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Measuring Emotions in Marketing and Consumer Behavior.

Is Face Reader an applicable tool?

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Abstract

This thesis investigates the topic of measuring emotions in marketing and consumer research. An overview of existing implicit and explicit methods of measuring emotions is presented in the thesis, followed by a literature review of methods used in empirical research during the last decade. The last part of the thesis focuses on automatic facial expression analysis as a tool for measuring emotional responses. A pilot study conducted by the Center of Service Innovations in the Norwegian School of Economics is presented in the thesis and illustrates the possibility of using FaceReader software to measure emotions in consumer research.

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Introduction

For many decades, emotions have been an important research topic within various academic disciplines, ranging from psychology, neuroscience and endocrinology to medicine, history and sociology. In marketing and consumer behavior, emotions represent an important research topic as they convey valuable information about consumers. Existing studies show that emotions can affect consumers' behavior in various ways. For example, emotions can influence customer satisfaction (Oliver & Westbrook, 1993) and customer loyalty (Yu & Dean, 2001). Moreover, emotions can predict customers' judgments (Schoefer, 2008), decision-making (Angie, Connelly, Waples, & Kligyte, 2011), and overall evaluation of products or services (Kim & Gupta, 2012). Empirical studies exploring the role of emotions in marketing employ different methods to measure emotions. One of the challenges associated with the research on emotions is to find an efficient way to measure them. Numerous factors contribute to the complexity of measuring emotions, such as the mixed nature of emotions, the difficulty of recalling emotions experienced in the past, and social desirability bias – the human tendency to answer questions in a manner viewed favorably by others.

In this thesis, I will focus on methods used to measure emotions in consumer research. I will conduct a literature overview of how emotions have been measured in empirical studies published in major marketing journals during the last decade. Moreover, an empirical study employing FaceReader software by Noldus will be presented as part of this work. The aim of this study is to test whether FaceReader is an appropriate tool to measure consumer emotions. Specifically, the study will test whether emotions can predict moral judgments of companies' ethical behavior. We will employ both facial expression analysis and self-report methods to measure emotions.

The following research questions were formulated to address the purposes of the study:

RQ1: *What methods to measure emotions are available within the area of consumer research?*

RQ2: *How have emotions been measured in recent research works?*

RQ3: *Is FaceReader an appropriate tool for measuring emotional responses in consumer behavior research?*

This thesis will be divided into three chapters. The first chapter provides background information on the concept of emotions. In this chapter, I present definitions of emotions and major theoretical

concepts. This will be followed by a description of the concept of emotions particularly within the contexts of marketing and consumer behavior. At the last part of this chapter, I will present a brief overview of some findings on the role of emotions within the aforementioned disciplines. I will focus specifically on the studies exploring the roles of emotions in marketing and decision-making.

The second chapter of the thesis will focus on the different approaches to measuring emotions. Explicit and implicit methods to measure emotions, as well as advantages and challenges associated with such methods will be presented in this part. Moreover, I will describe various measurement tools available within each of the broad categories of explicit and implicit methods to measure emotions. An overview of recent works in which various approaches to measure emotions were employed will conclude this part of the paper.

The third chapter of the work will focus on analysis of facial expressions as an approach to measure emotions. An empirical study in which emotional responses were measured by the employment of the FaceReader software by Noldus will be presented in this chapter. Empirical study was conducted by the Center of Service Innovations (CSI). I have been part of this project through my work with the master thesis.

Three main chapters of the paper will be followed by the general discussion of findings, limitations of the study and suggestions for the further research.

Chapter 1. Emotions - what is it?

Emotions represent an important topic within various research areas. Initially, emotions were studied mainly by psychologist, however, emotions are now an area of research interest in other disciplines including consumer behavior research and marketing (Huang, 2001).

Historically, many scholars considered emotions to be an emergency mechanism linked to the adaptive function of human beings. Here we can turn back to the works of Darwin who more than hundred years ago suggested that emotions evolved due to their adaptive value for human beings. According to Darwin, fear, for example, evolved because it helps people to act in ways that increase the chances of survival, as it serves as a signal of potential dangers in the environment (Darwin, 1859). Thus, many psychological theories focus primarily on negative emotions because they are the ones that serve as emergency signals for humans and are the most important for survival. More recently, marketing research has extended studies to other forms of emotional responses (usually more implicit). Different concepts and models of emotions were introduced with the development of the research on the topic of emotions (Huang, 2001).

This chapter gives an overview of the basic concept of emotions followed by an outline of the role of emotions in marketing and consumer behavior.

1.1 The basics of the concept of emotions

Main concepts and definition of emotions

Numerous attempts to define emotions have been made over time. According to a framework proposed by Ortony, Clore and Collins (1988), an "*emotion is a valenced affective reaction to perceptions of situations*" (p. 191). This definition excludes descriptors that refer to non-valenced cognitions (such as interest and surprise), bodily states (such as sleepy or droopy) and subjective evaluations of people (such as self-confident). According to another popular definition*, "emotion is a full-blown, conscious state that includes an evaluative reaction to the event"* (Baumeister & Bushman, 2014, p. 191). Thus, emotion is a reaction to something (to the stimuli), and the person who experiences emotion is aware of it.

A number of researches consider emotions as a component process. That means they are trying to enhance the understanding of the nature of emotions by studying different components that constitute emotions separately. In his component process model, Scherer defined emotions as "*an episode of interrelated, synchronized changes in the states of all or most of the five organismic subsystems in response to the valuation of an external or internal stimulus event as relevant to major concerns of the organism*" (2005, p. 697). According to this model, components of an emotion are the restrictive states of the corresponding subsystems. The process represents coordinated changes taking place over time. In this model, components include cognitive component or appraisal; neurophysiological component or bodily symptoms; motivational component or action tendencies; motor expression component or facial and vocal expression; subjective feeling component or emotional experience. Here it is important to note that feeling, sometimes used as a synonym for emotion, factually presents just one out of five emotion components and thus such equating the two terms can provoke certain confusion and hamper the understanding of the phenomenon of emotions.

According to the component model, emotions are elicited by stimulus events. Stimulus event can be either external (thunderstorm, behavior of others, etc.) or internal (memories, images occurring in mind, neuroendocrine changes, etc.). In order to cause emotional reaction, the stimulus event needs to be relevant to major concerns of the organism (be appraisal driven) (Scherer, 2005). The simple illustration of this note is that people typically have emotional reactions only on the events that they care about for various reasons.

To understand the concept of emotions it is important to differentiate between emotions and various other related phenomena such as for example moods and affects. While an emotion is a conscious evaluative reaction to some event, mood is a feeling state that is not clearly linked to some event. Affect in its turn can be defined as an automatic response that something is good or bad (Baumeister & Bushman, 2014).

We cannot only differentiate between emotions and other types of related phenomena, but also between different types of emotions such as utilitarian and aesthetic emotions (Scherer, 2005). Utilitarian emotions include for example anger, fear, joy, disgust, and shame. These emotions facilitate our adaptation to events happening around us. In certain cases, utilitarian emotions are high-intensity emergency reactions, which have important role in the survival function of human beings.

Esthetic emotions lack utilitarian consideration (Scherer, 2005). An example of an aesthetic experience is one caused by work of visual art or music. Emotions elicited by such experiences are not linked to our survival function or bodily needs, but rather shaped by the appreciation of the intrinsic qualities of an art work or performance. Appendix 1 summarizes some of the important differences between various types of affective phenomena as well as between aesthetic and utilitarian emotions.

Basic emotions

Some scholars attempt to order the universe of emotions by identifying a set of basic emotions. Basic emotions are typically considered to be biologically based and universally experienced (Richins, 1997). Among the literature on the basic emotions, fundamental works conducted by Plutchik (1980) and Izard (1977) should be mentioned. According to Plutchik, 'primary' emotions include fear, anger, joy, sadness, acceptance, disgust, expectancy and surprise. Izard, in his work, identified sets of emotions that are universally associated with distinctive facial expressions. Izard identifies 10 fundamental emotions; interest, enjoyment, surprise, distress (sadness), anger, disgust, contempt, fear, shame/shyness, and guilt. According to both Plutchik and Izard, more complex emotions represent a mixture of the 'basic emotions'.

Prominent work on basic emotions was conducted by Ekman (1992). He did not only make a distinction between basic emotions, but also linked them to specific facial expressions and provided detail descriptions of how facial expressions could be analyzed in order to measure emotions. Ekman distinguishes between six basic emotions; anger, happiness, surprise, disgust, sadness, and fear (Ekman P., 1999). Moreover, in his work, Ekman also pointed so-called 'candidate basic emotions' which include contempt, shame, guilt, embarrassment, awe, amusement, excitement, pride in achievement, relief, satisfaction, sensory pleasure, and enjoyment (Ekman P., 1999). A number of researches questioned the criteria for the distinction of basic emotions, and the list of basic emotion itself. For instance, Sabini and Silver (2005) in their work elaborated on the question of why love and jealousy were not considered by Ekman as being basic emotions.

One other essential contribution made by Ekman is his findings of the universal (rather than cultural) nature of emotions and facial expressions. Before his work it was generally believed that

facial expressions and corresponding emotions are primarily defined by the cultural background (Ekman, 1999).

One of the major criticisms of the concept of basic emotions was presented by Ortony and Turner (1990). They came to the conclusion that "*there is no coherent nontrivial notion of basic emotions as the elementary psychological primitives in terms of which other emotions can be explained*" (Ortony & Turner, 1990, p. 315). Later, this critic was addressed by Ekman in his works. Ekman mentioned that Ortony and Turner's reviews are flawed, and that their alternative theoretical explanations do not fit the evidence. Moreover, Ekman provided some more recent evidences based on the studies of facial behavior, which support the theory of basic emotions (Ekman P., 1992).

Conscious emotions vs automatic affect

With various definitions and approaches to emotions, it is important to make a distinction between conscious emotion and automatic affect. Conscious emotion is a powerful single feeling state. Automatic affect is a response of liking or disliking towards something. Automatic affect can occur unconsciously in the first microseconds of thoughts (Baumeister & Bushman, 2014). Researchers suggest that as soon as we know what something is, we start either liking or disliking it. Thus, affective reaction happens even towards things or events that a person has never encountered before (Baumeister & Bushman, 2014).

The nature and role of affect in consumer behavior was studied by various scholars including Cohen, Pham & Andrade (2007), who suggests that affective states can actually shape consumers' responses from the more basic (perceptual) to the highest (decision making) cognitive levels.

Dual-process theory of emotion regulation

One of the important concepts within the research on emotions is so-called emotion regulation. This topic is important for understanding the role of emotions in consumers' judgment and decision-making processes. Emotion regulation is a "*goal directed process functioning to influence the intensity, duration and type of emotion experienced*" (Gyurak, Gross, & Etkin, 2011, p. 401). Emotion regulation allows differentiation in emotional responses depending on one's momentary or one's long-term goals. An important distinction in the research on emotions is made between

explicit (or effortful) and implicit (or automatic) forms of emotion regulation. The dual-process framework integrates these two forms of emotion regulation (Gyurak, Gross, & Etkin, 2011).

Explicit emotion regulation requires conscious effort for initiation and monitoring after the initiation. Thus, generally, explicit emotion regulation is associated with at least a certain level of awareness. Implicit regulation, on the other hand, is evoked automatically by the stimulus and is executed without monitoring and awareness. Emotion regulatory challenges may force people to adjust initial implicit reactions by the explicit regulation of the emotions (for instance in cases when person faces an ethical dilemma). It is important to note that explicit and implicit regulations are not mutually exclusive; the process typically varies over time and depends on situational context. A number of studies have focused on emotional conflicts that occur when the explicit regulation has to "overcome" the initial implicit one. Congruency effect (slowdown in response time) normally occurs as a result of emotional conflict (Gyurak, Gross, & Etkin, 2011). Practice or continuous repetition of certain stimulus may lead to the formation of a habit in which explicit regulatory process is becoming more implicit (Tran, Siemer, & Joormann, 2011).

Usually research adopts two generic terms; System 1 and System 2, to refer to two cognitive systems. The systems are used as labels for a set of processes, which are possible to distinguish between by factors like speed, controllability, and the operational context (Khnerman & Frederic, 2001) . The differences between the systems are summed up in the table below.

System 1 (intuitive)	System 2 (Reflective)
Process characteristics	
Automatic; Effortless; Associative; Rapid; Skilled action	Controlled; Effortful; Deductive; Slow; Self-aware; Rule application
Content on which processes act	
Affective; Casual propensities; Concrete; Prototypes	Neutral; Statistics; Abstract; Sets

Table 1.1.1 Two cognitive systems (Khnerman & Frederic, 2001, p. 3)

From the perspective of the dual system errors of intuitive judgment can occur when the error created by System 1 are not detected or corrected by System 2. The dual process model is important for understanding judgment and decision-making processes, and it is used by some authors as a reason to doubt the causal importance of reason in the moral judgments (Haidt, 2001). Haidt (2001) proposes a social intuitionist model by categorizing moral judgments as resulting from automatic evaluation or intuition. According to this model, moral reasoning is typically a post hoc construction

generated after the judgment has been made. In other words, the social intuitionist model suggests that people tend to make moral judgments based on intuitive feelings. After the judgment has been made, the person creates a plausible, reasonable or logical explanation for the judgment. Thus, this model emphasizes the role of affect and work of the System 1 (intuitive system) in the decision-making process. This model is a response to the rationalists model, in which System 2 (reflective system) is responsible for the decision making process (Haidt, 2001). In any case, affect and emotional regulation are important for understanding the role of emotions in consumers' judgment and decision-making processes.

As suggested by the dual-process model, emotions represent an important part of judgment and decision-making processes. For this reason, emotions are of research interest in disciplines such as marketing and consumer behavior research. In the next section, I will elaborate on the role of emotions in consumer behavior. Specifically, I will focus on the role of emotions in consumers' decision-making and will present some of the important findings in this topic.

1.2 Do emotions predict (affect) consumers' decisions?

Emotions represent an important topic in marketing and consumer research. Research shows that emotions can predict consumer's behavior in different areas (Mogilner, Aaker, & Kamvar, 2012; Kim, & Park, 2010; Labroo & Ramanathan, 2007; Shiv & Fedorikhin, 1999). In this part of the chapter, the features of the approach to emotions in marketing will be presented. Further, some of the main findings on the importance of emotions in marketing and consumers' decision-making process will be presented.

Emotions in psychology vs emotions in marketing

A lot of effort has been devoted to investigating the role of emotions in marketing (Shiv & Fedorikhin, 1999; Yu & Dean, 2001; Zhang, Cheung and Lee, 2014). To assess the role of emotions in consumer behavior, many researches have borrowed theories from the area of psychology. In his work, Huang (2001) pointed out three main differences between concepts of emotions in psychology and marketing.

- *Range of emotions*.

Whereas psychological studies characterize emotions either via dimensions (dimensional view) or via identifying primary emotions (discrete view), Huang (2001) claims that *"the range of emotions that can be experienced in marketing depends on whether emotions are treated as the properties of consumers or of a marketing context"* (p. 244). The idea is that context of consumption can cause a wide range of emotions. By comparison, psychological studies normally focus on narrower range of emotions (Huang, 2001). Thus, psychology and marketing approaches identify different ranges of experienced emotions.

- *Intensity of emotions*.

Psychologists view on emotions accentuates the emotions personal relevance and survival value (Darwin, 1859). Hence, extreme and primary emotions are most likely to be identified (Huang, 2001). Due to the fact that marketing context is less intimate, more mild and mixed emotions are likely to be experienced (Huang, 2001).

- *Positive/negative emotions*.

According to the approach used in psychological literature, positive and negative emotions do not co-exist (though they can interact and/or relate). In marketing, "*the presence of positive emotions does not imply or preclude the absence of negative emotions*" (Huang, 2001, p. 244). Moreover, aimed at studying dysfunctional and adaptive behavior, psychological studies are often focused on negative emotions (with only two out of ten basic emotions proposed by Izard (1977) being clearly positive). Therefore, psychological studies can sometimes overlook subtle positive emotions that are important for marketing purposes (Aaker, Stayman, & Vezina, 1988).

Thus, one can see quite significant differences in the approaches to emotions in marketing and psychology. Therefore, psychology theories on emotions are often adapted to the needs of marketing and consumer behavior research. Moreover, there are several features of the concept of emotions in marketing that should be taken into account. These will be discussed in the next section.

The study of emotions in marketing and consumer behavior

In marketing research it is important to distinguish between emotions induced by advertising and those that occur during consumption. Consumption emotions can be defined as subjective feeling states that occur when a consumer is considering buying or using a product (Ruth, Brunel, & Otnes, 2002). Richins (1997) suggests that as emotions elicited by advertising are vicarious rather than directly experienced, and are likely to be of lower intensity compared to the emotions elicited by consumption. This assumption is validated by several studies including Aaker, Stayman and Vezina (1988) who explicitly recognized the low intensity of emotions generated by advertising. Moreover, some researchers propose that whereas advertising executions are capable of representing and eliciting the entire range of feelings available to consumers, the range of emotions elicited by consumption is probably more restricted (Richins, 1997).

Two prominent streams of research aim at understanding consumption emotions:

- Research focusing on the investigation of isolated emotions (for example Ruth and Faber (1996) investigated the emotion of guilt in response to advertising)
- Research aimed to examine the effects of multiply emotions (as many consumption experiences are associated with mixed emotions or ambivalence)

The challenge of researching consumption emotions is that emotions often occur in a complicated context, where several emotions can be experienced by consumers at the same time (Ruth, Brunel, & Otnes, 2002). Thus, the ability to distinguish between emotions, and to see how emotions co-exist, is important for marketing purposes.

Some studies focus on cognitive appraisals and consumption emotions. These studies center on the relationship between consumption emotions and situational conditions in which emotions are experienced (Ruth, Brunel, & Otnes, 2002; Nyer, 1997). The challenge here is that some emotions (such as for example joy and satisfaction) can be elicited by the same event, as was shown by Ortony et al. (1988). One of the interesting finding on the investigation of appraisals and consumer emotions is the asymmetry in mixed positive versus mixed negative emotions. That means that when reporting on a particular positive emotion, the level of other positive emotions is also driven up, whereas such 'spillover' was not noticed in the case of negative emotions (Ruth, Brunel, & Otnes, 2002). The same study found that when choosing and consuming, consumers typically experience mixed combination of positive and negative emotions. This complicated nature of emotions in consumption makes it a rather challenging topic of research. The process of measuring emotions is

complicated by the mixed nature of emotions in consumption and the fact that various emotions can be elicited by the same effect. The challenge in measuring emotions is to identify all variety of experienced emotions as well as valence of each emotion.

Effect of emotions on consumers' decisions

Existing research demonstrates the importance of emotions in the marketing context. A number of studies have been conducted specifically on the topic of emotions in the consumption experience (Mano & Oliver, 1993; Westbrook, 1987; Derbaix & Pham, 1991; Hennig-Thurau, Groth, Paul, & D.Gremler, 2006; Malär, Krohmer, Hoyer, & Nyffenegger, 2011). These studies found emotions to be an important component of consumer response. Studies in this field of interest focus on a broad variety of aspects of the consuming experience. Certain studies focus on the relations between emotional reaction and product satisfaction. For instance, Oliver and Westbrook (1993) showed how emotions relate to specific product outcome experience (such as customer satisfaction). Yu and Dian (2001) explored the role of emotions in customer loyalty by re-testing of the satisfaction-loyalty relationship and including the emotional component. The study showed that the emotional component of satisfaction serves as a better predictor of loyalty compared to the cognitive components typically used (Yu & Dean, 2001)

Existing research also focuses on the role of emotions in consumers' decision-making. Positive emotions influence overall product evaluation and thus influence decision-making process (Hakkyun, Kiwan, & Norbert, 2010). Moreover, Winterich and Haws (2011) investigated correlation between consumers' future-focused positive and future-focused negative emotions and self-control. The study shows that future-focused positive emotions influence self-control and product choice decisions made by consumers. A number of studies focused on the role of affect in decision-making. For example, Shiv and Fedorikhin (1999) showed that spontaneously evoked affective reaction in certain cases influences consumers' product choice. Moreover, Chang and Pham (2013) in their work concluded that affective reaction has greater influence on judgments whose outcomes and targets are closer to the present than on those whose outcomes and targets are temporally more distant. In addition, some works focus on the role of emotions on decision-making within specific industries. For instance, Zhang, Cheung and Lee (2014) showed the importance of emotional trust and its influence on on-line shopping decisions.

Thus, emotions can predict consumers' behavior in many different ways and can affect consumers' decision-making. The discussion above demonstrates that emotions are an important topic for marketing research. Emotions can be studied from different perspectives and there is a significant amount of studies conducted on this topic. Different methods to measure emotions are employed in the research. An overview of the methods of measuring emotions in marketing is presented in the next chapter of this thesis

Chapter 2. Measuring emotions

As it was shown in the first chapter of this thesis, emotions contain valuable information about consumers. Thus, instruments for the measurement of emotional responses experienced by consumers are needed. While the measurement of emotions is associated with a number of challenges, different ways to measure emotions have been developed and can be employed. In this section the methods of measuring emotions will be presented and evaluated (part 2.1), and followed by an analysis of methods used in the scientific empirical research during the last decade (part 2.2).

2.1 Methods to measure emotions

Measuring emotions in marketing and consumer research is a challenging task for various reasons. These reasons include: the mixed nature of emotional experiences (as several emotions can be experienced simultaneously and can be elicited by the same event) (Ortony, Clore, & Collins, 1988); the different valence of emotional reactions (as for example emotions elicited by advertisement are likely to be of a lower intensity compared to emotions elicited by consumption) (Richins, 1997); the difficulties associated with the ability to recall emotions experienced in past and recalling of mixed emotions (Aaker, Drolet, & Griffin, 2008); and presence of low-order emotions (subconscious emotions) (Poels & Dewitte, 2002; Richins, 1997).

There are various methods to measure emotional responses and each method has certain benefits and challenges. Generally, methods of measure emotions can be divided into two broad categories: explicit and implicit methods. In the following, these methods will be presented along with the discussion of the individual challenges and advantages of each method.

Explicit methods

Explicit methods of measuring emotions are based on asking consumers directly (by utilizing verbal or non-verbal instruments) about the emotions they experience. Consumers are offered to use different types of scales, cartoon-like pictures or other means to evaluate their emotional responses

to the stimulus. Thus, explicit methods are capable to assess subjective feelings regarding experienced emotions (Poels & Dewitte, 2006).

Generally, explicit methods are associated with a number of advantages. Explicit methods are typically easy to conduct for researchers. Moreover, these methods do no not require substantial time commitments in gathering or interpreting the information and results. Additionally, explicit methods do not require complex professional equipment and thus are economical to conduct. The above-mentioned factors make explicit methods well suited for large-scaled research.

However, explicit methods also have a number of disadvantages that need to be addressed. Results of explicit methods can be influenced by a cognitive bias, meaning that explicit methods are only able to measure the subjective perception of the emotional reaction, not the reaction itself (intentionally or unintentionally, responders may not be completely honest in reporting experienced emotions). Moreover, since explicit methods are based on subjective self-feelings, this method might lack the ability to capture lower-order emotions. Lower-order emotions are the ones that occur automatically and that also can be called subconscious emotions (Shiv & Fedorikhin, 1999; Poels & Dewitte, 2006). Also, the results can be affected by social-desirability concerns of the responders (especially when it comes to sensitive topics) (Poels & Dewitte, 2006).

Explicit methods include such tools as verbal self-report, visual self-report, and moment-to-moment ranking. Each of these is discussed in the following sections.

Verbal self-report

Verbal self-report is used extensively in scientific empirical research (see part 2.2 of this thesis). This method is used in various forms, such as questionnaires and interviews. In order to assess consumers' emotional reactions, open-ended questions can be used, as was done by Botti, Orfali and Lyengar (2009) or various scales (for example sematic differential and Likert scales) can be employed.

Verbal scales used in self-report typically emerge from a dimensional approach to emotions and a basic emotions approach. The dimensional approach states that all emotional states are characterized by three bipolar dimensions: pleasure-displeasure; arousal-nonarousal; dominance-submissiveness (PAD). According to this theory, emotional states account for moods, feelings and other feeling-

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related concepts (Huang, 2001). The basic emotions approach was first proposed by Izard (1977). In the approach developed by Izard ten fundamental (or basic) emotions play an important role in the survival function of human beings. The theory states that basic emotions can interact with each other and all other emotions are a mixture of the basic emotions. Moreover, some of the studies using self-reporting methods to assess emotions adopt emotion items from Positive and Negative Affect Schedule (PANAS) scales (see for example Aaker, Drolet, & Griffin, 2008). The PANAS model proposes the mutually exclusive positive and negative affects as the primary emotional dimensions. A mood scale is designed as a part of this theoretical approach. In marketing and consumer behavior a bi-dimensional measurement of positive and negative affects corresponds to satisfaction/dissatisfaction evaluations (Huang, 2001). Thus, scales based on various theoretical frameworks can be employed by researches for the creation of verbal self-repot tools.

Verbal self-report method typically does not require any special equipment and thus can be conducted relatively easily and at a low-cost. Moreover, by choosing between various scales, researchers can ensure having results in a form suitable for the purpose of the study. However, verbal-self report has some disadvantages (apart from the disadvantages common for all explicit methods, which were described above). First, verbal self-reports may produce fatigue in responders, which can affect the quality of responses. Second, the retrospective nature of the method limits the ability of its implementation. The retrospective nature means that responders are asked to assess emotions experienced in the past, rather than to provide a real-time evaluation. Thus, with this method it is difficult, for example, to identify which part of an advertisement caused the strongest emotions or when a shift in emotions happened (Poels & Dewitte, 2006). This difficulty, however, can be overcome by combining verbal self-report with other tools, which are capable of tracking these attention shifts. One such tool is an eye-tracking instrument. An experiment employing both verbal self-report and eye tracking was conducted by Nielsen, Shapiro and Mason (2010). This study will be presented more in details in a later part of this chapter. Third, sometimes responders may find it difficult to express emotions by picking a value on a scale. For instance, Vanhamme and Chung-Kit (2008) showed that verbal scales are not well suited for measuring children's emotions due to children's tendency to pick extreme options on the self-report scales.

Visual self-report and moment-to-moment ratings are at least partly capable to overcome some of the challenges associated with verbal self-report.

Visual self-report

As mentioned above, an important challenge associated with verbal self-report, is that it can be difficult to verbalize experienced emotions, as shown by a number of studies including Reijnveld et al. (2003) and Vanhamme and Chiu (2008). In order to overcome this problem, non-verbal descriptions of emotions have been developed. Instruments such as Self-Assessment Mankind and EmoCards were designed for the measurement of emotions (Isomursu, Tähti, Väinämö, & Kuutti, 2007).

Self-Assessment Manikin (SAM) is a pictorial assessment technique designed to measure pleasure, arousal and dominance associated with the responders' affective reaction to stimuli. Illustration 2.1.1 shows an example of pictures used in SAM.
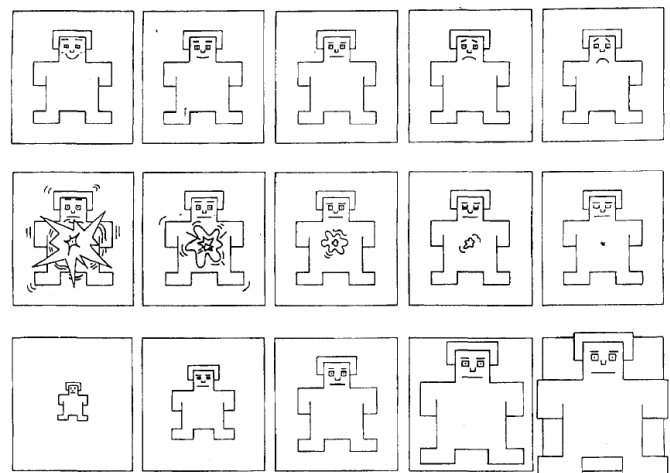
Illustration 2.1.1 The Self-Assessment Manikin (SAM) used to rate the affective dimensions of valence (top panel), arousal (middle panel) and dominance (bottom panel) (Bradley & Lang, 1994, p. 51).

SAM is based on the dimensional approach to emotions (PAD), which was briefly presented above. In SAM, responders are asked to point the figure which best represents their emotional states. SAM was utilized in various scientific research projects. After testing SAM method in their study, Bradley and Lang (1994) concluded that SAM is a simple and efficient technique for evaluating consumers' emotions in three dimensions. Later, SAM was modified into the AdSAM approach to the measurement of emotions. AdSAM illustrates each PAD dimension with a graphic character arranged on a linear nine-point (AdSAM®'s Empirical Foundations, 2014).

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Another method designed for the visual self-report is *Product Emotion Measurement instrument* or PrEmo. PrEmo measures a set of 14 emotions, each of which is illustrated with an animated cartoon character. Cartoon characters have dynamic facial, bodily or vocal expression and a computer interface is needed to present illustrated animations. During the test, responders are asked to pick animation corresponding with the experienced emotions. Important to note that PrEmo is better suited for the measurement of mixed emotions than SAM and AdSAM, as it allow register several emotions experienced simultaneously (Desmet P. , 2005). Illustration 2.1.2 shows an example of cartoon character used in PrEmo.
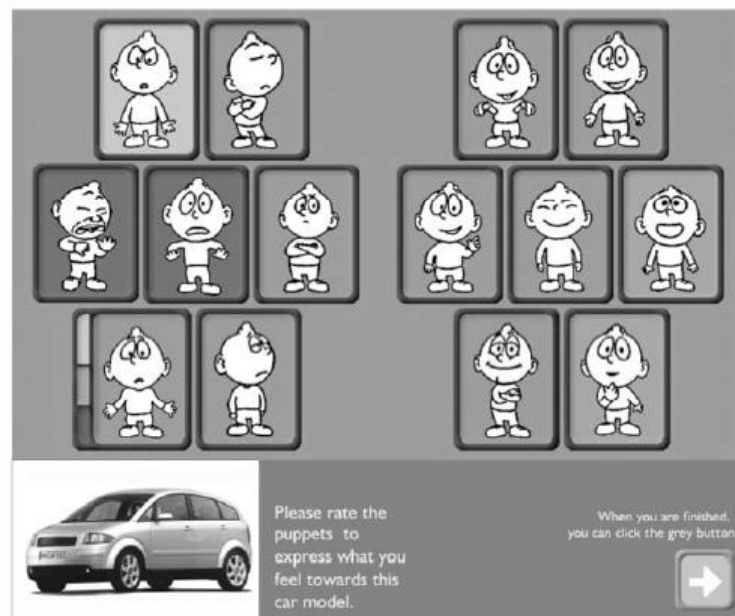
Illustration 2.1.2 Product Emotion Measurement instrument interface (Desmet P. , 2005, p. 115)

There are other types of visual self-report instruments suggested in the scientific literature. For example, Vanhamme and Chiu (2008) developed the NUKI emotion measurement instrument as a tool especially suited for the assessment of children's' emotions. The authors found that children may have trouble with assessing certain emotions, and thus they developed a visual scale that is better suited for this particular target group.

Visual self-report overcomes some of the challenges associated with verbal self-report methods. For example, visual reporting is more entertaining and thus is less likely to cause fatigue. Moreover, it resolves the problem of the verbalization difficulty of emotions (Morris & McMullen, 1994). However, results achieved by visual self-report may still be affected by the cognitive bias and social

desirability concerns of responders. Visual self-report also normally has a retrospective nature that implies certain limitations of its implementation in the research.

Moment to Moment rating

Moment to Moment rating is based on the dimensional approach to emotions. In this method, responders are asked to rate in real time the strength of the experienced emotions relatively to the neutral state. The tool, which is normally used in advertising research, is a so-called 'warmth monitor' (also certain variations of this tool such as 'feeling monitor' can be used). In the 'warmth monitor' participants are offered to move a pencil or digital cursor to indicate emotional response (Poels & Dewitte, 2006). For example, a move of the cursor upwards can indicate the increase of the valence of the experienced emotion and the move downwards indicates decrease of the valence. A slightly modified version of the warmth monitor was adopted by Zhao and Tsai (2011). In their experiment participants were asked to report real-time experiences while listening music. In order to do so, a computerised 15-point scale was used to capture a reaction every 3 seconds, yielding 10 real-time evaluations.

Although able to measure immediate and continuous emotional responses, moment-to-moment rating only allows for the measurement of only one dimension. For example, consumers can be asked to indicate emotions towards advertising on sad-happy dimension scale. Introduction of two scales at the same time is not possible for the purpose of real-time evaluation. Moreover, some researchers suggest that instead of measuring discrete emotion, warmth monitor rather registers a general indication of any positive or negative feelings (Abeele & MacLachlan, 1994). Additionally, this method is also faced with the disadvantages common for all explicit methods, such as cognitive bias and social desirability concerns of the responders.

Although easy and cheap to conduct, all explicit methods to measure emotions have an important disadvantage. Explicit methods measure only responders' perception of the experienced emotions, rather than emotional reactions itself. Implicit methods for measuring emotional reactions can be beneficial for the research on consumer behavior since participants are not always able or willing to honestly assess all emotional reactions experienced. The following section of this chapter presents implicit methods to measure emotions.

Implicit methods

Implicit methods to capture emotions are able to assess reactions that are beyond the individual's control (autonomic reactions). Implicit methods include Implicit Associations Test (IAT), linguistic analysis of written text, and various automatic methods.

A significant group of the implicit method tools consists of so-called psychophysiological measurement instruments. These instruments are able to measure typical physiological or bodily reactions, which normally arise alongside emotions. Such reactions include, but are not limited to, skin conductance, heart rate and pupil dilatation (Poels & Dewitte, 2006).

Implicit methods of measuring emotions can be designed in a way that measure emotional responses in real time and thus are able to indicate the exact moment of the changes in emotional responses. This feature is important for marketing and consumer research. Unlike explicit methods, implicit ones are not influenced by the cognitive bias or social desirability concerns of the responders. Moreover, instruments used in the implicit methods can be designed to capture the smallest changes in physical reactions and thus are appropriate for the measurement of lower-order (subconscious) emotions.

Nevertheless, implicit methods also have disadvantages, which are mainly connected to the difficulty of conducting experiments and interpreting results. Implementation of these methods is not as convenient as with self-report methods, and often requires professional equipment (which adds to the cost of research). Moreover, some of the implicit methods only indicate the amount of arousal that is part of the emotion rather than emotions itself. Thus, interpretation of results can be challenging and must account for many individual differences. Further, professional knowledge is often needed in order to de-code the results (Poels & Dewitte, 2006).Some of the explicit tools to measure emotions will be presented in the following part.

Implicit Associations Test (IAT)

IAT is designed to measure evaluative associations that underlie implicit attitudes (or subconscious emotional reactions). The main idea behind this method is that it is easier to make the same response to items representing different concepts when they are well associated, than when they are not. IAT was first developed in 1998 by Greenwald, McGhee, and Schwartz (Cai, Sriram, & Greenwald,

2004). To illustrate this method, imagine that researches are trying to identify the implicit attitude towards such concepts as flowers and insects (with corresponding attitudes as pleasant and unpleasant). In this scenario, responders will be asked to give the same response (for example to press key A on the keyboard) to a pleasant word and image of flower and give another response (to press key B) to an unpleasant word and image of insect. Afterwards the task will be rotated and the same response key will be linked to image of flower and an unpleasant word, and accordingly the other key with a pleasant word and image of insect. The test developers suggest that differences in performance results (such as speed and accuracy of responses given) between the two conditions reflects the relative strengths of associations between the IAT concepts and attributes. In other words, if responders provide more accurate results in a scenario where flowers are linked with pleasant words and insects are linked with unpleasant ones, implicit association between flowers and positive attitude is stronger than between insects and pleasant attitude. Thus the result of such test, allows researchers to see which of the attribute (pleasant or unpleasant) is more strongly linked to the corresponding concepts (flower or insect) (Cai, Sriram, & Greenwald, 2004). IAT can be used to measure affective reactions (positive or negative) and subconscious emotions. For example, Bongers et al. (2012) used IAT to assess positive and negative emotions associated with emotional eating.

While this method can provide more accurate measurement of the consumers' attitudes and subconscious emotions than the self-report method, IAT has certain important limitations, such as its retrospective nature. Emotional reactions elicited by advertisement cannot be measured in real time but rather need to be recalled afterwards.

Linguistic analysis of written text

Linguistic analysis of written text can be used as implicit method of measuring emotional responses (see for example Ludwig et al. (2013) and Argo, Zhu and Dahl (2008)). The idea behind this method is that the words people use can reveal important information about people's psychological worlds and experienced emotions. Research provides evidence that links natural world use to personality (Pennebaker, Mehl, & Niederhoffer, 2003). Thus, analysis of the text written by responder can be used in order to assess emotions experienced by responder when the text was written. Linguistic Inquiry and Word Count (LIWC) program can be used in order to determine the degree any text uses

positive or negative emotions (LIWC, 2014). Validity of the results provided by LIWC was confirmed for example by Kahn et al. (2007).

While being able to assess subconscious emotional reactions, linguistic analysis has certain limitations. Linguistic analysis can provide only general measurement of whether responder experienced positive or negative emotions (LIWC, 2014). Moreover, method is not able to provide continuous measurement of experienced emotional reactions.

Measurement of heart rate

The heating rate of the heart conveys information about phenomena such as attention, arousal, cognitive and physical effort (Lang A. , 1990). Thus, measurement of the heart rate can be used for the indication of the valence of an emotional response. In empirical experiments, device measuring heart rate is usually placed on the finger of the individual. In this method phasic (short term) changes in the heart heating rate are used to measure attention while tonic (long term) changes serve as indicators of arousal (phasic deceleration of heart rate indicates increase in attention; tonic acceleration indicates arousal) (Lang A. , 1990).

An important advantage of this method is that it presents valid real-time and continuous measures. However, caution is needed in interpretation of the results as heart rate can convey information about many different phenomena, each of which can influence heart rate in different ways. Thus, the 'decoding' process can be rather complicated and require professional knowledge (Lang A. , 1990).

Measurement of skin conductance

Research shows that skin conductance (SC) can be used as a measurement of activation of the autonomic nervous system. The idea behind this is that sweat glands are involved in emotion-evoked sweating making. SC can be used as an indicator of the electrical conductance of the skin, which is related to the level of sweat in the eccrine sweat glands. (Poels & Dewitte, 2006). In this method electrodes are placed on the sweat-sensible places of the palm of the hand. These electrodes register level of conductance with a light electrical current. This information could assist in the 'reading' and measuring of the experienced emotions.

An important advantage of this method is that achieved results cannot be affected by social desirability or any other concerns of the responders. However, it is rather complex to conduct an experiment that employs this method, as it requires special, sensitive equipment and knowledge to decode the results. Moreover, the results achieved can be impacted by such factors as fatigue, medication, and illnesses. Thus, interpretation of results needs to account for a number of individual differences. Another important drawback is that this method only determines the direction of the valence of emotional reaction (it is only capable to measure the arousal that can have either negative or positive valence), rather than the reaction itself (Poels & Dewitte, 2006).

Measurement of brain activities (brain imaging)

Stemming from neuroscience, brain imaging is now also used in consumer research. The idea behind this method is that stimulation of certain areas of the brain correspond with certain emotions. Conclusions regarding the experienced emotions can be made by tracking activities in these areas. There are few methods of brain imagining from neuroscience, such as: electroencephalography (EEG); magneto encephalography (MEG), position emission topography (PET) and functional magnetic resonance imaging (fMRI). EEG is the oldest and least expensive imagining method and thus is the most widely available method for brain imaging (Sørensen, 2008).

While having obvious advantages (such as non-ability of the responders to manipulate results in any way), this method is associated with a number of difficulties. First of all this method requires rather costly equipment and professional help for the decoding of the results (Sørensen, 2008). Moreover, it is a challenging task to make the experimental conditions natural for participants while using brain imagining methods (Hedgcock & Rao, 2009).

Analysis of facial expressions

Facial expressions convey a lot of information about the emotions experienced by individuals. According to the survey conducted by Mehabian, the verbal part of communication accounts for only 7% of the whole message, vocal part (intonations) for 38%, while facial expressions of the speaker contain 55% of the message (Mehrabian, 1968). Hence, 'reading' of the facial expressions is

a useful tool for assessing of emotional responses. Two approaches are used for facial expression analysis in consumer research:

- Facial Action Coding System (FACS) developed by Ekman and Friesen (Ekman & Rosenberg, 1997) and links visible facial muscle movements and discrete emotions, and is used for the derivation of information regarding emotions from the facial expression.

- Facial electromyography (EMG) method in which facial EMG electrodes are placed on two facial muscles - corrugator and zygomatic muscles. According to some studies, EMG is able to register activity in these muscles when FACS detects no change in facial expression. (Poels & Dewitte, 2006)

An important advantage of this method is that it is able to capture low-order emotions that the responders may be not aware they are experiencing. Moreover, real time measurement can be achieved, which is beneficial for research purposes. Unlike the measurement of the skin conductance and heart rate, analysis of facial expressions allows not only for the measurement of the valence of the emotional reaction, but emotion itself.

The challenges associated with these method are: the laboratory setting in which experiments are conducted can influence responders' behavior and the validity of the results (this limitation is particularly important in case of EMG methods); the responder awareness facial monitoring can make responders more conscious about facial expressions (for instance due to social desirability concerns) and can impact results (this limitation can be overcome when FACS method is used, but not in case of EMG method as electrodes should be placed directly on the face of the responders); both EMG and FACS methods require special equipment.

Implicit methods provide researches with means to achieve measurement results, which are not affected by the desirability concerns and cognitive bias of the responders. However, implicit methods are typically associated with higher costs and difficulties with the decoding of the results. Analysis of facial expressions in particular seems to be a promising tool for the measurement of

emotions, because unlike other implicit methods, it is able to measure arousal or the valence of emotions and the experienced emotion itself. Moreover, it can assess low-order and mixed emotions, which is valuable for the consumers research (Poels & Dewitte, 2006). Nevertheless, explicit methods are still more widely used in scientific empirical research, as it will be shown in the next part of this chapter.

2.2 How have emotions been measured in scientific empirical research? Literature review

As was shown in the previous part of this chapter, there are various methods available for the measurement of emotions in marketing and consumers research. However, each of the methods is associated with a number of advantages and disadvantages or limitations (see part 2.1). Thus, it is interesting to analyze which of the methods have been used in empirical studies. A review of the methods used in the literature to measure emotions will be presented in this part of the work.

First review

In order to limit my search I analyzed articles presented in the database Business Source Complete with the search terms of 'emotions AND consumers'. Only papers published in journals with an ABS rank of 4 (Journal of Marketing, Journal of Consumer Research and Journal of Marketing Research) during the last decade (from January 2004 until January 2014) were considered.

In 61 out of 102 articles identified using the search criteria, a measurement of emotions was conducted. Table 2.2.1 summaries methods used in these articles.

Methods used/ Source of publication	Explicit methods		Implicit methods		
	Verbal self-report	Moment to Moment rating	Analysis of Facial Expressions	Analysis of Brain Activities	Linguistic analysis of written text
Journal of Marketing (JM)	5				1

Journal of Consumer Research (JCR)	33	2			1
Journal of Marketing Research (JMR)	17		1	1	
Total number of studies	*55*	*2*	*1*	*1*	*2*

Table 2.2.1 Methods to measure emotions employed in empirical studies

According to the conducted research, one can see that explicit methods (and particularly explicit verbal self-report method) prevail in the literature identified. The popularity of verbal self-report can be explained by several factors such as the convenience of conducting the process and interpreting the results; the flexibility (by employment of different types of scales for self-report researches can ensure getting results in the form convenient for the purpose of the particular study); and the suitability for large-scaled studies (due to comparatively low time and financial resources demanded). The Likert scale frequently appears in research using verbal self-report for the measurement of the emotional response. This scale was adopted by Hong & Lee (2010), for example, in their work focused on the analysis of mixed emotions.

In one of the studies, self-reported emotional responses were assessed not by asking responders to fill in a questionnaire but via personal talk with the interviewer. The study investigated a sensitive topic of emotional reactions of parents who lost their children and thus this method was employed for ethical reasons (Botti, Orfali, & Iyengar, 2009). In some of the studies, the explicit self-report method was combined with implicit methods to capture consumers' reactions. Nielsen, Shapiro and Mason (2010) employed self-report method to access customers' emotional responses to advertising; in one of the experiments, eye-tracing method was also employed as a part of the study and was used successfully to detect shifts in the allocation of attention from one stimulus to another. In this experiment, participants' faces were videotaped and then analyzed by the experts. However, eye tracking analysis in this experiment was aimed not at capturing the emotional responses but exclusively at determining the attention shifts. Thus in table 2.2.1 this study was classified as the one employing only explicit method to measure emotions.

In two of the studies (Galak, Kruger, & Loewenstein, 2013; Zhao & Tsai, 2011) the moment-to-moment rating method was adopted in order to observe the dynamic change of the experienced emotions. Zhao and Tsai (2011) used moment-to-moment rating to assess real-time emotional

responses to music. To obtain moment-by-moment reports, a computerized 15 point scale was used. Ratings measuring emotions were captured every three second, yielding ten real time evaluations. An advantage of the moment-to-moment rating method used in this study is that it provided immediate and continuous measurement of emotional response.

Although explicit methods of measuring emotional reactions are most widely used in the analyzed body of literature, implicit methods were employed in some of the studies. For instance, Teixeira, Wedel and Pieters (2012) in their work on emotion-induced engagement in internet video advertisements, used an eyed-tracking method in order to assess emotional responses of participants. During experiment participants' visual attention, facial emotion expressions, and zapping decisions were simultaneously assessed. A 17-inch eye-tracker monitor and a separate camera fixed on the top of the monitor for facial expression recording were used for the purpose of the study. In order to avoid facial image disruption (for example by hands' movements), participants were asked to keep one hand over the space bar and the other over the mouse at all times. The continuous video images served as input to the emotion detection software, which works by fitting a virtual face mask to the video image of the face. The face mask adjusts to the form of the face to capture 64 deviations in the line segments that relate to Ekman's FACS. The captured measures were processed online using a Bayesian Neural Network Classifier calibrated on the images of the Cohn-Kanade database. Emotions of joy and surprise were the focus of this study (Teixeira, Wedel, & Pieters, 2012). From this sample, one can see that use of facial expression analysis is suitable in the experiments where consumers are asked to interact with the computer (to watch an advertisement; to complete online survey; to do some online browsing, etc.). This is because facial expression can be easily videotaped by the camera fixed on the monitor, and enables the researchers to create natural environmental design for the study.

In the study conducted by Hedgcock and Rao (2009), functional Magnetic Resonance Imaging (fMRI) was used to observe the activation in areas of the brain associated with negative emotion. Behavioral and brain imagining data of 16 participants were analyzed in the study. Participants were asked to provide responses to certain stimuli by pressing one of three keys on a keypad located near their right hand. Activities in the areas of the brain associated with negative emotions during the process of participants' decision-making were analyzed. While having clear advantages (such as participants being unable to – intentionally or unintentionally –influence the results), this method has certain disadvantages, whichcan be seen in the study conducted by Hedgcock and Rao (2009).

Firstly, the experiment environment was not natural for consumers (during the experiment they were lying on their back on the scanner). Generally it seems to be rather challenging to design an experiment where fMRI can be conducted in the environment close to natural consumption situation. Secondly, in order to participate in the fMRI study potential participants need to be screened to ensure that their health conditions would allow them to take part in such experiment; moreover potential participants that had a history of psychological illnesses were excluded from the study (Hedgcock & Rao, 2009).

Two other studies employed linguistic analysis of written texts in order to assess emotional responses of the participants. In the work of Ludwig et al. (2013), Linguistic Inquiry and Word Counting program analyzed emotional writing was used to analyze review texts. Linguistic Inquiry and Word Count (LIWC) is a text analysis software program designed by James W. Pennebaker, Roger J. Booth, and Martha E. Francis that allows researchers to determine the degree to which any text uses positive or negative emotions (LIWC, 2014). In total 18 682 customers' reviews of 591 books available at Amazon.com were analyzed using the LIWC software in order to assess customers' emotional responses (study focused on the correlation between LIWS results and conversion rates of the books).

Another study by Argo, Zhu and Dahl (2008) used linguistic analysis in order to measure consumers' emotions. In this study participants were asked to write down any thoughts or feelings they had while reading a story designed to elicit certain reactions from consumers. Afterwards, two specially trained coders independently classified the total number of emotional words participants reported. It is important to note that emotions related to an evaluation of the story itself, such as "the story was not sad," were not included in the analysis. Thus, in contrast with the study by Ludwig et al. (2013), Argo, Zhu and Dahl (2008) used manual method of linguistic analysis of written text.

In table 2.2.1 I classified linguistic analysis as an implicit method to measure emotions, as it focuses on capturing explicit emotional responses 'hidden' in the written text, rather than on implicit emotions in the analyzed texts. However, I would assume that an experienced writer, familiar with language tools, can manipulate the results of the linguistic analysis if he/she desires. Thus, the results of such methods can still be affected by the cognitive bias and social-desirability concerns of participants. Moreover, it would be interesting to see how efficient linguistic analysis method is in the analysis of texts written by non-native speakers.

Second review

As first review revealed just one study employing facial expressions analysis, I expanded the search criteria to find other studies employing facial expressions analysis. In order to extend the literature review, I conducted an alternative search in the Business Source Complete database with the following search terms: 'emotions AND consumer AND facial expressions'. Articles published during the last two decade (1994-2014) were considered; unlike the previous search, this time no limitation on the journal of publication was set. The search generated 6 research papers consistent with the search criteria. One of the articles (Teixeira, Wedel, & Pieters, 2012) has already been analyzed in the first review. Another paper presented a literature review, which was concluded by certain propositions regarding service' providers emotional display; facial expressions were not factually measured in this work (Chou & Huang, 2013). Yet another article, consistent with the search criteria, gives brief overview of the news according to which Unilever contracted software designers to create emotion-recognition software to evaluate consumers' reactions to products based on facial expressions (Wolfe, 2007). A brief summary of the other papers is given below.

Lewinski, Fransen and Tan (2014) conducted a psychophysiological study of facial expressions of happiness produced by advertisements. The authors used the FaceReader software by Noldus for the purpose of their study (FaceReader software will be discussed in details in the third chapter of this thesis). Authors claim that this study provides evidence for the applicability of FaceReader methodology in consumer science research. During the experiment people's facial reactions on amusing stimuli were studied. Six amusing advertisements were used as stimuli. FaceReader software was used in order to assess basic emotion of happiness. During the experiment participants used their own laptops with installed flash camera (later all data was collected through MTurk). People's reactions to persuasive stimuli were recorded in their natural environment - their houses and offices. This manipulation let researchers avoid laboratory setting of the experiment (though during the analysis some problems with quality of the video that resulted from this manipulation were identified). Since FaceReader scores were not normally distributed, non-parametric Friedman and Wilcoxon tests were used for the analysis. Results showed that FaceReader's scores were correlated with self-reported results of the advertisement's effectiveness. This study though has certain limitations. Only amusing stimulus were used in the experiment, while according to authors disgusting or gloomy stimulus are likely to evoke corresponding facial expressions. Moreover,

authors emphasize the importance of studying applicability of the software in other contexts involving other emotions and importance of the analysis of contextual factors (Lewinski, Fransen, & Tan, 2014).

An article by Vanhamme and Chung-Kit (2008) focuses on the NUKI Emotion Measurement Instrument as a tool for accessing children' emotions. According to the authors, verbal scales are not a well-suited option for measuring children's emotions due to children's tendency to pick extreme options on the self-report scales. Thus, the purpose of this paper was to develop and validate an alternative measurement instrument for 8-11-year-olds. Proposed instrument consists of a set of pictograms, each representing the facial and bodily expression of a basic emotion coupled with a 4-points scale indicating the intensity. The facial expressions theory by Ekman was used in this paper to develop non-verbal self-report instrument aimed to measure the child's emotional responses.

The last paper in the second search (Widen & Russell, 2008) investigates the ability of kids and adults to recognize disgust as a facial expression. Participants of the study were offered to complete various tasks including free labelling of faces, deciding whether or not a face expresses disgust, or finding a 'disgust face' in an array of faces. The majority of children and 25% of adults associated the prototypical 'disgust face' with anger (Widen & Russell, 2008). Thus, this study emphasizes certain inconsistency with identifying 'disgust' and 'angry' facial expressions among different nations and different age groups of consumers. In this study, images of the 'disgust' face were selected from Ekman and Friesen's Pictures of Facial Affect.

General discussion

Though explicit methods appear significantly more frequently in research papers, few researches found evidence that implicit methods are better than explicit methods at measuring emotional responses (Hazlett & Hazlett, 1999; Bongers, Jansen, Houben, & Roefs, 2012). Typically, in order to assess performance's differences between explicit and implicit methods, researchers conduct experiments employing both types of methods at the same time. For example, Hazlett and Hazlett (1999) used EMG method to measure TV advertisement reactions and compare the results with the ones achieved by self-report methods. Authors concluded that EMG measurement of facial

expression let researchers overcome limitations and biases associated with the usage of explicit self-report methods to measure emotional responses.

Moreover, the disadvantages of explicit methods imply certain limitations of the usage of explicit methods in consumer research. Explicit methods generally have retrospective measures and thus unable to provide researchers with the dynamic picture of experienced emotions. An exception of this is the moment-to-moment rating, but this method is only able to measure emotions on one dimension (Poels & Dewitte, 2006). This limitation is especially important in marketing and consumer research, due to the mixed nature of consumption emotions. For instance, Brakus, Schmitt, & Zarantonello (2009) tried to create a model of brand experience, which includes emotional component. They claim that one of the limitations of their research is the inability to assess consumer's dynamic experience with the brand (verbal self-report method was used in this research and provided authors with only the measurement of retrospective experience with the brand).

Brakus, Schmitt, & Zarantonello claim that the investigation of the dynamic experiences as a valuable contribution of potential further research (2009). Moreover, due to its retrospective nature, explicit methods are not suited well enough for the measurements of customers' affective experiences. In addition, it seems to be difficult to measure low-valence emotions by the employment of self-report scales, as sometimes consumers may not be able to assess emotions accurately (Vanhamme & Chung-Kit, 2008). Another important limitation appears in a research, and deals with intimate or ethically sensitive topics, in these cases responders may influence the results of explicit measurements due to ethical or social desirability concerns. For instance, a consumer may not be willing to report any emotions that can be used to claim that he/she are unethical or have certain prejudices.

To sum up, there are certain situations when using implicit measurement tools is beneficial. Such situations include measurement of affective reactions, measurement of dynamic changes in emotional responses, measurement of ethically sensitive topics, and measurement of mixed emotions and low-valenced emotional responses. Consumer research often addresses this type of research problems. Thus, using implicit methods of measuring emotions seems to be beneficial in consumer research.

In general, analysis of face expressions appears to be a promising implicit way to measure emotions. The advantage of this method is its ability to capture low-order, subconscious emotions. Moreover, results achieved by this method are less impacted by social desirability concerns compared to explicit methods (Peck & Wiggins, 2006). An important feature distinguishing Facial Action Coding System (FACS) is the measurement of emotions based on the observation of bodily reactions (facial electromyography; measurement of skin conductance and heart rate) and that experiments employing FACS can measure emotions without participants knowledge. Using equipment for facial analysis enables researchers to create natural conditions for the study and provide more accurate results compared to self-assessment methods.

Using facial expressions analysis in consumer research will be discussed in more detail in the next chapter. This is followed by the description of an empirical pilot study in which FaceReader software was used for the measurement of emotions.

Chapter 3. FaceReader as a tool for measurement of emotions. Pilot study example

The process of measuring emotions is complicated by various factors, including the different valances of emotional responses and the mixed nature of the emotions as was shown in Chapter 1. There are a number of methods available for researchers. Implicit methods of measuring emotional responses are useful in consumer research because the results achieved by these methods are not influenced by cognitive biases and social desirability concerns (see Chapter 2). In particular, analysis of facial expressions is a useful tool that can benefit to the research in marketing and consumer behavior, as it allows for assessment of different emotion valence and emotion mixes. There are two methods available for facial expressions analysis, including electromyography (EMG) method, in which facial EMG electrodes are placed on facial muscles, and automatic facial expressions analysis (AFEA) using Facial Action Coding System (FACS). AFEA has an important advantage because it allows researchers to design an experiment in a realistic environment, thus enabling the simulation of a real consumption experience. One of the instruments available for the AFEA is FaceReader software by Noldus. In this chapter I will focus on the FaceReader as an instrument to measure emotional responses (part 3.1), and I will provide an example of its usage in the pilot study (part 3.2).

3.1 FaceReader as a tool for Automatic Facial Expressions Analysis (AFEA)

In this part of the chapter, I will introduce the AFEA process and describe the FaceReader instrument.

Systems for AFEA

"*The face is the mean to identify other members of the species, to interpret what has been said by the means of lip reading, and to understand someone's emotional state and intentions on the basis of shown facial expressions*" (Pantic & Rothkrantz, 2000, p. 1423). Facial expressions contain great amount of information regarding emotional states of individuals. Due to the amount of information portrayed, automatic facial expression recognition is a dynamic research topic, with numerous

applications in the fields of marketing, human-computer interaction, psychology, and consumer behavior (Pantic & Rothkrantz, 2000).

Pantic and Rothkrantz (2000) define facial expressions as "*the facial changes in response to a person's emotional states, intentions, or social communications*" (2000, p. 1424). The first research done in the field of facial expression analysis dates back to the works of Charles Darwin in 1872. One of the early attempts to create an automatized analysis of facial expression was made by Suwa et al. in 1978. Starting in the 1990's, automatic facial expression analysis became a popular topic of research, mainly due to the advances that had been made in technology (Fasel & Luettin, 2003). Since the first attempts by Suwa et al. (1978), significant progress has been made in the creation of automatic systems for the identification of facial expressions.

Facial expressions do not only convey emotions, but also intentions, cognitive effort, physical effort and other intra- or interpersonal meanings. Thus, automatic facial expression analysis must be able to interpret the complex messages conveyed and facial changes must be recognized regardless of factors such as race, gender, context, etc. (Pantic & Rothkrantz, 2000). AFEA technology is able to interpret the complex messages in different contexts and is used in clinical psychology, psychiatry, neurology, lie detection, multimodal human computer interface, marketing, consumers' behavior and others.

Thus, we can see that AFEA is complex process. Usually AFEA program operates in three steps, which I will present in the following part.

Three steps of the automatic facial expression analysis

Generally, the algorithm of AFEA consists of three steps:

1. Face acquisition (face detection and head pose estimation).
2. Facial data extraction & representation (feature based and appearance based approaches).
3. Facial expression recognition (Frame based and sequence based approaches) (Pantic & Rothkrantz, 2000).

In the first step, the face region is determined. Head finder, head tracking and pose estimation functions are applied in the first step of the AFEA in order to handle significant head motion. The

goal of the second stage is to extract facial changes caused by facial expressions. In cases where facial data extraction cannot be performed automatically, fully automatic facial expression analyzer cannot be developed (Pantic & Rothkrantz, 2000). There are two approaches to extracting facial data: geometric feature-based method and appearance-based method. In the geometric feature-based method, the shape and location of face components such as eyes, mouth, eyebrows, and nose are important. A feature vector is generated to represent the face geometry. In the appearance-based method, a feature vector of the face is extracted by employing image filters, such as Gabor wavelets (Pantic & Rothkrantz, 2000).

In the last step of the AFEA system, the facial expression conveyed is recognized by the usage of either frame-based or sequence-based approach. In this step it is important to define a set of categories in order to devise mechanism of categorization. One of the crucial limitations of this step is that interpretation of body language is situation-dependent. This means that in order to make a reliable conclusion on the emotional state of the responder, facial expression analysis should be accomplished alongside an analysis of the context and other elements of the non-verbal communications. Importance of additional analysis of the context was documented for example by Carrol and Russel (1996). Appendix 2 includes the detailed framework of the three steps approach to facial expressions analysis.

Challenges associated with AFEA systems and properties of an ideal AFEA system

There are challenges in developing an AFEA system that is able to provide reliable results. Some of these challenges will be investigated bellow, followed by a summary of the properties of an ideal AFEA system.

Typically, AFEA's are set up to recognize a set of prototypical emotional expressions (such as for example sadness, happiness, surprise, etc.). This approach is justified by works of Darwin, Ekman, and Friesen (1997) and Izard (1977). The challenge of doing this is that prototypical expressions are rare in real life encounters, emotions are normally communicated by the subtle changes in facial features. Thus, it is necessary for AFEA systems to have an automated recognition of changes in facial expression (Pantic & Rothkrantz, 2000). Moreover, such features as face shape, texture, color, facial and scalp hair are dependent on many factors including age, sex, ethnic background, etc., and are important for the AFEA system. An obvious example of these differences is the variation in eye

shape between Asians and Europeans. Such differences can greatly affect facial expression analysis and eye tracking. Furthermore, eyeglasses, facial hair, headdress and jewelry can obscure certain facial features. AFEA systems must also account for individual differences in expressiveness, which can be caused by culture, personality or other factors (Pantic & Rothkrantz, 2000). Another challenge is that facial actions frequently vary in intensity. Methods that work well enough for intense expressions may be not applicable for low-order emotions (Pantic & Rothkrantz, 2000) Thus AFEA systems suited to capture intense expressions may lack ability to capture micro expressions important in consumer research.

The data sets of facial expressions normally used for AFEA are typically composed of images where subjects were asked to perform certain expressions. According to Ekman and Rosenberg (1997), spontaneously occurring expressions can vary significantly from the directed facial tasks. While certain facial actions can easily be performed spontaneously (for instance raising the outer brows while leaving inner brows at rest), it can hardly be reproduced intentionally (Pantic & Rothkrantz, 2000). Thus, it is important to use databases including both deliberate and spontaneous face expression in AFEA system.

As previously mentioned, AFEA systems need to use a certain set of basic emotions in order to classify facial expressions. Many AFEA software packages (including Face Reader) use Ekman's six basic emotions (plus 'neutral' emotion) for this purpose. One of the challenges of the usage of basic emotions proposed by Ekman in AFEA systems is that Ekman's description of the six prototypic facial expressions of emotions is linguistic and thus ambiguous. No uniquely defined description of basic emotions in terms of either facial actions or any other universally defined facial code is available (Pantic & Rothkrantz, 2000).

Ekman also states that expressions can occur irrelatively to the emotions (Ekman & Rosenberg, 1997). Thus, it is important to be able to detect the context and other explanations causing facial expressions. There are many factors that can influence facial expression, such as mental states, non-verbal communication, physiological activities and verbal communications. It is important for the system to recognize that facial expression of the responder may be influenced not by the emotion experienced but by these other factors (such as head ache). Hence, AFEA systems need to be able to overcome this challenge. In the illustration 3.1.1 various sources of facial expressions are presented.
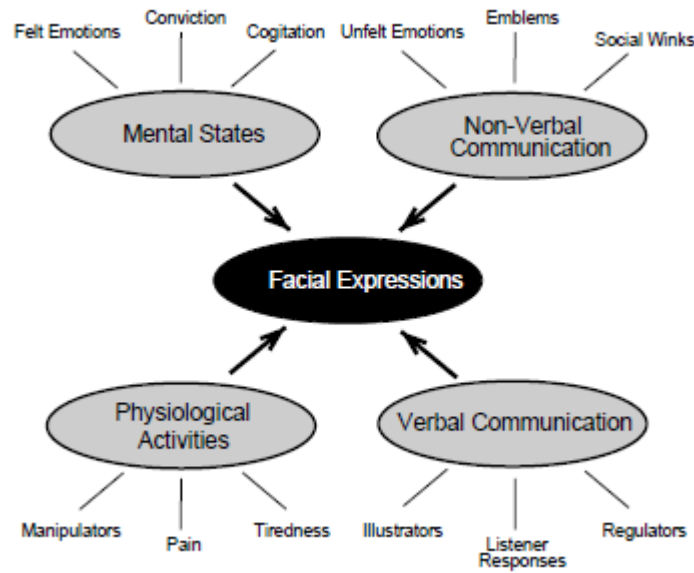
Illustration 3.1.1 Sources of facial expressions. (Fasel & Luettin, 2003, p. 260)

Illustration 3.1 shows that there are numerous challenges associated with each of the steps of the AFEA system (face acquisition; facial data extraction & representation; facial expression recognition). In order to overcome these challenges AFEA's should use complete and reliable databases, and training and test data should be used to validate the reliability of the results. The properties of an ideal facial expression analysis system are presented in the Table 3.1.1 Ideal facial expression analysis system needs to have properties ensuring its robustness (be able to deal with different ethnicities, ages, genders; handle lightning and head motions, etc.), be an automatic, real-time, and autonomic process.

Properties of an ideal facial expression analysis system

Robustness	Automatic process
- Deal with subjects of different age, gender, ethnicity - Handle lightning changes - Handle large head motion - Handle occlusion - Handle different image resolution - Recognize all possible expressions	- Automatic face acquisition - Automatic facial feature extraction - Automatic expression recognition

		Autonomic Process
- Recognize expressions with different intensity - Recognize asymmetrical expressions - Recognize spontaneous expressions		
Real-time process - Real-time face acquisition - Real-time facial feature extraction - Real-time expression recognition		**Autonomic Process** - Output recognition with confidence - Adaptive to different level outputs based on input images

Table 3.1.1 Properties of an ideal facial expression analysis system (Pantic & Rothkrantz, 2000, p. 1431).

Limitations discussed above have important implications for research in consumer behavior. Research on consumer behavior needs to deal with consumes of different age, gender and ethnicity. Thus, it is important to be able to adjust AFEAs for different consumers. Moreover, AFEA's ability to capture micro expressions is crucial in consumer research. Consumption emotions and emotions elicited by advertisement may vary in intensity and it is important to be able to assess them. In addition, ability to identify spontaneous facial expressions is important for the research.

FaceReader software

FaceReader is a facial expression analysis software developed by VicarVision and is commercially available since 2007. FaceReader is one of the few publically available automatic facial expression recognition systems with advanced analyzing and reporting functions (Benta ,. K., et al., 2009). This software is used in a variety of research areas, such as psychology, education, human-computer interaction, usability testing, market research and consumer behavior (Noldus, 2013). The list of clients of who use the software includes leading universities and research institutions in Europe, North America, Australia and Asia (Noldus, 2013).

FaceReader is programed to classify face expressions into categories of seven basic or universal emotional categories as identified by Ekman (Ekman & Rosenberg, 1997). The seven categories are: Happy, Sad, Angry, Surprised, Scared, Disgusted, and Neutral. In addition, the software offers other classifications, which include facial states such as head orientation, global gaze direction and subject characteristics.

FaceReader works in three steps, presented in the illustration 3.1.2

| Facial expression recognition | → | Modeling of the face | → | Facial expression classification |
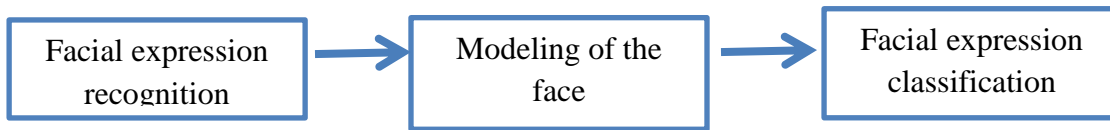
Illustration 3.1.2 FaceReader algorithm (Noldus, 2013)

During the first step, the Viola-Jahanes algorithm is used to detect the presence of a face. In the next step, the Active Appearance method is used for an accurate modeling of the face. The model is developed with a database of annotated images, which describes over 500 key points in the face and the facial texture of the face defined by these points. While the key points provide the description of the global positioning and the shape of the face, the texture provides extra information about the state of the face. This information is crucial for determining the emotional states of the responder. During the third and last step the facial expression is classification by comparing against an artificial network consisting of over 10000 manually annotated images (Methodology, 2013).

Some faces can be biased towards certain face expressions and in order to maintain the accuracy of the results, a calibration function is available in the software. Through this function, the user can calibrate FaceReader to correct for the person-specific biases. This mechanism is fully automatic and only requires a set of images or videos in order to sample the intensities of the individual expressions of the focal person.

FaceReader's output and validation of the results

FaceReader provides an output in the form of charts listing the classification of the facial expressions of the test participants. For each expression, a value from 0 (absent) to 1 (fully present) is assigned to each emotion. As a person's face usually combines mixture of emotions, the sum of the meaning for 7 emotions is normally not equal to 1. Moreover, the valence (which indicates whether the emotion is positive or negative) is calculated. The software also has an option to analyze expressions of the group of participants. FaceReader provides results with a time scale (thus it is possible to conduct a detailed analysis of the mix of emotions presented in each particular moment) (Methodology, 2013).

In order to validate the accuracy of FaceReader, a number of tests were conducted. One test was comparing FaceReaders analysis with the intended expressions in images of the Radbound Face Database. FaceReader had an overall accuracy for emotion identification of 90%, with the highest meaning of accuracy equal to 95.9% for 'happy'. Another test compared the results of FaceReader with those of human observers. In this test FaceReader demonstrated a high level of accuracy, ranging from 70 to 99% for different emotions (Methodology, 2013). In their study, Benta, et al. (2009) validated the accuracy of FaceReader at detecting inducted emotions in real-time. They concluded that while the score valance provided by the human is slightly more accurate than the one by FaceReader, the correlation difference is rather small (Benta et al., 2009). An important advantage of the FaceReader in comparison with the human observers is the lower cost, both in terms of time and financial resources.

However, one of the limitations of the software is its inability to distinguish between authentic and posed expressions. This means that FaceReader will provide the same results irrespective of whether the facial expression was acted by the tested person or not.

In order to illustrate how FaceReadeer can be used in actual research, an example of a pilot study in which this software was employed will be presented in the following part of this chapter.

3.2 Pilot Study

Study design and research purposes

The Center of Service Innovations (CSI) at the Norwegian School of Economics conducted the pilot study during the spring 2014. The project aimed to study whether emotions predict moral judgments in the context of business ethics. FaceReader was used as an instrument to check the manipulation (the mood induction) during the experiment. CSI is interested in the topic of measuring customer's emotional responses in service settings. Thus, this project is of research interest for CSI. I have been part of the project through my work with the master thesis.

Three research questions were formulated for the purpose of the study:

RQ1: Does induction of emotion disgust lead to moralization of violations of purity?

RQ2: Does spontaneous emotional responses in facial expression predict moralization?

RQ3: Does individual differences in moral preferences moderate moral judgments following emotion induction?

In order to answer the research questions, we conducted a laboratory experiment with two groups of participants. The test group was exposed to a disgust stimuli and the control group with neutral stimuli. The study participants were 55 students of the Norwegian School of Economics (both bachelor and master levels). Participants were told that they will be part of the study on personality and how people process visual and auditory information. All participants were randomly assigned to either the test or control group. Participants in the test group were asked to watch a film clip from Trainspotting, as it was shown by the previous studies to induce disgust (Horber, Keltner, Oveis, & Cohen, 2009). Participants assigned to the neutral condition were asked to watch a film clip inducing neutral emotion. Participants were given compensation valued at 200 NOK.

Prior to the main experiment, we conducted a pretest of the violation of purity. 30 participants (bachelor and master students of the Norwegian School of Economic) were asked to read definitions of purity and impurity and rate how well, according to their opinion, each of a set of violation and virtue scenarios fit with the definition. Based on the results of the pretest three vignettes representing violation of purity were selected for the main experiment. Questionnaires used for the main experiment and for the pretest are presented in the Appendixes 3and 4 accordingly.

The dependent variables during the main experiment included a moral judgment rating (from not wrong at all to very wrong) and company attitude. Control variables included political orientation, socio-economic status, disgust sensitivity and moral foundations. Moreover, we included self-reported disgust emotions as a manipulation check in addition to the automatic facial expression measure. For the purpose of this thesis, I will focus not on the main results achieved in the experiment, but on the employment of FaceReader as a tool for the measurement of emotions in this experiment.

FaceReader as a tool for the measurement of emotions in the pilot study

During the experiment, participants first were asked to watch a video episode (induced either with disgust or with neutral emotion) and then answer a questionnaire. During the whole session,

participants' faces were videotaped and analyzed by the FaceReader software (participants were warned that there would be video recording). In order to avoid image distractions, the participants were asked try to keep their hands on the keyboard during the session. Further, lighting and background were chosen to meet the needs of the software. A consultancy with the representative of the company-developer of the software was conducted prior the experiment, to ensure that software will be used in a proper way.

Results of the experiment reveal that both the self-reported measure and the FaceReader confirm that the manipulation was successful. Conducted T-test shows that the two groups are significantly different on two emotional dimensions manipulated in the experiment: neutral and disgust. Levene's test shows that assumption of equal variances is violated for 'Surprised', 'Disgusted' and 'Disgust_SelfReport'. Thus, it is important to use correct p-values for 'Surprised', 'Disgusted' and 'Disgust_SelfReport'. We can see significant difference between groups for Neutral emotion and self-reported Disgust (with $p < 0.05$). For the Disgust emotion (provided by FaceReader) p-value is equal to 0.064. Taking into account relatively low N, it is possible to report difference for Disgust emotion as significant at the 10% level (though further test with a larger N should be conducted to confirm findings).

Participants in the neutral condition scored significantly higher on the neutral dimension, whereas participants in the disgust condition scored significantly higher on the disgust dimension. Even though results show that participants in both groups score very low on the disgust dimension, the difference between groups is significant. This result indicates that the FaceReader tool may be useful to capture expressions that are not necessarily evident through a researcher's subjective interpretation. Results of the group statistic for each of the emotion measured by FaceReader (plus the results for disgust emotion achieved via self-report) are presented below.

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Neutral	Disgust	23	.5112487565	.26646009239	.05556077004
	Neutral	31	.6869827742	.26807200384	.04814715321
Happy	Disgust	23	.2139149617	.27300350338	.05692516554
	Neutral	31	.1217952901	.18127013472	.03255707729
Sad	Disgust	23	.0691842683	.08198102371	.01709422512
	Neutral	31	.0718667287	.08376155815	.01504401995

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Angry	Disgust	23	.0396452944	.05316847874	.01108639419
	Neutral	31	.0238192841	.03640517036	.00653856162
Surprised	Disgust	23	.0181521589	.03392617242	.00707409596
	Neutral	31	.0090921787	.00968324679	.00173916246
Scared	Disgust	23	.0029442140	.00658190856	.00137242281
	Neutral	31	.0017246069	.00538764698	.00096764996
Disgusted	Disgust	23	.0024054116	.00362455681	.00075577234
	Neutral	31	.0008867370	.00115268561	.00020702845
Disgust_Self report	Disgust	23	4.8551	1.64171	.34232
	Neutral	32	1.2917	.77019	.13615

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Neutral	Equal variances assumed	.049	.827	-2.388	52	.021	-.1757340177	.0735866902	-.3233965144	-.0280715209
	Equal variances not assumed			-2.390	47.715	.021	-.1757340177	.0735197084	-.3235780794	-.0278899559
Happy	Equal variances assumed	2.830	.099	1.490	52	.142	.0921196716	.0618375085	-.0319663672	.2162057104
	Equal variances not assumed			1.405	35.927	.169	.0921196716	.0655777230	-.0408874507	.2251267939
Sad	Equal variances assumed	.347	.558	-.117	52	.907	-.0026824604	.0228453484	-.0485250058	.0431600849
	Equal variances not assumed			-.118	48.111	.907	-.0026824604	.0227713651	-.0484646219	.0430997010
Angry	Equal variances assumed	3.732	.059	1.299	52	.200	.0158260103	.0121856160	-.0086262170	.0402782377
	Equal variances not assumed			1.230	36.710	.227	.0158260103	.0128709333	-.0102599395	.0419119602
Surprised	Equal variances assumed	5.054	.029	1.415	52	.163	.0090599801	.0064013425	-.0037852533	.0219052135
	Equal variances not assumed			1.244	24.674	.225	.0090599801	.0072847457	-.0059533010	.0240732613
Scared	Equal variances assumed	1.248	.269	.748	52	.458	.0012196071	.0016298516	-.0020509294	.0044901435
	Equal variances not assumed			.726	41.745	.472	.0012196071	.0016792531	-.0021698767	.0046090908
Disgusted	Equal variances assumed	12.442	.001	2.194	52	.033	.0015186746	.0006921043	.0001298657	.0029074835
	Equal variances not assumed			1.938	25.321	.064	.0015186746	.0007836151	-.0000941742	.0031315234
Disgust_Selfreport	Equal variances assumed	16.927	.000	10.767	53	.000	3.56341	.33096	2.89959	4.22722
	Equal variances not assumed			9.673	28.996	.000	3.56341	.36840	2.80993	4.31688

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The results of the experiment provide evidence that FaceReader was capable to capture emotional responses in the pilot study.

Moreover, in order to validate the usability of FaceReader's results, ANCOVA test was run in SPSS. Value for the Disgust emotion was set as dependent variable and Group (belonging to the group primed with disgust or neutral condition) was set as independent variable. Results (presented below) show that there is no effect when controlling for the self-reported measure of disgust (with p = 0.184). That means that covariate (self-reported measure of disgust) does not affect dependent variable. Thus, this finding validates the FaceReader's measure.

Between-Subjects Factors

		Value Label	N
Group	1.00	Disgust	23
	2.00	Neutral	31

Tests of Between-Subjects Effects

Dependent Variable: Disgusted

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	$3.045E\text{-}005^a$	1	3.045E-005	4.815	.033
Intercept	.000	1	.000	22.626	.000
Group	3.045E-005	1	3.045E-005	4.815	.033
Error	.000	52	6.325E-006		
Total	.000	54			
Corrected Total	.000	53			

a. R Squared = .085 (Adjusted R Squared = .067)

Between-Subjects Factors

		Value Label	N
Group	1.00	Disgust	23
	2.00	Neutral	31

Tests of Between-Subjects Effects

Dependent Variable: Disgusted

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	4.177E-005[a]	2	2.088E-005	3.354	.043
Intercept	1.570E-006	1	1.570E-006	.252	.618
Disgust_Selfreport	1.132E-005	1	1.132E-005	1.817	.184
Group	1.092E-007	1	1.092E-007	.018	.895
Error	.000	51	6.227E-006		
Total	.000	54			
Corrected Total	.000	53			

a. R Squared = .116 (Adjusted R Squared = .082)

FaceReader not only indicated significance difference in the disgust emotion experienced by participants in different test groups, but also provided other interesting findings. For instance, it showed rather high meaning of happy emotion for the participants in disgust condition. Analysis of videotaped facial expressions shows that some of the participants were smiling while watching video episode aimed to elicit disgust. Research suggests that smiling can be natural reaction to distress (Ansfield, 2007). Moreover, contextual factors could have influenced behavior of participants. Participants knew that their faces were videotaped. Also, a technical assistant was in the room during the whole experiment. Such contextual factors should be taken into account for the correct interpretation of the achieved results. Carroll and Russell (1996) showed that analysis of facial expressions that is not accompanied by analysis of situational information, might often result in the wrong interpretation of emotional responses.

We can see that FaceReader provided interesting insights into experienced emotions. Such insights are valuable for research. Discussion of the findings is presented in the following part of the thesis.

Discussion and implication

This thesis was aimed to answer three research questions stated at the beginning:

RQ1: *What methods to measure emotions are available within the area of consumer research?*

RQ2: *How have emotions been measured in recent research works?*

RQ3: *Is FaceReader an appropriate tool for measuring emotional responses in consumer behavior research?*

For the first question, I conclude that various methods to measure emotions are available for researchers. The methods can be divided into two broad categories of implicit and explicit ones. Explicit methods are designed to measure self-accessed emotional responses of the responders. Thus, the main challenge associated with these types of methods is that it measures the responder's perception of experienced emotions rather than the emotions itself. Results of explicit methods may lack accuracy, as responders are not always able to evaluate emotional responses precisely (due to different valence and mixed nature of emotions). Moreover, results can be affected by social desirability concerns and cognitive bias. On the other hand, explicit methods do not require complex equipment, and results are easy to interpret. These factors make explicit methods well suited for the conduction of large-scaled experiments.

Explicit methods include tools such as visual self-report, verbal self-report and moment-to-moment rating. *Verbal self-report* adopts various scales for the measurement of emotional responses based on various theoretical approaches such as PANAS scales, dimensional approach and theories of basic emotions. As in certain cases the verbalization of emotions can be difficult, visual self-report tools were developed to overcome this challenge. *Visual self-report* tools include such instruments as SAM, EmoCards, and PrEmo. The third type of explicit methods is *moment-to-moment rating*. Unlike other self-report tools, moment-to-moment rating is able to track continuous emotional responses in real time. This method is beneficial when it is important to track changes in emotional responses (for instance if a researcher wants to see which part of an advertisement caused the strongest emotional response). The drawback of this method is that it is capable to measure valence

of just one emotion at a time, thus it can be difficult to apply it in situations when mixed emotions are experienced.

Another broad group of methods contains the so-called implicit methods of measuring emotions. These include the implicit associations test, linguistic analysis and various tools designed to measure bodily reactions of the responders. Typically, emotions come along with certain bodily reaction, such as face expressions, the activation of certain parts of the brain and changes in skin conductance. Research suggests that by tracking these activities it is possible to make conclusions on the emotions experienced by the participants. Disadvantages associated with implicit methods include the necessity to use special equipment, difficulties with the de-coding of the results and difficulties of conducting experiments in a natural environment (for example, in order to track responder's brain activities, the responder must be attached to a scanner). Implicit methods have obvious advantage of measuring emotional reactions rather than responder's perceptions of the experienced emotions.

To conclude, there are various methods available and can be employed for the measurement of emotions depending on the aims and features of an experiment. Moreover, with the development of new technologies it seems reasonable to assume that new implicit methods for the measurement of emotions could be introduced more widely.

In order to answer the second research question a literature review of existing empirical studies was conducted. In the review articles presented in the database Business Source Complete with a search terms defined as 'emotions AND consumers' were analyzed. The review was limited to the works published in journals with an ABS rank of 4 (Journal of Marketing, Journal of Consumer Research and Journal of Marketing Research) during the last decade – from January 2004 till April 2014. In total 102 articles were analyzed out of which 61 employed various methods of emotions measurement. The results show a strong prevalence of explicit methods (and particularly verbal self-report) in the current empirical studies. Verbal self-report was employed in 55 studies.

The above results can be explained by several factors. First, the self-report method is rather simple in its implementation and results decoding. Moreover by utilizing various scales, verbal-self report can provide results in a form convenient for the researches (decoding of the results is not needed). Two of the studies employed explicit methods to measure emotions in the form of moment-to-

moment rating. The authors of these studies emphasized the advantage of this method as it provides continuous real time measurement of emotional responses what was beneficial for the purposes of the studies. Only 4 out 61 studies employed implicit methods of measuring emotional responses with one study using the facial expressions analysis, one using the analysis of brain activities and two studies employing the linguistic analysis of the written texts. A comparatively low percentage of empirical studies using implicit methods that employ measurement of various bodily reactions (such as facial expressions and brain activities), can be explained by the necessity of the usage of professional equipment for such experiments. Moreover, in case of the measurement of brain activities experiment needs to be conducted in a laboratory setting, which can influence results. An interesting finding of the review was the employment of linguistic analysis for the measurement of the emotional responses. This method was adopted in two studies. In one of the studies specially trained people were hired to conduct an analysis while the other study employed special automatized software for this purpose. While the linguistic analysis method seems to be an interesting and beneficial tool for the analysis of emotional responses, it has its limitations mainly connected with the experiment's design.

In general, the conducted review shows a strong prevalence of the explicit methods to measure emotions, with the visual self-report method being employed in 90% of the analyzed studies.

As a response to the third question, I can conclude that FaceReader is able to capture emotional responses and thus can be used in consumer research. In the study conducted, participants in the disgust condition scored significantly higher on the disgust dimension than participants in the neutral condition. The results were validated by self-report. During the experiment, FaceReader analyzed facial expressions of the responders of different ethnicity, age and gender. This said, it is possible to conclude that the software is able to adjust to individual differences of responders. Moreover, FaceReader provided real-time measurement of emotions. This feature has various potential implications in consumer research (for instance it can be used to measure which part of an advertisement causes the strongest emotional reaction). In addition, FaceReader presents automatic and autonomic processes and thus the software meets the basic requirement for AFEA systems presented in Table 3.1.1 Moreover, FaceReader provided not only measurement of the studied emotion (disgust), but as well of all other emotions available in software. This indicates that FaceReader can be useful tool for the research on mixed emotions.

During the experiment, FaceReader also provided some unexpected results. For instance, both groups of participants demonstrated rather high scores for the 'happy' emotion. Analysis of videotaped facial expressions shows that some of the participants actually were smiling while watching the video aimed to elicit disgust emotion. This phenomenon can be explained by contextual factors. Research shows that in certain cases smile can be a predicted reaction to emotional distress (Ansfield, 2007). The importance of the contextual analysis of the facial expressions was investigated for example by Carroll and Russell (1996). Carroll and Russell investigated cases when situational rather than facial information was predicted to determine emotion. Thus, FaceReader analysis of facial expressions needs to be accompanied by the contextual analysis in consumer research.

Some other studies also explored applicability of FaceReader. One of these studies was presented in Chapter 2 (Lewinski, Fransen, & Tan, 2014). While the study of Lewinski, Fransen and Tan focused on the emotion of happiness and our study focused on the emotion of disgust, both studies proved applicability of the software in consumer research. Lewinski, Fransen and Tan (2014) emphasized the importance of studying applicability of the software in other contexts involving other emotions. Thus, study conducted by the Center for Service Innovations and presented in this thesis is a valuable addition to the existing research. Moreover, presented study provides evidence that supports assumption made by Lewinski, Fransen and Tan (2014), according to which disgusting and amusing stimuli can elicit similar facial expression.

In general, FaceReader seems to be a useful tool for the measurement of emotional responses that can be applied in consumer research. Results achieved by FaceReader are not affected by cognitive bias and social-desirability concerns of responders, which suggests opportunities of the employment of FaceReader in research concerned with sensitive topics. However, certain limitations of the software also should be taken into account. FaceReader's methodology is based on the theory of basic emotions proposed by Ekman. As many other theories borrowed from psychology, Ekman's theory focuses on negative emotions (as they are the ones mainly important for survival function of human beings). Thus, only 1 out of 7 emotional reactions measured by FaceReader are positive ('happy' emotion). This implies certain limitations of the potential usage of the software in consumer research. For example the inclusion of the so-called 'candidate basic emotions' (contempt, shame, guilt, embarrassment, awe, amusement, excitement, pride in achievement, relief, satisfaction, sensory pleasure, and enjoyment), discussed in the first chapter, could expand FaceReader's

applicability in consumer research. Moreover, in its current form, the software does not account for any contextual factors that may be important for the correct interpretation of the emotions experienced by responders. These limitations may be used as a basis for further development of the software.

General limitations of this thesis and suggestions for the further research are presented in the next part of the thesis.

Limitations and further research

This thesis has certain limitations. In this part several suggestions will be presented with respect to how the current study could be extended and improved for providing theoretically more sound outcomes.

First of all, this work focuses solely on the emotions in marketing and consumer behavior and the ways to measure them in these particular research areas. It would be interesting to assess what are the measurement tools available within other areas (clinical psychology as an example), which are not currently used in marketing and consumer behavior researches. It seems important to analyze whether any of these methods can be implemented in other fields of research. Moreover, in order to extend the second question of the thesis, it could be useful to see what are the methods prevailing in other research areas.

Some limitations are associated with the experiment's design and results' interpretation used in the pilot study. Pilot study presented in the third chapter of this thesis employed t-test analysis of data. Results reported difference between groups for disgust emotion as significant at the 10% level (with p-value equal to 0.064). Usage of a larger sample is needed in order to validate significance of the results. Moreover, facial expressions of the participants may have been biased by various factors (for instance, people who scored higher on 'happy' emotion, may have been in general in better mood prior the experiment). Thus, either control-premeasure could have been conducted to overcome this limitation or larger sample of participants could have been used in order to minimize the influence of mood.

It could also be interesting to compare the results achieved in the pilot study with similar studies employing other tools for the analysis of facial expressions (such as EMG). Further research should investigate whether EMG method can provide more accurate results and assess micro emotions, if to be used in identical experiment conditions. Moreover, investigation of the role of context in the pilot study seems to be of research interest.

While being prospective directions for the future research, these questions were not in the focus of this particular thesis and thus are not addressed in this work.
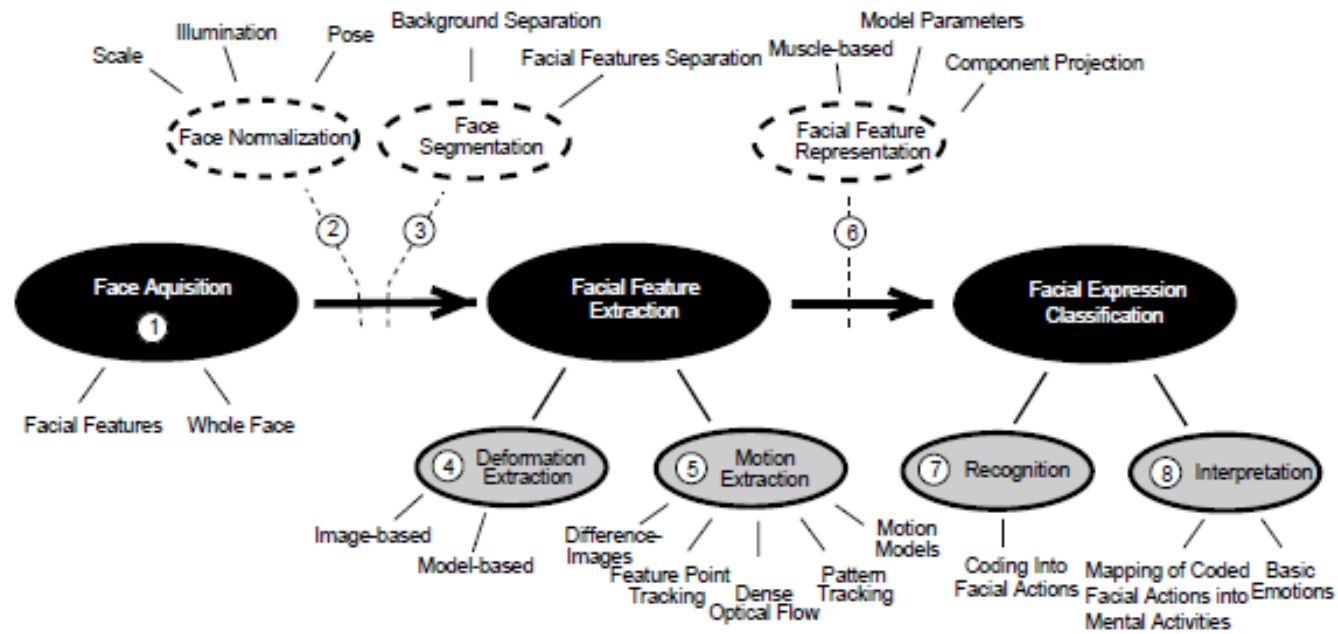
Appendix 1

Relationship between organismic subsystems and the functions and components of emotion

Emotion function	*Organismic subsystem and major substrata*	*Emotion component*
Evaluation of objects and events	Information processing (CNS)	Cognitive component (appraisal)
System regulation	Support (SNS, NES, ANS)	Neurophysiological component (bodily symptoms)
Preparation and direction of action	Executive (CNS)	Motivational component (action tendencies)
Communication of reaction and behavioral intention	Action (SNS)	Motor expression component (facial and vocal expression)
Monitoring of internal state and organism – environment interaction	Monitor (CNS)	Subjective feeling component (emotional experience)
*CNS = central nervous system; NES = neuro-endocrine system; ANS = autonomic nervous system; SMS = somatic nervous system		

Table 1. Relationship between organismic subsystems and the functions and components of emotion (Scherer, 2005, p. 698)

Appendix 2.

Three steps of facial expressions analysis

Generic facial expression analysis framework (Fasel & Luettin, 2003, p. 262)

Appendix 3.

Experiment survey (Qualitrics)

Default Question Block

Resp ID

Welcome to this study.

First, we will show you a short video clip. Please watch it carefully.
Further instructions follow after the video.

Click the arrow below and the video will appear.

Click the right arrow when the video clip is finnished

Instructions

We will now show you a short description of three different companies.

After each description, we will ask you to answer a few questions.

Please read the texts carefully before you proceed to the questions.

Vignette 1

Company description

The new office of the investment company IEG is placed centrally in a historical

old city. The building's architecture represents a disturbing mismatch with the

historical buildings surrounding it.

1.

	Not at all wrong 1	2	3	4	5	6	Very wrong 7
How wrong do you think IEG's behavior is?	○	○	○	○	○	○	○

2.

	Do not punish 1	2	3	4	5	6	Punish severely 7
To which extent do you think the behavior should be punished?	○	○	○	○	○	○	○

3.

	Not at all 1	2	3	4	5	6	Very much 7
If I had bought a product or service from IEG, I would feel regret.	○	○	○	○	○	○	○

4.

	Not at all 1	2	3	4	5	6	Very much 7
If I had bought a product or service from IEG, I would feel guilty.	○	○	○	○	○	○	○

5.

	Not at all 1	2	3	4	5	6	Very much 7
If I had bought a product or service from IEG, I would feel ashamed.	○	○	○	○	○	○	○

6.

	Bad						Good
	1	2	3	4	5	6	7
My overall impression of the company is							

7.

	Unfavorable						Favorable
	1	2	3	4	5	6	7
My overall impression of the company is							

8.

	Negative						Positive
	1	2	3	4	5	6	7
My overall impression of the company is							

vignette 2

Company description

The real estate company MileStone has agreed to let a striptease club rent one of their locations, which is placed right next to the local church's cemetery. A commercial banner, containing sexually explicit pictures, now covers the entire front side of the building.

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1.

	Not at all wrong 1	2	3	4	5	6	Very wrong 7
How wrong do you think MileStone's behavior is?	○	○	○	○	○	○	○

2.

	Do not punish 1	2	3	4	5	6	Punish severely 7
To which extent do you think the behavior should be punished?	○	○	○	○	○	○	○

3.

	Not at all 1	2	3	4	5	6	Very much 7
If I had bought a product or service from MileStone, I would feel regret.	○	○	○	○	○	○	○

4.

	Not at all 1	2	3	4	5	6	Very much 7
If I had bought a product or service from MileStone, I would feel guilty.	○	○	○	○	○	○	○

5.

	Not at all 1	2	3	4	5	6	Very much 7
If I had bought a product or service from MileStone, I would feel ashamed.	○	○	○	○	○	○	○

6.

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	Bad						Good
	1	2	3	4	5	6	7
My overall impression of MileStone is:							

7.

	Unfavorable						Favorable
	1	2	3	4	5	6	7
My overall impression of MileStone is:							

8.

	Negative						Positive
	1	2	3	4	5	6	7
My overall impression of MileStone is:							

vignette 3

Company description

The Bellary Coffee Company admits that their coffee contains up to 3% insect fragments. The company refuses to take any action since the coffee insects don't have any damaging effect on human health

1.

	Not at all wrong						Very wrong
	1	2	3	4	5	6	7

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How wrong do you think Bellary Coffee Company's behavior is?

◯ ◯ ◯ ◯ ◯ ◯ ◯

2.

	Do not punish 1	2	3	4	5	6	Punish severely 7
To which extent do you think the behavior should be punished?	◯	◯	◯	◯	◯	◯	◯

3.

	Not at all 1	2	3	4	5	6	Very much 7
If I had bought a product or service from Bellary Coffee Company, I would feel regret.	◯	◯	◯	◯	◯	◯	◯

4.

	Not at all 1	2	3	4	5	6	Very much 7
If I had bought a product or service from Bellary Coffee Company, I would feel guilty.	◯	◯	◯	◯	◯	◯	◯

5.

	Not at all 1	2	3	4	5	6	Very much 7
If I had bought a product or service from Bellary Coffee Company, I would feel ashamed.	◯	◯	◯	◯	◯	◯	◯

6.

Bad   Good
1   2   3   4   5   6   7

My overall impression of Bellary Coffee Company is:						

7.

	Unfavorable						Favorable
	1	2	3	4	5	6	7
My overall impression of Bellary Coffee Company is:							

8.

	Negative						Positive
	1	2	3	4	5	6	7
My overall impression of Bellary Coffee Company is:							

conclusion

Finally, we have a few questions regarding you as a person

First, we would like to know how you felt when you viewed the film clip.
Please indicate a point on the scale below that best represent your feeling.

(1 = not at all and 7 = a great deal):

	Not at all 1	2	3	4	5	6	A great deal 7
Grossed out	○	○	○	○	○	○	○
Disgusted	○	○	○	○	○	○	○
Sick to my stomach	○	○	○	○	○	○	○

Please indicate how much you agree with each of the following statements, or how true it is about you.

	Strongly disagree (very untrue about me) 0	Mildly disagree (somewhat untrue about me) 1	Neither agree nor disagree 2	Mildly agree (somewhat true about me) 3	Strongly agree (very true about me) 4
It would bother me to see a rat running across my path in a park	○	○	○	○	○
Even if I was hungry, I would not drink a bowl of my favorite soup if it had been stirred with a used but thoroughly washed flyswatter (= a device for swatting insects)	○	○	○	○	○
It would bother me to be in a science class, and see a human hand preserved in a jar	○	○	○	○	○
It would bother me tremendously to touch a dead body	○	○	○	○	○
I probably would not go to my favorite restaurant if I found out that the cook had a cold	○	○	○	○	○

How disgusting would you find each of the following experiences?

	Not disgusting at all 0	Slightly disgusting 1	Moderately disgusting 2	Very disgusting 3	Extremely disgusting 4
You see worms on a piece of meat in an outdoor garbage pail	○	○	○	○	○
You see a man with his intestines (= organs in the human stomach) exposed after an accident	○	○	○	○	○
You take a sip of soda and realize that you drank from the glass that someone else had been drinking from	○	○	○	○	○
A friend offers you a piece of chocolate shaped like dog-doo (= dog excrements)	○	○	○	○	○

Please indicate your political orientation from the following:

○ Left

○ Centrist

○ Right

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Please select the social class of the family you grew up in from the following:

○ Lower class

○ Lower middle class

○ Middle class

○ Upper middle class

○ Upper class

Please write a few words about what do you think was the purpose of this study:

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The end

The purpose of the study you have participated in is to measure the relationship between emotions that naturally occur after watching short films and how people make judgments about moral issues. We will not analyze data from each participant in detail, but rather try to compare how different groups in the experiment have responded to different questions.

There are no right/wrong or correct/incorrect responses to these questions – all questions asked are a matter of personal, subjective opinion. You have participated in one out of two groups, and have been presented to different materials during the study.

Appendix 4
Pretest violations

A behavior can be unethical if it is *harmful* or *impure*. We want you to evaluate the behaviors at the next pages and decide whether you believe they are mostly harmful or mostly impure. But first, please read the following descriptions of harm and impurity.

HARM has to do with:
CARING: If someone does something harmful or uncaring
SUFFERING: If someone causes suffering or pain
WEAKNESS: If someone hurts someone weak or vulnerable
CRUELTY: If someone does something cruel

IMPURITY has to do with:
DECENCY: If someone does something sinful or impure
CLEANLINESS: If someone does something dirty or cause contamination or pollution
BEAUTY: If something is bad taste or ugly
DISGUSTING: If someone does something disgusting

Your task is twofold:
- Based on the definitions on the first page, we want you to indicate the degree to which you believe the behaviors in the table can be characterized mostly as *impure* or *harmful*, where 1 = impure and 7 = harmful. Please choose a point on the 7-point scale that best represents your opinion.
- Second, evaluate the extent to which you think the behavior is **wrong** (1 = Not at all wrong, 7 = Very wrong), and to what extent you believe the behavior should be **punished** (1 = Do not punish, 7 = Punish severely)

	I think this behavior can be characterized mostly as:							How wrong do you think the behavior is?	To which extent do you think the behavior should be punished?
	IMPURE						HARMFUL	Not at all wrong Very wrong	Do not punish Punish severely
The resource center Alpro provides short-term housing for drug addicts. When they move out and leave unwanted belongings behind, the Alpro employees sometimes bring this "left over" shoes and clothing back home for private use.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
One day at the grocery store Supermart, you observe an employee kicking a dog that blocks the doorway.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Corporal punishment is a form of physical punishment that involves the deliberate infliction of pain. 19 states in the U.S. allow corporal punishment for the purpose of disciplining students.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

	I think this behavior can be characterized as:							How wrong do you think the behavior is?	To which extent do you think the behavior should be punished?
	IMPURE HARMFUL							Not at all wrong Very wrong	Do not punish Punish severely
The majestic nature view in Everglades national park has recently been obscured by smog. The primary cause is burning of fossil fuels by the local energy company DAT Energy.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
The CEO of the investment company Aroni ridicules his young employees' clothing in front of their colleagues.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
The new office of the investment company IEG is placed centrally in a historical old city. The building's architecture represents a disturbing mismatch with the historical buildings surrounding it.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
The telecom company Vimpel uses child labor in the developing countries in which the company operates. The children work under very poor conditions.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

	I think this behavior can be characterized as:							How wrong do you think the behavior is? Not at all Very Wrong wrong	To which extent do you think the behavior should be punished? Do not Punish punish severely
	IMPURE						**HARMFUL**		
The real estate company MileStone has agreed to let a striptease club rent one of their locations, which is placed right next to the local church's cemetery. A commercial banner, containing sexually explicit pictures, now covers the entire front side of the building.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
A student member of the fraternity group "Red foxes" refuses to lend lecture notes to a fellow student who missed an important lecture, which is not a member of the group.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
The sandwich chain *Bahia* tends to keep its waste close to the food storage. Untidy and dirty kitchen areas in several of the chain's restaurants have been discovered.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

	I think this behavior can be characterized as:							How wrong do you think the behavior is?	To which extent do you think the behavior should be punished?
	IMPURE						HARMFUL	Not at all wrong — Very wrong	Do not punish — Punish severely
A factory in Indonesia owned by the shoe brand Zoe, hired high-ranking Indonesian military officers to force workers to agree to work for less than the country's minimum wage. The military officers intimidated reluctant workers into signing the contract.	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
The Bellary Coffee Company admits that their coffee contains up to 3% insect fragments. The company refuses to take any action since the coffee insects don't have any damaging effect on human health	1	2	3	4	5	6	7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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