, during the design process it was found that, although they belong to the same emotion family, the type of event that elicits them is sometimes very different; indeed, they might even oppose each other. For instance, worry is characterized by long periods of pondering about something that might go wrong, whereas startle is a very short, visceral reaction to something unexpected. Additionally, nervousness means someone has a certain amount of personal influence over the outcome of a situation, whereas being afraid or anxious means that someone has little or no control. The descriptions in Table 10 were the starting point for the creative process, but were along the way complemented by examples of personal experiences with these emotions, as well as several exercises to find how a product could be altered in order to proceed from eliciting one specific emotion to another, which produced additional useful information about these emotions.

3 *Three fear-emotions from the typology, insecurity, distrust, and doubt, were not used in this project. Insecurity and distrust were discarded in an early phase because their implementation would most likely have to involve social elements (the threat of social failure and the threat of being deceived, respectively), which we found too distant from the main theme of being physically chased. Doubt was considered, but eventually not used, because its implementation would have to involve the user making certain (difficult) decisions during the interaction, which was judged too obtrusive to the main activity of running.*

Table 10: Definitions and examples of specific fear emotions.

Emotion	Definition	Example of an eliciting event
Fear	The feeling when you encounter or think about a thing or person that can harm you. You have the urge to avoid or get away from the threat.	Being afraid of the drill while being at the dentist
Worry	The feeling when something happened that could mean something bad will happen to you or someone else. You cannot stop thinking about this.	Thinking you don't have enough money to last until the end of the month
Nervousness	The feeling when you have to do something, but you think that something might go wrong that prevents you from succeeding. You don't feel in control of the situation.	Having to do a difficult exam
Startle	The feeling when suddenly something unexpected happens, which could be something bad. You have the immediate urge to find out what is going on.	Seeing a pedestrian suddenly step out in front of your car
Confusion	The feeling when you get information that does not make sense to you, leaving you uncertain what to do with it.	Being lost in a big city
Anxiety	The feeling when you think about bad things that could happen to you. You are on guard, because you don't know what the threat is.	Hearing an inexplicable noise while alone in the dark

Definitions are derived from chapter four, table 2

In conclusion, these differences between emotions proved to be a fruitful basis for finding answers to more practical questions, such as: Which emotion would be most effective at what point in the interaction? How much control should the user be granted over the interaction? How long should certain episodes last?

Elicitation of fear emotions

To explore possible interactions, a list was made of all possible fear elicitors, starting from each of the specific emotions (see Table 10 for an example of each). Out of this list, three categories emerged: visceral stimuli, associations, and situational components (Figure 70).

Firstly, theory suggested that there are certain stimuli that innately evoke certain emotions (e.g., Norman, Ortony, & Russell, 2003). For fear, such stimuli included sudden, loud noises, electric shocks, frantically blinking lights and disharmonious noises. These visceral stimuli were expected to be simple and effective, and several were incorporated into the prototype. However, it was also expected that these stimuli are prone to habituation. For instance, a loud bang may be frightening the first time, but much less so the third time.

Secondly, product interactions could evoke *associations* with real or imaginary fear-inducing things. Interaction elements that made use of associations included angry dog sounds, heartbeat vibrations on the wrist, and supernatural running behavior in the pursuer. Such stimuli are effective if they evoke memories and imaginations in the user. However, their success depends more than the other two types of elicitors on subjective conditions: one person may be terrified of a barking dog, while another may not mind it.



Figure 70: Three categories of fear elicitors: visceral stimuli, associations and appraisal components

The third category contained elements that people interpret in a situation, such as the (un)expectedness of information, (im)possibility of avoiding certain events, (in)consistency of information, and (in)congruity between interaction elements. For this category, the framework and knowledge of *appraisal components* was found particularly useful. Appraisal components are the 'molecular' elements of a person's appraisal of a situation, which together lead that person to have a specific emotion. Different emotions can be described as profiles of combinations of such components (Ellsworth & Scherer, 2003; Smith & Lazarus, 1993). For example, compare the (abridged) profiles of fear, anxiety and anger (based on Roseman, 2013) in Table 11.

Table 11: Abridged appraisal component profiles of fear, anxiety and anger

	Certainty	Control potential	Focus	Cause
Fear	Low	Low	Local	Circumstance
Anxiety	Low	Low	Global	Circumstance
Anger	High	High	Local	Other person

Emotions that have more components in common (such as fear and anxiety) are thought to be 'closer' to each other than emotions that have fewer components in common (such as fear and anger). Several scholars have composed lists of appraisal components for different emotions, such as Smith and Ellsworth (1985), Frijda (1986), Scherer and Fontaine (2013), and Roseman (2013). This third category of elicitors was more abstract than the first two, but most useful when creating and fine-tuning the 'interaction behavior' of the product. A challenge in identifying and adapting appraisal components was that the existing literature sources did not distinguish emotions at the level of granularity that was maintained in this project. However, the overall framework and the available knowledge were a useful starting point for further exploration of more specific fear emotions. For example, we hypothesized that to evoke worry, the user would be relatively far ahead of the pursuer, but would get sporadic signals about the pursuer's imminent advancement. In contrast, nervousness would be evoked by a pursuer that was closer behind, not gaining on the user quite so quickly, but constantly making small attempts to catch him.

Distinguishing these three categories helped to consider the variety of fear elicitors. However, theoretically the categories had fuzzy boundaries and were primarily considered of practical value. This is illustrated by the fact that several fear elicitors fit into multiple categories. For example, a sudden

loud bark can be interpreted from the first category (a loud, sudden noise), the second category (association with a vicious dog), and the third category (a sudden, unexpected, novel event). Thus, these categories represented complementary perspectives on fear elicitation, rather than clusters of mutually exclusive stimuli.

Interaction variables and experience scenarios

These theoretical insights into emotional granularity and the elicitation of emotion (constrained by the technical possibilities of the prototype and the contextual possibilities of running) led to the identification of a number of 'interaction variables' that were expected to have different beneficial effects on the user experience. Figure 71 shows an overview of the variables as they were used at the start of the first testing iteration. The squares of the same color represent the different variants of a single variable, such as the type of sound, the mode of the vibration feedback, or the strategy of the pursuer.

A prominent example of an interaction variable was the type of display used. There were three different types, of which only one was used in each running session (see Figure 65). The three displays provided the same information – the distance between the runner and the pursuer – but in different ways, which was expected to have different effects on the user's emotions. The number display showed the distance as a number of meters, the bar display gave a representation in the form of an actual distance between a green bar and a red bar, and the color dome display represented the distance with a color from green (far away) to orange (getting closer) to red and blinking (very close). Of the three, the number display gave the most detailed information in the most 'rational' format. This was thought to have two, partially opposite effects on the user. On one hand, the detailed information increased the user's certainty and predictability of the pursuer's behavior. However, this amount of detail also made the user more aware of all the nuances of the distance situation, increasing the salience of the experience. Thus, this display was hypothesized to work well in the worry scenario. The bar display was expected to be the most intuitive of the three, as it actually showed a distance. Because there were only ten bars to show the difference in distance, the information of this display had a lower resolution than the number display. The color dome display was thought to be the most 'affective' of the three, as it did not give a clear representation of distance, but a color to indicate how close the threat was. A continuous green light would mean 'you are fine', while a red, blinking light meant 'you are in danger'.

Using these variables, 'experience scenarios' were created. These were creatively constructed combinations of variables that were expected to evoke a certain emotional experience or stimulate a certain motivation for running. Four scenarios resulted from this creative process: the 'minimal' scenario, the 'game-like' scenario, the 'inevitable' scenario, and the 'horror' scenario. Table 12 shows a description of these scenarios, the fear emotions that characterized them and the combination of interaction variables as they were mainly tested in that scenario. In the testing sessions, small variations were made to these scenarios in order to evaluate the influence of single variables (e.g., the game-like scenario was in some sessions tested with the color-display (A4) rather than the bar display (A3)).

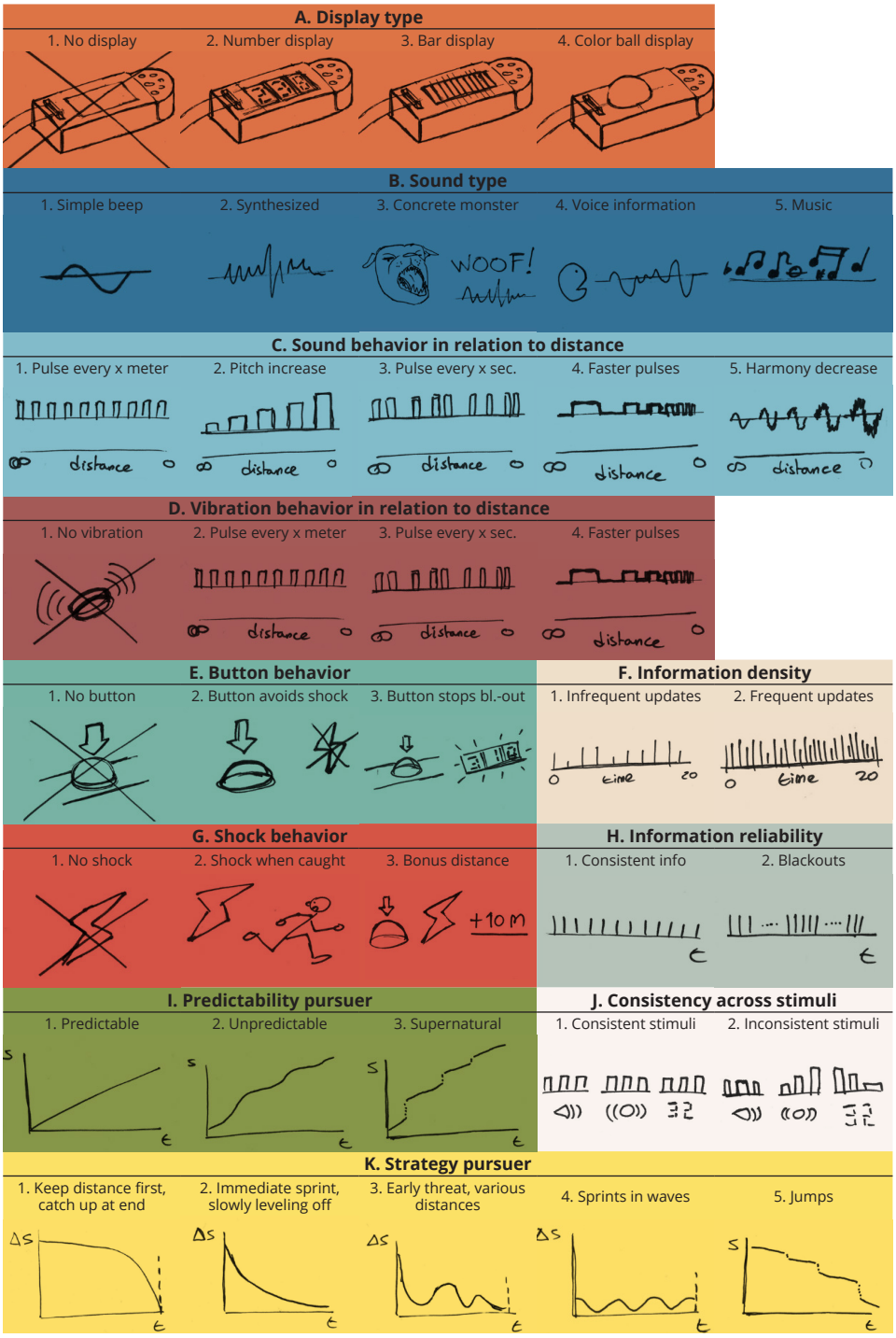


Figure 71: Overview of the interaction variables used in the project

Table 12: The four experience scenarios. The codes and colors under 'Interaction variables' refer to Figure 71

Scenario	Emotions	Description	Interaction variables			
The minimal scenario	Confusion	The runner only gets very little information, in the form of a beeping sound that becomes increasingly distressing when the pursuer comes closer. There is no tactile information. The display either shows nothing or minimal information in the form of a single color.	A1	B1	C2	D4
			E1	F1	G1	H1
			I2	J0	K3	
The game-like scenario	Fear / Nervous-ness	The pursuer is relatively close, and during the run makes several attempts to catch the runner in short sprints which the runner has to be quick enough to avoid. These sprints are announced shortly beforehand. The pursuer is represented by dog sounds; the display shows a visual representation of the runner and the distance to the pursuer.	A3	B3	C2	D4
			E2	F2	G2	H1
			I2	J1	K4	
The inevitability scenario	Worry	The pursuer starts relatively far behind, but is constantly drawing closer, and threatens to catch the runner at the end of the run. The runner gets clear information about this prospect through voice information and the numbered display.	A2	B4	C1	D4
			E1	F2	G1	H1
			I1	J1	K1	
The horror scenario	Anxiety / Startle	The pursuer displays unexpected and superhuman behavior, by defying the laws of physics – e.g., being able to run very fast, skipping distances, disappearing and reappearing. At certain times, the pursuer pops up unexpectedly behind the runner, and the runner has to sprint to outrun it. The runner hears eerie music most of the time and very intense music during the startle moments.	A4	B5	C0	D4
			E3	F2	G2	H2
			I3	J2	K5	

Lessons learned from the process of testing manifestations of experience

Rich experience success criteria

Chapter two showed that a rich experience is defined on the basis of three necessary conditions: a) the experience has to involve at least one negative and one positive emotion, b) the person has to subjectively judge that the experience as a whole has been pleasant or worthwhile and c) the negative emotion has to be felt as a necessary ingredient in that evaluation (as opposed to being an undesired side-effect).

In the tests, different factors emerged that determined whether the prototype was successful in eliciting a rich experience in the user and whether it was successful in motivating them. These factors seemed to work as a chain of successive criteria: the prototype succeeded only when all were met. If a certain criterion was not met, the ones succeeding it became irrelevant. Firstly, the participants had to accept the basic premise of the concept. Participants for whom this criterion failed seemed to reject the hypothesized principle of enjoying negative emotions. People in this group sometimes asked whether it was not possible to develop the same concept, but with a more 'positive goal', like chasing something yourself. There were also people who did not want to have their emotions influenced by a product at all (positively or negatively). 3 (of 11) participants fell into this group. Secondly, some of the participants who did accept the basic premise, sometimes did not like the specific emotions that were evoked for a given scenario. For instance, two participants expressed a liking for the

nervousness scenario, but found the emotions evoked in the confusion scenario very unpleasant. In some cases there was also a discrepancy between the effect the emotions had on the experience and the motivation of the runner: one participant said that the worry scenario was the most effective in motivating her to run but that she would not pick it if she had the choice. Thirdly, participants who liked both the concept and the scenario sometimes felt the specific sensory stimuli were unpleasant or did not work. For example, some people found the beeping sound disturbing or frightening, whereas they liked the scenario overall. When each of the three conditions were met, participants expressed a liking for the experience and felt more motivated to run.

Influence of personal running style

Another important factor that determined the effectiveness of the prototype was the personal running style that different participants had, as well as the meaning they attributed to running. Among the participants, roughly three groups emerged. One group of participants (4 of 11) ran mostly to relax or clear their minds, and wanted to be able to run at their own pace. People in this group most often did not use any tools, apps or music during running and were mostly uncharmed by the prototype, or preferred to have a minimal version of it. A second group of participants (3 of 11) ran mostly to improve their performance or to keep fit. People in this group mostly commented on how specific interactions and emotions could help them to improve their performance. A third group of participants (4 of 11) were mostly looking to having a more engaging running experience, and wanted to have more motivation to run. People in this group liked the prototype the best, and pointed out that variety in the experience was important to them. Overall, the most insights were obtained from the second group ('functional fear') and the third group ('fear to enjoy').

Effectiveness of different emotion elicitations

In the design stage, three different ways were found to elicit fear emotions in the user: hard-wired stimuli, association, and appraisal components. The effectiveness of these different strategies was also found to depend to a great extent on personal differences. Some participants had strong mental associations with the different stimuli, most notably with the sounds that were used. Several participants said that the dog sounds not only evoked visual images of dogs, but also stimulated them to construct mental stories that explained why the dogs were chasing them. The abstract beeps evoked widely varying explanations: a mosquito, a ticking clock, a UFO, and the 'sound of darkness'. Other participants had little or no associations with the stimuli, and approached them more functionally. The appraisal components proved more consistent in influencing the experience, although their effectiveness largely depended on the tension between the functional value (see next section) and combinations with other variables (see later section). For instance, the predictability of the pursuer (high in the worry scenario, lower in the nervousness scenario, lowest in the confusion scenario) made a salient difference to the emotions reported by the participants. The hard-wired effects were least successful, with the exception of the shock element, which became an important factor for many participants, one of whom said: "*Although the shock did not feel that bad at all, the idea of being*

shocked makes a big difference." The other stimuli: sound, vibration and visuals, were not successful in scaring the user directly.

The tension between functional interactions and engaging experiences

The aim of the design process was to create a product that would evoke certain experiences, but which also had a clear functional aim – to support the user in their running. Three aspects were found during the design and research iterations that made the running experience more engaging but hindered the runner from performing well, and vice versa. All these aspects were in some way related to the *control* the user had over the product or the experience. Firstly, there was the extent to which the runner had *enough information* to understand what was happening during the run. Especially in the confusion scenario, an important experience factor was to leave the runner relatively in the dark about the whereabouts of the pursuer. For some participants this was effective, and they ran faster as a result. For other participants, not getting enough information was a reason to stop interacting with the prototype altogether, rendering it useless. Secondly, there was the degree to which the runner could *predict* what the pursuer was going to do. A high level of predictability helped runners to plan their run and divide their energy but at the same time it made the experience less novel and engaging. Thirdly, there was the degree to which the runner could *influence* the behavior of the pursuer. Some participants requested the ability to determine when the pursuer was going to sprint. However, the same participants acknowledged that this would also make the experience less effective.

Additional lessons relevant for experience driven design approaches

Holistic combinations of variables

Interpreting the data from the test runs, it seemed that there was no direct correlation between single variables and psychological effects. Specific variables, such as sensory stimuli (e.g., beeps) or appraisal components (e.g., ambiguity of information) did not seem, on their own, to decisively influence the type of emotion or experiences. Rather, different *combinations* of variables changed people's experiences with the prototype. For example, participants found the 'worry scenario' quite comforting during the first two thirds of the run if it was combined with a voice announcing the distances, whereas they found the same scenario very 'pressurizing' when it was instead combined with beeps of increasing pitch. In other scenarios, the switching of these stimuli had different effects.

Dosage of stimuli

One finding that emerged during the testing of the scenarios, which was not fully anticipated in the design phase, was the importance of the proper 'dosage' of certain stimuli over time. For example, vibration was found to have a much more powerful effect on the experience when it was applied moderately (only in the most intense moments) than if it was applied throughout the run. For sound, this dosage seemed to depend mostly on personal taste. Participants who preferred to run without music or aids favored the scenarios that had the least sound, whereas participants who wanted to be entertained while running were conversely annoyed by long silences.

Variation of experience

Another emerging observation was that most people will not have the same (emotional) experience over time if the interaction is not changed. After a while, the same stimuli are less effective in creating the same intensity of experience in the user. For example, a pursuer who is just behind you may be scary during the first minute, but this effect will be lost if it stays at the same distance for the remaining 20 minutes of the run. Two scenarios (worry and nervousness) implicitly remedied this problem in different ways. The worry scenario was relatively static and predictable, but because the pursuer was constantly getting closer, and thus the stimulus became more intense, this scenario was (most of the time) effective until the end. The nervousness scenario, on the other hand, worked because different emotions succeeded each other in time: the user first felt nervous anticipation (when they were told the dogs would be approaching soon), then distress (when the dogs were in pursuit), and finally relief (when the runner had momentarily shaken them off), after which this cycle was repeated.

7.5 Conclusions

This project adopted a research through design approach with the aim of investigating how theory-driven approaches could be useful in the manifestation phase of designing. The approach was a) to use theory to create concrete interactions and b) to design and test explicit combinations of these variables in 'experience scenarios'. This approach was intended to combine the explicit treatment of variables and the clarity of documentation that characterizes research activities, with the ability to make holistic sense of a great number of variables in a creative task, which is typical of design activities.

The followed design process had a highly methodical character to identify useful strategies and relevant challenges in the manifestation stage of designing. We found this approach very useful for research purposes, however, we do not necessarily propose that designers should undertake a similarly structured approach for design projects. Rather, we encourage them to integrate the findings and guidelines into their own design process.

The experience scenarios were found to be a very helpful in the process. Recently, Hassenzahl and colleagues (2013) described a similar construct to translate abstract experience elements into concrete product interactions, which they named an 'experience pattern'. In their approach, they took a certain enjoyable and rich experience as a starting point (a live concert visit), and translated its qualities into the redesign of a product that could evoke a similar experience (a family television). There are a few differences with the approach outlined in this chapter and theirs. Firstly, their approach selects a concrete 'source experience' as its starting point and analyzes this source through the lens of universal psychological needs, such as relatedness, autonomy, and stimulation (Sheldon, Elliot, & Kim, 2001). In contrast, our approach chooses an experience profile based on the effects of different emotions. Secondly, their approach may be more directly suitable as a design exercise, while our approach is

more suitable for research purposes. Regardless of these differences, we believe that these kinds of approaches can contribute a great deal to the way designers approach experience design of products and services.

An important question is to what extent the insights obtained in this study are generalizable. For instance, the study was specifically about fear emotions in the context of running. Are the results also relevant for designers who want to evoke the same type of emotions in completely different user contexts? Or, even more generally, do the results provide useful insights for designers who want to evoke different types of emotions in a different context? More studies in different contexts will have to be carried out to answer these questions. At least one factor that we strongly believe in – but which would have to be confirmed in other studies – is the use of clear and granular descriptions of emotions, motivations and behavior when designing for concrete interactions. We think that specificity and rigor in thinking both have a strong positive impact on the design process and outcome.

We believe that current theory-driven approaches are very valuable for the development of concepts that offer new functions, serve new purposes, or even represent entirely new product categories. However, these approaches offer very few guidelines that assist in choosing a material or designing a specific interface interaction. There are several reasons why it could be beneficial for theory-driven approaches also to provide knowledge and guidelines for the manifestation phase of design. First of all, many theory-driven product ideas are promising in the conceptual phase but fail to deliver their intended experiences effectively. Although there are obviously many reasons why a promising concept might not turn into a successful product, a mismatch between the experiences that are meant to be evoked by the product concept as such, and the concrete design interactions is certainly one of them. Secondly, designers who use experience-driven approaches can get frustrated if they cannot find ways to successfully manifest their concepts, and may end up abandoning such approaches altogether. Thirdly, most consumer products that are developed for the market are not intended to be conceptually novel in their purpose or functions, but just incrementally innovative. For the development of such products, designers could benefit from theory that guides them in eliciting certain experiences and emotions through concrete interactions.

8

REVERSING NEGATIVE EMOTIONS

Life is essentially a cheat and its conditions are those of defeat; the redeeming things are not happiness and pleasure but the deeper satisfactions that come out of struggle.

— F. Scott Fitzgerald

The previous chapters introduced and evaluated the rich experience approach, with which designer can deliberately evoke negative user emotions to create richer product experiences. Up until this chapter, the approach was mostly used to enrich user situations that do not yet involve strong emotions or experiences. This chapter investigates whether the philosophy underlying rich experience design can also be used in a more traditional, problem-solving manner. The central question is how user situations that already feature a dominant and persistent negative emotion can be designed for. First, two existing strategies to improve user experience are discussed, and it is argued how these fall short when designing for a situation with a persistent negative emotion. Three strategies are introduced that designers can follow for this particular type of design problem. The strategies were tested in two full-day workshop with novice designers. The participants were given one of four design briefs that had either anger, sadness, fear, or shame as the preexisting, dominant emotion. The results show that all three strategies can lead to interesting and effective design concepts.

8.1 Introduction

Designers are natural problem solvers. When faced with a problematic situation, they will immediately search for creative solutions. But what can designers do when faced with a problem that is unsolvable in the scope of their assignment? For instance, if the design brief is to improve the driver experience in a traffic jam, without being able to solve the traffic jam itself? Or, when asked to make people feel more comfortable undressing in front of the doctor, without being able to change the fact that people do not like to expose themselves? In this chapter, three experience-driven strategies are proposed that intend to address such design challenges.

Experience-driven design aims to improve the user experience of a product or service by focusing on the needs and emotions of the person that it designs for. It evaluates and designs all aspects of a product, its functions, usability, ergonomics, technology, material, and form, with the aim to create the most optimal user experience. In its most prevalent form, experience design focuses on the experience that the user has directly with the product, for example, if the navigation on a website is intuitive, if a car seat remains comfortable after several hours, or if an educational toy creates a fun and instructive experience.

Increasingly, experience-driven design also considers the impact of products on people's experiences beyond the direct product interaction, and includes experiences and behavior that the product may indirectly facilitate (Fokkinga, Hekkert, Desmet, & Özcan, 2014). For example, manufacturers of luxury cars do not just consider whether their cars are functional and comfortable, but also how their appearance and driving style can support the driver's identity. Similarly, the Philips' wake-up light[1] intends to change not only how people interact with alarm clocks, but also how they experience waking up altogether.

Approaches that aim to create or improve experiences can roughly be divided into two types: The problem-solving approach and the opportunity-seizing approach. The first type attempts to improve a situation in which people have a negative experience. For example, the Dutch company Senz Umbrellas wanted to improve the experience people have with umbrellas[2]. Umbrellas are made from light materials to make them easy to carry, but also makes them fragile to wind (Figure 72). By developing an umbrella that is aerodynamic and sturdy enough to face a force 10 storm, they alleviated the frustration and disappointment of the user in the existing situation (Figure 73).

The second type of approach does not start from a problem, but makes use of opportunities for new activities and experiences in a given situation. For example, Hassenzahl (2010, pp. 69-70) described

1 *See: http://www.usa.philips.com/c-p/HF3470_60/wake-up-light*

2 *See: http://www.senz.com/en*

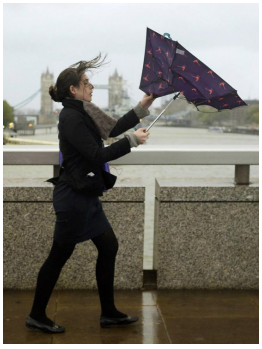


Figure 72: The problem with most umbrellas

Figure 73: The Senz umbrella

Figure 74: The Touch Trace Mirror concept

the Touch Trace Mirror, a concept for a mirror that allows people to leave messages for their loved ones. When the mirror is steamed up, the receiver sees a moving light that directs her finger over the mirror, thus recreating the message the other person left (Figure 74).

Both approaches can successfully improve the experience of many situations. However, in situations with a dominant negative stimulus that cannot be solved or taken away, these approaches are less helpful. Products and services have solved many of people's problems and made life more comfortable and enjoyable. However, there remain many situations in life in which people experience negative emotions without the ability to solve the underlying cause. The study in this chapter looks at four such cases: being stuck in a traffic jam (anger, frustration), having lost a beloved pet (sadness, loneliness), having to give an important public presentation (fear, nervousness), and exposing oneself for a medical exam (shame, embarrassment). In these cases, the first type of approach is fruitless, as it revolves around solving the problem, which is assumed to be outside the possibilities of the project. The second type of approach may generate ideas that add enjoyable activities and experiences to these situations, but these have a considerable chance of striking the wrong note, as the user might not be in the right mood for these experiences, given the dominant negative emotion.

We propose a set of emotion-driven strategies that attempt to *work with* the dominant negative emotion, instead of attempting to solve or ignore it. These strategies are intended to complement the existing approaches, specifically for cases with an unsolvable negative experience. We believe this approach can only be successful if it involves a close consideration and understanding of the relevant negative emotions.

The first section of this chapter discusses the basic emotion appraisal model, which is used to explain how the new approach differs from the current approaches to improve experiences. The use of this model is extended in the next sections, which introduce three strategies that follow the approach of 'working with the negative emotion' in different ways. The second half of the chapter discusses a study

in the form of a workshop with novice designers, who tested these design strategies in several design briefs. In the last section, we discuss the strengths and weaknesses of the new approach.

8.2 The emotion model and design strategies

The emotion model

Figure 75 shows the basic model of emotion elicitation[3] (based on Desmet, 2002). People have an emotion when something happens that is somehow relevant to their wellbeing. More specifically, they have a positive emotion when something happens that fulfills or benefits their concerns, and a negative emotion when something happens that harms or threatens their concerns. The appraisal system constantly checks the relevance of every event, and if it is, which specific emotion should be evoked (Roseman & Smith, 2001).

Concerns comprise people's needs, wants and desires: everything we want to happen in life (Frijda, 2007). Different concerns shift to the foreground or background during different moments in time. For instance, everyone has the concern for being physically safe, but when you are in the comfort of your own home, this concern is probably latent. A concern 'wakes up' when something touches upon it. For example, the concern for safety can suddenly come to the foreground when you see a car approaching you at high speed.

The reason we have so many different emotions is that each emotion is a specific program that changes how a person thinks and acts, in such a way that it promotes an adaptive response to the event or object that evoked the emotion. This program is called the *action tendency*. Action tendencies can be seen as urges to undertake certain actions (very short and direct, e.g., to look at someone) and activities (more elaborate, e.g., to go for a walk). Every emotion has a different action tendency, and each action tendency can manifest itself in a number of ways[4]. For instance, an angry person can have the urge to hit, shout, oppose, and/or to punish. People get angry when someone unfairly wrongs them, so these tendencies can help them to stand up to the other person and make sure it will not

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3 *The division of appraisal, emotion, and action tendency in separate elements, as if these elements comprise three sequential steps of a process, may not align with most theoretical models. Some scholars argue that the appraisal is a constituent of the emotion, rather than its antecedent (Ellsworth, 2006). Other scholars consider the emotion a felt action tendency, instead of the emotion causing the action tendency (e.g., Arnold, 1960; Frijda, 1986). In this model we have opted to maximally divide these elements for practical purposes. The three strategies each take one of these elements as its focal point, and dividing them made that most clear in a visual sense.*

4 *The term action tendency is used in different scopes by different scholars. For some, it is one part of a broader range of emotion outcomes, next to thoughts and 'emotivations' (the motivations and goals that people tend to have when experiencing a certain emotion; e.g., see Zeelenberg & Pieters, 2006). Others use the term action tendency to denote the entire range of these outcomes (sometimes called 'thought-action tendencies', see Fredrickson & Branigan, 2005). In this project, we have adopted the term in the broadest sense, including thoughts and emotivations.*

happen again. In this sense, action tendencies represent shortcuts to suitable modes of behavior, for the kind of situation that evokes them. However, in some cases action tendencies can do more harm than good. For instance, it may be very counterproductive for someone to shout and curse at their boss after they have been passed over for a promotion.

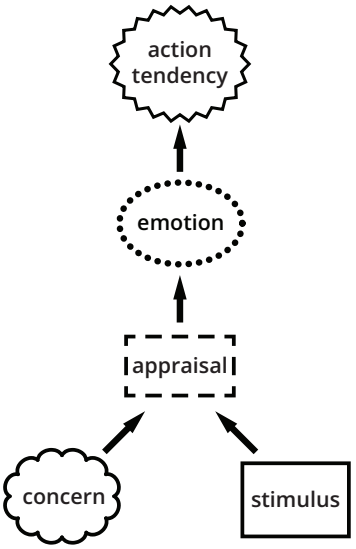


Figure 75: The basic emotion model (adapted from Desmet, 2002)

The *stimulus* can consist of anything that happens and is perceived by an individual: an event (e.g., receiving a phone call), absence of an event (e.g., a coffee machine stops working), perceiving an object (e.g., a beautiful car), one's own action (e.g., being late for a meeting), or even a thought or memory (e.g., thinking of a friend). The role of products are solely on the stimulus side in the model. A product can either be the stimulus itself (e.g., the beautiful car), it can help to facilitate an event (e.g., talking to a distant friend through a phone), it can help making a desired action possible (e.g., a car to be in time for a meeting), and so forth (see Desmet, 2008). Similarly, the influence that design has to change a situation is exclusively through the stimulus; a designer can introduce, take away or change a certain stimulus, depending on the control he has over the environment, and thus make it more or less likely that certain emotions are evoked.

Experience design approaches

The emotion model can be used to analyze the two aforementioned experience design approaches. In the situation that is addressed by the first approach, there is a stimulus that harms an active user concern, which evokes a negative emotion. The approach is to remove or alter the stimulus so that the concern is no longer harmed, and the negative emotion is taken away (Figure 76). In the example of the umbrella, the user is frustrated because she cannot use the umbrella when there is both rain and wind, or risk the disappointment of breaking it. The redesign of the umbrella changed the stimulus and took away these negative emotions.

In the situation addressed by the second approach there is an unfulfilled, latent need. In this case, the opportunity for improvement is not to take away a present negative emotion, but to add a positive one. The approach is to add or alter the stimulus so that it fulfills the latent need and evokes a positive emotion (Figure 77). Before the Touch trace mirror, people were probably not feeling bad that they could not leave dynamic notes to each other on the mirror: the need was latent. However, when the concept made it possible, it did add a positive emotion.

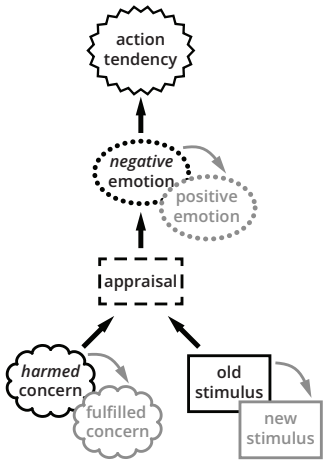


Figure 76: The problem-solving approach visualized in the basic emotion model

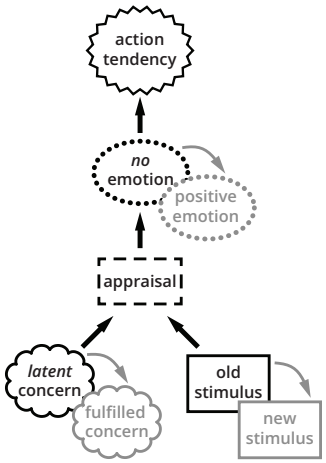


Figure 77: The opportunity-seizing approach visualized in the basic emotion model

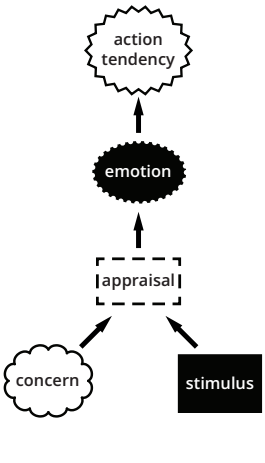


Figure 78: Situation with a negative context emotion visualized in the basic emotion model

Now consider a situation with a dominant and persistent negative emotion, for example, when someone gets stuck in traffic or grieves over a deceased pet. In these cases, the emotion model can be depicted as in Figure 78. The black box at the bottom right represents the unsolvable stimulus, e.g., the inescapable traffic jam or the irrevocable loss of the beloved pet. This results in the black emotion: the dominant and persistent 'context emotion'[5]. For this kind of problem, the first type of experience design approach fails because it is based on removing the source of negative emotion by removing the stimulus, which was assumed impossible. The second approach falls short because it attempts to fulfill a latent need, while the active need is being ignored. It adds something positive, but cannot significantly improve the situation because it does not address the negative part.

Three strategies for situations with an unsolvable negative emotion

Three strategies were developed that each start from the premise that the source of the negative emotion cannot be altered or taken away. The strategies were developed from the philosophy of understanding and 'working with the negative emotion' rather than 'working against it'. The strategies are: 1) 'Empowering the action tendency', 2) 'Adding a mood-congruent decoy stimulus', and 3) 'Evoking a reappraisal using virtues'. Each strategy takes one element of the emotion model as its focal point: the action tendency, emotion, and appraisal, respectively. All three strategies consist of two steps: creating a list of items based on the focal point of the strategy, and generating design solutions based on these possibilities.

5 *Throughout the chapter the term 'context emotion' is used to mean the unsolvable emotion in a specific situation (e.g., anger in the traffic jam situation)*

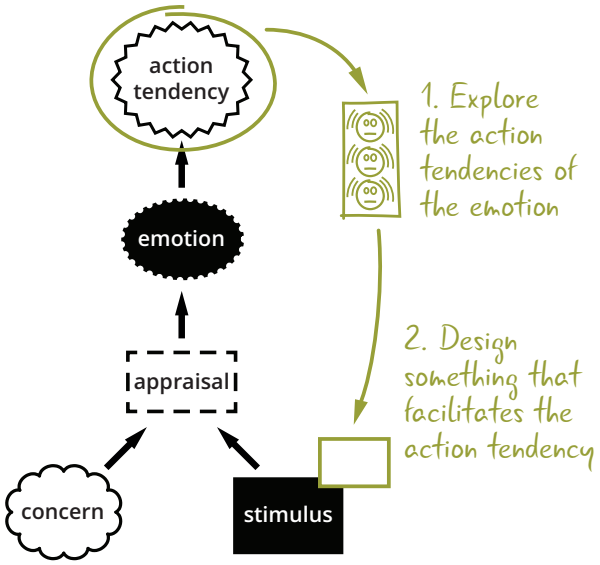


Figure 79: Visual representation of strategy 1: Empowering the action tendency

Strategy 1: Empowering the action tendency

The purpose of an action tendency is to help a person deal with the stimulus that evoked the emotion. However, in a situation with an unsolvable negative stimulus, the action tendency is essentially powerless. A person caught in a traffic jam, for example, can be frustrated and angry, resulting in an agitated physiological state and an urge to hit something or punish someone, but none of these reactions can change anything about the situation, nor will they result in anything constructive. The inability to purposefully express the action tendency can even become an additional source of negative emotion.

The strategy focuses on creating something that facilitates a constructive or meaningful expression of the action tendency. It consists of two steps (Figure 79). In the first step, the designer makes a list of possible manifestations of the action tendency of the context emotion. For inspiration, the user can explore literature on the relevant emotion, or imagine personal examples of action tendency manifestations. For example, for the emotion anger, a designer can ask herself questions like: 'What do I feel like doing when I'm angry at someone?', 'What did I do last time someone insulted me?', or 'What activities do I engage in when I'm frustrated?' The resulting list of manifestations is subsequently checked with the opportunities and constraints of the context, as certain manifestations (e.g., shouting out loud) may be more suitable or relevant in one context (e.g., being alone in a car) than in another (e.g., being in a crowded restaurant).

In the second step, the designer generates products or services that facilitate an expression of the action tendency. Obviously, the action tendency will not reach the goal that it was intended for –

Figure 80: The Hush pod (Design by Freyja Sewell)

Figure 81: The flower grenade (Photo by suck.uk)

solving the traffic jam – but at least it serves some other purpose. The action tendency can be facilitated at two levels. At the basic level, a product can simply make the expression of an action tendency possible. For example, providing a boxing ball in the car would make the expression of the action tendency of anger possible, but not useful beyond that. In addition, a product can make the expression of an action tendency useful or meaningful. 'Meaningful', in this case, means that it serves some purpose or goal that is relevant to the context. For example, if something could be designed in the traffic jam situation that makes hitting, shouting, or punishing serve a meaningful purpose, the experience is supposed to improve even more.

There are a few examples of existing products that make use of this strategy. An example of a product that simply makes an action tendency possible is the chair Hush pod (Figure 80). People who feel sad often experience a tendency to withdraw from social contact. At the same time, they may have the urge not to be alone. This paradoxical set of tendencies is facilitated by the Hush pod, as people can use it to sit privately in a public space. The product does not solve the cause of someone's sadness, but it can be used to satisfy the action tendencies of the sadness.

An example of a product that makes an action tendency meaningful is the flower grenade (Figure 81), a ceramic, grenade-shaped container from which flowers grow after it has smashed into something. An angry person could use this product to do something constructive with his feelings.

Strategy 2: Adding a mood-congruent decoy stimulus

The second strategy aims to distract the user's attention away from the negative stimulus by introducing a new stimulus that evokes the same type of emotion, but in a more manageable or enjoyable way. This strategy builds on three premises. It starts from the premise that negative emotions can be enjoyable when elicited under the right conditions, which has been substantiated in chapter three. Secondly, it is based on emotion attention bias, the phenomenon that people are more likely to attend to stimuli that confirm their current emotion (DeSteno et al., 2000; Öhman, Flykt, & Esteves, 2001). For instance, people who are anxious see more risk in the world, while people who are angry see more opportunity (Lerner & Keltner, 2001). Thirdly, it is based on the mood-congruency preference effect,

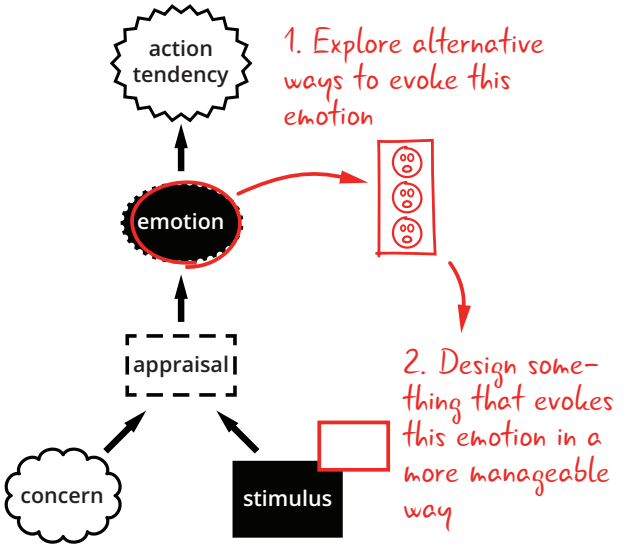


Figure 82: Visual representation of strategy 2: Adding a mood-congruent decoy stimulus

the phenomenon that people who are experiencing a mood or emotion prefer stimuli that evoke the same emotion. This was investigated experimentally by Martin and colleagues (1997), who found that sad people preferred to see a sad movie clip or read a sad story over happy ones, while happy people preferred the happy stimuli. People may recognize this in their own life. When you feel sad, you are often more in the mood for a tearjerker movie than a situation comedy. Lee, Andrade, and Palmer (2013) found the same effect for music preference. Rucker and Petty (2004) found that emotions also influence the type of physical activities people prefer. Sadness, a low-arousal emotion, causes people to prefer passive holidays, while anger, a high-arousal emotion, causes them to prefer active holidays.

Combining these three premises yields the hypothesis that people who are stuck with a stimulus that continuously evokes a negative emotion are more effectively engaged and distracted by a stimulus that evokes a similar negative emotion, rather than a positive (or different negative) emotion. This stimulus is called an emotional decoy, because, like a physical decoy, it closely resembles the real thing, but it is in fact a means to distract attention.

Similar to the first strategy, two design steps are involved (Figure 82). In the first step, the designer identifies the context emotion and makes a list of stimuli that elicit similar emotions. Inspiration for these stimuli can come from literature sources about the emotion, or from personal exploration. For example, the designer can ask himself: 'What makes me angry?' In this activity, it is helpful to consider different categories of elicitors, such as sensory stimuli, external events, other people's actions, or one's own actions.

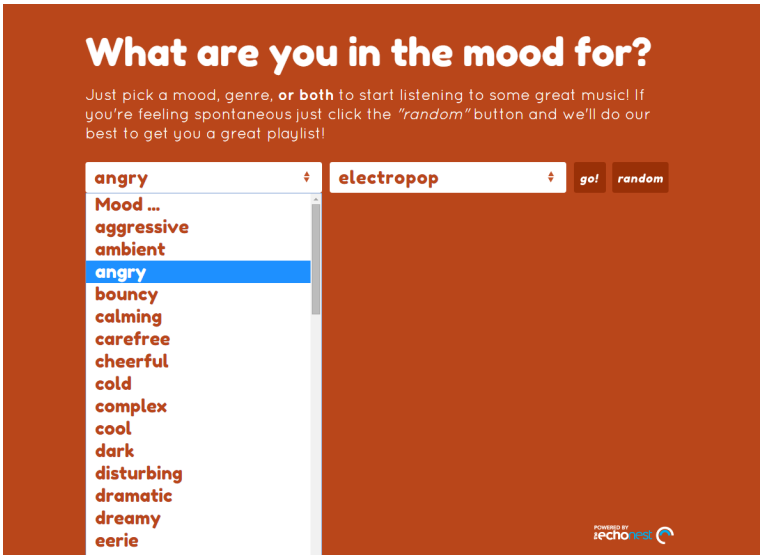


Figure 83: Screenshot from the website www.moodfuse.com

In the second step, the designer generates products or services that evoke this emotion in an enjoyable way. For example, in the traffic situation the user is angry and frustrated. The design challenge is to create a new stimulus that also evokes anger, but in a more enjoyable way. This is similar to the approach of designing a rich experience product (see chapter five), but in this case, specifically using the emotion that is already present in the context.

There are several cultural products, such as movies, television programs, novels, video games, and music, which people seem to intuitively use as emotional decoys. However, it is difficult to find examples of designed products that are deliberately intended to provide decoys for people. One category of applications are search engines that help users to find cultural products – movies, novels, music – that fit their current mood, and can thus function as an emotional decoy. For example, the website moodfuse.com suggests music based on the selection of your current mood (Figure 83).

Strategy 3: Evoking a reappraisal using virtues

While the first strategy focuses on the action tendency, and the second on the negative emotion, the third strategy focuses on the appraisal. People who experience a negative emotion have made an appraisal that a stimulus is harmful of threatening for their wellbeing. However, people can make reappraisals of situations (Frijda, 1986). For example, chapter two, cluster 1d showed an example of a woman who was angry with her friend for being unreasonable and not returning her calls, but she later came round and judged that her friend was allowed to be a bit unreasonable, and that it would not jeopardize their friendship.

The aim in this strategy is to design something that helps people make a reappraisal about the negative situation. Appraisal is a complex process. There are numerous factors that determine how someone (re)appraises a situation, including all the relevant concerns a person has at that moment, their personality traits, prior events, expectations of what might happen, and so on. As such, there is not a simple formula for encouraging people to make a positive reappraisal in a given situation.

The entry point that was adopted in this strategy was virtues. Virtues are personal traits or qualities that are considered beneficial or morally excellent, such as diligence, compassion, courage, and loyalty. Virtues often promote behavior that benefits social goals (e.g., diligence, self-sacrifice) or personal long-term goals (e.g., thriftiness, integrity) over immediate goals of self-interest. Human virtues have been a topic of scholarly interest for millennia, from Aristotle (trans. 2009) to, more recently, proponents of positive psychology (e.g., Peterson & Seligman, 2004).

There were two main reasons that virtues were taken as the starting point for reappraisal in this strategy. Virtues are often character qualities or strengths, which are exercised and recognized when contested by an adverse situation. For example, courage can only be recognized in a fearful situation, solidarity only in a situation where group integrity is threatened, and compassion only when someone else is in an unfortunate situation. As such, emphasizing virtue in a negative situation may be a good way to help people see its silver lining and thus reappraise a situation as less bad. Secondly, the list of potential virtues is nearly endless, and it is relatively easy to find virtues that connect to a specific emotional situation. This allows for a creative exploration of specific design directions.

The process of the strategy is depicted in Figure 84. In the first step, the designer explores which virtues may be appropriate for the emotion and context in question, and how these are connected. It was found useful to consider two groups of virtues in the process: individual virtues and interpersonal virtues. Individual virtues are traits that lie within a person, such as diligence or honesty. Interpersonal virtues are values that characterize how people interact with each other, such as trust or justice. Lists of virtues can easily be found in literature sources, both classical and contemporary.

In the second step, the designer generates products or services that insert this virtue into the situation, or that make the user aware of existing virtues. For example, for the anger-in-traffic-jam context, the designer may explore the virtues of tolerance and courtesy (possible relevant individual virtues), or equality and solidarity (possible relevant interpersonal virtues). In the sadness-for-a-lost-pet context, the designers could explore the virtues loyalty and gratitude (individual virtues), or dignity and spirituality (interpersonal virtues).

Four ways are proposed in which a virtue can be inserted in a user context. Each of these ways is illustrated with an example of an existing product. First of all, a design can make the user *aware of an existing virtue* in himself, a situation, or an activity. In this case, the virtue does not have to be introduced, merely revealed. For example, the 999bottle is a refillable water bottle on which the

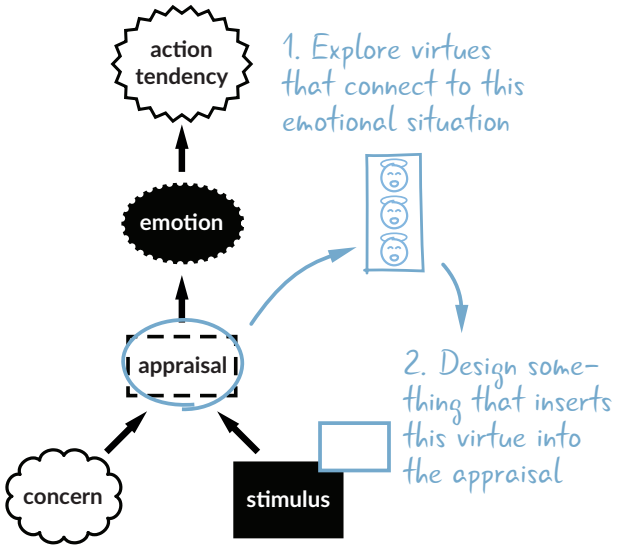


Figure 84: Visual representation of strategy 3: Evoking a reappraisal using virtues

user turns a numbered dial one turn for every refill (Figure 85). This way, it keeps track of how many disposable plastic bottles the user has saved by using the product, emphasizing virtues such as thriftiness and consideration for the environment. Secondly, a design can *embody a virtue*. In this case the design itself is virtuous, or 'behaves' in a virtuous way, which in turn increases the user's awareness for this virtue. An example is a wabi-sabi teacup, characterized by its imperfect manufacturing, which embodies virtues of humility and authenticity (Figure 86). Thirdly, a design can *inspire a virtuous activity* in the user. For example, the 15 minutes timer explicitly encourages users to take fifteen minutes of the day to reflect on their life. This promotes virtues like self-discipline and conscientiousness (Figure 87). Lastly, a design can reimagine an existing product in a form that strongly encourages the user to *use it in a virtuous way*. For example, Poor fishy is a water tap that draws its water from a fish bowl. If someone uses too much water, the bowl will run out and the fish will die. This strongly encourages users to exercise thriftiness and compassion (Figure 88).

Recently, virtues have been the focus of a number of other design philosophies and approaches. For example, Tromp and colleagues (2011) proposed a design approach to create products that promote socially desirable behavior. Chapman (2015) wrote about emotional durable design, a design philosophy that stimulates more sustainable use of consumer products by improving people's long-term experience with them. Lastly, Desmet and Pohlmeyer (2013) proposed a framework to design for subjective wellbeing, which had 'design for virtues' as one of its three pillars.

Figure 85: The 999bottle (Design by Artefact, Photo by Douglas Evans)

Figure 86: A wabi-sabi teacup

Figure 87: The 15 minutes timer (Photo by The School of Life)

Figure 88: The 'Poor little fish' water tap concept (Design by Yan Lu)

Compared to these approaches, a characteristic of the current strategy is its chief purpose of improving the user experience – involving virtues to make the user feel better – and not explicitly to achieve higher ends such as social behavior, sustainability, or happiness[6].

Development of the strategies

The idea to develop a design approach that 'works with' existing negative emotions originated from a reflection on the rich experience approach, with which designers can enrich experiences by deliberately evoking negative emotions (see chapters three and five). This raised the question whether situations with preexisting negative emotions could be made more acceptable in a similar way. Initially, the starting point was to use the last design step in the rich experience approach – constructing a protective frame around the experience (see pages 41-44 and pages 91-93). This direction was quickly dismissed, however, as it seemed in most cases impossible to design a protective frame around an existing negative stimulus. For instance, the detachment frame makes a negative stimulus enjoyable because the user only interacts with a representation of it (such as the runner's wristband in chapter

6 *Although such additional effects would certainly be welcome*

seven). However, if someone encounters an actual negative stimulus (such as a traffic jam), there is no way to transform that stimulus into a mere representation of itself. Similar arguments can be made about the other protective frames[7].

Modeling the situation with a context emotion as in Figure 72 turned out to be a better approach. By accepting that the negative stimulus and emotion were immutable, the other elements of the emotion model were analyzed for design possibilities. This eventually led to the creation of the three strategies.

8.3 Evaluation study: design workshop

The strategies– for brevity henceforth called 'action tendency', 'decoy', and 'virtue' – were the subject of an evaluation study in the form of a workshop with designers. A design workshop is a method to observe and evaluate design work in a relatively controlled way and short amount of time (e.g., see Cila, Hekkert, & Visch, 2014; Jansson & Smith, 1991). In such workshops, participants receive one or more design briefs and get allocated periods of time to go through different stages of a design task. Collected data can include the design results, questionnaire data on participants' evaluation of the process or their own results, and interviews about participants' experience of the workshop. The current workshop study evaluated the following questions:

a) Whether designers could use the strategies to produce effective and original design concepts that improved a user context with a persistent negative emotion;
b) If there were any notable patterns in the type of solutions generated in general, and for each strategy;
c) What the strengths and limitations of different strategies were;
d) What kind of challenges designers encountered in the process of designing with the strategies;
e) If the applicability of the approach varied for different emotions, and whether this depended on the specific strategy (i.e., if one strategy worked well with one emotion, but not with another).

Workshop setup

Participants

The participants were 24 novice designers (14 female, 10 male; average age: M=26.7, SD=2.3), who were a mix of MSc. students and recent graduates of the Industrial Design program at the Delft University of Technology, The Netherlands (years of experience studying/working in design: M=6.9, SD=1.6). Nationalities of the participants were Dutch (N=15), Chinese (N=4), Taiwanese, German

7 *An exception was the perspective frame (see p.44 and p.92), which was an important inspiration for the virtue strategy.*

Table 13: Overview of the design briefs

	Target user and situation	Dominant emotions	Physical context
1	Someone who is stuck in a traffic jam	Anger, frustration, and annoyance	The user's car
2	Someone who has just lost their beloved pet	Sadness, longing, and loneliness	The user's home
3	Someone who is about to give an important presentation	Fear, nervousness, and anxiety	An office environment
4	Someone who has to expose for a thorough medical examination	Shame, embarrassment, and insecurity	A hospital

Italian, Spanish and Slovenian (each N=1). They received a book as compensation for their participation in the workshop.

Design briefs

The participants were given one of four design briefs, each of which involved a specific user context and negative context emotion. See Table 13 for an overview of the briefs. The briefs had been formulated with a number of criteria. Each brief had a clear negative emotion present, which was considered 'unsolvable'. Secondly, the aim was to have a variety of negative emotions between the briefs, to evaluate whether the strategies would work well for different emotions. Lastly, the problems in the briefs, although unsolvable, were relatively common and relatable for the designers, to prevent that they first needed to do extensive research into the topic of the design brief itself[8].

The design task for each brief was to use the strategies in successive sessions to design something (a product, a service, a system, or an organized activity) that would improve the experience for the person in the negative situation, without attempting to negate the stimulus of the negative emotion. For example, the participants of the traffic design brief were not supposed to come up with ideas to solve the traffic jam itself.

Workshop structure

A full-day workshop was developed to let participants apply each of the three strategies to a design brief in a single day. The workshop was highly structured to allocate an equal amount of time to each strategy and to facilitate the substantial amount of work.

Two workshops with different participants (both N=12) were held that were identical except for the order of the strategies: the first workshop had a 1-2-3 order; the second a 3-2-1 order. This was done in an attempt to balance out possible within-participant effects, such as an increased familiarity with

8 *For example, a number of medical problems (such as long-term hospitalization or dementia), or sociological issues (such as loneliness in elderly or online bullying) would also make for suitable design briefs, however, these would require a thorough study of the issues and the user groups, which was beyond the time available in the workshop.*

the design brief and the design approaches (advantaging the later work), but also an increased fatigue over the day (disadvantaging the later work).

The workshop was divided into three stages. Prior to the workshop, participants received the design brief and a homework assignment, but not yet information about the strategies. In the beginning of the workshop, participants used the results of their homework to make sense of the design brief and the emotions (stage 1). In the main part of the workshop, two activities were carried out for each strategy, in line with the two strategy steps: an analysis activity and a design activity. The participants first went through the analysis step of the three strategies in the morning (stage 2). In the afternoon, they worked consecutively on the design step of each strategy (stage 3). The three analysis sessions and three design sessions each lasted about an hour. The analysis and design work was aggregated to create equal conditions for the design sessions: it was expected that each analysis session would also deepen the participants' understanding of the context, and that it would be best if the design sessions of each strategy could benefit from this. The strategies were not explained until right before the respective design session.

The participants were put into four groups of three people, with each group receiving one of the four design briefs. The analysis sessions in the morning were done as group work, while the design sessions in the afternoon were carried out individually. The analysis work was done in groups because it was expected that it would be easier for participants to collect and discuss relevant material together, and to make sense of the assignment in a short amount of time. Conversely, the design work was done individually, because it was expected to produce a higher quantity and idiosyncrasy of results.

Stage 1: Preparation and first workshop task
Prior to the workshop, the participants received the information about their design brief as shown in Table 13. They were asked to do three individual homework tasks and bring the results to the workshop. The first task was to collect six or more images related to their brief and context emotion. The second task was to explore an online database about negative emotions (the database described in chapter four), in particular for the three emotions relevant to their context. Thirdly, participants were asked to write short examples of recent personal experience with the three emotions.

At the start of the workshop, participants met their team members, discussed the results of the homework and explored their brief. The deliverables of the first session were an inspirational collage composed from the collected images and their interpretation of the brief in the form of a description of a specific situation and persona [9]. For example, for the traffic jam design brief, the group had to describe the characteristics of a specific person in a specific traffic jam: who the person is, why he is traveling,

9 *For a description of how of collages and personas are used as a source of inspiration in design, see Van Boeijen et al. (2013, pp. 93-95)*

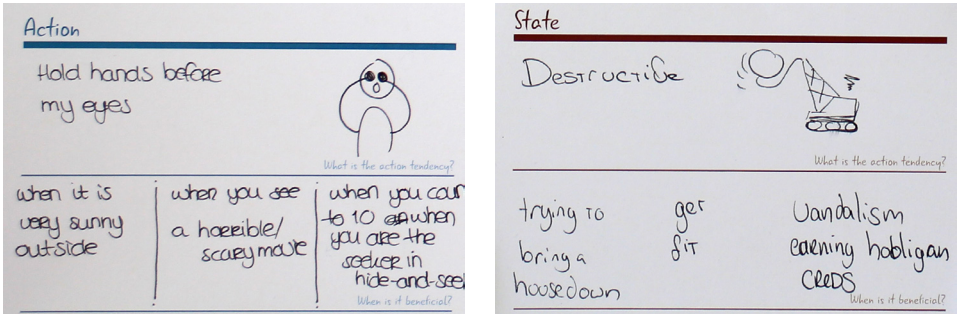


Figure 89: Action tendency cards: an example of an action for fear (left) and a state for anger (right)

where he is going, and so on. This process stimulates focus and empathy for specific user concerns and emotions (Pruitt & Adlin, 2010).

Stage 2: Analysis sessions

There were three consecutive analysis sessions, one for each of the strategies. Each session was introduced with a lecture that explained the activity and the theory behind it, using the emotion model and examples. The sessions were structured as creative group activities with a game-like character. A different set of cards had been developed for each session to facilitate the analysis. The cards contained some information for each activity, but were mainly templates on which participants could write and sketch their generated analysis examples.

For the action tendency analysis, a set of 'action tendency cards' was put in the middle of the table, face down. Each round, one of the three group members took a card and came up with an example of a relevant action tendency manifestation. Then, every group member had to generate examples of how that manifestation could somehow be useful or meaningful in any possible situation (see Figure 89 for two examples). The person that had taken the card, sketched and wrote the generated information on the card, after which the turn would go to the next group member. Three types of cards had been developed: action cards, activity cards and state cards. 1) Action cards were supposed to generate very short actions that a person with the context emotion would feel like doing, such as caressing something, shouting, curling up, or mentally picturing something. 2) Activity cards were supposed to generate more elaborate activities, such as going shopping, calling a friend, or going to sleep. 3) State cards were supposed to generate external descriptions of another person's behavior under the influence of the emotion, such as submissive, restless, rude, or downcast. The variation of the three card types was intended to make the participants consider action tendencies from different perspectives and to keep the session engaging. After several rounds of filling in cards, the resulting action tendency manifestations were discussed, and sixteen of them were selected based on their variety and suitability for the design brief.

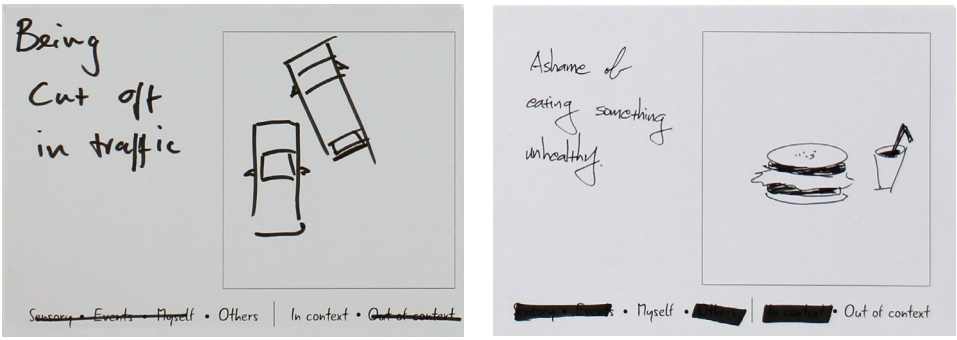


Figure 90: Stimulus cards: an example of an in-context anger stimulus (left) and an out-of-context shame stimulus (right)

In the decoy analysis session, a different set of cards ('stimulus cards') was put in the middle of the table. For this session, there was only one type of card. Each round, one of the three group members took a card and shared an example of a possible elicitor of one of the emotions from their brief, while another group member sketched and wrote that example on the card (Figure 90). The participants were asked to alternate between generating an example of a stimulus that could occur within their given context (e.g., in the car or the hospital), and an example of a stimulus in an entirely different context. The cards contained four categories of stimuli to help the participants consider the variety of possible stimuli: direct sensory, external events, myself, and others. After several rounds, the group members discussed the generated results, and selected sixteen stimulus cards as inspiration for the design session.

The virtue analysis session was slightly different from the previous two sessions. Instead of a stack of template cards, participants received eight cards that each described a specific virtue. These cards were put on the table, and every group member took one card at the same time, and thought for a moment about how this virtue might fit their context and emotion, and wrote this down on the card underneath the virtue (see Figure 91 for an example). After a few minutes, the participants took turns to 'pitch' the suitability of their virtue to the other two group members. After this was done with all the virtues, the group members collectively chose the four that fit their design brief the best. The eight virtues had been preselected for each brief from two online databases, each containing hundreds of virtues: virtuescience.com and virtuesforlife.com. For example, the eight virtues for the deceased pet brief were: dignity, gratitude, kindness, respect, transcendence, humility, caring, and loyalty. The motivation behind this procedure was the expectation that participants would find it too difficult to select virtues from a long list, or coming up with their own, in a short amount of time. Providing eight virtues instead of only four gave participants the opportunity to narrow the spectrum to their own preference and increased the likelihood that each virtue would be considered and discussed in detail.

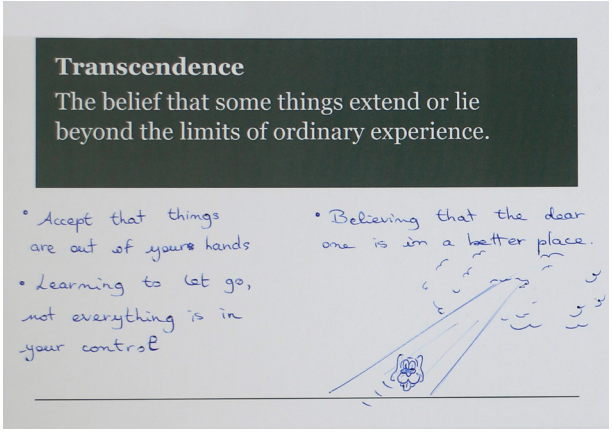


Figure 91: Example of a virtue card for the pet/sadness brief

At the end of each session, the participants pasted the selected cards on separate large foamboards that they could consult during the design sessions in the afternoon.

Stage 3: Design sessions

After the three analysis sessions, the participants proceeded to the design sessions. Prior to each design session, participants were briefed on the aim and procedure of the relevant strategy. In the design sessions, participants were first given half an hour to come up with as many different design ideas as possible. They were asked to put each new idea on a separate paper, so that the ideas could be counted afterwards. In the second half, the participants spent another half hour to elaborate their (self-selected) best idea into a single design concept[10]. This concept had to include a factual description of the product, an explanation of how the product improved the user's situation, a drawing of the product, and a storyboard showing the use of the product in the context (Figure 92).

Data collection and analysis

At the end of each design session, the participants handed in all their design work. After the last session had finished, the participants filled out a questionnaire. The first part of the questionnaire asked them to rate to what extent they agreed to statements about the strategies, on a scale from 1-7. The items were usefulness ("This strategy worked well to come up with effective design solutions for my design brief"), inspiration ("This strategy made it easy to generate many different design ideas"), and preparation ("The analysis assignments prepared me well for this strategy"). Then, the participants were asked to rate their own concepts on a scale from 1-10 (following the standard grading system for student work at the University in question), while taking the efficacy, the originality, and the feasibility

10 *Throughout this chapter (as well as during the workshop), the term (design) concept is meant as a more elaborated and detailed version of a (design) idea, following a common practice in design nomenclature.*

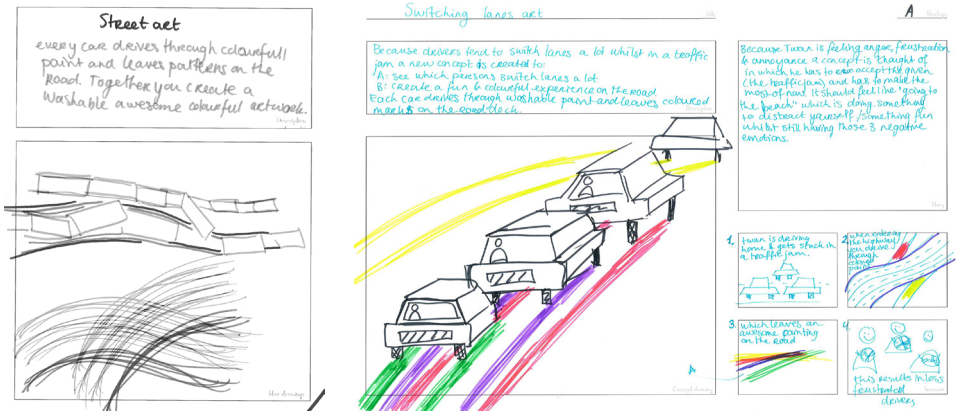


Figure 92: Example of a design idea (left) and the concept that was elaborated from it (right) for the action tendency strategy of the traffic jam/anger brief

of their concepts into account. Participants were urged to score their product concept independently from the strategy that it had been designed with.

The final activity in the workshop was a group interview in which participants elaborated on their experiences, specifically on the insights they had gained and the challenges they had encountered.

After the workshop, a count was made of the number of ideas that each design session had produced (the number of concepts was fixed to one per session).

Two researchers, the author and a full professor of emotion-driven design, did a qualitative review of the design concepts. Firstly, an assessment was made which strategies could be recognized in the concepts. This was done 'blind' – without knowing the strategy that a particular concept had been generated with. In this assessment, concepts could also be judged to incorporate more than one strategy, or none at all. Secondly, and without regard for the outcome of the first analysis, the concepts were reviewed in several iterations to look for any noticeable characteristics or patterns. A short description of each concept was made that discussed its strengths and weaknesses.

The strategy ratings and concepts scores from the questionnaire were analyzed for general differences and differences between the design briefs. Lastly, the group discussions were written up and analyzed for relevant comments.

Results & discussion

General results

The 24 participants had produced several design ideas and one design concept for each of the three strategies, resulting in a total of 415 design ideas and 72 design concepts. Overall, the participants had found the workshop very insightful, but also exhausting. This had an effect on participant's perceived performance over the course of the day – several participants mentioned that they found their work in the last design session of lower quality compared to the first two sessions. However, this effect was not distinctly reflected in participants' scores for their own concepts: M=6.93 for their first concept, M=6.79 for their second concept, and M=6.72 for their third concept (not significantly different according to repeated measures ANOVA, $F(2,46)=.26$, $p=.77$)[11]. At any rate, possible order effects were mitigated by the reverse order of strategies between the two workshop days.

Table 14 shows the participant's ratings for the strategies, the participant's score of their own concepts, and the amount of ideas generated for each strategy. Both the strategy ratings and the group interview revealed an overall difference in preference for the strategies. The virtue strategy was most liked with a rating of M=5.21; the action tendency strategy was second with a rating of M=4.97; the decoy strategy finished last with a rating of M=4.24 (significantly different with a repeated measures ANOVA, $F(2,46)=4.717$, $p=.014$)[12]. However, the scores for the design concepts did not follow the same pattern. Among the concepts, the ones generated with the virtue strategy still scored highest on overall quality (M=7.11), but the decoy concepts scored higher (M=6.79) than the action tendency strategy (M=6.54) (not significantly different according to repeated measures ANOVA, $F(2,46)=2.00$, $p=.15$).

Table 14: Participant ratings for the strategies and design concepts, and the number of generated ideas

	Action tendency	Decoy	Virtue	**Average**
Strategy usefulness rating (1-7)	4.96	4.13	5.58	**4.89**
Strategy inspiration rating (1-7)	5.08	4.21	4.92	**4.74**
Strategy preparation rating (1-7)	4.88	4.38	5.13	**4.79**
Strategy average rating (1-7)	**4.97**	**4.24**	**5.21**	**4.81**
Overall quality score for design concept (1-10)	6.54	6.79	7.11	**6.81**
Idea count	147	138	130	**138.3**

11 *The scores for the design concepts were on a scale from 1-10, and assigned by participants for their own concepts in the questionnaire after the last design session.*

12 *The ratings for the strategies were on a scale from 1-7 and were assigned in the (same) questionnaire after the last design session.*

The following sections discuss the results of each strategy, based on the participant ratings and the review of the design and analysis work. Each strategy is illustrated by examples of the generated analysis work, and three design concepts that were considered good examples in their category.

The action tendency strategy

A review of the analysis results found that all eight participant groups had been able to come up with relevant and interesting manifestations of action tendencies in the analysis session (see Table 15 for a few examples per design brief). However, during the workshop it was observed that some groups had only just been able to generate sixteen examples in the given amount of time, which is an indication of the relative difficulty of coming up with manifestations for an action tendency. Many groups found it especially difficult to find examples of how manifestations could be useful or beneficial to the user. This exercise involved the kind of reversed problem thinking (i.e., finding a problem for a solution – see page 120) that is challenging, especially in a short time. In the group discussion, some participants had mentioned that the overall exercise had been useful, but that during the design session they had to come up with new manifestations of the action tendency, as many of the prepared ones were not found helpful. Compared to the other three emotions, the participants in the shame brief found it most difficult to generate a variety of action tendency manifestations: most revolved around actions to reduce contact with others.

Table 15: Examples of action tendency manifestations generated during the analysis session

Brief	Anger / Traffic jam	Sadness / Dead pet	Fear / Presentation	Shame / Hospital
Examples of action tendencies	Shout out loud; turn you back on someone; kick something	Crying in bed; eating ice-cream; staring out of window	Nail-biting; practicing over and over; asking for confirmation	Disappearing from sight; Avoiding eye contact

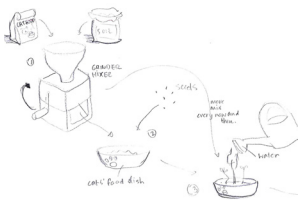
The participants had rated the action tendency strategy averagely high on usefulness, but highest on inspiration. It had also generated the most ideas. In the group discussion, it was generally commented on as the most 'concrete' strategy, because it took observable user actions as the starting point. Participants commented that this made it easy to generate ideas. At the same time, participants expressed that they found it more difficult to make their subsequent design concept connect to the user situation in a meaningful way, which was reflected in the lower scores for the design concepts.

A similar observation was made in the concept evaluation. There were many designs that simply made the action tendency possible, but not in a way that would be meaningful to the user, or that connected well to the context. For example, in one concept, the car's gas and brake pedals turned into exercise equipment that the driver could repeatedly kick when stuck in a traffic jam. Although this correctly facilitated an action tendency of anger/frustration, it did not make a lot of sense in the context.

Figure 93 shows three concepts that were designed for shame (a), sadness (b), and anger (c).

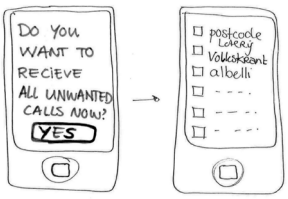
a) Gimme privacy (shame/hos.)

Someone getting ready for a medical exam undresses behind an aesthetic object consisting of movable flaps. When ready, she can arranged these flaps to selectively expose herself in a way she chooses.



b) Grief grinder (sadness/pet)

With this product the user grinds the ashes of their pet and its leftover food, together with soil and plant seeds. It is a mystery what plant will grow out of this mixture, but it will have to be well taken care of.



c) Still-to-call (anger/traffic jam)

A phone app prompts the user to call people and arrange a few things he has postponed, right when he is stuck in a traffic jam. This provides the perfect time and mood to deal with some of those nasty chores.

Figure 93: Three examples of design concepts generated with the action tendency strategy

Shame and embarrassment involve the tendency to hide oneself, which is obviously problematic during a medical exam. Concept (a) played with this opposition by giving the user control over how and why she is exposed. Furthermore, the interaction was made enjoyable through the aesthetics of the design's appearance and movement.

Concept (b) made use of an action tendency of sadness, which was to nurture and care – the idea was that if the pet was gone, this tendency should be put to use in an activity that was still somehow related to the pet - by planting and caring for a plant that has grown from the remains of the pet.

The action tendencies in concept (a) and concept (b) were given purposes that mostly benefitted the experience of the activity itself. In contrast, concept (c) shows that action tendencies can also be given an external purpose. By specifically offering certain tedious chores at a moment when the user is frustrated, he could be in the right behavioral mode to efficiently deal with them.

The decoy strategy

Table 16 shows examples of stimuli that participants had generated for the decoy strategy. Overall, this exercise had been well understood and participants had been able to generate a variety of interesting stimuli. Unlike the action tendency exercise, participants had no trouble generating a great number of stimuli in the time available. This could also be a result of the fact that the stimuli exercise only consisted of a single step, while the action tendency activity comprised two steps.

Participants had rated the decoy strategy the lowest on almost all accounts. In the group discussion, several participants remarked that its underlying principle was not well understood. In the design session they found it difficult to design a stimulus with the same negative emotion, without making the situation worse.

Table 16: Examples of emotion stimuli generated during the analysis session (both in-context and out-of-context)

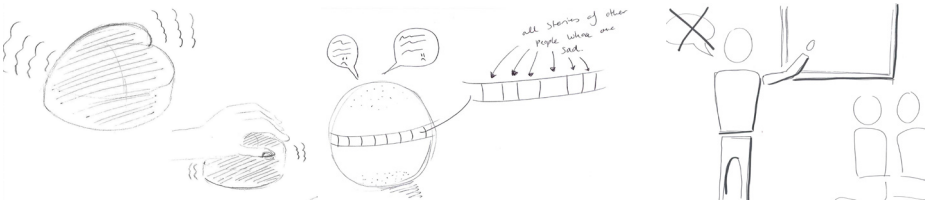
Brief	Anger / Traffic jam	Sadness / Dead pet	Fear / Presentation	Shame / Hospital
Examples of emotion stimuli	Being cut off in traffic; having an appointment cancelled last-minute	Eating alone; seeing a beautiful tree cut down; coming home to an empty house	Seeing audience frowning; having a spider in your clothes; jumping from an airplane	Making a joke but no one laughs; seeing a bad picture of oneself; farting in public

The strategy had a challenge similar to that of the action tendency strategy: participants had no trouble coming up with ideas for decoys, but found it difficult to make it somehow useful or meaningful to the user. For the decoy strategy this was even more problematic, because an unsuccessful decoy could actually make the user's situation worse. The strategy also received the lowest score for preparation, which indicates that the difficulty participants experienced could in part be blamed on the fact that they did not feel well prepared by the analysis activity. In general, participants stated that the step between generating stimuli and coming up with ideas for decoys was too large.

In contrast, the concepts generated by the decoy strategy were scored much better on overall quality by participants, which fell between the action tendency concepts and the virtue concepts. In addition, in terms of idea quantity the strategy also scored a good average: it generated more ideas than the virtue strategy, but less than the action tendency. Lastly, the concept review found quite a few interesting concepts generated from this strategy.

A characteristic of several decoy concepts was that they did not require any user action. Rather, they involved a one-way stimulus that intended to evoke an emotional response without requiring further interaction. For example, a concept for the medical exam brief was a monitor that showed examples of medical oddities during an exam, which was intended as a decoy for the embarrassment felt in the procedure. Although such one-way solutions can create successful decoys and interesting product concepts, the fact that so many concepts relied on it could indicate that participants found it difficult to broaden the design space and also come up with more interactive ideas.

Figure 94 shows three concepts that were designed for fear (a), sadness (b), and fear (c). Concept (a) is an example of a concept that did require user interaction. The device initially evokes additional nervousness in the user through its sound and vibration, but by requiring the user to hold it and concentrating on the behavior of the device, the user can also bring down her own stress level. This reveals an approach that was taken by several participants for the decoy strategy: attempting to evoke a particular emotion through empathy, by making it seem the product is 'experiencing' the same emotion as it attempts to evoke in the user. Concept (b) demonstrates this approach for sadness: being empathetic with other people's sad stories evokes pity in the user, which is closely related to sadness. However, this empathy-approach does not always work as a decoy, as not all expressed emotion are empathically mirrored. For example, one decoy concept featured a medical chair that made shy and



a) Calm me down (fear/pres.)

A soft, heart-shaped device detects when the user is nervous and starts beating violently. The only way to make it stop is to take it into your hands and squeeze it until you both calm down.

b) Grief to share (sadness/pet)

When your pet has died, you get a device on loan from a community of pet lovers, which contains spoken stories of people who dealt with a lost pet. It contains many stories, but only plays a few random ones at a time. You can also share your own story.

c) Silent treatment (fear/pres.)

An activity in which you rehearse for your presentation without being allowed to speak. You can use images, your hands and body, but you cannot say a word.

Figure 94: Three examples of design concepts generated with the decoy strategy

insecure comments about itself. However, seeing something else being insecure would not necessarily evoke insecurity in the user – possibly even the opposite.

Decoy concepts could also add a challenge to a situation, in a way that helped the user deal with the context emotion. For example, (c) was a concept for an activity that makes presentation rehearsals more challenging, by preventing the user to speak. Although this evokes additional nervousness in the presenter, the imposed challenge can function as a humorous distraction and put the difficulty of the real presentation in perspective.

The results of the medical/shame groups raised the question whether decoys are possible for all emotions. Participants remarked that it was easier to imagine enjoyable forms of anger, fear and sadness, than to find enjoyable forms of embarrassment.

The virtue strategy

For the virtue exercise, participants had received eight preselected virtues from which they had to select four to use in the design sessions. Table 17 shows an overview of virtues chosen by one of the two groups for each design brief. Most participants remarked that they had enjoyed the analysis session with the virtues, because they could go more into depth with fewer examples to discuss, compared to the other two sessions. The annotations participants had made on the virtue cards showed that some had just listed a few examples of occurrences of the virtue in their context, while others had written an extensive reflection of how the virtue connected to their context and emotion.

The virtue strategy received the highest overall ratings from participants. The group discussion also revealed that most participants had found it the most interesting strategy. Several participants

Table 17: Examples of virtues selected during the analysis session

Brief	Anger / Traffic jam	Sadness / Dead pet	Fear / Presentation	Shame / Hospital
Examples of virtues	Reliability, solidarity, tolerance, patience	Gratitude, respect, loyalty, dignity	Ambition, resourcefulness, passion, excellence	Authenticity, equality, courage, honesty

remarked it was effective in bringing the user situation to 'a higher level', and that out of the three strategies, it was most clear how it could turn a negative situation into a more positive one.

A critical note was that some participants found the virtues a rather abstract starting point for design, which made it harder to generate ideas. This resulted in an opposite pattern compared to the action tendency strategies: it was difficult to generate a lot of ideas – the virtue strategy had generated the least amount of ideas and was rated with a lower inspiration score than the action tendency strategy – but the eventual design concepts were often found to be more effective and meaningful by participants.

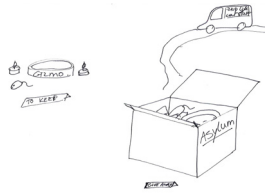
Some participants also liked that the virtue strategy provided a clear goal for the design, while the other strategies were more 'means-driven'. One participant explained his observation that the action tendency and decoy strategy both provided a process for designing – facilitating the expression of the action tendency or evoking a negative emotion, respectively – but that for these two strategies the challenging aspect was to find a meaningful connection to the context. The virtues, in contrast, were already meaningfully connected to the context, but in that strategy the challenge lied in finding a good way to concretely implement the virtues in the situation.

This challenge was apparent in some less successful virtue concepts. These concepts involved a meaningful and interesting virtue, but were not very elegant in its implementation. For example, a concept for the presentation/fear brief showed a 'courage bar' alongside the presentation, which would fill up as the presenter progressed in his presentation. Although courage is a relevant virtue in that context, calling attention to it in this way would probably not really improve the situation. Concept (a) is an example of a concept that made a better connection to the context (Figure 95). It is a card game that drivers could play while stuck in a traffic jam, which gave them different virtuous challenges.

In terms of inspiration, the virtue strategy was especially liked by the pet group. They had scored the other two strategies lower than any of the other three groups, while they had scored the virtue strategy the highest of all groups. A possible explanation is that virtues connect especially well to the grief situation, a state in which people are already more susceptible to seeing and reflecting on virtue. This brief also saw concepts with multiple implemented virtues. For example, concept (b) involved both the virtue of charity for the items given away, and an increased sense of value for the items that were deliberately chosen to keep.

a) Tolerant challenges (ang./tr.)

A set of cards that challenges a driver to be exceptionally tolerant and courteous towards other drivers. After finishing five challenge cards, there is a card with a nice reward activity.



b) Loved, for others (sadn./pet)

A service from a company that sends someone to pick up the dead pet's things for second use. However, they also provide a nice display case and encourage the user to pick three things to keep and put in the case.

c) Funny facts (shame/hospital)

While waiting for a medical exam, a patient receives a book that is filled with funny and interesting facts about the human body. The book is customized to the gender and age range of the reader.

Figure 95: Three examples of design concepts generated with the virtue strategy

An issue with some other design concepts was an unequal 'cost-effect balance'. These concepts implemented a meaningful virtue, but required a disproportionate amount of material means or user effort to succeed. For example, one concept involved large television screens on the backside of cars as a service to drivers directly behind them in traffic jams. There are arguably more elegant ways to implement the virtue of solidarity. Concept (c) showed that products can also be simple in their manifestation. By providing patients with a light-hearted book that shows how all people are imperfect in their own way, they could put their own insecurities into perspective.

Concepts that involved more than one strategy

Table 18 shows the result of the first concept review, which judged for each design concept which strategy or strategies could be recognized in it. Beforehand, it was expected that there would be concepts in which more than one strategy would be recognizable, because the strategies had been devised with the same goal and philosophy: to improve a persistently negative situation by working 'with' the emotion, instead of trying to solve it. However, it was surprising to find such a high number of concepts involving multiple strategies: 26 out of 72. This raised the question whether elements of earlier strategies could have been 'bleeding over' into sessions of subsequent strategies, meaning that participants applied earlier-learned strategies in later concepts. If this was the case, a relatively large amount of the multiple-strategy concepts should be found in the later sessions. Indeed, a count revealed that of the 26 multiple-strategy concepts, six had originated from the first session, ten from the second session, and another ten from the third session. Note that this finding depends on the assumption that it is possible to recognize strategies in design concepts post hoc, which is not evidently valid. Thus, the result should be taken as indicative rather than conclusive.

Table 18: Participant ratings for the strategies and design concepts, and the number of generated ideas

		Concepts designed with strategy			
		Action tendency	Decoy	Virtue	Total
Frequency strategy recognized in concepts	Strategy 1 (Action tendency)	20	5	7	**32**
	Strategy 2 (Decoy stimulus)	5	20	2	**27**
	Strategy 3 (Virtue reappraisal)	6	9	18	**33**
Amount of concepts with number of recognized strategies	Concepts with no strategies	3	1	4	**8**
	Concepts with one strategy	13	12	13	**38**
	Concepts with multiple strategies	8	11	7	**26**

Figure 96 shows three interesting concepts that were found to include more than one strategy.

Concepts that included the action tendency as well as the decoy strategy were often in the form of a product that evoked an emotion, and simultaneously facilitated the user's behavioral reaction to this emotion. Concept (a) was a good example of such a concept: the thought of going through the entrance evokes additional nervousness (decoy), but the physical act of going through is also an outlet for the nervous energy (action tendency).

Concepts that involved both an action tendency and a virtue often did this by encouraging the user to engage in a virtuous activity that was in line with the action tendency of their emotion. For example, in concept (b) the activity of singing out loud matches the action tendency of frustration, while this activity also creates a sense of solidarity among the drivers.

Lastly, some concepts included both a decoy and a virtue by offering a stimulus to the user that simultaneously evoked a negative emotion and revealed a virtue. For example, the statue in concept (c) offers a saddening display of a nice statue slowly decaying, which also embodies the virtues of acceptance and closure.

Not all concepts that involved multiple strategies were successful, however. Some concepts implemented multiple strategies by offering several loosely related functions or features. An example was a website for owners of deceased pets, which encouraged them to reflect on their own situation (action tendency), offered stories of people in the same situation (decoy), and gave people the opportunity to offer help to each other (virtue). We read such 'collage-concepts' as a signal that the participant had not found an effective implementation, and combined several weaker ones in the hope they would reinforce each other.

Differences between the design briefs

The four design briefs had been created to see how well the strategies would hold up in a variety of contexts and emotions. The aim was to make the briefs equal in terms of difficulty, appeal and design

a) Tough entry (fear/pres.)

Action tendency + Decoy stimulus

Just before starting a presentation, the presenter has to wrestle herself through an entrance made of tough rubber sheets. When she has come through, she is welcomed by applause and can start her story.

b) The f*cking sing-along (a./tr.)

Action tendency + Virtue appraisal

When stuck in a traffic jam, the car radios of people connected to the system start playing the same music and record the singing efforts of each drivers. A local sing-along is created.

c) What remains (sadness/pet)

Decoy stimulus + Virtue appraisal

A statue of a cat that has an abstract resemblance to a cat that has recently passed away. The cat is put outside, where it will slowly weather until nothing remains.

Figure 96: Three examples of design concepts in which more than one strategy was recognized

opportunities. Overall, this aim succeeded. Although the briefs were diverse, participants were able to perform an insightful analysis and generate promising design concepts for each of them. However, there were also differences in how participants had experienced working with the briefs. Table 19 shows an overview of the strategy ratings, the concept scores, and the idea counts per design brief.

Table 19: Per-brief ratings for strategies and design concepts, and the number of design ideas generated

	Traffic jam (anger)	Deceased pet (sadness)	Presentation (fear)	Hospital (shame)	Average
Strategy average rating (1-7)	4.78	4.33	4.94	5.17	**4.81**
Average concept score (1-10)	6.35	6.74	7.00	7.17	**6.81**
Idea count	134	82	96	103	**103.8**

Participants of the anger-in-traffic-jam brief commented that their emotion made generating ideas relatively easy, as there are numerous ways to evoke it and it has a clear action tendency. This was also reflected in the high number of ideas they had generated. However, at the same time they found it challenging to do something constructive with anger, as its tendencies are, quite literally, the opposite. They found similar problems for the virtue concepts. They argued that it was more natural for a sad person to see virtue in a situation, than for an angry person.

The nervous-about-presentation group also had an emotion with a clear action tendency. Their concepts were often games or had game-like features, which was related to the emotion (game-features easily evoke thrill) and the context (giving a digital presentation).

The shame-about-medical-exam brief was challenging for a number of reasons. First of all, shame or embarrassment were not found to have as clearly defined or usable action tendencies as the other

emotions. Secondly, participants found it difficult to create enjoyable forms of the embarrassment, unless they made it humorous – which a lot of concepts did. Lastly, a participant remarked that because shame and embarrassment are social emotions, the concepts almost always had to involve other people, which constrained the opportunities for designing.

The sadness-for-deceased-pet group found it hardest to design with the strategies, judging from the relatively low ratings they gave to all strategies and the low number of generated ideas. This could in part be explained by the relative seriousness of their topic, which made it difficult to experiment with more light-hearted or playful ideas. However, they ended up generating a number of interesting concepts. Many concepts had a 'poetic' quality, and facilitated or encouraged the user to engage in a ritual to cope with the loss of their pet.

Conclusions

Participants had been able to generate design concepts for each of the twelve combinations of strategies and design briefs. Furthermore, each combination had produced one or more interesting concepts.

The virtue strategy was found to be the most successful, with the highest participant ratings for the strategy and the resulting concepts. Participants found that it gave a clear goal to design for and appreciated the preselected virtues in the analysis session. A point of improvement for the virtue strategy is the relative difficulty participants had to find concrete implementations to involve the abstract virtues in their design brief. The development of an additional design step or approach to explicitly design a range of specific virtues into a user experience may be an interesting topic for future research.

The decoy strategy was the least well-understood and appreciated of the three. For some participants this was a fundamental issue – they did not acknowledge the idea that adding negative emotions could improve anything – but most said they just had trouble applying it. However, the outcomes of the decoy strategy show a different picture. Participants had been able to generate good examples of emotion stimuli in the analysis session for the decoy strategy, and they had produced several concepts that were judged promising by both participants and researchers. The decoy strategy was in fact a variant of the rich experience approach (see chapter five), with the difference that in this project the target negative emotion was already present in the context. Previous experiences had shown that most designers need time to absorb and embrace the rich experience approach (see chapter six). The time that participants had to design an emotional decoy in the workshop was evidently too short for this process to take place. Participants should especially be given more guidance in the step between generating emotion stimuli and coming up with emotionally rich design examples.

An artefact of the study conditions was that participants did the analysis sessions for the three strategies consecutively, before moving on to designing for each strategy. Overall, this was not considered

a problem by participants. However, it also meant they did the analysis without yet knowing what the strategies themselves would entail. This may have been more disadvantageous for the decoy strategy than for the other two, as the mental leap between applying emotion stimuli as decoys seemed larger than finding applications for action tendencies and virtues.

The action tendency strategy scored between the decoy and the virtue strategy. Participants liked its concrete approach, but found it challenging to create a meaningful connection between the action tendency and the design context. This was already apparent in the analysis phase: generating manifestations of action tendencies was relatively easy, but finding applications for these manifestations was the real challenge. Future studies could evaluate the effect of giving some pre-selected manifestations of action tendencies and spending the analysis session on finding the most meaningful applications.

The decision to offer preselected virtues had been a pragmatic deviation from the overall aim to let participants generate their own analysis material. However, the results suggest it may be worthwhile to try a similar approach for the other two strategies. A number of preselected action tendency manifestations and emotion stimuli may provide better starting points for those analysis sessions.

8.4 GENERAL DISCUSSION

This chapter introduced three emotion-based strategies that aim to improve the experience of a situation with a dominant and persistent negative emotion. Each strategy originates from the view that it is more constructive to investigate and work with these negative emotions than to ignore or reject them. The workshop showed that each strategy can be used to generate product ideas that improve the user situation, although there were differences in the successfulness of the strategies in different design briefs.

When evaluating the outcome of the design work, it is important to realize the limitations of the study setup. Participants had little time to absorb and apply the new knowledge and analyze their design context, which means that the subsequent design was based on relatively simplified assumptions. In addition, having less than an hour to produce a design concept tended to make the results somewhat gimmicky, as designers often overemphasized the experiential effect at the cost of elegance and sensitivity. Keeping these limitations in mind, design workshops can nevertheless give a good indication of the viability of an approach, especially if several approaches are compared under equal conditions.

There was some indication that the strategies worked better with certain emotions. At first glance, anger seemed like an easy emotion to reverse, as it has clear action tendencies and its experience is already relatively positive (Lerner & Tiedens, 2006). However, participants found it difficult to design things that made the emotion constructive or meaningful. The sadness participants were fond of the virtue strategy, but were also able to come up with interesting concepts for the other two strategies.

Sadness seemed to have the advantage that its concepts could be pushed towards poetic qualities (also see pp. 102-104). Fear was found to work well with the first two strategies, but participants found it difficult to connect the emotion to meaningful virtues. Participants in the shame brief found it difficult to generate a wide range of action tendency manifestations and to find enjoyable forms of the emotion for the decoy strategy. Thus, shame may be the one of the most challenging emotions to design for with these strategies. Note that because the emotions were always linked to the same brief, it is difficult to precisely determine to what extent the varying effectiveness of certain strategies is related to the emotion and to what extent to the context of the brief. Future studies could test the effectiveness of the strategies on the same emotions in different briefs.

One of the most surprising findings of the study was that several design concepts employed multiple strategies, and moreover, that some of these were among the most interesting concepts. Together with the evaluations and comments of the participants, this made us reconsider whether it may be better to regard the strategies as ingredients of a solution, rather than separate directions. For different design briefs, these ingredients could be combined in different compositions. For instance, the decoy ingredient could be applied to attract the user's attention, the action tendency ingredient could give direction to what kind of user actions are desirable to facilitate, and the virtue ingredient could direct the meaningfulness of this action.

In the course of the project, we found an interesting parallel between our approach and literature on emotional coping. Folkman and Lazarus (1988) proposed that individuals who are faced with a negative emotion have basically two options to deal with it: problem-focused coping and emotion-focused coping. The first entails that the person looks for solutions to the problem by removing or altering the cause of the negative emotion. If solving the problem is not possible (or if the individual fails to engage in this type of coping for other reasons), emotion-focused coping comes into the picture[13]. Seen from this perspective, the three strategies from this chapter propose different ways to help the user exercise emotion-focused coping: either by meaningfully expressing oneself (action tendency strategy), by distracting oneself (decoy strategy), or by seeing the positive side of a situation (virtue strategy). Additional research on 'design for emotion-focused coping' could span a broader range than the current three strategies and may be an interesting future direction.

This research in this chapter investigated whether designers could use the strategies to come up with viable and original solutions for the given design briefs. Unfortunately, it was out of scope for the study to test whether the design concept would actually improve the user situation as predicted.

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13 Folkman and Lazarus defined six types of emotion-focused coping: distancing, escape-avoidance, accepting responsibility or blame, exercising self-control over the expression of feelings, positive reappraisal, and seeking social support. The virtue strategy has a lot of resemblance with their description of 'positive reappraisal', but the other two strategies do not have clear counterparts. Interestingly, the action tendency strategy seems even opposite to the 'exercising self-control over the expression of feelings' coping type. Further research could investigate if these and other types of coping are also interesting starting points for design.

Future research will have to indicate whether people actually feel better when they can express their action tendencies, if emotional decoys successfully divert people's attention, or if emphasizing and exercising virtues really helps people to reappraise their situation.

In the introduction, we stated that three types of situations could be distinguished in designing for an improved user experience: situations with a solvable negative stimulus (approach 1), situations with an unused potential for positive stimuli (approach 2), and situations with an unsolvable negative stimulus (the approach in this chapter). With this classification, the question arises how often situations of the last type actually occur. Is it a niche problem that only designers in specific areas of expertise should concern themselves with, or is it something that all designers should be able to deal with? Over the course of history, man-made products and services have been able to solve an immeasurable amount of problems. People's lives have become more comfortable and pleasurable as a result. Analogously, future products and services will undoubtedly continue to solve problems that we take for granted today. However, we can expect a few important exceptions to this general trend. First of all, certain negative emotions are inherently connected to the reality of life and mortality, such as sadness caused by the loss of a loved one, or despair over the gradual decrease of one's physical and mental abilities. Such problems can be alleviated, but probably never fully solved by technology. Secondly, technological and sociological changes have also introduced new problems. Some of these problems are relatively benign and eventually solvable, such as traffic jams and bad phone reception, but others are more fundamental, such as global warming, obesity, and elderly loneliness. In short, we think that being aware of the possibilities to improve such situations in lieu of being able to solve their underlying causes is a valuable addition to the repertoire of every designer.

9

GENERAL DISCUSSION

There is always a well-known solution to every human problem — neat, plausible, and wrong.

— H.L. Mencken

The previous chapters have presented studies that addressed the research questions posed in the introduction chapter. The answers to these questions are briefly summarized in this final chapter. In addition, the chapter discusses some implications of the findings that have not yet been addressed in the discussion sections of the previous chapters, because they are the result of progressive insight or because they benefit from a larger scope than the individual chapter could provide. The last sections discuss the ethical implications of evoking negative user emotions and two directions for further research: the accurate measurement of rich experiences and the possibility of dynamic product experiences.

9.1 Discussion of the research questions

The following sections present a general discussion of the findings in this thesis, structured by the five research questions outlined in the introduction chapter. The sections first briefly summarize the answers to the research question, followed by discussions of other relevant points.

R1. What kinds of events or conditions elicit emotionally rich experiences?

The phenomenon of emotionally rich experiences has been defined from different perspectives throughout the thesis. In the introduction of chapter five, they were defined by their experiential effect: emotionally rich experiences are experiences that are notable, somehow pleasant or beneficial, and distinct from highly favorable experiences (Figure 35, p.87). The introduction chapter stated the assumption that rich experiences are always the results of mixed emotions, but that not all mixed emotions lead to a rich experience (Figure 3, p.11). Chapter two further investigated this relationship, and found five types of mixed emotions that constitute rich experiences: 2a) a fundamentally mixed stimulus, 2b) an arousing mix of opposite action tendencies, 3a) a negative emotion has a beneficial effect on thoughts and actions, 3b) a negative emotion signifies the importance of something, and 3c) overcoming a negative emotion evokes a sense of achievement. The six other types of mixed emotions were not rich, either because the overall experience was not worthwhile or because the emotions were evoked by different stimuli – a positive and a negative one. The first attribute clearly violates chapter five's definition of rich experiences, while the second is dismissed because it implies that taking away the negative stimulus would improve the overall experience. Chapter three subsequently proposed a framework that models the formation of rich experiences (Figure 24, p.39). An object or event evokes a negative emotion that has certain effects on a person's perceptions, attitude, and overall experience. These effects can be more or less beneficial, depending on the situation or the task at hand. Lastly, if the negative stimulus is experienced through a protective frame, the overall experience is enjoyable. The combination of these different perspectives makes it possible to arrive at an integral definition: An emotionally rich experience is a notable and distinct experience of a negative stimulus through a protective frame, which is pleasant or worthwhile on account of the unique effects that the evoked negative emotion has on the perception, attitude and overall experience of the user.

Order of emotions

Even though a rich experience involves both a negative and a positive emotional component, the framework conceived the negative emotion to be the principal element in its formation. This was done for a mix of theoretical and pragmatic reasons. First of all, three of the five clusters (3a, 3b, 3c) explicitly start from the negative emotion. The other two clusters (2a, 2b) start from a stimulus that evokes both emotions simultaneously, however, it was found that when designing for experiences that fit in these categories, it still makes more sense to consider the negative emotion first. For example, consider the 'direct dietitian'. This concept can be placed in category 2a (see Table 20, below),

because the image of exaggerated bodies simultaneously evokes disgust and fascination. It makes more sense to first think of something that is (mildly) disgusting, and then make it acceptable (by using cartoon characters), instead of first making the product interesting and afterwards finding ways to evoke disgust.

Other types of 'rich experience'

This thesis worked from the definition that emotionally rich experiences always involve a mix of negative and positive emotions. However, other types of rich emotional experiences are conceivable, for example, an experience that involves a multitude of contrasting *positive* emotions. Several authors have argued for the diverse consideration of positive emotions and demonstrated how positive emotions can differ a great deal in terms of arousal, eliciting conditions and experiential content (e.g., Averill, 1980; Campos, Shiota, Keltner, Gonzaga, & Goetz, 2013; Desmet, 2012; Smith et al., 2014). For example, the emotions euphoria, gratitude and pride have distinct characters, and evoking them simultaneously in a product interaction would presumably result in an emotionally rich experience. As was argued in chapter five (p.87), it is challenging to create products and services that elicit highly positive emotions, and eliciting a rich mix of such positive emotions may even be more challenging.

Secondly, richness in user experience can be considered from other perspectives than an emotional one. For instance, some researchers have proposed that products should afford a *rich interaction*, which "*capitalizes on the full range of human skills and abilities for an aesthetic interaction*" (Dourish, 2004; Hummels, 2007). This standpoint comes from the observation that the rise of electronic and digital technology has increasingly made interfaces intangible, narrow in usage possibilities, and poor in aesthetics of interactions (Zimmerman, Hurst, & Peeters, 2007). Löwgren (2009) proposed four concepts that characterize a richer aesthetics of product interaction. Frens (2006) elaborated an example of a digital camera that was designed with the principles of rich interaction. Instead of relying on digital tropes such as icons and arrow buttons, the interactions are intended to be physical and intuitive. For example, the resolution of the photos can be changed by moving physical scalers that make the screen larger or smaller, and photos are saved by moving the screen towards the memory card.

Users can also experience richness in the *meaning* that a product elicits. For example, one could argue that a classic moka coffee maker evokes richer images, memories and imaginations than an average coffee maker from an electronics store. Several authors have proposed approaches to increase the semantic richness of products. Cila (2014) proposed how designers can attach symbolic meanings to products by mapping relevant metaphors onto them. Sengers and Gaver (2006) suggested that product meaning can become more significant if the questions of what a product does, how it should be used, and even what it is, are left open for the user to interpret. A design example of this approach, the drift table, was already discussed in chapter three (p.35).

Starting in the late 1990s, companies, designers and researchers increasingly considered enjoyment with products, through concepts like pleasure (Jordan, 2000), playfulness (Arrasvuori et al., 2010), and

fun (Blythe, Overbeeke, & Monk, 2004). The increasing consideration of richness, on an emotional, aesthetic, physical and semantic level, could constitute a second wave of interest in subjective experience. In all these cases, 'richness' stands for the consideration of the whole spectrum of each aspect of experience, not just the most superficially appealing or most easily implemented aspect.

R2. How can rich experiences be evoked through product interaction?

Chapters five and six described twelve different design concepts that have been created using the rich experience design approach. These designs used a variety of negative emotions and protective frames to evoke a rich experience. Table 20 and Figure 97 show an overview of the design concepts, including the emotion they employed, what the direct stimulus of the emotion was, which mixed emotion category they could be classified in, and the protective frames that were involved.

Table 20: The rich experience design concepts discussed in chapters five and six with post-hoc identification of negative emotions, emotion sources, mixed emotion category and protective frame

	Emotion		Mixed emotion types	Protective frame			
	Negative emotion	**Source of emotion**		**Detachment**	**Safety-zone**	**Control**	**Perspective**
1. Direct dietitian (p.94)	Disgust / Shame	Grotesque human bodies	2b	Represented in cartoon	–	–	–
2. Donor hero (p.98)	Anxiety / Sadness	Depiction of dead person and organs	2a, 3b	Abstracted person/ organs	–	–	Heroism
3. Clinger (p.96)	Poignancy / Pity	Suffering companion	2a	Behavior is emulated	–	–	Loyalty
4. Antarctica Shower mat (p.109)	Guilt	Melting continent	3b	Representation of ice/ continent	–	User determines water use	Thriftiness / consideration
5. Run for your life (p.93)	Fear (various)	Being pursued	2b, 3a	Representations of pursuer	–	User influences being caught	–
6. Fingerbite (p.95)	Disgust / Embarrassment	Touching food / Unacceptable eating	2a, 2b	–	Glove between hand and food	User determines dedication to hand-eating	–
7. Impulse (p.97)	Fear / Embarrassment	Inappropriate public behavior	2b	–	Safety of being in a crowd	User determines dedication to task	–
8. Horribly hungry (p.114)	Fear / Anger	Getting a cold meal	2b	–	–	User determines amount of teasing	–
9. Sinsecret (p.110)	Embarrassment / Shame	Inappropriate public behavior / Negative body image	2b, 3c	–	–	User determines dedication to task	Liberty / Equality
10. Mr. piggy (p.111)	Fear / Distress	Losing a nice product	2a, 2b	–	–	User influences breaking moment	Acceptance / transcendence
11. Alla goccia (p.107)	Annoyance	Having to hold glass until finished	2b	–	–	User can finish drink	Solidarity / Equality
12. Procrastination timer (p.113)	Regret	Losing work	3b	–	–	User can control procrastination	Diligence

Figure 97: Visual overview of the twelve rich experience design concepts discussed in chapters five and six

Product aspects

Experience-driven design considers that all aspects of a product – including appearance, cultural meaning, functionality, interaction, usability, technology, and indirect consequences of use – holistically collaborate in evoking the overall product experience. 'Holistic' in this sense means that all aspects of the product depend on each other in delivering the experience, and that considering only a single aspect will not suffice to predict the overall effect. Consider the aspect of appearance. For example, Mr. Piggy is designed to evoke fear and distress, but looks the opposite of scary. However, this appearance is instrumental in delivering the experience: the more attached the user gets to Mr. Piggy, the more he will dread its moment of destruction. In other cases the appearance of the product is directly related to the intended rich experience. For example, Donor hero is intended to evoke fear and sadness by its appearance (and the meaning that people infer from it). Yet other products have relatively neutral appearances that are not intended to evoke strong emotions, such as the Fingerbite, which evokes the rich experience because of what the user does with it. Thus, a single product aspect does not necessarily reflect the rich experience that the whole product is intended to evoke.

Mixed emotion categories

The lectures that accompanied the design projects (discussed in chapter six) always introduced the five mixed emotion categories to show designers the different reasons why rich experiences can be enjoyable. Although these categories were not an explicit part of the stepwise design approach, it can be insightful to analyze which of the categories could be attributed to the user experiences of the twelve product concepts.

The fourth column of Table 20 shows that all five categories are represented among the different product concepts. Furthermore, several concepts can be classified to more than one category. For example, the experience with the Donor hero is rich because it involves an ambiguous appraisal (2a), because it evokes a mixed emotion through the same stimulus (a person giving their life to save someone else), as well as inspire the realization of something important (3b), because it makes people reflect about their own organ donation choice.

It seems that categories 2a and 2b, belonging to the 'ambiguous emotions' cluster, are more prevalent than 3a, 3b, and 3c, from the 'positive effect of negative emotion' cluster (see Table 1, p.22). Particularly categories 3a and 3c seem somewhat underrepresented. Category 3a comprised situations in which a person makes use of the effects of a negative emotion. The Run for your life product is the only product that makes use of this effect – the fear is supposed to improve the running performance. Other products could make use of the effects of other emotions. It would be especially interesting to see if a product could evoke anger to help the user become more assertive, as that was a promising example of category 3a (see pp.26-27). Category 3c, overcoming a negative emotion, seems only used in the Sinsecret concept: it lets the user go through activities that she would normally not dare to, with the intention that she feels better afterwards. This category has particular potential in the design of dynamic experiences, in which the designer involves multiple emotions over time. This is further

discussed in the last section of this chapter. In general, the infrequency of these two categories among the design concepts could simply be a result of the relatively small sample of design concepts. Future research could investigate whether the five categories could be more explicitly involved in the design process, to see if they lead to different outcomes.

Protective frames

Throughout the project, the protective frame proved to be a very relevant and useful concept to understand the generation of emotionally rich experiences. Its basic principle was easy to comprehend, and the four different versions provided a useful overview of the ways in which a negative emotion can be experienced as acceptable and enjoyable.

One reservation was that some designers found it difficult to create a protective frame as a separate design step, in the way it was proposed by the rich experience approach (see Figure 37, p.90). These designers noted that they could not separate the application of the protective frame (the third step) from finding a specific elicitor for the negative emotion (the second step). For example, the designers of 'Impulse' argued that they were not able to generate different protective frames after coming up with the negative emotion elicitor (dancing in public), but that the particular protective frame 'came with the solution'. Thus, for some designers the protective frame was mostly a useful concept to understand the phenomenon of rich experience before designing, but not an inspirational tool that they could use during the design process. Furthermore, designers found it often difficult to articulate which particular frame they had used in the design process.

To evaluate the last point, I identified which of the four protective frames – the detachment, safety-zone, control, and perspective frame –were present in the twelve design concepts of Table 20. The results are listed in the last four columns. The first observation is that all four frames can be used to create a rich experience product. Secondly, in almost all cases there is more than one protective frame at play. For example, Fingerbite provides both a safety-zone frame by means of the impenetrable glove, and a control frame because the user can determine how far she takes the eating-with-bare-hands. For example, eating soup or spaghetti with one's hands is more confronting than eating some potatoes. The safety-zone frame and the detachment frame seem mutually exclusive: if the stimulus of the negative emotion is real, there can only be a safety-zone frame; if the stimulus is represented, there will be a detachment frame. The presence of the control frame and the perspective frame seems independent: they may exist in addition to the other two frames and each other.

Detachment frames are typically the most potent protective frames, which means that they allow more radical negative stimuli than the other frames (Apter, 2007, p. 53). For example, consumer products that make users see dead bodies (Donor hero) or run for their lives (Run for your life) could probably only exist with this frame. Products that do not make use of this frame typically have milder negative stimuli, such as having to hold on to a glass (Alla goccia) or getting a cold meal (Horribly hungry). A possible exception is the Procrastination timer, which quite radically deletes parts of the

user's work. Consequently – as was previously argued – the balance in this concept probably tips too much towards the negative to be a successful rich experience product. Apart from differences between protective frames, the examples make clear that the influence of a particular frame is not a binary condition (only on or off) but can be varied in potency.

The presence of a control frame points to the amount of user action that is required to evoke the rich experience. There seem to be three categories of products. 1) Products without a control frame (i.e., the first three in Table 20) *deliver* the rich experience without relying on a certain user action, other than looking at the product[1]. For example, the Clinger concept evokes pity because of the product's behavior, without requiring much action from the user. 2) Most products that feature a control frame evoke the rich experience in the direct *interaction* between product and user. For example, the fear emotions in Run for your life are evoked in the interplay of the product's and the user's actions. 3) There is also category of products that only *facilitate* a rich experience, meaning that the negative emotion is not evoked by the product, but that the product stimulates a certain user action that in turn evokes the emotion. Products in this category are Impulse, Fingerbite, and Sinsecret. For example, Impulse is an app that encourages people to engage in public dancing. The thrilling and potentially embarrassing experience is evoked by the looks of passers-by, not in the direct interaction with the product.

R3. What different types of rich experiences are possible?

Chapter five introduced ten rich experience qualities that were based on the overall rich experience approach. Chapter six discussed fifteen additional rich qualities that had been generated by designer participants. These 25 qualities give an impression of the variety of rich experiences. The negative emotions that form the basis of these experiences represent every subcluster of the emotion typology in chapter four (see Table 2, p.57). The benefit of an extensive set of rich experience qualities is that designers can pick the most appropriate to use for their design brief. The findings of chapter seven suggest that especially the manifestation phase of design could benefit from such a high level of emotion differentiation. Table 20 shows that the designers have chosen a wide variety of emotions as the basis of their intended product experiences.

Differences between negative emotions

Over the course of the project, some general differences between negative emotions became apparent, which are relevant in the context of product design. First of all, negative emotions vary in terms of how context-specific their eliciting conditions are. Some emotions, like disgust and startle, have very concrete triggers that are virtually universal across cultures and user groups. The triggers of other emotions, such as insecurity and envy, depend more on specific cultural, contextual and individual characteristics. For example, the specific events that arouse envy in a young business school student

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1 Note that this does not necessarily mean that the product is not interactive (as the Clinger and the Direct dietitian demonstrate), but rather that the user's actions do not make a difference in the elicitation of the rich experience.

may be very different from those that evoke the same emotion in a middle-aged retiree, while both will mostly find the same things disgusting. This may mean that products that are intended to elicit emotions with more abstract triggers are less universally applicable, or that they need to be dynamically adaptive to the specific context and user. In either case, the designers of such products will require more specific information about their users and product context.

Secondly, there is a group of negative emotions that are (typically) about a person's own actions, such as guilt, regret, shame, embarrassment, and nervousness. Such emotions seem to be implementable in one of two ways. One option is that the product encourages the user into certain behavior, which the designer expects to lead to the appropriate emotion and experience, such as the Impulse, Sinsecret or the Fingerbite concepts. Another option is that the product is somehow 'aware' of the user's behavior and gives feedback that trigger the emotions. This awareness can be very simple, such as the Antarctica shower mat, which physically reacts to the amount of water it comes into contact with. The product can also be an intelligent system that uses sensors and algorithms to deduce the user's behavior, such as the Direct dietitian or the Procrastination timer.

Thirdly, emotions like loneliness, jealousy, rejection, or pity are called social emotions, because they are about the presence, behavior or wellbeing of other people. These emotions can only be evoked if there is an 'other' in the context of the user. This 'other' can be a person that is somehow involved in the context of user. For example, the Donor hero concept represents specific people who have passed away in an accident. Alternatively, the 'other' can be the product itself, in which case the user has to attribute agency to the product. For example, the Clinger concept intends to evoke feelings of poignancy and pity because its behavior makes it look like a suffering agent.

Lastly, one may wonder whether *every* negative emotion can be turned into a rich experience. Although I believe in principle it is possible, there are probably some emotions for which that would be very difficult. Two emotions from the typology come to mind: hate and desperation. Firstly, they only exist in high intensities: you cannot feel a little hatred or be a little bit desperate. Secondly, they can both only be evoked in a long-standing interaction with a person or situation. Both aspects make it difficult to imagine how these emotions could be the basis of enjoyable product experiences[2].

R4. How can designers create functional products and services that evoke rich user experiences?

Chapter five explained what steps designers can take to evoke a rich user experience with their product. First, they select a negative emotion based on the desired effect on the user and the appropriate-

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2 *Then again, it seems that these emotions can be enjoyed in narrative entertainment. For example, Barnes & Nobles (among other) have made a list of 'fictional characters you love to hate', see http://www.barnesandnoble.com/blog/ten-literary-characters-you-love-to-hate/. Similarly, Unreality magazine wrote about five bleak films that leave people in despair, see http://unrealitymag.com/movies/five-incredibly-bleak-films/.*

ness for the context of use. Next, the designer finds an appropriate way to evoke the emotion through the product interaction. Lastly, the designer considers which protective frame or combination of frames makes the experience acceptable and enjoyable.

There are many different ways in which the product can evoke an emotion, as the examples in Table 20 show. The emotion can be evoked by direct sensory impression (e.g., Fingerbite), by the meaning of the stimulus (e.g., Donor hero, the Direct dietitian), by the product's interpreted behavior (e.g., Clinger), by creating anticipation for a certain event (e.g., Mr. Piggy), by shaping the interaction with the product (e.g., Alla goccia), by facilitating a certain interaction with other people (e.g., Horribly hungry), by encouraging the user into an activity (e.g., Sinsecret, Impulse), by showing the consequences of the user's actions (e.g., Antarctica shower mat, procrastination timer), or by a combination of several of these (e.g., Run for your life).

Functional products for mainstream use

The introduction of this thesis stated the ambition of a rich experience approach that leads to functional and mainstream products, as opposed to art, critical design or entertainment (see p.5 and pp.35-36). With the list of product concepts in Table 20, the realization of this ambition can be checked. Over the course of the project, some people expressed the impression that several of the generated rich experience concepts could be classified as art or entertainment, and more specifically, as critical design or games. For example, Run for your life could be considered a running game, Impulse and Sinsecret could be considered live action games, while concepts like Donor hero, Antarctica shower mat and Direct dietitian could be classified as critical design. Although the criteria for classifying products in this regard are not well-defined and are at some point bound to run into subjective differences, I would argue that nearly all the product concepts in Table 20 qualify as functional products that have at least the potential to appeal to a wide user group.

First of all, sometimes it was actually the involvement of enjoyable negative emotions that led people to associate rich experience concepts with critical design or games, since art and entertainment are the most familiar domains that commonly deal with such emotions. It may be clear that adopting this viewpoint would make the ambition unattainable from the outset. Nevertheless, some rich experience concepts do share certain formal elements of either games or critical design. For example, Run for your life has in common with a game that its users can 'win' or 'lose', by outrunning their pursuer or being caught, respectively. The Direct dietitian could be thought of as critical design, critiquing people's conceptions about food consumption and health. However, having some aspects in common with games or critical design is not problematic in itself, as long as it does not prevent these concepts from being functional consumer products. Moreover, there are also a number of concepts that do not seem to share any elements with games or critical design, such as Mr. Piggy, Alla Goccia, Clinger, and Fingerbite.

I would argue that functionality is the most meaningful criterion for distinguishing mainstream products from critical design or games. Consumer products have a certain practical function that is directly relevant in their context of use. The main intent of critical design is – similar to certain forms of art – to inspire people to imagine and reflect on certain issues. This can also be considered a function (see Malpass, 2015), but it is not a practical function that is relevant in the direct context of the user. For example, the Life counter, discussed in chapter three (p.34) could be said to serve the function of making people reflect on their mortality. This seems similar to the Antarctica shower mat, which aims to make the user reflect on their use of water. So what makes the first a product of critical design, and the second a functional rich experience product? The boundaries can seem quite narrow in comparison. Nevertheless, the shower mat has a clear functional purpose (preventing slippage) in addition to its experiential purpose, and crucially, these two purposes are linked in their direct relevance to the context of use (see chapter six, pp.120-123).

Games, in contrast, have the primary (and typically the sole) purpose of entertaining their players: people play video games and board games for enjoyment, not to fulfill a practical purpose[3]. The Run for your life concept, on the other hand, has the primary purpose of helping users to run, and the experiential purpose – supported by some game elements – is secondary.

Another criterion for products is that they are realistic in terms of the costs and benefits to the user. For example, consider The Tyrant, a critical design example that was discussed in chapter three (p.35). Strictly speaking, it is a functional product. The fear and embarrassment that the product evoke by calling up random contact are in service of the alarm clock's function: making sure that the user wakes up on time. However, the cost of this feature – annoying and alienating people – clearly does not outweigh the benefit of waking up, which could also be attained with less drastic measures. In this case, the lack of a protective frame pushes the product into the art domain. This also means that the concept could become a functional rich experience product if it would be redesigned with a less radical emotion elicitation.

Lastly, the reverse argument can also be made: not every game or critical design necessarily involves rich experiences. Some games are challenging or competitive, evoking certain enjoyable negative emotions, but games can also be easy and collaborative, evoking only positive emotions. Similarly, critical design is intended to oppose the status quo and arouse a strong reaction from people (Dunne & Raby, 2001), but it does not always have to do so through negative emotions. For example, Malpass (2015) describes the environmental health clinic in New York, which invites people ('impatients') to come on consult and prescribes design interventions rather than medication. Although the differ-

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3 The comparison becomes more complicated if we also consider so-called 'serious games', games that have a functional purpose such as to train, inform, or recruit people (e.g., see Ritterfeld, Cody, & Vorderer, 2009). However, the mot inclusive definition of serious games – 'offering an engaging, game-like experience in order to fulfill some functional purpose' – would fit almost all experience-driven design concepts.

ences with a regular clinic may evoke feelings of oddness and wonder, I do not think there are necessarily negative emotions involved in the experience.

In conclusion, rich experience products, games, and critical design can have similar elements, but not necessarily so. Secondly, the three groups can typically be distinguished by their main purpose for the user. The bottom line is that the rich experience approach intends to generate products that evoke a rich experience, serve a functional purpose and are intended for mainstream use. As long as the products can fulfill these criteria, it is not a problem if they are also (partly) regarded as games or art.

Nevertheless, there are some product concepts in Table 20 that do not pass the criteria. Donor hero has no other functional value than to let people reflect on something, and could thus also be classified as art. Similarly, Horribly hungry has little functionality other than offering a game-like social dinner experience. These concepts should be amended or redesigned if they are intended to become mainstream products.

Adoption of rich experience products

What chance would rich experience products stand on the market? I expect the adoption would follow a similar pattern as the responses I received when explaining the rich experience research. Some people only needed little explanation to grasp the main idea and would immediately provide their own rich experiences examples. In contrast, other people did not resonate with the idea of deliberately evoking negative emotions, even after a lengthy explanation of potential benefits and multiple examples. This contrast was especially clear when discussing design concepts. For example, when showing the Run for your life prototype, some people exclaimed that they could not believe that anyone would ever want to use it, while others asked if they could keep it after tests had finished.

In addition to appreciating the main idea of rich experience design, potential users also have to like the specific rich experience that the product evokes. Chapter seven demonstrated that this can even differ between closely related emotions: some people liked a scenario that evoked nervousness, but disliked a scenario that evoked confusion.

Nevertheless, my prognosis is carefully optimistic. This is in part based on one particular product that is currently on the market. During the development of the prototype of Run for your life, an app called 'Zombies, run!' was released, which offers a similar experience[4]. This audio-based app guides runners through a story in which they are chased by zombies, which is advertised as its main appeal. From its introduction in 2012, Zombies, Run! was one of the most expensive apps in Apple's app store, at $7.99, surpassing most health apps that were usually free or $0.99, and even most games, which were often

4 *See: https://zombiesrungame.com/*

in the range $3-5[5]. Yet, it became one of the most popular apps in the store, generating over a million downloads in a two years[6]. I consider this a testament to the fact that many people appreciate rich experiences in a functional product – Apple classified it as a Health&fitness app rather than a game. Moreover, the company changed their pricing strategy in early 2015 to making the base app free and charging runners for additional missions. This means that the company relies on the expectation that runners spend money on the app after they have been able to try it freely. This indicates that the product does not just generate excitement as a novelty, but that its users find the app sustainably effective and engaging.

Another important consideration is that most of the product concepts discussed in this thesis were developed with the aim to make the whole product 'about' the rich experience. In other words, designers started from one or more rich experience qualities and designed the concept around these qualities. In some cases this led to a product for an existing category, such as Mr. Piggy or Alla Goccia, and sometimes to a new type of product, such as the Procrastination timer, but in each of these cases, the rich experience was the leading feature of the product concept. This was done because it was expected to offer the most compelling and insightful exercise to the designer participants and to produce more communicable results for research. However, in a real-life scenario, the rich experience approach could just as well be used to design a single feature or function of an otherwise non-rich product. For example, the main feature of the procrastination timer could (in a less radical version) be a small feature of a traditional time logging app. Similarly, a restaurant could offer the Alla goccia glasses to guests for special drinking occasions only, and use normal glasses the rest of the time. Such a use of the approach could also increase the likelihood that products involving rich experiences are widely adopted.

R5. How can products reverse existing negative emotions into rich experiences?

Chapter eight introduced three strategies that designers can pursue to constructively employ existing negative emotions, instead of primarily evoking new emotions. The three strategies focused on different elements of the appraisal process – the action tendency, the emotion experience, and the appraisal – to generate possible ways to help the user deal with a persistent negative emotion. The study found that some strategies work better than others in combination with certain negative emotions, and that considering a combination of strategies may be the best solution in most cases.

The potential for this approach seems considerable, as people's lives contain numerous situations that are characterized by strong, unsolvable negative emotions. Subjects such as marital problems, financial issues, trauma processing, and (mental) health care could benefit from this design approach.

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5 *The creator of Zombies, Run! explained how the company decided on the price for the app in this blogpost: http://www.sixtostart.com/onetoread/2012/why-7-99-beats-0-99/.*

6 *See: http://blog.zombiesrungame.com/post/112137412954/season-4-is-coming*

At the same time, these situations are typically very sensitive and should be approached with care. Since designers are not trained therapists or counselors, they may not be aware of the implications of their design interventions, which could occasionally do more harm than good. This was one of the reasons that the design briefs in chapter eight involved relatively 'light' topics (for example, the loss of a pet instead of a person). Future research could carefully investigate the usefulness of the design approach for more 'serious' topics. Especially if designers team up with various subject experts, they could together break new ground to find creative and effective solutions for these types of problematic situations.

9.2 Further considerations

The ethics of rich experience design

A design approach that involves the deliberate elicitation of negative emotions needs to be accompanied by a careful consideration of the ethical implications. Although the explicit inclusion of negative emotions sounds like a potential problem for companies and designers wishing to use the approach[7], in reality, the concerns are largely similar to those of other experience-driven design approaches. Nevertheless, there are a few possible implications specific to rich experience design, which are reviewed here.

The most relevant ethical concern for rich experience design is that the resulting product inflicts unintended harm or distress on the user or another person. I can imagine four factors that influence the potential for such harm. First of all, the seriousness of the emotion elicitor. For example, the loss of information from a working document (Procrastination timer) is probably a more serious emotion trigger than having to hold a drink for longer than one wishes (Alla goccia). The second factor is the extent to which people know beforehand what the rich experience entails. For example, people who buy Mr. Piggy should be properly informed of what will eventually happen with the product. Thirdly, users should have the ability to 'opt out' of the negative emotion, both before and during the experience. This can simply mean that people have the option to not buy or interact with a product – which also necessitates that they are first properly informed about it. Products could also have an explicit opt-out for certain features. For example, the Run for your life prototype featured the possibility to administer a small electric shock at certain moments in the experience. Participants of the evaluation study were explicitly asked if they wanted to exclude this feature for their testing. The fourth factor

7 *Early in the research, I applied some of the insights in a design project for a large company. When writing the proposal, my contacts at the company expressly asked that it did not mention that the aim was to evoke negative emotions, as they expected that the proposal would not be approved if it did. This is when I first started using the term 'emotionally rich experience'.*

is the vulnerability of the user group. Special care should be exercised when the target group of the design are for instance children, people with psychological conditions, or patients.

The interplay between these factors will determine the possibility that people experience adverse effects from a rich experience product. If the emotion elicitor is not severe, such as that of Alla Goccia, it is probably not an issue if people are not well informed, or that they cannot opt out. If the emotion elicitor is more serious, such as with the Procrastination timer, it becomes crucial that people understand the consequences of use and can choose not to engage with it.

Products that make use of a detachment frame form a special case, because they only have a represented negative stimulus that does not have any consequences in the real world. For example, the Antarctica shower mat only melts metaphorically, without real repercussions. However, the fact that the negative stimulus is not real does not absolve the designer from all ethical considerations, as the emotional experience itself can also have harmful effects. For example, people could resent that the Direct dietitian shows them grotesque body images, or even be offended that the product is basing these images on their choice of groceries. In this particular case, the user can easily opt out of the experience by not using the product. This may not be possible in all cases. For example, the Donor hero is placed on the spot where someone had a fatal accident. There may be people who would strongly dislike such a statue in the vicinity of their house, as they are not able to opt out of the experience that it evokes.

Another special case are rich experience products that encourage the user to engage in a certain activity, such as Sinsecret or Impulse. These products can cause harm because they encourage behavior, which potentially has unintended side-effects. For example, a Sinsecret user could become a target of public ridicule during one of the assignments proposed by the product. Designers should carefully consider unintended consequences and make users aware of the possible risks. The concerns surrounding products that influence behavior have been more extensively discussed in the fields of persuasive technology (Atkinson, 2006) and social design (Tromp, 2013, pp. 181-184).

Although guidelines can be informative, I believe the best determinants for safe and pleasant products are the designer's personal assessment and responsibility, and the inclusion of real-world evaluations. Only extensive testing can give the designer assurance that an experience-driven product is not only effective, but also free of harmful side-effects.

Future research

Measurement of rich experience

At several stages of this research project, people's emotions were captured to understand and evaluate the emotional richness of different experiences. Most notably, the phenomenological study of chapter two investigated naturally occurring mixed emotional experiences, and the research through design study of chapter seven evaluated the user experience of the Run for your life prototype. In both cases, in-depth, qualitative interviewing was chosen as the main method of inquiry, for two reasons. First of all, the research had an exploratory character and still had to identify the relevant variables of rich experience. Qualitative interviewing made it possible to adapt to the idiosyncrasy of respondents' experiences and produce a quantity and nuance of data that allowed careful interpretation.

Secondly, there did not seem to be any existing measurement tools that were suitable to capture the occurrence of 'rich emotions'. Existing tools typically ask respondents to report their emotions on the basis of dimensions (usually valence and activation, (e.g., Russell, Weiss, & Mendelsohn, 1989) or on a number of discrete emotion words (e.g., Gross & Levenson, 1995). For our purposes, the latter is more useful because it allows participants to report the occurrence of several simultaneous emotions. For example, a respondent could indicate that they feel both fear and excitement, which could indicate a rich experience. However, these tools do not make a distinction between mixed emotions that are rich and those that are not. Moreover, these tools typically do not incorporate a high enough level of emotion granularity that allows participants to make a sufficiently nuanced evaluation of their experience. Lastly, relying on word labels may be problematic. The interview studies found that virtually all participants were able to talk in detail about their emotionally rich experiences, but not in the same terms. Thus, all participants described the experiences in their own words and found it difficult to sum these up in short labels.

When the research into rich product experiences moves beyond the exploratory stage, it may be beneficial to develop a self-report tool that can measure the occurrence of rich emotional experiences. The challenge for such a tool will be to concisely frame the rich experience phenomenon and to operationalize it into a manageable amount of questions. A helpful starting point is PreMo, a self-report tool that was developed and validated specifically for product emotions (Desmet, 2004). An advantage is that it makes use of animated characters expressing the emotions, and consequently does not rely on verbal labels. Furthermore, the tool allows the reporting of mixed emotions.

An initial idea for this measurement tool is that it asks respondents to indicate their emotions in increasing steps of granularity. For example, the tool could first show emotions only on an emotion-family level, such as anger, sadness, and fear. If the participant indicates he experiences fear, the tool could ask what specific type of fear he feels, such as worry, anxiety, and nervousness. Secondly, in case the participant reports a mixed emotion, e.g., fear and excitement, the tool could ask whether

these emotions make up a rich experience. The participant could then go on to select more specific 'rich emotions', such as 'thrilling', 'eerie', and so on.

Dynamic product experiences

It is a truism that human experience is essentially dynamic. The pleasantness of different experiences greatly depends on those that preceded and are expected to follow it. Several design scholars have underlined the importance of the dynamics of user experience and provided tools to consider it in the design process. Hassenzahl and colleagues' (2013) concept of dynamic experience patterns was already briefly discussed in chapter seven (p.144). Another example is the 'customer journey map', which is often employed in the fields of service design and hospitality to plot the customer experience over time (e.g., Stickdorn & Schneider, 2012, pp. 158-161). Lastly, Grimaldi, Fokkinga, and Ocnarescu (2013) investigated how designers can use narratives to structure dynamic user experiences.

A major part of this thesis focused on uncovering the different possible experience types that add richness to product experience – the rich experience qualities. However, these qualities were predominantly considered as isolated entities that a designer could select to shape an entire product experience. I believe an important next step in experience-driven design research is to consider the enjoyment of certain sequences of emotions and experiences over time. In such sequences, both positive and rich emotional experiences could be considered as building blocks that together constitute a *dynamic* rich experience. A starting point could be to combine the 25 rich experience qualities proposed in this thesis with the 25 positive emotions that Desmet (2012) found in product use. Similar to rich experience design, inspiration for enjoyable dynamic experiences can be derived from art and entertainment.

As a first step, research on dynamic experience design could investigate the enjoyment of sequences of two different positive or rich emotions. For instance, an experience sequence could start with a rich emotion and end with a positive emotion. This is a sequence that is heavily used in narrative structures. For example, thriller movies often use a suspense-relief sequence: the audience sees something approaching the protagonist and feels relieved when they find out it was just a cat. Other sequences of this type are transitions from frustration to satisfaction (e.g., having to work hard for something before getting the reward), or from insecurity to confidence (e.g., slowly becoming confident of one's own ability to do something). My hypothesis is that the positive emotions in these sequences are more gratifying if they are preceded by the negative emotions. An experiment could assess whether people assess the overall experience as more enjoyable with or without the initial negative emotion.

An experience sequence could also transition between two rich emotions, for example, from a fear-emotion to an anger-emotion. This is a transition that can be observed in the classic video game Pac-man. During most of the game, the player has to avoid getting killed by the ghosts that are constantly chasing him, which evokes (pleasant) fear. At certain moments in the game, the roles are reversed and the player can kill the ghosts for a limited amount of time. In these moments, the player can take

revenge and give full rein to her feelings of anger. It would be interesting to find out if the experienced anger towards the ghosts is more gratifying if people have first been afraid of them.

These are just a few examples of the manifestations of dynamic experiences that could be investigated. Eventually, sequences of more building blocks could be considered to build even longer narratives. Such narratives could help to create products that are relevant and emotionally durable over time. A dynamic experience approach could contribute to design that adopts the full spectrum of emotions and embraces the complexity of human experience.

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SUMMARY

Designers create objects, devices, and services – in short: products – that people use to make their daily lives better or easier. A certain group of designers, who go by titles like 'user-centered designers', 'interaction designers', and 'user experience designers', specifically focus on optimizing the subjective experience that users have with a product. They consider and integrate all the decisions about the product that make up the total user experience, such as what the product can do (the functionality), what it looks like (the aesthetics), what it makes the user think of (the cultural meaning), how easy it is to understand and work with (the usability), and how it impacts the user's life (the consequences of use). To get a grip on how all these aspects influence the product experience, designers apply theories, design tools and user tests. These theories, tools and tests are in turn developed by design researchers, who have the time and resources to dive into the elaborate relations between products and human experience and behavior.

Since the late 1990s, these researchers began to explicitly investigate how products elicit emotions in users, and how knowledge of specific emotions like joy, pride, frustration or sadness could help designers to improve the user experience of products. Generally speaking, each positive or negative emotion experienced by the user points to a success or failure in an aspect of the product. From this perspective, it seems that the most evident aim for a designer is to maximize the amount of positive emotions and to minimize the amount of negative emotions in the user experience.

However, this aim is based on the assumption that positive emotions are always desirable and negative emotions are always undesireable. More fundamentally, it assumes that all emotional experiences can be clearly divided between positive and negative ones. But if we look at some examples of enjoyable and meaningful human experiences, we quickly realize that neither assumption is always valid. This is apparent in examples of art and entertainment: People who ride rollercoasters, play challenging video games, or listen to downbeat music are experiencing fear, frustration, and sadness, respectively, but are also enjoying themselves. Furthermore, they do not seem to enjoy these activities despite these emotions, but because of them: unintimidating rollercoasters, effortless games and unmoving music are not nearly as satisfying. There are also many worthwhile experiences in real life that involve negative emotions, such as starting a new job or saying goodbye to an emigrating friend. If these experiences did not involve some anxiety and sadness, respectively, they would arguably not bear the same personal significance.

Throughout this thesis, I call this type of enjoyable and meaningful experiences 'rich emotional experiences', or 'rich experiences', for short. Although such experiences are ubiquitous in art and entertainment, they are virtually absent in the domain of consumer products. The main aim of the research in this thesis is to investigate the nature and possibility of rich experiences: What does a rich experience consist of? What different types of rich experiences exist? And most importantly: How can designers evoke rich experiences through mainstream consumer products?

Chapter two explores the first question through a phenomenological study – a study that examines the contents of subjective experiences. The starting point was the observation that rich experiences are always characterized by mixed emotions – the simultaneous experience of a positive and negative emotion – but that not all mixed emotions necessarily lead to a rich experience. In other words, rich experiences are a certain subset of mixed-emotion experiences. In the study, ten people kept a diary for a week to describe a dozen accounts of recent mixed emotion experiences. Afterwards, they were extensively interviewed about these experiences. An analysis of the 124 captured experiences revealed eleven underlying 'emotion constructs', of which five were experienced as 'rich' by the participants. Two constructs were experienced as rich because the involved positive and negative emotions came from the same emotionally ambiguous stimulus, such as in the experience of thrilling beginnings or meaningful endings. The other three constructs were rich because the positive emotion was in some way a result of the negative emotion, such as when a person can use her anger to better voice a grievance.

Chapter three looks more closely at the role of the negative emotion in rich experiences. Why do people engage in activities that involve negative emotions (like trying to solve a very difficult puzzle), when they could also choose a similar activity that does not evoke these emotions (like solving a very easy puzzle)? I discuss three theoretical explanations: The first states that people take the negative emotions for granted because they want to achieve something; the second proposes that people like these activities because they feel good after the negative part is over; and the third assumes that people do not actually experience any negative emotions in these activities. Because none of these explanations are able to account for most instances of rich experience, we propose an alternative explanation: Different negative emotions have certain physiological and mental effects on a person that give a unique experience in their own right and that can help the person (better) deal with a situation. For example, fear makes your heart pump faster, narrows your perception, brings back memories of other frightening times, and makes the passing of time seem slower. Furthermore, a person can subsequently enjoy these effects if there is a 'protective frame' around the situation, which means that he feels sufficiently protected from the adverse consequences of that which evokes the negative emotion. For example, people in a rollercoaster experience all the physical sensations of being part of a spectacular accident, but simultaneously know that they are actually safe from harm. Similarly, a viewer can be deeply moved by the misfortunes of a movie character, but can also enjoy these feelings because she knows that they are not aimed at a real person. In the remainder of the chapter, this framework is used to analyze rich experiences evoked by six existing products: a motorcycle, spicy

food, a countdown clock, a malfunctioning printer, a series of plush toys resembling microbes, and the glass balcony of the Willis tower in Chicago.

Although the framework proposes that all instances of rich experience follow the same mechanism, it is obvious from a comparison between the person in the rollercoaster and the compassionate film viewer that the resulting experiences can differ a great deal. This difference is important for designers who ultimately have to choose which rich experience is most suitable for their envisioned product. An evident and pragmatic way to distinguish these experiences is by the specific negative emotion from which they start. The higher the level of specificity with which designers are able to distinguish emotions, the better they are able to find and evoke the most fitting experience for their product. **Chapter four** describes a typological study that resulted in a database of 36 distinct negative emotions. The aim of this database is to increase both the analytical understanding and the intuitive familiarity of designers with these emotions, following the knowledge that designers need to use both reason and intuition in the design process. First, literature sources were consulted to build the set of 36 emotions and formulate a concise definition for each emotion. Next, comic strips were created and movie clips collected to represent each emotion. The definitions were validated by emotion experts; the movie clips by regular people. Thirdly, explanatory texts were written that describe and compare the different negative emotions. Lastly, all these elements were brought together in a freely accessible, online database (www.emotiontypology.com).

After chapter two established what rich experiences are, chapter three demonstrated how they are formed, and chapter four dived into the diversity of the negative emotions that constitute them, **chapter five** finally proposes how designers can evoke rich experiences through products. This is done through a three-step approach. First, the designer selects a negative emotion, based on the particular user experience she wants to evoke, or based on the mental effects she wants the product to have on the user. Second, the designer finds a way to evoke that negative emotion in the user-product interaction: the 'stimulus'. Third, she makes sure there is a 'protective frame' around the experience, meaning that the user is not exposed to adverse effects of the stimulus. Four protective frame types are proposed for this step: The user is shielded from the stimulus (e.g., a lion in a cage), the stimulus is not real but represented (e.g., a movie clip of a tiger), the user has sufficient control over the stimulus (e.g., a lion on a leash), or the user can accept the negative emotion by connecting a virtue to it (e.g., approaching a lion as part of a courageous dare). Designers can apply this three-step approach to create a rich experience for any product and, in principle, with any negative emotion. However, to help them along, ten 'rich experience qualities' were developed that describe the three steps for a particular negative emotion: the effects of the emotion, how to elicit it, and which protective frames apply. These ten experience qualities are elaborated with cultural examples and product examples. The chapter finishes with an exposition of six design projects that used the rich experience approach.

The rich experience approach has been applied in a project with a professional designer and in three projects with in total 59 design students. **Chapter six** describes these projects and the insights gained

by reflecting on the design processes. In each project, the designers first created their own rich experience qualities using the three-step design approach from chapter five. This process was fruitful and added fifteen new qualities to the existing set. The designers would then go on to design products that evoke a rich user experience. The results included a piggy bank, a shower mat and a digital work time tracker. The design processes emphasized the importance of a close relationship between the product experience and the product functionality. Another observation was the difference between two types of designers in the projects, who needed different types of input and guidance on the application of the design approach. Lastly, it was found that the approach could be more helpful to the designers in the materialization stage of the design process.

Chapter seven provides a more detailed look at the characteristics of using the rich experience approach to develop a product from first idea to prototype. The chapter describes a design project undertaken by the author. The difference with the projects in chapter six is that this design was fully prototyped and tested with users, and that the development process was extensively documented. The designed product was 'Run for your life', a device intended to be worn by runners, which tracks their progress and evokes fear emotions to motivate them to run longer and faster. Through visual, auditory and tactile feedback, it gives the runner the impression that she is being chased by something. A versatile prototype was built that could run a number of different scenarios and feedback modes. With this prototype, eleven amateur runners were recruited to use the prototype in a total of 26 runs and were afterwards interviewed about their experiences. The prototype was optimized between sessions based on the results. This process yielded insights on the design process of this particular product, as well as on the development of rich experience products in general. One main insight was that there were roughly three ways to elicit (fear) emotions in the user-product interaction: through hard-wired stimuli (e.g., loud bangs), by association (e.g., viciously barking dogs), and through so-called 'appraisal components' (e.g., the predictability of the pursuer). Secondly, the study showed that the effects of different aspects of the design on the user experience (e.g., the effects of the sound, images, and behavior of the pursuer) can only be described and predicted in relation to one another. The chapter describes a way to make these relations explicit. The third main insight was that the effectiveness of the product depended a great deal on the running styles and preferences of the participants. Three participants found that the prototype did not fit their running style. Three other participants mainly wanted to increase their running performance, and liked how the prototype helped them do that. Lastly, four participants mainly wanted to have a better running experience and found that the prototype made running more exciting.

Throughout the studies, the rich experience design approach was found especially effective to improve uninspiring or lackluster situations – in other words, situations without much emotion. However, an additional application is to use the approach for situations in which there is already a negative emotion present, which is unwanted but cannot be easily 'designed away'. For example, a designer gets the task to create a car-related product that makes traffic jams less unpleasant for the driver. Obviously, she cannot solve traffic jams within the scope of that project. So what can she do?

Chapter eight proposes and explores three design strategies that aim to improve user situations with such unwanted and unsolvable negative stimuli. The first strategy focuses on doing something useful or meaningful with the behavioral effect of the negative emotion. The second strategy attempts to create an 'emotional lightning rod' by adding a new stimulus that evokes the same negative emotion as the present one, but in an enjoyable way. The third strategy attempts to change the way the user experiences the negative emotion, by attaching a relevant virtue to it, such as courage or solidarity. These three strategies were tested in two full-day workshops with in total 24 designers. The workshop participants were given one of four design assignments, each with a different negative emotion, and consecutively used the three design strategies to generate product ideas. This resulted in a large amount of product concepts, many of which seemed effective, original and feasible. Although the designers were able to come up with interesting ideas for all three strategies, they found the first and third strategy most useful. The most surprising insight was that some of the best product ideas seemed to include multiple strategies, which led to the recommendation to use the strategies as constituent ingredients rather than separate approaches.

In the **final chapter**, I summarize the findings of the studies and discuss some progressive insights that had not yet been addressed. First, the twelve product concepts discussed in chapters five and six are analyzed along the theoretical frameworks of chapter two and three, to see how well they match. Next, I address the issue of differences between certain types of negative emotions. Although the running assumption in this thesis was that every negative emotion form a rich experience in the same way, there are indeed important differences between certain types of negative emotions, such as social emotions, self-directed emotions, and culture-dependent emotions. The third point of discussion is whether the rich experience design approach has been successful in producing mainstream consumer products, as opposed to art and entertainment products. An analysis of the twelve product concepts reveals that some concepts have elements also found in art or games, but that the approach has overall succeeded in its ambition. The last sections discuss the ethical implications of evoking negative user emotions and two directions for further research: the accurate measurement of rich experiences and the possibility of dynamic product experiences.

SAMENVATTING

Ontwerpers creëren objecten, apparaten en diensten – kortom: producten - die mensen gebruiken om hun dagelijks leven beter of gemakkelijker te maken. Een bepaalde groep ontwerpers, die titels hebben als 'belevingsgericht ontwerper' of 'interactie-ontwerper', richt zich specifiek op het optimaliseren van de subjectieve beleving die gebruikers hebben met een product. Ze overwegen en integreren alle ontwerpbeslissingen die samen de totale gebruikersbeleving vormen, zoals wat het product kan doen (de functionaliteit), hoe het eruit ziet (de esthetiek), waar het de gebruiker aan doet denken (de culturele betekenis), hoe makkelijk het is om te gebruiken (de gebruiksvriendelijkheid), en wat voor impact het heeft op het leven van de gebruiker (de gebruiksconsequenties). Om grip te krijgen op de invloed van al deze aspecten op de productbeleving passen ontwerpers verschillende theorieën, 'ontwerptools' en gebruikerstesten toe. Deze theorieën, tools, en tests worden op hun beurt weer ontwikkeld door ontwerponderzoekers, die de tijd en middelen hebben om in de complexe verbanden tussen producten en menselijke beleving en gedrag te duiken.

Zulk soort onderzoekers zijn sinds het einde van de jaren 90 expliciet onderzoek gaan doen naar hoe producten gebruikersemoties opwekken, en hoe kennis van specifieke emoties zoals blijdschap, trots, frustratie en verdriet ontwerpers kan helpen om de productbeleving te verbeteren. In het algemeen wijst elke positieve of negatieve emotie op het slagen of falen van een aspect van het product. Vanuit die optiek lijkt het meest vanzelfsprekende doel voor een ontwerper om het aantal positieve emoties in de productbeleving te maximaliseren en het aantal negatieve emoties te minimaliseren.

Dat doel is echter gebaseerd op de aanname dat positieve emoties altijd gewenst zijn en negatieve emoties altijd ongewenst. Verder neemt het aan dat alle emotionele belevingen überhaupt eenduidig verdeeld kunnen worden tussen positief en negatief. Maar als we naar een paar voorbeelden van plezierige en betekenisvolle ervaringen kijken, zien we snel dat geen van beide aannames altijd geldig is. Dit is onmiskenbaar in voorbeelden van kunst en entertainment: mensen die een ritje maken in een achtbaan, een uitdagend computerspel spelen, of luisteren naar sombere muziek beleven respectievelijk angst, frustratie, en verdriet, maar zijn zich ook aan het vermaken. Bovendien genieten ze niet van deze activiteiten ondanks de negatieve emoties, maar dankzij: futloze achtbanen, moeiteloze spellen en onbewogen muziek zouden niet half zo bevredigend zijn. Er zijn ook een heel aantal levenservaringen die de moeite waard zijn mede omdat er negatieve emoties bij betrokken zijn, zoals het

beginnen van een nieuwe baan of het uitzwaaien van een emigrerende vriend. Zonder een spoor van angst dan wel verdriet zouden deze ervaringen lang niet hetzelfde gewicht dragen.

Dit soort plezierige en betekenisvolle belevingen noem ik in dit proefschrift 'rijke emotionele belevingen', of 'rijke belevingen' in het kort ('rich experiences' in het Engels). Hoewel dit soort belevingen alomtegenwoordig zijn in de wereld van kunst en entertainment, zijn ze nagenoeg afwezig in het domein van consumentenproducten. Het voornaamste doel van het onderzoek in dit proefschrift is om uit te vinden wat de aard en mogelijkheid van rijke belevingen is: Waaruit bestaat een rijke beleving? Wat voor soorten rijke belevingen zijn er? En bovenal: Hoe kunnen ontwerpers rijke belevingen oproepen met mainstream consumentenproducten?

Hoofdstuk twee verkent de eerste vraag door middel van een fenomenologische studie – een studie die de inhoud van subjectieve belevingen onderzoekt. Dit ging uit van het inzicht dat rijke belevingen altijd gekenmerkt worden door gemengde emoties – de gelijktijdige beleving van een positieve en negatieve emotie – maar dat niet alle gemengde emoties noodzakelijkerwijs tot een rijke beleving leiden. In andere woorden, rijke belevingen zijn een bepaalde deelverzameling van gemengde-emotie belevingen. Voor de studie hielden tien mensen een week lang een dagboek bij waarin ze een dertiental beschrijvingen gaven van recente belevingen van gemengde emoties. Over deze belevingen werden ze aan het eind van de week uitvoerig geïnterviewd. Een analyse van de 124 opgetekende belevingen wees uit dat er elf verschillende emotionele constructies aan ten grondslag gingen, waarvan er vijf als 'rijk' werden ervaren door de deelnemers. Twee constructies werden als rijk beleefd omdat de betrokken positieve en negatieve emoties veroorzaakt werden door dezelfde emotioneel ambigue stimulus, zoals in de beleving van een spannende start of een betekenisvol einde. De andere drie constructies waren rijk omdat de positieve emotie op een bepaalde manier een resultaat was van de negatieve emotie, zoals wanneer iemand zijn woede kan gebruiken om zijn ongenoegen beter te uiten.

In **hoofdstuk drie** wordt de rol van negatieve emoties in rijke belevingen nader bestudeerd. Waarom ondernemen mensen activiteiten waarin ze negatieve emoties beleven (zoals het oplossen van zeer moeilijke puzzels), als ze ook kunnen kiezen voor activiteiten waarin dat soort emoties niet voorkomen (zoals het oplossen van zeer makkelijke puzzels)? Ik bespreek drie theoretische verklaringen: De eerste stelt dat mensen de negatieve emoties voor lief nemen omdat ze iets willen bereiken met de activiteit; de tweede stelt voor dat mensen deze activiteiten alleen ondernemen vanwege het goede gevoel achteraf; de derde neemt aan dat mensen eigenlijk helemaal geen negatieve emoties beleven in dit soort activiteiten. Echter, omdat geen van deze theorieën in staat is om de meeste gevallen van rijke belevingen te verklaren, stel ik een alternatieve uitleg voor: Negatieve emoties hebben bepaalde fysiologische en mentale effecten op een persoon die op zichzelf een unieke beleving vormen en die de persoon in staat stellen om iets (beter) te doen. Angst maakt bijvoorbeeld dat je hart sneller gaat slaan, dat je waarneming nauwer wordt, dat je herinneringen krijgt van eerdere momenten dat je bang was, en dat de tijd langzamer lijkt te lopen. Een persoon kan vervolgens van deze effecten genieten als er een 'beschermend kader' om de beleving zit, wat betekent dat hij zich voldoende beschermd voelt

tegen de ongewenste gevolgen van hetgeen de negatieve emotie veroorzaakt. Bijvoorbeeld, mensen in een achtbaan ervaren dezelfde sensaties als iemand die in een spectaculair ongeluk zit, maar weten tegelijkertijd dat ze in werkelijkheid veilig zijn. Op dezelfde manier kan een filmkijker diep geraakt worden door het noodlot van een personage, maar tegelijk van deze gevoelens genieten omdat ze weet dat ze niet gericht zijn op een echt persoon. In de rest van het hoofdstuk wordt dit model gebruikt om de rijke belevingen van zes producten te analyseren: een motorfiets, pittig eten, een terugtellende klok, een slechtwerkende printer, een serie naar microben gemodelleerde knuffelbeesten en het glazen balkon van de Willis toren in Chicago.

Hoewel het model stelt dat alle vormen van rijke beleving hetzelfde mechanisme volgen, toont de vergelijking tussen de persoon in de achtbaan en de meelevende filmkijker aan dat de uiteindelijke beleving nogal kan verschillen. Dit verschil is belangrijk voor ontwerpers die uiteindelijk moeten kiezen welke gebruikersbeleving het meest geschikt is voor het door hen ontworpen product. Een logische en pragmatische manier om rijke belevingen te onderscheiden is op basis van de onderliggende negatieve emoties. Hoe specifieker ontwerpers in staat zijn om deze emoties te onderscheiden, des te beter kunnen ze de best passende beleving vinden en in hun product ontwerpen. **Hoofdstuk vier** beschrijft een typologische studie die resulteerde in een database van 36 verschillende negatieve emoties. Het doel van deze database is om zowel het analytische begrip als de intuïtieve bekendheid met deze emoties te vergroten, gebaseerd op het inzicht dat ontwerpers zowel rede als intuïtie gebruiken in het ontwerpproces. Allereerst werden verscheidene literatuurbronnen gebruikt om de verzameling van 36 emoties samen te stellen en bondige definities voor elke emotie te formuleren. Vervolgens werden er korte strips gecreëerd en filmclips verzameld om elke emotie in een verhalende vorm te representeren. De definities zijn gevalideerd door emotie-experts; de filmclips door gewone mensen. Verder werden er teksten geschreven die de verschillende emoties beschrijven en met elkaar vergelijken. Als laatste werden al deze elementen samengevoegd in een vrijelijk toegankelijke online database (www.emotiontypology.com).

Nadat hoofdstuk twee had onderzocht wat rijke belevingen zijn, hoofdstuk drie had vastgesteld hoe ze ontstaan, en hoofdstuk vier in de diversiteit van de onderliggende negatieve emoties was gedoken, stelt **hoofdstuk vijf** eindelijk voor hoe ontwerpers rijke productbelevingen kunnen bewerkstelligen. Dit werkt volgens een driestappenaanpak. Als eerste kiest de ontwerper een negatieve emotie, gebaseerd op de specifieke beleving die hij wil oproepen, of gebaseerd op de mentale effecten die hij door het product op de gebruiker wil hebben. Ten tweede vindt de ontwerper een manier om die negatieve emotie op te wekken in de mens-product interactie: de 'stimulus'. Ten derde zorgt hij dat er een 'beschermend kader' om de beleving heen zit, wat betekent dat de gebruiker niet blootgesteld is aan de nadelige gevolgen van de stimulus. Er worden vier mogelijke beschermende kaders voorgesteld voor deze stap: De gebruiker is fysiek gescheiden van de stimulus (b.v. een leeuw in een kooi), de stimulus is alleen een weergave (b.v. een filmpje van een leeuw), de gebruiker heeft voldoende controle over de stimulus (b.v. een leeuw aan een riem), of de gebruiker kan de negatieve emotie accepteren door het te verbinden aan een bepaalde deugd (b.v. een leeuw benaderen als deel van een moedige

uitdaging). Ontwerpers kunnen deze driestappenaanpak gebruiken om een rijke beleving voor elk mogelijk product te creëren en, in principe, uitgaande van elke mogelijke negatieve emotie. Om ze echter op weg te helpen werden er tien 'rijke belevingskwaliteiten' ontwikkeld die de drie stappen alvast beschrijven voor een bepaalde negatieve emotie: welke effecten de emotie heeft, hoe de emotie opgewekt kan worden, en welke beschermende kaders toegepast kunnen worden. Deze tien belevingskwaliteiten worden uitgebreid beschreven met culturele voorbeelden en productvoorbeelden. Het hoofdstuk eindigt met een uiteenzetting van zes ontwerpprojecten die gebruik hebben gemaakt van de rijke beleving-aanpak.

De rijke beleving-aanpak is toegepast in een project met een professionele ontwerper en in drie projecten met in totaal 59 ontwerpstudenten. **Hoofdstuk zes** beschrijft deze projecten en de inzichten die zijn opgedaan door te reflecteren op de ontwerpprocessen. In elk project genereerde de ontwerpers eerst hun eigen rijke belevingskwaliteiten met de driestappenaanpak van hoofdstuk vijf. Dit proces bleek nuttig en voegde vijftien nieuwe kwaliteiten toe aan de bestaande verzameling. De ontwerpers gingen vervolgens rijke belevingsproducten ontwerpen. Onder de resultaten waren een spaarvarken, een douchemat en een apparaat dat de werktijd bijhoudt. Een reflectie op de ontwerpprocessen toonden onder meer het belang aan van een nauw verband tussen de productbeleving en de productfunctionaliteit. Een andere observatie was het verschil tussen twee soorten ontwerpers in de projecten, die verschillende soorten informatie en begeleiding nodig hadden in het toepassen van de aanpak. De laatste bevinding was dat de aanpak meer hulp zou moeten bieden aan de ontwerpers in de materialisatiefase van het ontwerpproces.

In **hoofdstuk zeven** wordt uitgebreider gekeken naar de kenmerken van de rijke belevingsaanpak om een product te ontwikkelen van eerste idee tot prototype. Het hoofdstuk beschrijft een ontwerpproject dat is uitgevoerd door de onderzoeker zelf. Het verschil met de projecten in hoofdstuk zes is dat dit ontwerp volledig is geprototyped en getest met gebruikers, en dat het ontwikkelingsproces grondig gedocumenteerd werd. Het ontworpen product, genaamd 'Ren voor je leven', is een apparaatje dat door hardlopers gedragen wordt, hun voortgang bijhoudt, en doelbewust angstgevoelens opwekt om de lopers te motiveren sneller en vaker te rennen. Door middel van visuele, auditieve en tactiele feedback krijgt de hardloper de indruk dat hij door iets achterna wordt gezeten. Er werd een aanpasbaar prototype gebouwd dat een aantal verschillende scenario's en feedback programma's kon draaien. Elf amateurhardlopers liepen die bij elkaar 26 rondjes met het prototype, waarna ze over hun ervaringen werden geïnterviewd. Gebaseerd op de resultaten werd het prototype steeds tussen de sessies door geoptimaliseerd. Dit proces resulteerde in een aantal inzichten over zowel het ontwerpproces van dit product in het bijzonder, als over de ontwikkeling van rijke belevingsproducten in het algemeen. Een van de voornaamste inzichten was dat er ruwweg drie manieren zijn om (angst) emoties op te wekken in de interactie met het product: door genetisch vastgelegde stimuli (b.v. harde knallen), door associatie (b.v. gemeen blaffende honden) en door zogenaamde 'taxatiecomponenten' (b.v. de voorspelbaarheid van de achtervolger). Verder toonde de studie aan dat de effecten van verschillende aspecten van het ontwerp op de gebruikersbeleving (b.v. de effecten van het geluid, de

beelden en het gedrag van de achtervolger) alleen beschreven en voorspeld konden worden in relatie tot elkaar. In het hoofdstuk wordt een manier beschreven om deze verbanden expliciet te maken. Het derde inzicht was dat de effectiviteit van het product voor een groot deel afhangt van de stijl van hardlopen en voorkeuren van de deelnemers. Drie deelnemers vonden dat het product niet bij hun stijl van hardlopen paste. Drie andere respondenten die er op waren gericht hun renprestatie te verbeteren waren vooral blij dat het product hen daarbij kon helpen. De laatste vier respondenten wilden met name hun renplezier vergroten en vonden dat dat het prototype goed werkte om het hardlopen opwindender te maken.

De rijke belevingsaanpak is door de verschillende studies heen vooral effectief gebleken in het verbeteren van saaie of ongeïnspireerde situaties – met andere woorden, situaties zonder veel emotie. Een aanvullende toepassing is echter om de aanpak te gebruiken voor situaties waarin er al een negatieve emotie aanwezig is, die ongewenst is en niet gemakkelijk 'wegontworpen' kan worden. Bijvoorbeeld, stel dat een ontwerper de taak krijgt om een autoproduct te ontwerpen dat iets doet om files minder onplezierig voor de bestuurder te maken. Het spreekt vanzelf dat ze het fileprobleem niet kan oplossen binnen dit project. Wat kan ze dan wel doen? In **hoofdstuk acht** worden drie ontwerpstrategiën voorgesteld en onderzocht die ieder als doel hebben om gebruikerssituaties met dit soort ongewenste en onoplosbare negatieve stimuli te verbeteren. De eerste strategie richt zich erop iets nuttigs of betekenisvols te doen met de gedragseffecten van de negatieve emotie. De tweede strategie poogt een 'emotionele bliksemafleider' te creëren door het toevoegen van een stimulus die dezelfde emotie oproept als de al aanwezige, maar dan op een plezierige manier. De derde strategie probeert de manier waarop de gebruiker de negatieve emotie beleefd te veranderen, door er een relevant deugd aan te koppelen, zoals moed of solidariteit. De drie strategieën waren getest in twee workshops van een dag met in totaal 24 ontwerpers. De deelnemers aan de workshop kregen één uit vier ontwerpopdrachten, elk met een andere negatieve emotie, en gebruikte de drie ontwerpstrategieën achter elkaar om productideeën te genereren. Dit resulteerde in een groot aantal productconcepten, waarvan er veel effectief, origineel en haalbaar bleken. Hoewel de ontwerpers voor alle drie de strategieën interessante ideeën wisten te bedenken, vonden ze de eerste en derde het meest bruikbaar. Het meest verrassende inzicht was dat sommige van de beste productideeën meerdere strategieën leken te bevatten, wat tot de aanbeveling leidde om de strategieën als elkaar aanvullende ingrediënten te gaan gebruiken in plaats van als afzonderlijke aanpakken.

In het **laatste hoofdstuk** vat ik de bevindingen van de studies samen en bespreek ik een aantal voortschrijdende inzichten die niet eerder behandeld waren. Als eerste worden de twaalf productvoorbeelden uit hoofdstuk vijf en zes geanalyseerd aan de hand van de theoretische modellen in hoofdstuk twee en drie, om te zien hoe goed ze overeenkomen. Vervolgens bespreek ik de kwestie van verschillen tussen bepaalde soorten negatieve emoties. Hoewel de doorlopende aanname in dit proefschrift was dat elke negatieve emotie op dezelfde manier een rijke beleving vormt, zijn er wel degelijk belangrijke verschillen tussen soorten negatieve emoties, zoals sociale emoties, zelfgerichte emoties en cultuurafhankelijke emoties. Het derde discussiepunt is of de rijke belevingsaanpak

geslaagd is in het produceren van mainstream consumentenproducten, in tegenstelling tot kunst- of entertainmentproducten. Een analyse van de twaalf productconcepten wijst uit dat hoewel sommige concepten elementen hebben die overeenkomsten vertonen met kunst en spellen, de aanpak in het algemeen is geslaagd in zijn ambitie. Het laatste deel van het hoofdstuk bespreekt de ethische implicaties van het opwekken van negatieve gebruikersemoties en twee richtingen voor vervolgonderzoek: het accuraat meten van rijke beleving en de mogelijkheid van dynamische productbelevingen

APPENDICES

A. Sources used for emotion word collection

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B. Additional sources to support emotion clustering and definition formulation

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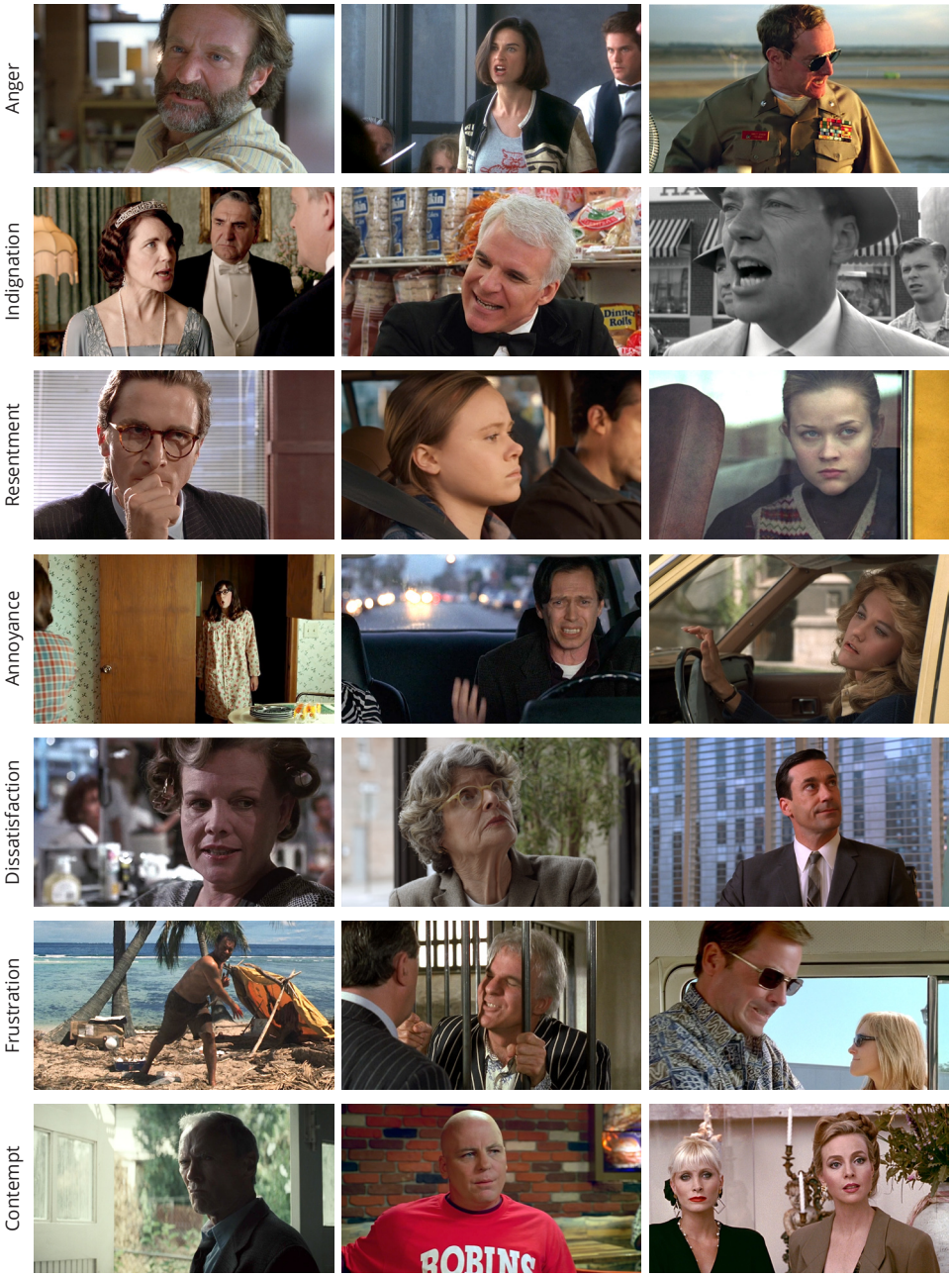
C. Three examples of cognitive scenarios

Anxiety
X felt something because X thought something
sometimes a person thinks for some time:
I don't know what will happen
maybe something bad will happen to me
I don't want this to happen
I want to do something because of this if I can
I can't do anything now
When this person thinks this this person feels something bad
X felt something like this because X thought something like this

Hate
X felt something because X thought something
sometimes a person thinks about someone else:
This person did some very bad things
This person can do some more very bad things
I cannot not think this person is very bad
I want to do something bad to this person
I cannot do anything now
When this person thinks this this person feels something bad
X felt something like this because X thought something like this

Disappointment
X felt something because X thought something
sometimes a person thinks:
I thought that something good would happen
I felt something good because of this
I know now: this good thing will not happen
When this person thinks this this person feels something bad
X felt something like this because X thought something like this

D. Still images from the 108 movie clips for 36 negative emotions




Hate
Disgust
Boredom
Reluctance
Sadness
Disappointment
Pity
Loneliness


Rejection
Humiliation
Longing
Envy
Jealousy
Guilt
Regret
Shame


Embarrassment
Fear
Startle
Worry
Anxiety
Distrust
Insecurity
Doubt


Nervousness
Distress
Desperation
Confusion
Shock

E. The comic strips for the 36 negative emotions in the order of the story

0

1

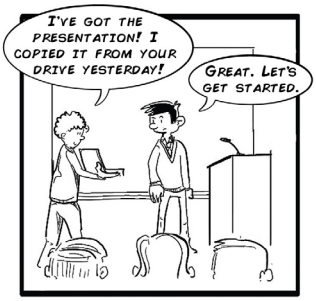
CONFUSION

2

NERVOUSNESS

3

DISTRESS



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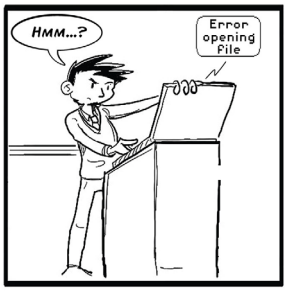
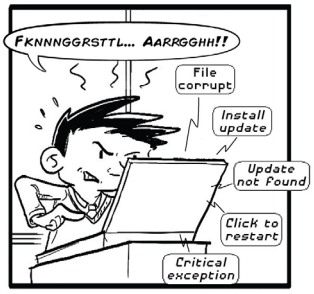




FRUSTRATION

5

EMBARRASSMENT

6

DESPERATION

7

RESENTMENT

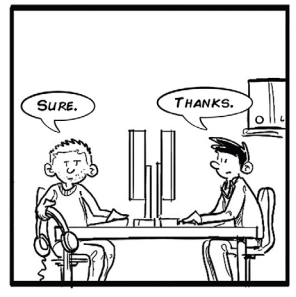
8

DISTRUST

9

RELUCTANCE

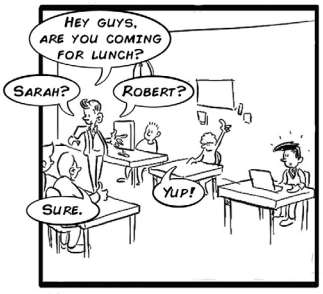
10



ANNOYANCE

11

LONGING



12

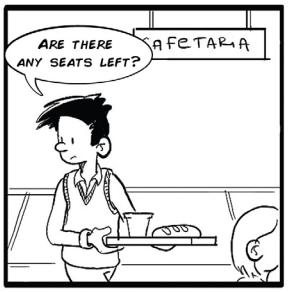
REJECTION

13

DISGUST

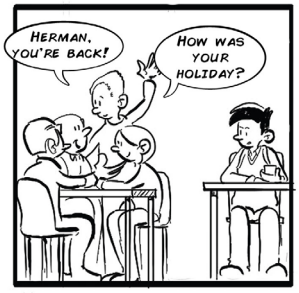
14

DISSATISFACTION



15

GUILT



16

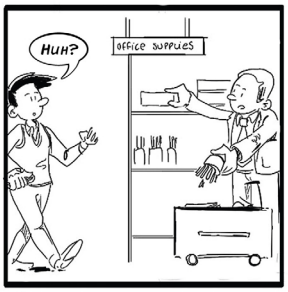
LONELINESS

17

ENVY

19

BOREDOM



21

INDIGNATION

22

HUMILIATION

23

INSECURITY

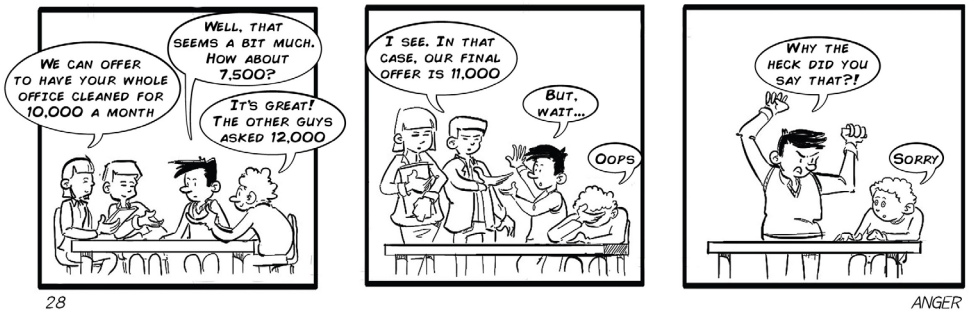
24

DISAPPOINTMENT

25 CONTEMPT

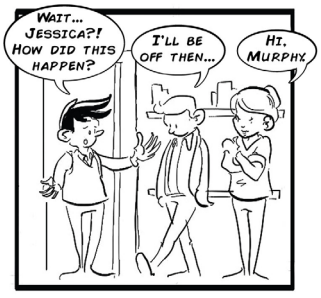
26 SHAME

27 FEAR

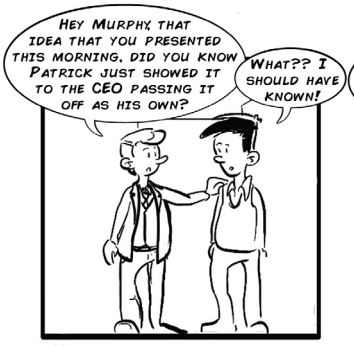


28 ANGER

30



JEALOUSY



31

HATE

32

ANXIETY

33

SHOCKED

34

AFRAID

35

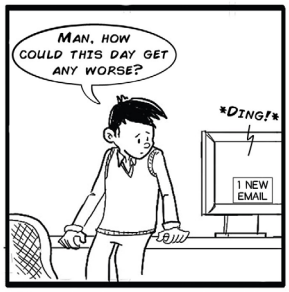
PITY

36

DOUBT

37

REGRET



38

SADNESS

39

WORRY

40

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Pieter, you have had such an enormous influence on my thinking and doing over the past seven years that it is hard know where to start. Since the beginning of the project you were deeply involved in the subject matter and approach, yet you generously entrusted me with all the freedom I could handle to bring it to life. The many profound, epiphanic, and hilarious conversations we have had over the years have been a highlight of my time as a PhD student. I can easily say that spending this time with you have made me a better researcher, thinker, designer – and a better person.

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In 2011, we founded the Delft Institute of Positive Design to initiate and stimulate research on the design for human happiness. Over the years, this institute has grown into a like-minded research group with an impressive state of record. Pieter, Anna, Deger, Jay, Mafalda, Boudewijn, Lavender, Irene, and Beatrijs, I'm delighted that we have built this institute together.

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Finally, I would like to dedicate this thesis to my late grandfather Pim, who had had a significant influence on my life and decision to pursue an academic path. From when we very young, he shared with my brother and me his love for traveling, knowledge and science, by bringing us along on trips and to museums, and taking the time to discuss anything worth reflecting on. His presence resonates after all these years.

LIST OF AUTHOR'S PUBLICATIONS

Publications as first author

Fokkinga, S.F., Desmet, P.M.A. (2014). Reversal Theory from a Design Perspective. *Journal of Motivation, Emotion, and Personality, 2*(2), 12-26.

Fokkinga, S. F., & Desmet, P. M. A. (2014). Run for your life! Using emotion theory in designing for concrete product interactions. In J. Salamanca, P. M. A. Desmet, A. Burbano, G. D. S. Ludden, & J. Maya (Eds.), *9th International conference on Design and Emotion: The colors of care* (pp. 384-393). Bogota: Ediciones Uniandes.

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Guest editorship

Guest editor for the Special issue of the Journal of Motivation, Emotion, and Personality, 2(2), Design & Reversal theory.

Publications as secondary author

Desmet, P.M.A., Fokkinga, S.F. (in press). Design by Emotion: Current emotion research in the design discipline. *Emotion Review*.

Van Midwoud, F.A., Huijgen, R.G., Scarpellini, I., Fokkinga, S.F. (2014). Carousel of feelings: Reversal theory as a design tool. *Journal of Motivation, Emotion, and Personality*, 2(2), 56-70.

Grimaldi, S., Fokkinga, S.F., Ocnarescu, I. (2013). Narratives in Design: A Study of the Types, Applications and Functions of Narratives in Design Practice. *Proceedings of the Designing Pleasurable Products and Interfaces Conference 2013*, 3-5 September 2013 in Newcastle, UK.

Ozkaramanli, D., Fokkinga, S.F., Desmet P.M.A, Balkan, E., George, E. (2013). Recreating AlaTurca: Consumer goal conflicts as a creative driver for innovation. *Proceedings of Qualitative 2013*, 17-19 November in Valencia, Spain. ESOMAR.

ABOUT THE AUTHOR

Steven Fokkinga was born in 1983 in Baarn, The Netherlands. After finishing his secondary school education at the Molenplein in Den Helder, he pursued a Bachelor's in Industrial Design Engineering and a Master's in Design for Interaction, both at the Delft University of Technology. In 2009, he graduated cum laude on a project about rich product experiences at Philips Research in Eindhoven.

This project sparked his interest for research at the intersection of technology and psychology, which he was able to further develop in his PhD project at Delft University. He investigated how designers can deliberately evoke negative user emotions to make product experiences more engaging and meaningful. Over the course of his PhD project, he published a number of papers in leading design journals, such as Design Issues and The International Journal of Design. In 2012 he was awarded the best paper award at the International Conference on Design & Emotion in London. London was also where he spent eight months as a visiting researcher at Central Saint Martins.

During his project, Steven had the objective to increase collaboration between researchers in the fields of human-centered design and psychology. To this end, he acted as guest editor to a special issue in the Journal of Motivation, Emotion, and Personality, and presented at the 2015 conference of the International Society for Research on Emotion – both in collaboration with Pieter Desmet.

In 2011, Pieter and Steven founded the Delft Institute of Positive Design (DIoPD), an academic institute that investigates the role products can play in advancing people's subjective well-being. The institute has since hosted several research projects and a few dozen students who have pursued the design for human happiness.

In the same year, Steven co-founded a design research agency specialized in consulting companies on product innovation projects and emotion-driven research methodologies. This agency, which was branded Emotion Studio in 2015, has run consultancy projects for a wide range of companies, including Pepsico, Unilever, Mondelez, and Lego. In 2011, the agency was asked to present a vision on the news of the future to the main Dutch news broadcaster NOS, which was an important inspiration for a complete redesign of their news programs.

Steven is an avid filmmaker and photographer. During his studies, he taught film at the university cultural center, produced a web series about student life and directed numerous short company movies.