

DISS. ETH NO. 23035

***DEVELOPMENT OF A LINGUISTIC-BASED APPROACH
TO DESIGN FOOD-RELATED EMOTIONAL EVALUATION
LISTS (FEE-LISTS) AND FIRST APPLICATIONS***

A thesis submitted to attain the degree of
DOCTOR OF SCIENCES of ETH ZURICH
(Dr. sc. ETH Zurich)

presented by
ANGELINA SUSANNA GMÜR
MSc ETH in Food Science, ETH Zurich

born on *09.09.1987*
citizen of *Amden, SG*

accepted on the recommendation of

Prof. Dr. Michael Siegrist
Dr. Jeannette Nuessli Guth
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To my beloved parents, Ansgar and Sandra Gmür

for their deep love, endless care, constant support, and strong belief in me.

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Table of Contents

Table of Contents	vii
List of Figures	x
List of Tables	xi
List of Abbreviations	xii

1	General Introduction	1
1.1	Introduction	2
1.2	Defining, characterizing, and classifying emotions	5
1.3	Source and nature of food and odor emotions	8
1.4	Assessing emotions evoked by food and odors	11
1.5	Emotion assessment and its benefit	24
1.6	Research gaps, thesis objectives, and chapter overview	26
	References	28
2	Application of a systematic, linguistic-based approach to design a food-associated emotion lexicon	37
2.1	Introduction	39
	<i>Study 1: Exploration of German terms appropriate for describing food-elicited emotions</i>	46
2.2	Material and method	46
2.3	Results	50
	<i>Study 2: Characterization of German emotion terms as positive, negative or neutral</i>	52
2.4	Method	52
2.5	Results	54
2.6	Discussion	55
2.7	Conclusions	58
	Acknowledgments	60
	References	60
	Supplementary material	64

3	Application of the elaborated German Food-related Emotional Evaluation List in the context of Coca-Cola and Pepsi	69
3.1	Introduction	71
	<i>Study 1: Semantic similarity reduction via free similarity sorts of candidate emotion terms</i>	75
3.2	Methodology	75
3.3	Results	77
	<i>Study 2: First application of the final list to assess emotional associations with two cola brands</i>	79
3.4	Web-based survey	79
3.5	Results	81
3.6	Discussion	84
3.7	Conclusions	90
	Acknowledgments	91
	References	91
	Supplementary material	94
4	More than disgust? – Emotional associations evoked by snacks that contain insects	101
4.1	Introduction	103
4.2	Methodology	107
4.3	Results	111
4.4	Discussion	116
4.5	Conclusions	123
	Acknowledgments	124
	References	124
5	General Discussion	129
5.1	Discussion of the main results, implications, and future research	130
5.2	Conclusions	156
	References	157

Summary	162
Zusammenfassung	163

List of Figures

Figure 1.1	Definitions of the three research fields considered in this doctoral thesis.	3
Figure 1.2	Examples of non-verbal and verbal emotion assessment tools.	12
Figure 1.3	Steps of the development approaches that exist in the sensory science literature for developing lists.	14
Figure 2.1	Multiple-step approach for developing a food-related emotion lexicon.	48
Figure 2.2	Percentage distribution of all candidate and most approved terms concerning their positive-negative categorization.	54
Figure 3.1	Comparison of the mean positive emotional association intensities and neutral (°) and negative emotional association intensities between Coca-Cola and Pepsi.	82
Figure S3.1	Dendrogram for the negative terms without the expression <i>restrained</i> [<i>eingeschränkt</i>].	94
Figure S3.2	Dendrogram for the positive terms without the expression <i>restrained</i> [<i>eingeschränkt</i>].	97
Figure S3.3	Dendrogram for the neutral terms	99
Figure 4.1	Stimuli material used in the present study: (A) “reference,” (B) “flour,” (C) “bits,” (D) “mix,” (E) “crickets” product.	109
Figure 4.2	Positive (aroused – well), negative (bad – uneasy), and neutral (charged – surprised) emotional associations for the four insect-containing products.	112
Figure 4.3	Comparison of the positive (aroused – well), negative (bad – uneasy), and neutral (charged – surprised) emotional associations between flour-containing tortilla chips and reference tortilla chips.	115
Figure 4.4	Pearson’s correlation coefficients r for the relationship between emotional associations and WTE for the “flour,” “bits,” “mix,” “crickets,” and “reference” product.	117
Figure 5.1	Six-step, linguistic-based, systematic approach exemplified for the German language in order to develop FEE-Lists.	132

List of Tables

Table 1.1	Direct and indirect sources of food-related emotions.	9
Table 1.2	Advantages and disadvantages of non-verbal and verbal emotion assessment tools.	13
Table 2.1	Overview of emotion and feeling lexicons in the sensory science literature.	41
Table 2.2	Comparison of domain-and product-specific emotion and feeling lexicons in the sensory science literature.	44
Table 2.3	Comparison of the 49 most approved terms with two existing emotion or feeling lexicons.	51
Table S2.1	Evaluated candidate terms with their approval frequencies depicted in decreasing order.	64
Table 3.1	German Food-related Emotional Evaluation List (G-FEE-List).	78
Table 3.2	Pearson's correlation coefficient r between liking data and emotional association intensities.	85
Table 4.1	Mean scores, standard deviations, degrees of freedom, F- and p-values of the 39 emotional associations for the „flour,“ „bits,“ „mix,“ and „crickets“ product.	113
Table 4.2	Compared willingness to eat (WTE) and expected liking (EL) mean scores with standard deviations (SD), degrees of freedom (df), F- and p-values for the four insect-containing products.	116
Table 5.1	Overview of the thesis' main findings.	131
Table 5.2	Overview of the participant samples that participated in the present thesis and data on the Swiss population.	149
Table 5.3	Future research avenues in the field of odor-related and food-related emotions.	153

List of Abbreviations

CATA	Check-all-that-apply
CES	Consumption Emotion Set
df	Degrees of freedom
EL	Expected liking
EOS	Emotion and Odor Scale
ESP	EsSense Profile™
FEE-List	Food-related Emotional Evaluation List
G-FEE-List	German Food-related Emotional Evaluation List
GEOS	Geneva Emotion and Odor Scale
PrEmo	Product Emotion Measurement Instrument
MAACL	Multiple Affect Adjective Check List
MAACL-R	Revised version of the Multiple Affect Adjective Check List
RATA	Rate-all-that-apply
SD	Standard deviations
UniGEOS	Universal Emotion and Odor Scale
WTE	Willingness to eat
“Bits”	Tortilla chips containing deep-fried cricket bits
“Crickets”	Deep-fried crickets
“Flour”	Tortilla chips made of cricket flour “flour”
“Mix”	A snack consisting of tortilla chips and deep-fried crickets
“Reference”	Non-insect-containing, regular tortilla chips

*“Be with someone who gives you the same feeling of
when you see your food coming at a restaurant.”¹*

¹ Reference of the proverb that was presented on the previous page was retrieved October 28, 2015. Available from <http://www.lovepictures.im/be-with-someone-who-gives-you-the-same-feeling-of-when-you-see-your-food-coming-at-a-restaurant/#.VjDeV6S-21w>

CHAPTER I

General Introduction

1.1 Introduction

A salad of perfectly grilled woodsy-flavored calamari paired with subtly bitter pale green leaves of curly endive and succulent petals of tomato flesh in a deep, rich balsamic dressing. Delicate slices of pan-roasted duck breast saturated with an assertive, tart-sweet tamarind-infused marinade. A big, vibrant Pinot Noir with ripe, sun-dried cherry fruit and smoky, wood-spiced notes. (Anderson et al., 2003, p. 581)

Eating is a pleasure, and eating without emotions would be like a forest in autumn without colors. How would you feel if you imagined consuming the above-described menu? Happy, refreshed, guilty, or disgusted? Would your feelings change if you imagined eating the menu at home or at a candlelight dinner with your spouse? Questions of this type have not been profoundly explored in sensory and consumer research until recently. In a world of absolute oversupply, where the failure rate of new products is high (Köster, Mojet, & MacFie, 2007) and products can no longer be distinguished based on quality, price (Schifferstein, Fenko, Desmet, Labbe, & Martin, 2013), or liking ratings (Cardello et al., 2012), knowing which emotions consumers experience when seeing, smelling, tasting, touching, or eating food products is important for building unique and satisfying goods. Apart from this marketing perspective, measuring food-related emotions is also essential for other disciplines (e.g., nutritional science). In order to explore food-evoked emotions in a satisfying manner, appropriate measurement instruments are necessary. Various verbal measurement tools have been designed in the past using different approaches (e.g., Chrea et al., 2009; King & Meiselman, 2010; Pionnier Pineau et al., 2010; Thomson et al., 2010). The used approaches and resulting lists are highly valuable, but they have several flaws that call for the development of a new approach. Moreover, food-related emotion research is still in its early stages of development, and numerous further studies are required to develop a better understanding and enhanced knowledge about the roles emotions play in consumer behavior and people's everyday lives.

Objectives of the thesis

The present dissertation focuses on the development and application of a new approach to design food-related emotion evaluation lists. As a second objective, the dissertation tests the usefulness of the resulting list in describing food-related emotions in a positive and a negative food context. By tackling the development of food-related emotion lists from a linguistic perspective, the thesis is located at the intersection of sensory, consumer, and language research. Definitions for these three research fields are given in Figure 1.1. In addition to its methodological contribution, the thesis sheds light on the terms that people use to express emotional states and provides new knowledge on the nature and intensity of the emotional associations people have with cola brands and new, innovative food products that contain insects. Moreover, the findings contribute to a better understanding of the development of appropriate verbal measurement tools and the benefits involved in assessing emotions. Thus, the results are beneficial for not only commercial research (e.g., marketers, product developers), but also nutritionists and academic research (e.g., sensory food science, linguistics).

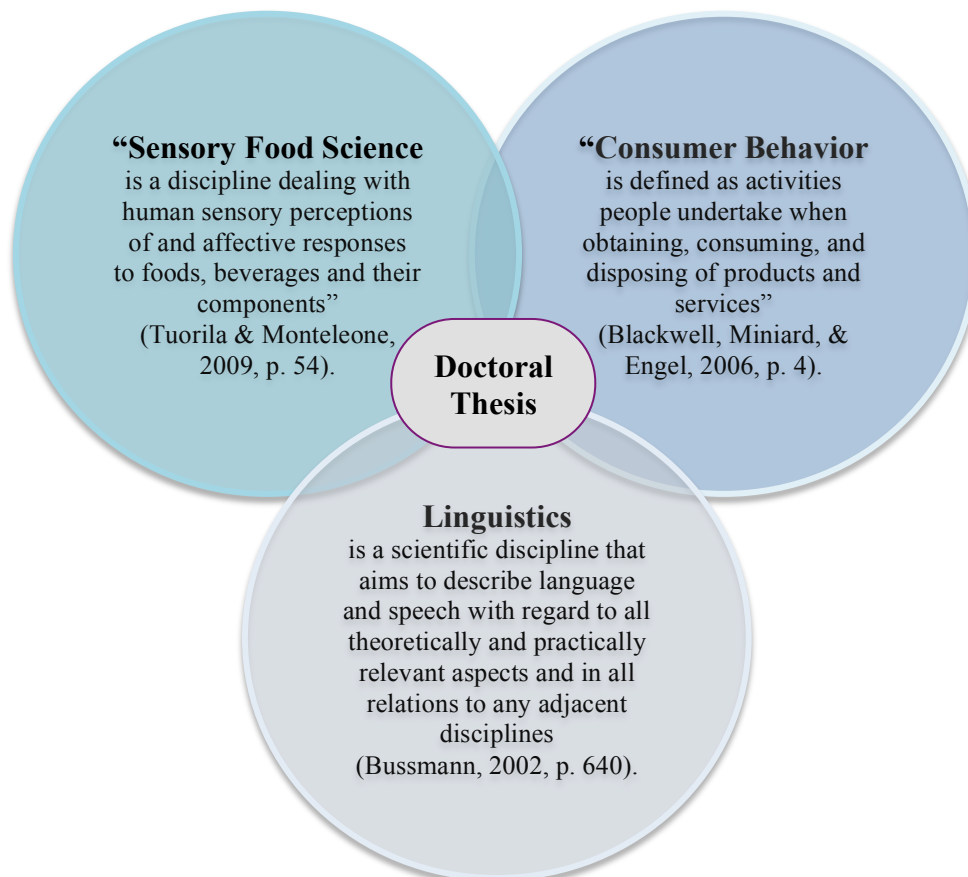


Figure 1.1. Definitions of the three research fields considered in this doctoral thesis.

The thesis comprises five chapters. The general introduction, Chapter I, presents an overview of the definition, source, and nature of food emotions. In addition, Chapter I outlines the approaches and lists available to assess food-related emotions, identifies the limitations in using these approaches and their resulting verbal measurement tools, and highlights the need to assess food-related emotions. It concludes with the formulation of the thesis objectives and a chapter overview. Chapters II, III, and IV present new studies conducted to (i) develop and apply a systematic, linguistic-based approach to design food-related emotional evaluation lists and (ii) apply the resulting list to assess the emotions evoked by different food products. Chapter V summarizes and discusses the findings on a larger scale and presents opportunities for future research.

1.2 Defining, characterizing, and classifying emotions

To study emotions, it is important to know the definition, characteristics, classification, and verbal labels of an emotion. However, before presenting information on the definition from literature, the reader is invited to ask him or herself the following questions: What do you think an emotion is? How would you characterize an emotion? Are there any differences between a feeling and an emotion? It is assumed that the reader quickly realizes that defining the term *emotion* is more difficult than initially expected. The reader might have looked up the definition in the Merriam Webster dictionary, which defines emotion as a mental reaction perceived as a “strong feeling.” An emotion is usually focused on a specific object and typically results in behavioral or physiological responses (“Emotion”, 2015). This definition is rather vague (“usually” and “typically”) and therefore fails to provide a satisfying answer to the questions posed above. The reader may have opted to read about the definition of *emotion* in the scientific psychology literature. However, it becomes apparent that even researchers fail to agree on the definition of the term *emotion* (Ferrarini et al., 2010; Scherer, 2005), the number of different emotions that exist (Jaeger, Cardello, & Schutz, 2013; Scherer, 2005), which terms should be used to describe an emotional experience (Wallace & Carson, 1973), and which labels are emotion terms (Laros & Steenkamp, 2005). Furthermore, different theories have emerged in psychology to explain the occurrence and number of existing emotions (see Kroeber-Riel, Weinberg, & Gröppel-Klein, 2009, for an overview). In an attempt to classify existing emotion definitions, Kleinginna and Kleinginna (1981) categorized more than 90 different definitions. However, they reported that the largest category of reviewed definitions postulates the multicomponent nature of an emotion and that this viewpoint has shown an increasing trend since 1970. Today, considering an emotion as a multicomponent phenomenon is widely distributed (Desmet, 2003; Rousset et al., 2005; Scherer, 2005). A multi-aspect definition of emotion, which may be considered an enriching contribution to the literature, is the component process definition from Scherer (2001): An emotion is “an episode of interrelated, synchronized changes in the states of all or most of the five organismic subsystems in response to the evaluation of an external or internal stimulus event as relevant to major concerns of the organism” (p. 93). According to this conceptualization, the components are functionally defined as the states of the subsystems and include the following five: (1) cognitive component (appraisal); (2) motivational component (action tendencies); (3) neurophysiological component (bodily symptoms); (4) motor expression component (facial and vocal

expression); and (5) subjective feeling component (emotional experience) (Scherer, 1987, 2001, 2005). For many years in literature on emotions, the latter three components have primarily obtained acceptance as being emotion components (Scherer, 2005). It has to be noted that the term *feeling* cannot be used interchangeably with *emotion* (Scherer, 2005). A feeling is solely the subjective and often conscious perceivable component of an emotion (Desmet, 2003; Scherer, 2005). Let us make an example for Scherer's (2005) definition of emotion: Imagine someone has the deep wish to marry (major concern). On the day when the partner proposes, the proposal is rated as relevant (appraisal) and leads to changes in respiratory activity¹ (bodily symptoms), feelings of happiness (emotional experience), a smiling face (facial expression), and perhaps an embrace (action tendency). According to this definition, happiness is an emotion.

In the same paper, Scherer (2005) defined several other affective phenomena (e.g., affect dispositions, moods, preferences). However, differentiating emotions from other affective phenomena is a challenging task. For example, the difference between mood and emotion might be clear in theory (King & Meiselman, 2010). Moods are rather long-lasting, not evoked by a specific event/appraisal or referent, have a low intensity, and have a more diffuse characteristic. In contrast, emotions are caused by an event/appraisal or referent, have a higher intensity, and are not long-lasting (King & Meiselman, 2010; Scherer, 2005). However, trying to actually allocate emotional terms to a group (moods or emotions) is difficult (e.g., *happy, nervous*).

Because divergences exist between emotion theories and definitions, another possibility is to approach the definition from a language perspective by exploring the terms used to describe emotional states (e.g., Storm & Storm, 1987). Literature shows that the number of possible expressions encompasses several hundred candidate terms (Fehr & Russell, 1984; Laros & Steenkamp, 2005; Niedenthal et al., 2004; Shaver, Schwartz, Kirson, & O'Connor, 1987; Storm & Storm, 1987; Thomson & Crocker, 2013; Zammuner, 1998). The words listed in these studies were mainly assembled from previous research activities (e.g., Zammuner, 1998) or from reports of consumers via free-listing or feeling-labeling tasks (e.g., Storm and Storm, 1987). From the general language use, we know that emotions and feelings are expressed by the syntactic context "*I feel/I am + [word]*." Wallace and Carson (1973) used a similar syntactic context, "*He has a feeling of + [word]*" and "*He feels + [word]*," and screened English dictionary entries for potential emotion terms. The authors identified more than an 2,000 candidate

¹ An increased respiratory activity was reported to be related to happiness (Kreibig, 2010).

terms describing an emotional state from a linguistic perspective. Approaching the definition from a linguistic perspective would be more closely related to the folk concepts of emotion, or as Scherer (2005) stated, “emotions are what lay people say they are” (p. 697), which indicates that individuals identify things (emotions) and use words to label them (Frijda, Markam, Sato, & Wiers, 1995). Whether all emotion terms designate different occurring emotions is somewhat questionable.

In literature, an emotion is often characterized by its hedonic tone (valence: positive versus negative) and its intensity level (weak versus strong) (Rousset et al., 2005). While the intensity level is especially important when measuring emotions, valence gives important information on the nature of evoked emotional states, with the result that food-related emotion researchers categorize the emotion terms contained in their verbal measurement instrument as either negative, positive, and/or neutral/unclassified (e.g. King & Meiselman, 2010; Ng et al., 2013a). Unclassified or neutral terms can be either positive or negative (depending on the context) or neither positive nor negative. Furthermore, valence or positive and negative affect categorization is represented in several prototypical models of emotions and constitutes the most basic classification of emotions (Thomson & Crocker, 2013). Prototypical models are classification schemes based on people’s labeling or conceptualization of emotions. The classification of emotions into mutually exclusive dimensions is defined as structural models and is based on a theoretical background (Thomson & Crocker, 2013). The following section briefly presents some prototypical models but not structural models because the present thesis does not rely on emotion theories (for further reading see Thomson & Crocker, 2013).

Russell (1980) introduced a circumplex model that represents the mental map of lay people. Affective experiences are located on a circle comprising two independent, underlying dimensions *pleasure–displeasure* and *arousal–sleep*. These two underlying dimensions were confirmed in food-related emotion research (e.g., Ferrarini et al., 2010; Ng et al., 2013a).

Laros and Steenkamp (2005) constructed a hierarchical consumer emotion model comprising three classification levels differing in the degree of specificity. At the superordinate level, emotions are considered as positive and negative affect. The intermediate class comprises eight basic emotions. The basic emotions summarize 42 terms, which were taken from Richins (1997), and build the more differentiated subordinate level. A more comprehensive hierarchical taxonomy constructed by Storm

and Storm (1987) is based on 525 emotion terms and contains an additional level that represents general words related to the quality of an emotion such as, *bad*, *excellent*, *good*, *sensational*, and *terrible*. More recently, Thomson and Crocker (2013) collected more than 500 expressions from literature and built a prototypical model. Subjects self-reported the occurrence of these emotions on everyday occasions. Based on the results, 55 feeling clusters (23 positive and 32 negative) were derived. In a further step, the 60 exemplar terms selected from the clusters were structured into 25 lower-level clusters and 12 higher-level clusters. Some further details on the approach are given below (section 1.4.1).

1.3 Source and nature of food and odor emotions

The relationship between food and emotions is bi-directional: On the one hand, emotions influence eating behavior, while on the other, eating behavior influences emotional states (Desmet & Schifferstein, 2008). The latter is a recent subject of research in sensory science literature, which has started to explore this relationship in a comprehensive manner. The present thesis also focuses on the influence of food and odor stimuli on emotions.

A survey on the pleasure people assign to different activities in everyday life revealed that eating a fine meal at home is a primary pleasure sources (Iglo-Forum, 1991, as cited in Westenhoefer & Pudiel, 1993). This raises questions about which factors of a consumption situation trigger emotions and whether the emotions are always positive. An informative qualitative study (Desmet & Schifferstein, 2008) provided 11 negative and 11 positive emotions (with two synonyms each) and asked respondents to list conditions in the past in which these emotions were evoked by eating or tasting food. All of the sources of food-related emotions mentioned by the participants could be organized into five evoking conditions that were either direct or indirect (Table 1.1). The first three categories were summarized as product aspects. The product aspects that were most often reported as emotional triggers were taste and smell (Desmet & Schifferstein, 2008). The effect of taste on our affective state has already been suggested in studies with neonates by observing their facial reactions; administration of a sweet solution on the tongue resulted in a hedonically positive facial expression, while a bitter solution evoked a negative facial expression (Ganchrow, Steiner, & Daher, 1983; Rosenstein & Oster, 1988; Steiner, 1974; see also Desmet & Schifferstein, 2008).

Table 1.1

Direct and indirect sources of food-related emotions (adapted from Desmet & Schifferstein, 2008)

	Source	Specification	Examples
Direct sources	Sensory attributes	Sensory attributes include not only olfactory or gustatory stimuli, but also visual or tactile emotion-triggering aspects of a product.	- Boredom elicited by an unsalted snack. - Amusement elicited by the textural properties of cotton candy.
	Experienced consequences	Experienced consequences include physical consequences (e.g., nausea) or mental consequences of eating a food.	- Stimulation elicited by drinking a cup of coffee. - Dissatisfaction because eating a dish did not lead to satiation.
Indirect sources	Anticipated consequences	Anticipated consequences include associated, expected, or imagined consequences of eating a product.	- Fear elicited by the thought of becoming fat from eating fast food. - Unpleasant surprise because the food contained allergy-evoking hazelnuts.
	Personal or cultural meanings	This category contains all associated meanings with food products.	- Amusement elicited by magic candies because they are associated with carnivals. - Enjoyment because the taste of roasted turkey is associated with Christmas.
	Actions of associated agents	Agents are the people involved in preparing, eating, or producing the product (e.g., cook, consumer).	- Pride elicited by compliments from others on a cooked dish. - Feeling ashamed because of the behavior of drunk friends.

Among the growing literature on food-related emotions, the first studies investigated the effect of actual food and odor stimuli on evoked emotions by using unbranded stimuli (e.g., Cardello et al., 2012; Chrea et al., 2009; Desmet & Schifferstein, 2008; King & Meiselman, 2010; Ng et al., 2013a; Spinelli, Masi, Dinnella, Zoboli, & Monteleone, 2014). Unsurprisingly, favorite food products evoked positive emotions and least favorite food products evoked negative emotions (King & Meiselman, 2010; Manzocco, Rumignani, & Lagazio, 2013). A similar result was observed in regard to the consumption frequency: the higher the consumption frequency, the higher the rated intensities of positive emotions. Non-product users had rather a negative emotion profile (King & Meiselman, 2010). Furthermore, studies that tested actual food stimuli revealed that food and odor stimuli evoked a large number of different and simultaneously occurring emotions (Chrea et al., 2009; King & Meiselman, 2010; Ng et al., 2013a), and that positive emotional experiences are more prevalent or intense in relation to food and odor than negative emotional experiences (Cardello et al., 2012; Ferrarini et al., 2010; King & Meiselman, 2010). Desmet and Schifferstein (2008) named this observation the

hedonic asymmetry effect after conducting their study in which participants rated the prevalence of a provided set of 22 emotions on a scale ranging from 1 (*=I never experience this emotion in response to eating or tasting food*) to 5 (*=I very often experience this emotion in response to eating or tasting food*). The second part of the study is described above in the section on emotion sources. In an additional separate part of Desmet and Schifferstein's (2008) studies, participants rated the intensity of the same 22 emotions in response to actually tasting food samples. The findings showed that the reported prevalence of positive emotions was higher than that of negative emotions, with satisfaction, enjoyment, and desire having the highest ratings, and that the participants remembered more instances for positive emotions. Similar but attenuated results were observed during the tasting session. Desmet and Schifferstein (2008) explained the hedonic asymmetry effect by the fact that we choose to eat products that we expect to evoke positive emotions. As a result, we experience more positive emotions with food products and are therefore affectively positively disposed towards eating food. A second reason Desmet and Schifferstein (2008) gave for the hedonic asymmetry effect was that food companies develop products that aim to please the consumer. Desmet and Schifferstein (2008) attributed the weaker hedonic asymmetry effect observed in the tasting session to the fact that participants did not choose the products themselves. The higher prevalence of positive emotions not only holds true in relation to food products. In everyday life, people who are mentally healthy exist in a positive basal state of mind (Thomson & Crocker, 2013).

Most of the recent food-related emotion studies in sensory science literature focused on familiar and/or generally liked products (King & Meiselman, 2010; Ng et al., 2013a; Spinelli et al., 2014; Thomson et al., 2010), which were especially related to positive emotional experiences. However, interaction with food products or odors can also be negative. For example, the odor of fruits, which have a smell of decay (Ferdenzi et al., 2011), food that is of bad quality (Desmet & Schifferstein, 2008), and least favorite food products (King & Meiselman, 2010; Manzocco et al., 2013) may provoke disgust, and if the food taste does not meet their expectations, people may be disappointed (Desmet & Schifferstein, 2008). Desmet and Schifferstein's (2008) study showed that, while the 11 negative emotions they tested can occur with food products, boredom, dissatisfaction, and disappointment seemed to be experienced more often than other negative states, such as anger or sadness. To my knowledge, comprehensive research on

the negative emotional profiles of food products is rare and requires an appropriate measurement tool to capture negative food emotions (see Ng et al., 2013a).

1.4 Assessing emotions evoked by food and odors

Owing to the multi-aspect nature of emotions, an emotion can be measured in many different ways by assessing one of its single components (Desmet, 2003). However, a method that allows us to capture all emotional manifestations simultaneously does not yet exist (Scherer, 2005). Because a vast number of different measurement techniques exist (Desmet, 2003), only the broadest categories and most important instruments are briefly mentioned, based on Desmet's (2003) compilation. Questionnaires will be discussed in more detail (Section 1.4.1) because they have been overwhelmingly used in sensory science in the last few years and are essential for the objective of the present thesis. For extensive and comprehensive reading, Köster and Mojet (2015), Kroeber-Riel et al. (2009), and Mauss and Robinson (2009) provide valuable reviews on emotion measurement techniques and their detailed classifications.

Following Desmet (2003), emotion assessment tools can be characterized as non-verbal or verbal on a broad level (Figure 1.2). According to the componential model mentioned above, non-verbal tools assess the emotion components related to changes in physiology or expression (Desmet, 2003). Expressive reactions include facial expressions (e.g., measured by the FaceReader from Noldus Information Technology (2013)) or vocal characteristics (e.g., see the review of Scherer (2003) on vocal emotion communication), while physiological assessment includes tools that measure brain activity (e.g., Phan, Wager, Taylor, & Liberzon, 2002) and autonomic nervous system activity, such as skin temperature or blood flow (Kreibig, 2010).

Verbal measurement tools are self-reports such as think-aloud protocols, diaries, or questionnaires. These tools assess the conscious, subjective feeling component of an emotion (Desmet, 2003; Kroeber-Riel et al., 2009). However, Desmet (2003) highlighted that verbal and non-verbal measurement instruments have several advantages and disadvantages, of which Table 1.2 presents some examples. In order to cope with some limitations of non-verbal and verbal measurement tools (e.g., expensive investments, cultural limitations), researchers developed non-verbal, self-assessment scales, which depict different emotional states as pictograms (Desmet, 2003; Kroeber-Riel et al., 2009), such as the Self-Assessment Manikin (SAM) (Bradley & Lang, 1994) or the Product

Emotion Measurement Instrument (PrEmo). Desmet (2003) developed PrEmo to assess 7 positive and 7 negative emotions. The emotions are displayed on a computer screen as cartoon animations that comprise facial, bodily, and vocal expressions. Although PrEmo was originally developed for application in product design, it was later validated with food products (Gutjar et al., 2015). The advantages of PrEmo are that no verbalization of emotions is needed, cross-cultural applications are possible, PrEmo measures simultaneously occurring emotions, the task is fun, and it is neither expensive nor difficult to apply. Because of the continuous development of PrEmo, the number of assessed emotions varies depending on the version (cf. Desmet, 2003; Desmet, Hekkert, & Jacobs, 2000). Laurans and Desmet (2012) recently presented a newer version, PrEmo2, that differs in the character style and emotion set.

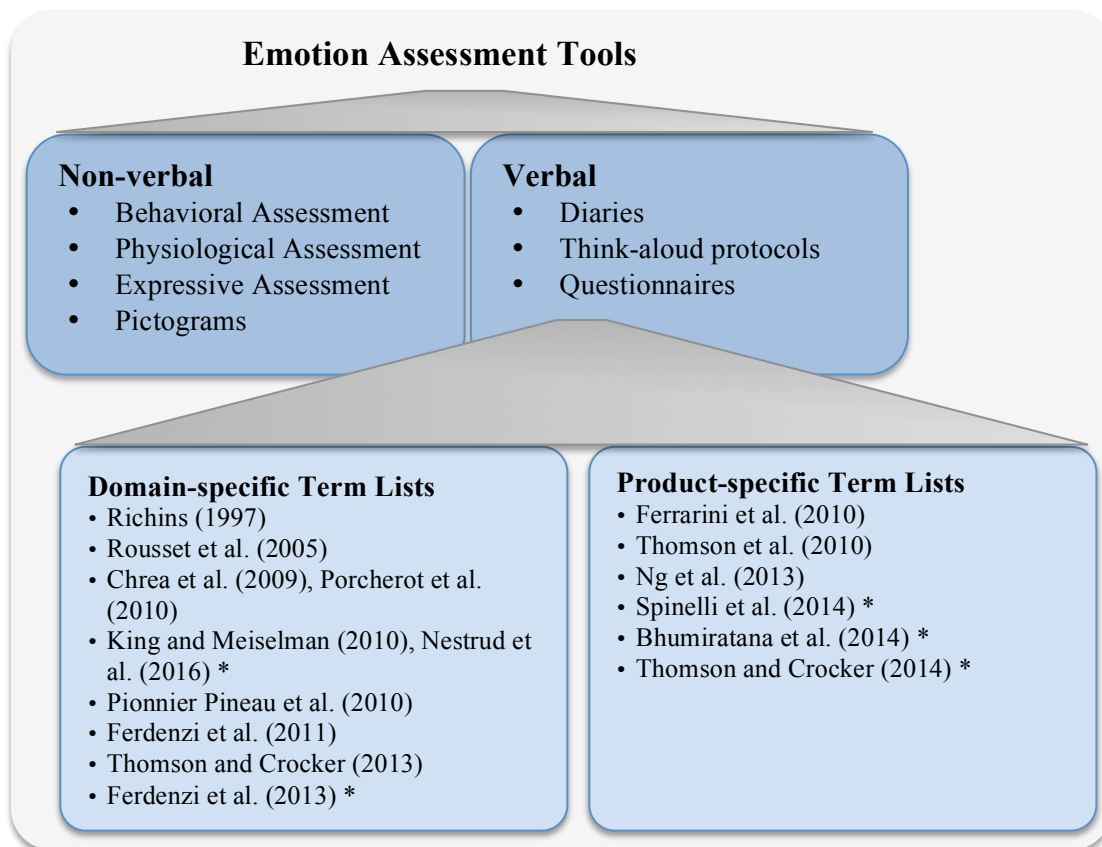


Figure 1.2. Examples of non-verbal and verbal emotion assessment tools. The questionnaire category includes domain-specific and product-specific lexicons that were developed in sensory science. All references with an asterisk emerged after the start of the present project and did not contribute to the initial decision-making. Information on the different non-verbal and verbal instruments was taken from Desmet (2003), Kroeber-Riel et al. (2009), and Mauss and Robinson (2009). The overview is incomplete.

Table 1.2

Advantages and disadvantages of non-verbal and verbal emotion assessment tools

	Non-verbal tools	Verbal tools
Advantages	<ul style="list-style-type: none"> • Language-independent (i.e., cross-cultural comparisons or application with non-linguistically sophisticated people possible) • Do not disturb participant, sometimes more natural • Less subjective 	<ul style="list-style-type: none"> • Cheaper • No additional equipment or technical knowledge needed • Assessment of simultaneously occurring emotions possible • Large number of emotions measurable • Home-use tests and tests in real life situations possible • Larger sample size
Disadvantages	<ul style="list-style-type: none"> • Assessment of a small number of predominantly negative emotions (e.g., facial expressions), lack of emotion specificity • Simultaneously occurring emotions not measurable • Expensive equipment • Technical knowledge • Smaller sample size (e.g., brain activity assessment) • Home-use or test in real life situations more difficult 	<ul style="list-style-type: none"> • Explicit attention necessary, more subjective • Emotions can be hidden • Difficulties for participants with identification of emotional state • Language-dependent <ul style="list-style-type: none"> - Cross-cultural limitations (translational challenges) - Difficulties with verbalizing emotions during free-listing - Difficult to use with non-linguistically sophisticated people (e.g., aphasics) - Influence participants by providing terms - Missing or unfamiliar terms force people to choose another label

Note. This table is compiled from Bradley and Lang (1994), Desmet (2003), King and Meiselman (2010), Köster and Mojet (2015), Kroeber-Riel, et al. (2009), and Scherer (2005). The author extended the table with additional points.

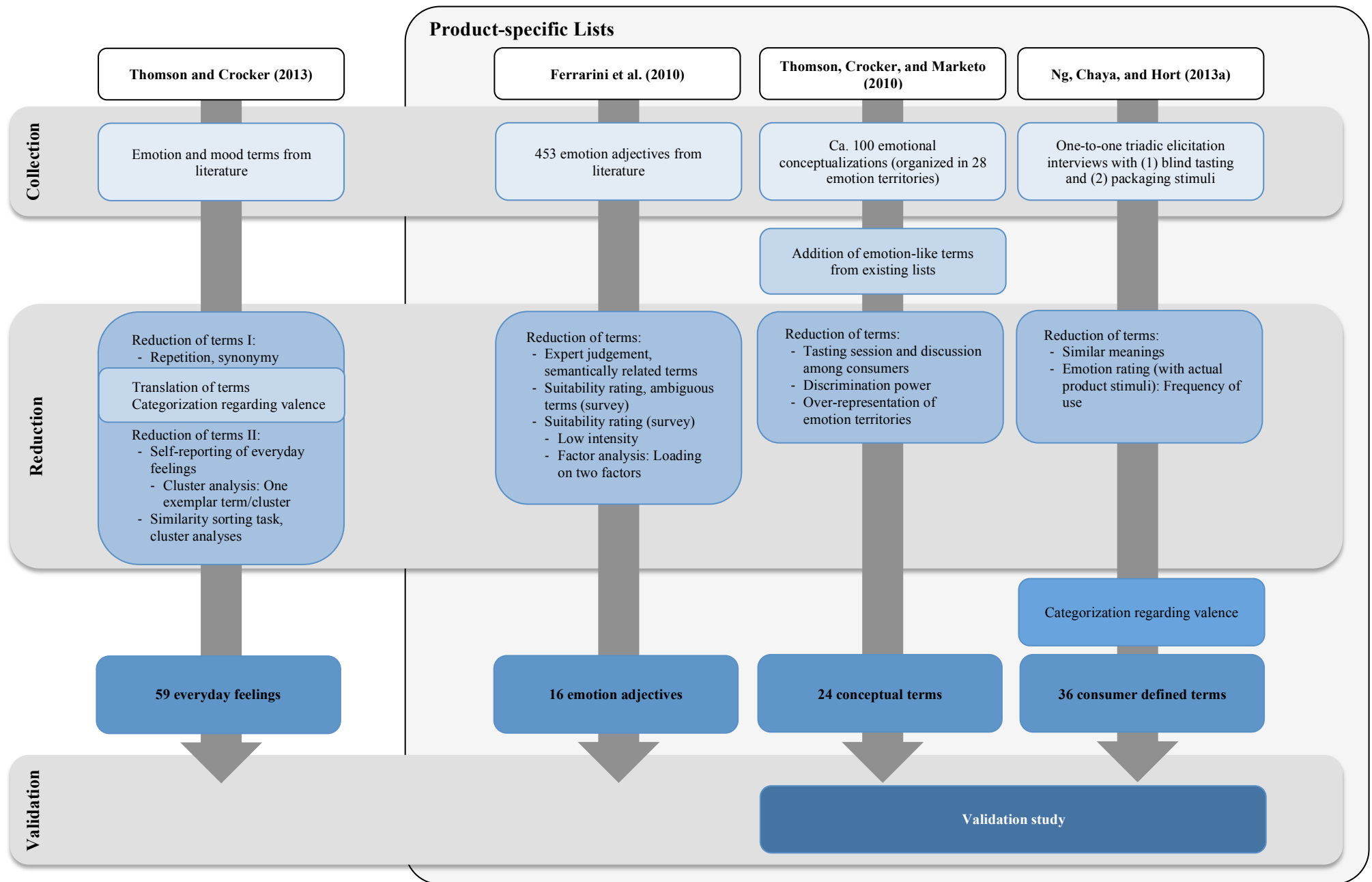
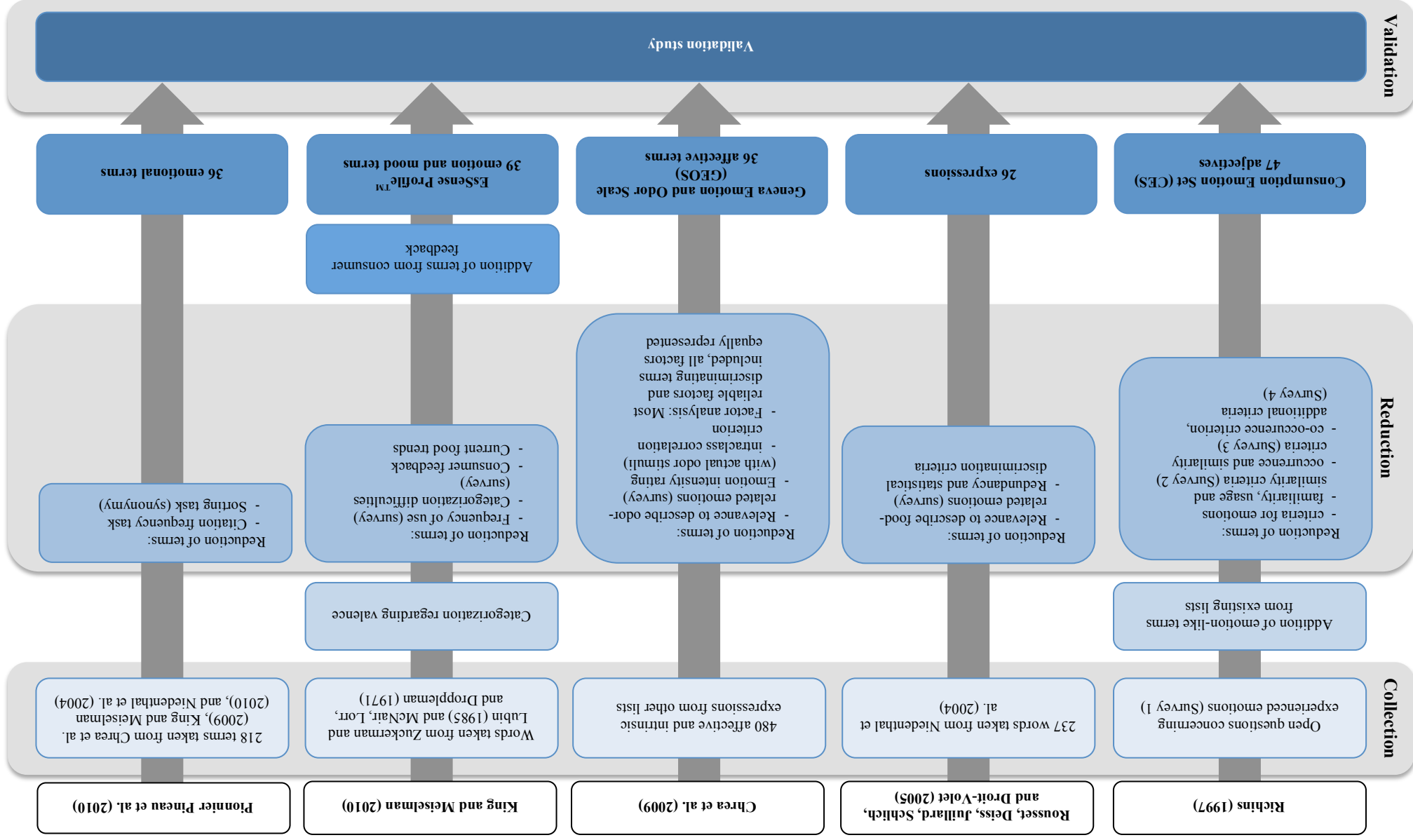


Figure 1.3. Steps of the development approaches that exist in the sensory science literature for developing product-specific lists (framed) and domain-specific lists.

Figure 1.3. (continued)



1.4.1 Verbal measurement tools in sensory science

Although some non-verbal measurement instruments have been used to explore emotions related to taste, odor, or food (e.g., Alaoui-Ismaili, Robin, Rada, Dittmar, & Vernet-Maury, 1997; Danner, Sidorkina, Joechl, & Duerrschmid, 2014; de Wijk, Kooijman, Verhoeven, Holthuysen, & de Graaf, 2012; Lemercier et al., 2014; Pionnier Pineau et al., 2010), researchers often choose verbal measurement instruments to explore food-related emotions. The most frequently verbal assessment tools in sensory science are self-report questionnaires, which invite participants to rate a list of emotion terms. However, the usage of questionnaires used in other disciplines was argued to be less appropriate for describing emotions or moods associated with consumption experiences, foods, or odors. Specifically, several researchers (Delplanque et al., 2012; Ferrarini et al., 2010; Schifferstein & Desmet, 2010) stated that the prominence or the nature of negative expressions in existing lists was not useful to satisfactorily capture the overwhelmingly positive emotions evoked by food (Desmet & Schifferstein, 2008). For example, the Multiple Affect Adjective Check List (MAACL) was often used to explore clinical research questions and the revised version MAACL-R contains extremely negative expressions (e.g., depression-related terms, see Hunsley, 1990) that were irrelevant in a commercial context (King & Meiselman, 2010). In addition, several lists from other disciplines lack terms that might be essential in consumption situations or do not provide information on specifically evoked emotions (Richins, 1997). As a result, various verbal measurement tools were developed in sensory science that can be classified as either domain-specific or food product-specific (Figure 1.2). Figure 1.3 gives an overview of the approaches applied to develop these emotion lists. Please note that all lists that emerged after the start of the present project (indicated by an asterisk in Figure 1.2) were not considered in Figure 1.3 and are not further explained in detail because they did not contribute to the initial decision-making of the project. After presenting the different lexicons and approaches, Section 1.4 introduces the most commonly used emotion response format and explains the limitations of existing lexicons and development approaches.

Domain-specific lexicons. As one of the earlier comprehensive verbal measurement instruments for use in a consumption context (Cardello et al., 2012), Richins (1997) developed a lexicon that covers emotional experiences evoked by various goods and consumption situations (i.e., from buying to using a product). Although the approach for

designing the list did not specifically focus on food products, the first step of the approach considered food-related emotions. Food contexts were also possibly relevant during other approach steps; however, the authors failed to consistently specify the object to which the task was referred. In the first step, emotion terms were collected via two sources (see Figure 1.3). In several subsequent surveys, the gathered terms were reduced by different selection criteria. The result was a Consumption Emotion Set (CES) in English that comprises 47 terms. The terms are organized into 16 clusters and the list can be expanded with nine additional expressions.

In 2005, Rousset and colleagues presented a 26-item food-related emotion list. As the list was originally developed by Juillard (2003) in French as part of an unpublished Master's thesis, details about the applied approach are inaccessible. The list intends to measure the emotions evoked by diverse food products and comprises 13 positive and 13 negative expressions.

Chrea et al. (2008) introduced a scale to verbally assess odor-related emotions during a poster presentation at the European Chemoreception Research Organization Congress. This poster was an antecedent of the first comprehensive odor-related emotion list, the Geneva Emotion and Odor Scale (GEOS), which was published one year later (Chrea et al., 2009). Based on an extensive number of collected expressions (see Figure 1.3), Chrea and colleagues (2009) identified 36 terms that were rated by French and Swiss participants as appropriate for describing odor-evoked emotional experiences, including food odor-related emotional states. Compared to several other applied approaches to developing domain-related lexicons (Figure 1.3), the approach that Chrea et al. (2009) used included actual stimuli rather than mere surveys. The final 36 French expressions, which were predominantly positive, were grouped into six dimensions: "pleasant feeling," "unpleasant feeling," "sensuality," "relaxation," "refreshment," and "sensory pleasure." All six dimensions were assumed to be associated with different functions that odors have in daily life (Chrea et al., 2009). A shorter version of the GEOS, the ScentMoveTM questionnaire (Porcherot et al., 2010), included the three most representative and consensual terms from each of the six dimensions. Instead of rating each of the selected 18 terms, the ScentMoveTM questionnaire presents the terms that belong to the same dimension as triads. Participants therefore rated six series of three expressions. The shorter version yielded similar results as the GEOS and was useful for discriminating between different fine fragrances, perfumery oils, and strawberry flavors. Several subsequent studies validated the GEOS and ScentMoveTM questionnaires

(Delplanque et al., 2012; Porcherot, Delplanque, Gaudreau, & Cayeux, 2013; Porcherot et al., 2012). Moreover, by applying the same approach used for designing the GEOS (Figure 1.3) to six other geographic regions (e.g., Liverpool and Singapore), further Emotion and Odor scales (EOSs) were developed. As an additional result, the Universal Emotion and Odor Scale (UniGEOS) was generated using the terms and corresponding categories that most frequently occurred in the individually developed EOSs of the different regions (Ferdenzi et al., 2013; Ferdenzi et al., 2011). A minor number of the included terms are culture-specific. The UniGEOS consists of 25 affective terms, which are organized into nine categories and provided in four languages (Ferdenzi et al., 2013). Because the UniGEOS was developed considering different cultures and languages, it may be widely applicable.

The introduction of the EsSense ProfileTM in 2010 contributed majorly to food-related emotion research. Its introduction and initial results (King & Meiselman, 2010) prompted several discussions and were probably the springboard for further studies. The EsSense ProfileTM was designed for a commercial context and for measuring emotions that product users/likers have. The ballot includes the evaluation of emotion terms (on a 5-point scale) and overall acceptability (on a 9-point hedonic scale). The approach to designing the list started with the collection of English expressions from standardized questionnaires that emerged in clinical/psychiatric research. Because the subsequent steps (see Figure 1.3) were not food product-specific, the resultant 39-emotion and mood term list (3 negative, 25 positive, and 11 unclassified expressions) is applicable to various food products (see also Ng et al., 2013a). The EsSense ProfileTM is currently the most frequently used questionnaire for exploring food-related emotions in sensory science (e.g., Cardello et al., 2012; Gutjar et al., 2015; Jaeger & Hedderley, 2013; King, Meiselman, & Carr, 2010; Piqueras-Fiszman & Jaeger, 2014). The EsSense ProfileTM has also been used to explore methodological aspects regarding designing and using emotion questionnaires (Jaeger et al., 2013; King, Meiselman, & Carr, 2013; Ng et al., 2013a; Spinelli et al., 2014). A shorter version, the EsSense25 list, was recently derived via similarity sorting tasks (Nestrud, Meiselman, King, Leshner, & Cardello, 2016).

In 2010, researchers from Nestlé proposed a lexicon during a poster presentation at the Fourth European Conference on Sensory and Consumer Research to assess beverage-related emotional states (Pionnier Pineau et al., 2010). By applying the approach shown in Figure 1.3, the result was a list containing 36 expressions that were unrelated to any specific beverage. The 36 terms were organized by eight underlying

dimensions: “pleasure,” “disgust,” “surprise,” “envy,” “excited,” “nostalgic,” “refreshed,” and “serene.” However, the list and the validation study went unpublished.

Lastly, Thomson and Crocker (2013) chose an approach characterized by its multi-country nature and the classification of feelings from which the list was derived. Similar to Richins’ (1997) CES, the resulting list was intended to cover a wide range of consumer emotions. As a first step in the approach, several hundred potential English feeling terms were collected and translated into French, Italian, and German. In a subsequent survey, participants from four European countries reported their prevailing feelings at different points in time using the collected terms. The ratings were then subjected to a structural analysis, yielding 55 clusters, from which the final structured list of 59² representative exemplar terms was selected. In order to achieve a higher-level categorization, students from the UK performed a similarity sorting task on the aforementioned exemplar terms. Cluster analyses grouped the expressions into 25 lower-level clusters and 12 higher-level clusters (see Section 1.2). The lexicon has not been validated thus far. Figure 1.3 shows the translation step and categorization regarding the valence in light blue because they did not contribute to the reduction of the initial term pool but were relevant parts of the applied approach. The advantage of the final list is that it represents the terms used in four different European languages to describe everyday feelings. The list is therefore applicable to different countries, and no further translational step is needed. In addition, the underlying classification scheme indicates whether the included list terms cover adequately the wide range of important feelings (Thomson & Crocker, 2013).

In addition to these domain-specific lists that were not developed with reference to a specific food product, several food product-specific lexicons have arisen in the last few years.

Product-specific lexicons. Ferrarini et al. (2010) designed a relatively short 16-term lexicon (4 negative and 12 positive expressions) in Italian by collecting terms from existing literature and reducing the term number in subsequent surveys. The list aims to assess the emotions people experience when consuming wine. To my knowledge, the list has not yet been validated.

Thomson et al. (2010) developed and validated a lexicon containing 24 English emotional conceptualizations specifically for dark chocolate. The addition of terms

² Initially, there were 60 selected expressions. However, one term was rated as inappropriate during the analysis of the subsequent similarity sorting data because of its ambiguous meaning, leaving 59 terms.

during Step 2 (see Figure 1.3) was actually part of the discussion round in Step 3. However, owing to logistical reasons, it is depicted as a separate step.

By using quite a different approach that considered the consumers' language, Ng et al. (2013a) presented an emotion lexicon that measures emotions evoked by blackcurrant squash products. In contrast to other approaches, the terms were collected from consumer responses using one-to-one triadic elicitation interviews instead of existing emotion term lists. More specifically, various products were presented blindly in different combinations of triads. The consumers had to taste the products and write down "in what way two products were similar but different from the third in terms of their conceptual response" (Ng et al., 2013a, p. 196). In a subsequent tasting session, consumers had to rate each product by checking all the terms on their generated list that applied. The same procedure was conducted with respect to the product packaging. The application of diverse selection criteria (Figure 1.3) resulted in a 36-term list that, unlike other emotion term lists, has a substantial amount of negative expressions (19 negative, 16 positive, 1 unclassified). In a subsequent study (Ng, Chaya, & Hort, 2013b), the list was extended by adding terms to measure emotions evoked by sensory and packaging cues of blackcurrant squashes.

By using product-specific or domain-specific lexicons, emotion assessments were conducted via different response formats.

Emotion response formats

Food-related emotion research most frequently uses checklist or rating questionnaires. By applying checklist questionnaires (King & Meiselman, 2010; Manzocco et al., 2013; Ng et al., 2013a, 2013b), emotion terms are presented to participants who are invited to check all the expressions that apply (check-all-that-apply; CATA), similar to a multiple choice question (Ares & Jaeger, 2013). Rating questionnaires present respondents with a long list of emotion terms. The participants are invited to rate each term on an intensity scale. The applied scaling methods include category scales that range from 3- to 5-point rating scales (Desmet & Schifferstein, 2008; King & Meiselman, 2010; Richins, 1997; Rousset et al., 2005; Schifferstein et al., 2013; Spinelli, Masi, Zoboli, Prescott, & Monteleone, 2015) or linear scales (Porcherot et al., 2013; Porcherot et al., 2010). Compared to CATA tasks, the data produced by rating scales can be analyzed with a wider range of statistical techniques because of their quantitative nature (Ng et al., 2013a). A further advantage of rating scales is that they have a higher sensitivity in

revealing differences between products (King et al., 2013). However, the CATA response format is faster, easier to use, and less exhausting for respondents (Ng et al., 2013a). Both formats were shown to differentiate within product categories (King & Meiselman, 2010; Ng et al., 2013a). To combine the advantages of CATA tasks and linear scales, rate-all-that-apply (RATA) formats were proposed by Ng et al. (2013a). RATA formats require respondents to check all the terms that apply and rate the checked terms on linear scales (Ng et al., 2013a).

Limitations of existing development approaches and (resultant) lexicons

Before verbally assessing emotions in food research, investigators confront the decision of choosing an existing list or developing a new one. However, using existing lexicons and development approaches has several limitations that will be addressed in the following paragraphs.

By comparing the terms listed in existing lexicons, one might be surprised at how small the identical overlap between existing lexicons is. This shows the large number of words available to label emotions, even though few are actively used. Here, the distinction should be made between an individual's active and passive vocabulary, according to Corson's (1995) definitions.

Active vocabulary. Active vocabulary includes all of "those words people need to use and have no reservations about using to communicate with others on an everyday basis" (Corson, 1995, p. 45). Most often, active vocabulary contains terms that have a high frequency in a language and depends on diverse factors, such as sociocultural determinants. Little activation is needed to retrieve these terms (Corson, 1995).

Passive vocabulary. Passive vocabulary contains also those expressions "stored in verbal memory that people partially 'understand,' but not well enough for active use. These are words that people meet less often and they may be low frequency words in the language as a whole" (Corson, 1995, p. 45). The stimulus to activate these words has to be longer and more intense in order to use them compared to actively used words (Corson, 1995). Passive vocabulary is also often described as those terms whose meaning we understand but do not actively use (Cruse, Hundsnurscher, Job, & Lutzeier, 2005).

It has been indicated that our emotion vocabulary contains more negative than positive terms (Laros & Steenkamp, 2005; Thomson & Crocker, 2013). In a first attempt

to capture the extent of an individual's emotion vocabulary, Wallace and Carson (1973) estimated, based on interview data, that the vocabulary of an English-speaking person contains between 2^7 to 2^9 different terms. The nature of the terms varied between different subjects. Thus, summing the vocabularies of just five subjects resulted in more than 1,000 different expressions. Although the sample consisted of 10 patients and psychiatric professionals who held at least a high school degree, the data gave a rough estimate of the vast number of existing emotion labels. Therefore, the low correspondence between the lists from sensory science should not be surprising (Wallace & Carson, 1973). The lack of a uniform definition and theory of emotion, the challenge of translating existing term lists (see below), and methodological and cultural aspects may have led to differences in the lists. Methodological aspects, which include the application of different approaches that involve different selection criteria, may have led to differences in existing lists (see Figure 1.3). Additionally, some lists were developed with regard to a specific food product category, whereas others were not designed for a particular product. Culture and (consumers') language may play an important role in the assessment of emotions (van Zyl & Meiselman, 2015) and in the development of verbal emotion assessment tools (Ferdenzi et al., 2011; Spinelli et al., 2014), and should thus be considered during the design of list of emotion terms. A more detailed look at the approaches used in the sensory science literature shows that they consist of three main steps (illustrated as grey horizontal bars in Figure 1.3):

- The collection of potential emotion terms from existing lists (this is not true for the approach used by Ng et al. [2013a]).
- The reduction of the collected terms by involving consumers' evaluation and the application of diverse selection criteria.
- A validation step.

Using existing lists, which are often developed in other cultures or in another language, has several limitations: First, the resulting list is less culture- and language-specific. For example, in a cross-cultural study conducted with odors, Asian cultures perceived spiritual emotions in response to smelling the tested odors. These emotions were not relevant in European countries to report odor-related emotions (Ferdenzi et al., 2011). Furthermore, although several underlying dimensions are recurrent in different cultures (e.g., disgust, happiness/well-being), some dimensions are not shared (e.g.,

hunger/thirst), and the recurrent dimensions partially consist of different terms (Ferdenzi et al., 2013; Ferdenzi et al., 2011). Because existing approaches take other lists as a basis, it is suggested that the resulting list not only contains terms that are actively used by consumers in the everyday language but it may also contain passively used expressions. This could lead to difficulties during the task if the more familiar term or evoked emotion is not listed, or if participants do not understand the meaning of a term. Participants who do not understand the meaning of an emotion term may not be able to assess the emotion (Jaeger et al., 2013). Second, using lists that were published in another language requires a translation step. However, translating terms is a challenging task. There is often no one-to-one translation (see also Desmet, 2003). Some terms can be translated into several different expressions in another language. For example, the English word *merry* can be translated into the German words *lustig*, *fröhlich*, or *vergnügt* ("Merry", 2015). Furthermore, by trying to translate emotion terms, the precise meaning is lost (Köster & Mojet, 2015). A third limitation is that, as several existing approaches do not start from scratch, they are less systematic. Moreover, most procedures do not approach the development of emotion lists from a linguistic perspective. At the time when the present thesis was begun, one exception to this was the list developed by Ng et al. (2013a) which was started from scratch and based on consumers' language via one-to-one triadic elicitation interviews. A comparison of the performance of the resulting, consumer-driven product-specific lexicon with the performance of the product-unspecific EsSense Profile™ found that the consumer-driven lexicon was more discriminating. However, this could have been partly related to the product-specific nature of the consumer-driven lexicon. The disadvantage of Ng et al.'s (2013a) list is that it is highly product specific (blackcurrant squash). Furthermore, one-to-one triadic elicitation interviews are restricted by the respondents' capability to articulate their emotions (Ng et al., 2013a). Thus, a good alternative would be to use comprehensive data that contain actively used terms (actual language use data). Finally, only one comprehensive German lexicon exist in sensory science. However, this lexicon, which was developed by Thomson and Crocker (2013), is not food-specific and may therefore be inappropriate to describe food-related emotions. Chrea et al. (2009) emphasized the necessity to develop domain-specific lists in regard to odors.

1.5 Emotion assessment and its benefit

“Emotions guide, enrich and ennoble life; they provide meaning to everyday existence; they render the valuation placed on life and property” (Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2000, p. 173). Because emotions are a driver in everyday decisions and behavior, it is important to have knowledge of the sources, occurrence, nature, and impact of our emotional states. Thus, assessing the emotions evoked by consumer goods may be important and interesting for diverse disciplines, such as consumer behavior, sensory science, marketing, product development, dietetic treatments, or psychology.

Most consumer and sensory research studies stress the need to assess food-related emotions from a commercial perspective. Over the years, acceptance testing has been used to discriminate between food products (Cardello et al., 2012) or evaluate new products to estimate market success (Thomson, 2007, 2010). Acceptance testing belongs to the sensory test class of hedonic/affective testing and assesses the degree of liking. One of the most prevalent and traditional acceptance rating scales in consumer testing is the 9-point hedonic scale, which consists of nine verbal labels ranging from “dislike extremely” to “like extremely.” Numbers are often assigned to the labels (Lawless & Heymann, 2010). A tremendous number of studies have explored the influence of product information (e.g., price) on liking scores (e.g., Caporale & Monteleone, 2004; Johansen, Næs, Øyaas, & Hersleth, 2010; Kim, Lopetcharat, & Drake, 2013; Lee, Frederick, & Ariely, 2006; Plassmann, O'Doherty, Shiv, & Rangel, 2008; Siegrist & Cousin, 2009; Varela, Ares, Giménez, & Gámbaro, 2010). However, food industries have started to design products that no longer differ in liking (Cardello et al., 2012), quality, or price (Schifferstein et al., 2013). Furthermore, as the survival time of most new products launched into the market is relatively short (Thomson, 2010), new methods that predict market success (Thomson, 2010) and can discriminate between highly similar products are needed. The latest studies from odor-related and food-related emotion research (e.g., Bhumiratana, Adhikari, & Chambers IV, 2014; Cardello et al., 2012; King & Meiselman, 2010; Ng et al., 2013a; Porcherot et al., 2010; Rousset et al., 2005; Spinelli et al., 2014; van Zyl & Meiselman, 2015) have shown that emotions are able to differentiate between and within product categories. For example, the tasting of blackcurrant squashes resulted in significant differences in diverse emotional states (e.g., *satisfaction* and *disgust*) between the products (Ng et al., 2013a), and the tasting of an innovative chocolate spread made respondents significantly more *disappointed* and *bored*, and significantly less *energetic* and *happy* than the tasting of common chocolate spreads (Spinelli et al., 2014).

Additionally, some of these studies revealed that stimuli that did not differ in their liking scores were discriminated by evoked emotions. Besides the discrimination ability of emotions, assessing emotions could provide further information about products that is not captured by measuring liking alone (Jaeger et al., 2013; King & Meiselman, 2010). For example, if a product has a failure, companies could benefit from knowing whether consumers felt sad or angry in response to their interactions with it (Laros & Steenkamp, 2005). Emotions may also help to explain the differences in liking scores of two products (Spinelli et al., 2014). It is thus suggested that information provided by assessing emotions would contribute to a competitive advantage (Ng et al., 2013a; Schifferstein et al., 2013) and may explain market success (King & Meiselman, 2010). To investigate the relationship between liking scores and emotion evaluations and to determine their relative benefit, several questionnaires on food-related emotion research have included a measurement of liking (e.g., Gutjar et al., 2015; King & Meiselman, 2010; Ng et al., 2013a; Spinelli et al., 2014; Spinelli et al., 2015).

In addition to this commercial benefit, assessing food-related emotion might be important for dietetic or psychological treatments. Measuring emotions toward nutrient-rich food could be beneficial for developing products that appeal to nutrient-deficient people or people that are at risk for a nutrient deficiency (Rousset et al., 2005). These target groups include young and old people, but also people in developing countries. For example, Rousset et al. (2005) has shown that young women who had a low intake of meat and were therefore at risk for iron deficiency reported more negative emotions in response to meat and other food products than high meat-eating women. As another example, knowing the emotions that obese, bulimic, or restrained eaters have toward eating could help to understand their behavior and treat their disease. The relation between emotions and eating behavior in regard to the high prevalence of eating disorders has thus gained a great deal of attention in the literature (Köster & Mojet, 2015). However, in this case, applying clinical emotion questionnaires could be more helpful because they include more negative expressions (King & Meiselman, 2010). Moreover, the proportion of older people is growing faster than other age groups in almost every country (World Health Organization, 2016). Taste and smell perception and preferences for specific food products may change with age. Therefore, insight into the emotions older people experience with food products would help in the development of products that are pleasing to this consumer segment. One of the first studies on this topic was recently published by den Uijl, Jager, de Graaf, Waddell, and Kremer (2014), who

segmented older people based on the emotions associated with mealtimes into four different groups, namely, pleasurable averages, adventurous arousals, convivial indulgers, and indifferent restrictives. Segmenting young and old consumers based on the emotions they experience and developing products that evoke a specific emotion profile that appeals to individual consumer segments could further be beneficial for food industries. Lastly, I would expect that exploring the emotion profile of nutrient-rich food variants before introducing the product to the people, such as the differently looking golden rice, which was developed to fight against vitamin-A deficiency in developing countries (Golden Rice Humanitarian Board, 2015), may be beneficial for guiding product development and initial introduction steps, which may lead to increased acceptance.

1.6 Research gaps, thesis objectives, and chapter overview

In summary, based on the outlined state of knowledge, there are two main challenges to exploring food-related emotions: First, researchers do not agree on the definition, number of emotions, or emotion terms. Second, although considerable effort went into the development of verbal measurement tools in sensory science, most approaches or resulting lexicons were less systematic and did not consider the active language use of emotion terms in a comprehensive manner. Therefore, the objective of the present thesis is to develop a systematic, linguistic-based approach to design food product-unspecific emotional evaluation lists. By including consumers' active language vocabulary, the approach does not rely on any definition from the emotion literature but rather it tackles the problem from a linguistic perspective by using large actual language data. Because no comprehensive German food-related emotion term list exists, we applied the approach to the German language. Furthermore, we tested the usefulness of the resulting list in both a positive and a negative food context. To date, negative comprehensive emotional evaluation profiles of food products are somewhat unexplored.

Throughout this thesis, the terms obtained from the applied approach are given in English (approximate translation) and in the original language German (in parentheses).

Chapter overview

Chapter II

In this study, the new approach is introduced in detail and applied to the German language. The findings provide information on the nature of the terms that people find appropriate for describing food-related emotional experiences. Additionally, the resulting list of terms is compared and discussed in regard to other existing lexicons.

Chapter III

This study consists of two parts. In the first part, an extension of the approach that was presented in Chapter II is introduced and used to overcome some limitations in the initial list. In the second part, the finalized list is used to assess the emotional associations that people have in a positive food context; i.e., with cola brands. The study further provides information on whether the list can be used to differentiate between two similar brands.

Chapter IV

This chapter describes the findings from the test of whether the finalized list could be used to measure emotional associations in a negative food context. More specifically, the objective was to assess the emotional associations that people have with unfamiliar, innovative food products (i.e., snacks containing insects) and whether the hedonic asymmetry observed in the literature is maintained in this more negative context of food. Furthermore, this chapter provides recommendations and directions for how food that contains insects should be marketed in Western countries and gives further directions on the introduction of insect food into Western markets.

Chapter V

The general discussion summarizes the main findings and discusses them on a larger scale. Furthermore, methodological considerations and directions for future research are outlined.

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CHAPTER II

From emotion to language: Application of a systematic, linguistic-based approach to design a food-associated emotion lexicon

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Abstract

In recent years, new emotion and feeling lexicons developed in different languages and cultures have led to interesting insights into food- and odor-elicited emotions. However, most of the applied methods were not very systematic and used preexisting word lists as a starting point. None of the lexicons was generated from a linguistic perspective using comprehensive actual language use data. The aim of the present two studies was to explore the nature of the most appropriate terms used to describe food-related emotions with a systematic, linguistic-based method. In the first study, we applied a novel, three-step approach to the German language by collecting actively used emotion words. The collection and identification step resulted in 272 candidate terms that have an emotional connotation. In an online survey, 222 German-speaking participants rated the relevance of these candidate words in relation to food products. The positive-negative-neutral categorization in the second study was aimed to characterize the 272 candidate words and to test for the occurrence of a hedonic asymmetry. The application of the novel approach in Study 1 was useful to identify 49 terms. The result indicates that German-speaking consumers actively use differentiated and evaluative words to describe food-evoked emotions. Up to 70% of these expressions were positive, confirming the occurrence of a hedonic asymmetry by means of a linguistic-based approach. The nature of our identified expressions differed, however, from preexisting lists, which may be attributed to divergences in the applied approaches or suggested cultural aspects. Overall, the novel, systematic and linguistic-based approach, and the designed German emotion lexicon tailored to the consumers' active language use, are valuable tools to deepen our understanding of the role that emotions play in food consumption experiences.

2.1. Introduction

Emotions shape and color our everyday lives. Imagine that you are going to meet an old friend. You feel happy and probably a little bit nervous. Or when you are listening to music, a song may elicit sadness while another one joy. Even when you are eating and drinking, emotions play an important role. We know from everyday life that food can make us happy or elicit disgust; we might feel refreshed or guilty, for example. Eating and drinking are far more than just taking in energy; we want to be pleased with the food we eat.

In the last few years, studying emotions in the field of sensory science has gained momentum. Questions such as which and how many emotions are relevant and in relation to what food product have been investigated with food-specific emotion and feeling lexicons (e.g. King & Meiselman, 2010). However, existing verbal measuring instruments in the sensory science literature differ in the nature of terms, and none of these lexicons was generated from a linguistic perspective using comprehensive actual language use data. In contrast, most of the applied approaches were not very systematic and used preexisting word lists as a starting point. Therefore, the resulting word lists do not necessarily represent the terms actively used by the consumers. This may result in a relatively lower applicability in studies with consumers compared to tools that are tailored to the consumers' active language use. Thus, in our case study, we tested a novel, systematic and linguistic-based approach to develop a food-associated emotion lexicon by applying it to the German language.

Studying emotions involves the challenge of defining what an emotion is and how emotions can be characterized and measured. From an etymological perspective, the English and German term *Emotion* originates from the French words *émotion* and *émouvoir*, which trace back to the Latin word *emovere*. The latter means *to bring out, to shake, to stir up* and is composed of *e-* (from *ex*) meaning *out* and *movere* meaning *to move* ("Emotion", 2001; "Emotion", 2009; "Emotion", 2014). An emotion is therefore something that moves from the inside. However, as Fehr and Russell (1984) have already pointed out three decades ago, "Everyone knows what an emotion is, until asked to give a definition. Then, it seems, no one knows" (p. 464). The definition of the term "emotion" is still a "notorious problem" (Scherer, 2005) and "frequently debated matter" (Ferrarini et al., 2010). Therefore, a plethora of diverse definitions (Desmet, 2003; Kroeber-Riel, Weinberg, & Gröppel-Klein, 2009; for a review see Kleinginna & Kleinginna, 1981) and several hundred emotion words have been provided by the psychological literature (Fehr & Russell, 1984; Niedenthal et al., 2004; Scherer, 1984; Shaver, Schwartz, Kirson, & O'Connor, 1987; Storm & Storm, 1987; Zammuner, 1998). Comparing 10 important studies published in the field of psychology clearly shows that the

references differ in the number and nature of listed expressions (Laros & Steenkamp, 2005, Table 2, p. 1439).

In the sensory science literature, different domain- or product-specific emotion and feeling lexicons have lately evolved to verbally assess experienced emotions (Table 2.1). In pioneering research, scientists at the University of Geneva, Switzerland, extensively explored the words used in different cultures and languages to label odor-related feelings. This resulted in a series of culture-specific Emotion and Odor Scales (EOSs) that were developed by applying the same procedure in different countries (Chrea et al., 2009; Ferdenzi et al., 2013; Ferdenzi et al., 2011). At the peak of the investigations, a universal scale (UniGEOS) was recently designed (Ferdenzi et al., 2013). In addition to culture-specific aspects, the UniGEOS joins the most common affective term groups and descriptors of seven geographic regions in one lexicon. The first food-related questionnaire that has attracted wide interest in the emotion and food research community is the EsSense ProfileTM. The EsSense ProfileTM was designed for commercial research with product (category) users and contains a task for evaluating 39 English-language emotion terms (King & Meiselman, 2010). Since this method emerged, it has been actively used and discussed (Cardello et al., 2012; Jaeger, Cardello, & Schutz, 2013; Jaeger & Hedderley, 2013; King, Meiselman, & Carr, 2010, 2013; Ng, Chaya, & Hort, 2013). In addition to the UniGEOS, the second multi-lingual lexicon in the sensory science literature was developed by Thomson and Crocker (2013) and contains 59 feeling terms in English, French, German and Italian. It is the output of a self-report study on everyday occasions conducted in four Western countries.

A striking feature of several food- and odor-associated emotion lexicons (e.g. Chrea et al., 2009; King & Meiselman, 2010) is the predominance of positive terms. Physical or conceptual food and odor stimuli seem to trigger pleasant/positive emotions more often than unpleasant/negative ones (Cardello et al., 2012; Desmet & Schifferstein, 2008). Desmet and Schifferstein (2008) further observed that their participants remembered more instances of food-elicited emotions in the case of positive terms than negative words. These phenomena were labeled “hedonic asymmetry” and may be due to the industries’ aim of supplying appealing products, which therefore presumably implicate positive emotional experiences (Desmet & Schifferstein, 2008). Additionally, the authors assumed that healthy subjects “have a predominantly positive affective disposition towards eating and tasting food” because consumers tend to eat products that trigger the expectation of evoking pleasant emotional consequences.

Table 2.1
Overview of emotion and feeling lexicons in the sensory science literature

Reference	Instrument ^a	Domain/Product	No. of terms	Language
Domain-specific				
King and Meiselman (2010)	EsSense Profile™	food	39	English
Rousset et al. (2005)	lexicon	food	26	French
Pionnier Pineau et al. (2010)	lexicon	beverages	35	French
Chrea et al. (2009)	GEOS	odors	36	French
Ferdenzi et al. (2011)	LEOS	odors	37	English
Ferdenzi et al. (2011)	SEOS	odors	36	English
Ferdenzi et al. (2013)	BEOS	odors	37	Chinese
Ferdenzi et al. (2013)	CEOS	odors	33	Portuguese
Ferdenzi et al. (2013)	DEOS	odors	37	English
Ferdenzi et al. (2013)	FEOS	odors	37	English
Ferdenzi et al. (2013)	UniGEOS	odors	25	Various
Thomson and Crocker (2013)	lexicon	everyday	59	Various
Product-specific				
Ferrarini et al. (2010)	lexicon	wine	16	Italian
Ng et al. (2013)	conceptual consumer-driven lexicon	blackcurrant squash	36	English
Thomson et al. (2010)	conceptual lexicon	dark chocolate	24	English

^aDenoted is the specific name of the instrument. If there does not exist any specific label, the description "lexicon" is used.

Two other characteristics, which are common to all reviewed lists, are the highly differentiated (e.g. *amusing, disgusted, guilty, refreshed*) and large number of terms with an emotional connotation. These findings let us and other researchers (Cardello et al., 2012) conclude that food products or odors seem to be elicitors of various emotions. An advantage of using extensive emotion lists is seen in the additional information gained compared to a smaller number or higher-level, less specific descriptors, traditional hedonic measurement methods or whether solely positive and negative affect would be considered (King & Meiselman, 2010; King et al., 2010; Laros & Steenkamp, 2005; Ng et al., 2013; Porcherot et al., 2010). This implicates that more detailed information entails differently drawn conclusions (King et al., 2010). As an example, for suppliers of heavily emotion-laden products (e.g., genetically modified food or meat), knowing why their product is disliked or associated with negative affect might be an advantage. Does the consumer feel more afraid or sad (Laros & Steenkamp, 2005; Rousset, Deiss, Juillard, Schlich, & Droit-Volet, 2005)? Furthermore, it was reported that emotion data may contribute to better comprehending the ratings of consumer liking and could probably be a useful tool for differentiating products with similar hedonic scores due to the different emotional responses the products induce (King & Meiselman, 2010; Ng et al., 2013; Porcherot et al., 2010).

The approaches to determine the food- or odor-relevant emotion terms in most of the reviewed lists mainly include the compilation of terms from already published lexicons, the determination of the relevance or appropriateness of the terms to describe emotional

experiences by means of consumer reports and the application of specific selection criteria to the analyzed judgment results (e.g. Ferrarini et al., 2010; King & Meiselman, 2010). The applied methods can be praised for several aspects: Some of the lexicons were designed with physical food or odor stimuli (e.g. Chrea et al., 2009; Thomson et al., 2010); some approaches used several hundreds of expressions as starting material and/or let the candidate terms be judged by several hundreds of consumers (e.g. Chrea et al., 2009; Ferrarini et al., 2010; King & Meiselman, 2010; Thomson & Crocker, 2013); several methods included or were applied to different languages (Chrea et al., 2009; Ferdenzi et al., 2013; Ferdenzi et al., 2011; Thomson & Crocker, 2013); and most of the developed emotion lexicons were validated in studies with food pictures or actual samples (e.g. Chrea et al., 2009; King & Meiselman, 2010; Ng et al., 2013; Pionnier Pineau et al., 2010; Rousset et al., 2005; Thomson et al., 2010). The usage of the lexicons that originated from these approaches further proved to be helpful instruments in gaining relevant information about emotions in sensory science.

However, comparing the approaches in more detail reveals differences: The methods focused on different domains, products and varied in the degree of specificity (food in general versus specific product). As a second example, the compiled terms were partly selected from different references. Compiling terms from other lists carries the challenge of translation in cases in which the target language is different. Perfectly corresponding terms hardly exist in two languages. Which translation fits best for the context-less descriptor partly depends on the culture-specific influences (e.g. semantics) (Ferdenzi et al., 2011) and the translator's subjective opinion. These and further methodological aspects may have led to differences in the nature and number of emotion terms in the sensory science literature mirroring studies from the psychological literature (Laros & Steenkamp, 2005, Table 2, p. 1439). Table 2.2 of the present paper gives an overview of the terms contained in existing food- and odor-related emotion lexicons and shows, which domain- and product-specific lexicons agree on the relevance of certain words. The odor-related vocabularies developed by Ferdenzi et al. (2013) did not contribute to our decision-making because they were published at a later date. Therefore, they are not included in 2.2. As shown in this overview, some descriptors such as *disgust* and its derivations or the term *energetic* occur in almost all compilations. Other expressions were rarely included. We acknowledge that other researchers are aware that their lexicons may have missing or redundant terms depending on the product or context (Chrea et al., 2009; King & Meiselman, 2010). However, if the EsSense ProfileTM is compared to the other domain-specific lexicons based on Table 2.2, the maximal overlap of identical terms is 12 words in the case of the 35 terms identified by Pionnier Pineau et al. (2010). The number

of shared words is relatively low in regard to the total number of terms each lexicon contains. Comparing similar product-specific lists, Ferrarini et al.'s (2010) list has about one third of its terms in common with Ng et al.'s (2013) lexicon. More agreement would be expected for the odor-related vocabularies GEOS, LEOS and SEOS developed in the same manner (Chrea et al., 2009; Ferdenzi et al., 2011). Although the two European and the Asian cultures seem to agree on some odor-related associations emphasizing the universal functions of odors, the three lists differ somewhat in the nature and underlying dimensions of the terms (Ferdenzi et al., 2011). This finding suggests that the relatively low overlap between word lists may arise not only from divergences in the development methods used but also from cultural influences, which are assumed to include differences in the frequency of emotions experienced in response to several odor stimuli (e.g., spiritual feelings specific for the Asian country), differences in the frequency use of specific terms and therefore in the labeling of emotions and semantic differences (Ferdenzi et al., 2013; Ferdenzi et al., 2011; Ferrarini et al., 2010). Thus, a culture- and, therefore, language-specific verbal instrument is required to measure emotions properly (Ferdenzi et al., 2011). We think that this is best achieved with a verbal measurement tool that is developed with a systematic approach, which starts beyond published word lists, namely, with the active use of the language of the country under investigation, followed by the application of linguistic-based criteria. Actively used words are in contrast to a person's passive lexicon. The active vocabulary includes all the terms used by a person during his or her verbal communication. If a person understands the meaning of a word, but does not actively use the expression, this word is described as "passive" (Cruse, Hundsnurscher, Job, & Lutzeier, 2005). As a result, our passive vocabulary is larger than our active one (Bussmann, 2002).

Although the presented approaches in the sensory science literature required a lot of effort, they do not fully meet the requirements mentioned above. None of the investigations approached the emotion vocabulary from a linguistic perspective using comprehensive actual language use data. Therefore, prevailing lexicons do not necessarily fully reflect the terms consumers actively use in a given context, which could lead to confusion on behalf of future participants (cf. Jaeger et al., 2013). On the contrary, verbal measurement instrument that contain actively used words are assumed to have a higher applicability and acceptance in future studies with consumers. If the list encompasses terms that are relatively familiar to the participants, there could be less comprehension difficulties and emotional states could be referred to more precisely.

Table 2.2

*Comparison of domain-and product-specific emotion and feeling lexicons in the sensory science literature**

Absent minded^g, Active^a, Admiration/Admiring^{d,f,g}, Adoring^f, Adventurous^{a,g,k}, Affectionate^{a,g}, Aggressive^{a,g,h,k}, Alone^g, Amusement/Amused/Amusing^{b,c,d,f,h}, Anger/Angry^{c,d,f,i}, Annoyedⁱ, Anxious^g, Approvalⁱ, Arrogant^{g,k}, Astonishment^b, At easeⁱ, Attentiveⁱ, Attracted^{c,d,e}, Belittled^g, Bland^h, Bliss^c, Boredom/Bored^{a,f,i}, Calm^a, Caring^g, Cautiousⁱ, Charmed/Charming^{f,g}, Cheerfulness^c, Clean^{d,e}, Comforted/Comforting^{e,f,i,k}, Confident^{g,k}, Confused^{g,i}, Contempt^c, Content^b, Crabby^g, Critical^g, Curious^{h,i}, Daring^a, Delight^{b,c}, Depressed^f, Desire/Desirable^{d,e,f,h,i}, Despairing^g, Dirty^{d,e,f}, Disappointment/Disappointed^{b,c,i}, Disapproving^g, Discontented^{c,g,i}, Disgust/Disgusted/Disgusting^{a,b,c,d,e,f,g,h,i}, Disinterested lethargy^g, Displeasureⁱ, Dissatisfaction^d, Doubt^b, Dreamy^e, Drowsy^e, Dull^g, Eager^a, Easygoing^k, Elegant^h, Embarrassment^b, Energetic^{a,c,d,e,f,g,k}, Enthusiastic^{a,c}, Envy^c, Euphoric^h, Excited^{c,d,g}, Exhausted^g, Famished^e, Fascinated^f, Fear^c, Feeling awe^d, Feminine^k, Free^{a,c}, Friendly^a, Frustration^b, Fun^k, Furious^g, Glad^a, Good^{a,i}, Good-natured^a, Guilt/Guilty^{a,b,i}, Happiness/Happy^{a,c,d,f,g,h,i}, Heart-stricken^g, Hesitation^b, Horrible^f, Horrified^g, Impatience^b, In a good mood^e, In love^{d,e,f}, Indifference^b, Infatuation^c, Inferior^g, Inhibited^g, Interest/Interested/Interesting^{a,b,f,h,i}, Invigorated^d, Irate^g, Irritated^{d,f}, Jealous^g, Joy/Joyful^{a,c,h}, Keen^h, Lassitude^b, Light^d, Light-hearted^g, Lively^g, Loving^a, Lustful^e, Luxurious^k, Marvel^c, Masculine^k, Meditative^e, Merry^a, Mild^a, Nauseous^e, Neglected^g, Nervous^g, Nostalgia/Nostalgic^{a,b,c,d,e,g}, Not refreshedⁱ, Ordinary^k, Overjoyed^g, Overwhelming^h, Passionate^{g,h}, Passive^g, Peaceable/Peaceful^{a,e,h}, Pleasant^{a,c,d,f,h}, Pleasure/Pleased^{a,b,c,i}, Polite^a, Powerful^k, Pretentious^k, Pride^b, Protected^e, Purposeful^g, Quiet^a, Reassured^g, Refreshed^{c,d,e,f,i}, Regret/Regretful^{b,g,i}, Reinsured^d, Rejoicing^b, Rejuvenated^e, Relaxed^{d,e,f,g}, Relief^f, Religious feeling^f, Reminiscenceⁱ, Repelled^e, Resentmentⁱ, Respectful^g, Revitalized^{d,e,f}, Romantic^{d,e,f}, Sadness/Sad^{c,f,g}, Salivating^{d,e}, Satisfaction/Satisfied^{a,b,c,i}, Scared^g, Skepticalⁱ, Secure^a, Sensual^{d,e,f,k}, Sentimental^c, Serene^{b,c,d}, Serious^k, Sexually aroused^f, Sexy^{d,e,f}, Shivering^d, Shockedⁱ, Shy^g, Sick/Sickening/Sickly^{d,e,f,i}, Silly^g, Sluggish^g, Sociable^{g,k}, Soothed^{d,e}, Sophisticated^k, Spiritual feeling^f, Steady^a, Stimulated^{d,e}, Strange^g, Stressed^f, Subdued^g, Superior^g, (Un-/Pleasant) Surprise/(Un-/Pleasantly) Surprised^{c,d,e,f,g,i}, Suspicious^g, Tacky^k, Tame^a, Tender^{a,c}, Terrific^g, Thirsty^e, Thrilled^b, To feel intimacy^e, To like/Liking^{b,c}, Touched^g, Traditional^k, Trembling^c, Troubled^e, Trustⁱ, Trustworthy^k, Uncomfortable^{e,f,i}, Uncomplicated^k, Understanding^a, Uneasiness^b, Unhappyⁱ, Unpleasant^{d,e,f}, Vigilant^b, Warm^{a,c,i,k}, Well-being^{c,d,f}, Whole^a, Wild^a, Willful^g, Worried^{a,i}, Youthful^k

* Comparisons were conducted based on the English translations provided by the authors in cases in which the lists were originally published in another language than English.

Domain-specific^a King and Meiselman (2010)^b Rousset et al. (2005)^c Pionnier Pineau et al. (2010)^d Chrea et al. (2009) - GEOS^e Ferdenzi et al. (2011) - LEOS^f Ferdenzi et al. (2011) - SEOS^g Thomson and Crocker (2013)**Product-specific**^h Ferrarini et al. (2010)ⁱ Ng et al. (2013)^k Thomson et al. (2010)

We came to the conclusion that it is necessary to propose a linguistic-based and systematic approach to design a food-related, culture-specific list that contains actively used emotion terms. Comprehensive language databases, including the most important German-language thesaurus and the world's largest collection of electronic written German texts, were used as starting material (defined here as actual language use data) to extract the German emotion terms that are more actively used in everyday situations. This overcomes the disadvantages of a free-listing task (e.g. participants cannot recall or remember some expressions) applied by other researchers (Ng et al., 2013) to investigate the active language use of terms. Because there is no German comprehensive food-related emotion list, we applied our new approach to design a German word list containing the most important food-related emotion words. In contrast to several other emotion lists from the sensory science literature, the resulting lexicon

is aimed to represent the active language use of emotion terms to overcome possible translation difficulties and is tailored to the language use of consumers.

In the following sections, we present two related studies. The first study investigates which words are appropriate in the German language for describing emotions associated with food products by applying a three-step approach. After the collection step, all words were judged with several linguistic-related criteria to identify the German terms that possess emotional connotation. This includes potential emotion, feeling and mood terms that denote a specific state (e.g. *happy*, *disappointed*) and are henceforth referred to as differentiated terms. In addition, words describing an overall emotional condition (e.g. *bad*, *good*, *excellent*) were considered. We assumed that such evaluative terms are often used during eating or drinking to express one's personal mental or physical condition. Support for our hypothesis was found in the hierarchical emotional taxonomy constructed by Storm and Storm (1987) with the highest-order level containing words of this type. These terms were assembled through consumer free-listing or free-labeling tasks. In the third and main step of our study, the online survey, the relevance of the final 272 candidate terms was rated in relation to food products.

The objective of Study 2 was to characterize the 272 emotion terms from Study 1 as positive, negative or neutral in the same manner as other researchers (King & Meiselman, 2010). This would provide information about the nature of the terms and would therefore help to interpret the food-related emotional experiences assessed with the words. Furthermore, Thomson and Crocker (2013) recently showed that people seem to have a larger vocabulary of negative emotion terms for everyday situations. However, in several studies, in which a hedonic asymmetry was observed (King & Meiselman, 2010; Ng et al., 2013), the applied emotion lists were probably already biased towards more positive emotion terms (e.g. King & Meiselman, 2010; Ng et al., 2013). These studies did not take into account that a person's vocabulary contains more negative emotions. To our knowledge, none of the studies did investigate the hedonic asymmetry from a linguistic perspective by comparing the positive-negative distribution of a comprehensive starting material with the final list. Therefore, Study 2 was conducted to examine whether the hedonic asymmetry observed by other researchers (e.g. Desmet & Schifferstein, 2008; Ferrarini et al., 2010; King & Meiselman, 2010) could be confirmed with our approach.

Study 1: Exploration of German terms appropriate for describing food-elicited emotions

2.2 Material and method

The approach and its different levels are depicted in Figure 2.1 as a flow chart. Step one and two are presented in the next paragraph, followed by the description of the third step, the online survey. For more complete understanding, terms are given in German and English, whereas the German expressions are depicted inside brackets. Two bilingual individuals translated the German terms into English for the food context.

2.2.1 Collection and identification of candidate terms

Collection. Numerous words potentially used in the German language to describe emotions or feelings in diverse everyday situations, i.e. not necessarily food-specific, were gathered from two sources: the most important German-language thesaurus *Dornseiff* (Dornseiff, Quasthoff, & Wiegand, 2004, chap. 11) and the world's largest collection of electronic written German texts, called the *Deutsche Referenzkorpus* (DeReKo) (Institut für Deutsche Sprache, 2012). From chapter 11 of the thesaurus (feelings, affect and character traits), all single adjectives were collected. This was motivated by the fact that human beings usually communicate their feelings and emotions by saying *I am [Ich bin]/I feel [Ich fühle mich] + adjective or past participle*.

Inquiries in the DeReKo were conducted in May 2013 by using the web-based user interface of the Corpus Search, Management and Analysis System (COSMAS II, version 1.8; <https://cosmas2.ids-mannheim.de/cosmas2-web>). Because people express their feelings and emotions in the syntactic context *I am [Ich bin]/I feel [Ich fühle mich] + word*, we searched for all texts in the public area of the DeReKo that contained any word form of the verb *to feel [fühlen]* and its corresponding reflexive pronoun (accusative form) within one sentence. Based on the provided 256,029 hits, a co-occurrence analysis was run via the COSMAS II-application to locate the primary co-occurrence partners of any word form of the antecedent *to feel [fühlen]*.

Identification. The collection phase yielded more than 5000 linguistic elements that subsequently underwent various adjustment procedures (Figure 2.1). Because the term “emotion” is not unanimously defined in the literature (Kleinginna & Kleinginna, 1981;

Scherer, 2005), three different food-unspecific criteria were developed to identify candidate terms that have an emotional connotation, i.e. emotion, feeling, mood and evaluative terms. All adjustment and judgment steps were conducted with the help of the German-language monolingual dictionary *Duden* (Bibliographisches Institut GmbH, 2012) and/or the web search engine Google (<http://www.google.ch>). The three main identification criteria were as follows¹:

1. Words that the dictionary *Duden* specified as generally unknown, these are colloquial, uncommon, dated or regional (e.g. Bavarian) expressions, were eliminated. If a specific term was not in the dictionary, the word was not considered.
2. It had to be possible to express the word in the syntactic context *I am [Ich bin] + word* or *I feel [Ich fühle mich] + word*. Examples are *I am happy [Ich bin glücklich]* or *I feel alone [Ich fühle mich allein]*. Candidate terms that could be used in this manner but either did not possess an emotional component such as traits (e.g. *I am social [Ich bin sozial]*) or demanded an additional co-occurrence partner (e.g. *I am in a good mood [Ich bin gut aufgelegt]*) were excluded. Further attention was paid concerning the word combinations *I feel [Ich fühle mich] + word* in which the German speaker uses this expression as an alternative way of saying “I think that I am...” or “Something makes me feel like I am...” An example of this exception is *I feel pushy [Ich fühle mich aufdringlich]*.
3. If a candidate term had an emotional connotation but simultaneously described the involvement of one or more persons (e.g. an interaction), the term was excluded. For example, a person cannot feel cheated by a product but by another person. Other examples are *I feel exploited [Ich fühle mich ausgebeutet]*, *I am repelled by [Ich fühle mich abgestossen von]* or *I feel scorned [Ich fühle mich verachtet]*. Terms in this category were often past participles and could be used in the passive voice *I am [Ich werde] + word*².

¹These criteria were applied by the author. In cases of uncertainty, the judgment was also discussed between at least two researchers. All involved researchers were native Swiss-German speakers.

²Further information about criteria 2 and 3: In addition to the monolingual dictionary *Duden*, queries in Google helped us to assess whether a specific word could be used in the syntactic contexts *I am [Ich bin] + word* (criterion 2) or *I am [Ich werde] + word* (criterion 3). If Google provided less than 10,000 results that contained the entered syntactic context + *word* we were prone to exclude (criterion 2) or include (criterion 3) the word.

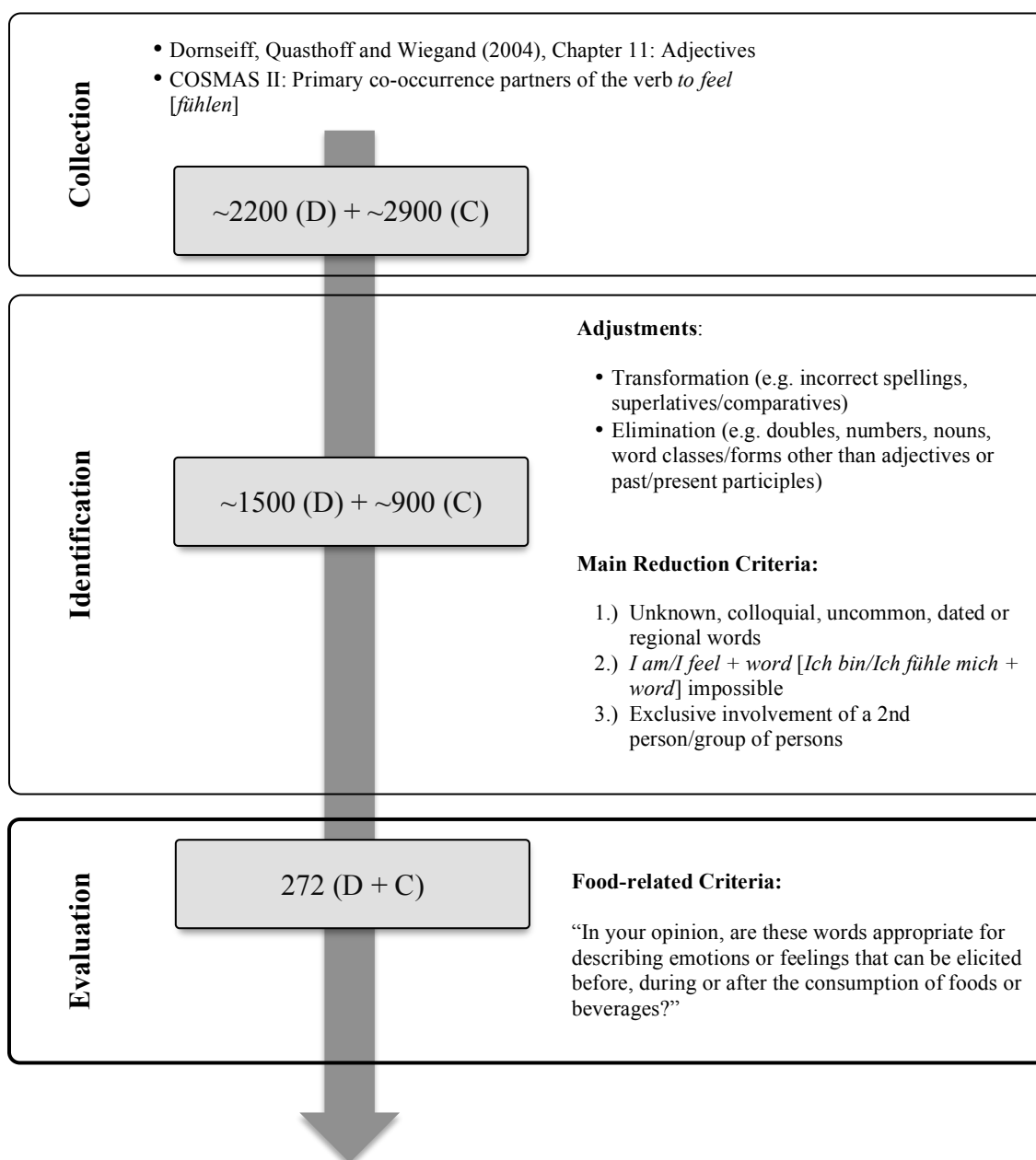


Figure. 2.1. Multiple-step approach for developing a food-related emotion lexicon. (C) denotes the linguistic elements obtained via the COSMAS II-application; (D) denotes the terms obtained from the thesaurus *Dornseiff* (2004).

Exceptional cases and additional criteria could not be avoided due to the large variability and flexibility of the German vocabulary. In cases of uncertainty, the web-based lexicon-database Wortschatz Universität Leipzig (<http://wortschatz.uni-leipzig.de>) was consulted. This vocabulary provides information about word frequency classes. A frequency class states the frequency of a selected word among the considered collection of texts (Leipzig Corpora Collection). The frequency is related to the frequency of the most frequent word in the German language, which is *the* [*der*]. If the frequency class of a word is, for example, 14, this means that the word *the* [*der*] occurs 2^{14} times more often than the selected word. The larger

the number, the less common the selected word (Quasthoff, Goldhahn, & Heyer, 2013). If the candidate term had a frequency class of ≥ 16 , we tended to exclude the word.

The criteria reduced the pool to 272 candidate terms that were used in the online survey to determine their relevance in relation to food products.

2.2.2 Participants

An online questionnaire was sent out by e-mail to 399 consumers residing in Switzerland who had volunteered to participate in surveys. After one reminder, a total of 229 persons completed the questionnaire in full corresponding to a return rate of 57.4%. Seven participants who did not indicate they were native (Swiss-) German speakers were excluded from the data set. The final sample consisted of 222 subjects (46% female; median age: 54 years; age range: 23-91 years). In our sample, 42.4% of the participants had completed college or university, 23.9% had finished higher vocational education, 32.0% hold an upper secondary school degree, 1.4% finished compulsory education and one person reported not having completed any education.

2.2.3 Design

To avoid fatigue during the participation, a between-subject design was used. The list of 272 candidate terms was divided into four versions. Each version contained 68 terms presented in four blocks of 17 words. The participants were randomly assigned to one version. The different versions were evaluated by 55 to 57 persons. The words were randomly allocated to the versions and blocks.

2.2.4 Procedure

After informed consent was obtained from the participant, the four word blocks appeared on the monitor in sequence. Each block was presented on a new page and started with the task description “In your opinion, are these words appropriate for describing emotions or feelings that can be elicited before, during or after the consumption of foods or beverages?” Response options were “yes,” “no” or “I do not know this word.” After the words were rated, demographic questions concerning gender, age, education degree and mother tongue were asked.

There was no time constraint. If a participant abandoned the survey, he or she could re-click on the link sent by e-mail and continue the survey at a later time point.

2.2.5 Data analysis

All analyses were conducted by using the IBM SPSS Statistics software (version 20). The approval frequency of each candidate term was calculated; however, the counts of the response category “I do not know this word” were not taken into account, because this option did not provide any information about the appropriateness of a word to describe food-elicited emotions or feelings. Instead, the frequencies with which words were chosen as unknown were separately calculated.

2.3 Results

The approval frequencies for all candidate German terms with English translations are given as supplementary material (Table S2.1). The approval frequencies varied greatly, from 3.6% for *unfeminine* [*unweiblich*], *cowardly* [*feige*] and *intimidated* [*eingeschüchtert*] to 98.2% for *refreshed* [*erfrischt*] and *outstanding* [*hervorragend*]. The terms can be divided into three groups according to their appropriateness for describing food-elicited emotions and feelings: The first group includes 49 descriptors approved by at least two-thirds of the participants (Table 2.3). The cut-off point of 66.7% was chosen referring to Chrea et al.’s (2009) procedure. The second group consists of 131 terms that have an approval frequency below 33.3% and were more clearly rejected. The middle group contains the remaining 92 words that were judged with greater inconsistency.

Small differences in terms of knowledge were observed. The three words *consternated* [*konsterniert*], *ecstatic* [*ekstatisch*] and *thrilled* [*verziückt*] were most often checked as unknown by 9.1%, 7.3% and 5.3% of the respondents, respectively.

As shown in Table 2.3, terms describing a differentiated emotional state (e.g. *strengthened* [*gestärkt*]) and unspecific evaluative words (e.g. *wonderful* [*wundervoll*]) seem to be relevant for verbalizing food-related emotions. The latter represent different grades of intensities between the opposite poles *miserable* [*miserabel*]/*horrible* [*fürchterlich*] and *outstanding* [*hervorragend*]/*divine* [*göttlich*] such as *good* [*gut*] or *bad* [*schlecht*] and constitute up to one third of the most approved expressions.

Table 2.3

Comparison of the 49 most approved terms (n=54–57) with two existing emotion or feeling lexicons. Comparable terms are depicted on the same line. Approval frequencies of the single terms from the present study are given in the second column

Present study German ^a	% approval	English (approx. translation)	King and Meiselman (2010) ^b	Chrea et al. (2009) ^c
erfrischt ⁺	98.2	refreshed		refreshed
hervorragend ⁺	98.2	outstanding, terrific		
gut ⁺	94.7	good	good	
begeistert ⁺	94.5	exuberant, excited	enthusiastic	excited
frisch ⁺	94.5	fresh		
gestärkt ⁺	94.5	strengthened		
überrascht ^u	94.5	surprised	*	un/pleasantly surprised
schlecht ⁻	89.1	bad	*	
herrlich ⁺	87.7	glorious		
wunderbar ⁺	87.7	wondrous		
ausgezeichnet ⁺	87.3	excellent		
grossartig ⁺	87.3	grand		
zufrieden ⁺	86.0	content	*	
fabelhaft ⁺	85.5	fabulous		
sensationell ⁺	83.6	sensational		
beschwingt ⁺	82.5	exhilarated		
göttlich ⁺	81.8	divine		
energiegeladen ⁺	80.7	invigorated, energetic	energetic	invigorated, energetic
kräftig ⁺	80.7	hearty		
unwohl ⁻	80.0	uneasy		
angeregt ⁺	78.9	aroused		
befriedigt ⁺	78.9	satisfied, fulfilled	satisfied	
entspannt ⁺	78.9	relaxed	*	relaxed
himmlisch ⁺	78.2	heavenly		
leistungsfähig ⁺	78.2	efficient		
wundervoll ⁺	77.2	wonderful		
wohl ⁺	76.8	well		well being
einzigartig ⁺	76.4	unique		
feurig ⁺	76.4	impassioned		
lustvoll ⁺	76.4	lusty		
unbefriedigt ⁻	76.4	dissatisfied		dissatisfaction
enttäuscht ⁻	75.4	disappointed		
eklig ⁻	74.5	icky, revolting		
entzückt ⁺	74.5	enchanted		
merkwürdig ⁻	74.5	strange		
vital ⁺	74.5	vital		
überwältigt ⁺	74.1	overwrought		
abscheulich ⁻	73.7	horrid		
glücklich ⁺	71.9	happy	happy	happiness
miserabel ⁻	70.9	miserable	*	
beglückt ⁺	70.4	delighted	pleased, happy	
angewidert ⁻	69.1	sickened, grossed out		
schrecklich ⁻	69.1	dreadful		
fürchterlich ⁻	67.9	horrible		
beflügelt ⁺	67.3	energized		
munter ⁺	67.3	chipper	merry	
angeekelt ⁻	66.7	nauseated, disgusted	disgusted	disgusted
erstaunt ^u	66.7	astounded		
verblüfft ^u	66.7	astonished		
Total number of lexicon terms		49	39	36
Comparable terms^d			~ 8 (21%)	~ 9 (25%)

^a "+", "-" and "u" denote "positive", "negative" and "unclear" categorization, respectively.

^b An asterisks indicates, which word from our most approved terms were in the starting material of King and Meiselman (2010) but eliminated during their development procedure.

^c The lexicon of Chrea et al. (2009) was originally validated in French.

^d Percentage overlap refers to the total number of terms in King and Meiselman's (2010) or Chrea et al.'s (2009) list, respectively.

Although semantic differences and translation difficulties exist, we tried to compare the 49 most approved terms with two emotion and feeling lexicons from the sensory science literature (Table 2.3): the food-related EsSense Profile™ published by King and Meiselman (2010) and the GEOS developed in Switzerland for the context of odors (Chrea et al., 2009). In the case of the latter lexicon, we analyzed whether one of the translated 49 terms occurred. Comparable noun forms were also accepted. We are aware that this comparison strategy is very rigorous. Therefore, for the domain-equal lexicon, the EsSense Profile™, we searched for terms that were similar in meaning compared to our 49 terms. As shown in Table 2.3, a relatively small number of the 49 terms occurred in one or both lexicons. Only 8 words (21%) were similar compared with the domain-equal lexicon. Interestingly, some terms identified as relevant in the present study were part of the starting material of the EsSense Profile™ (indicated with an asterisk in Table 2.3), but eliminated during its development phase (King & Meiselman, 2010).

Study 2: Characterization of German emotion terms as positive, negative or neutral

The aim of Study 2 was to characterize the identified 272 candidate words from Study 1 as positive, negative or neutral. In future studies, this would provide more detailed information about food-related emotions measured with the words. It would further allow to examine if the prevalence of a hedonic asymmetry in food-related emotions observed by other researchers (e.g. Desmet & Schifferstein, 2008) is confirmed by means of a linguistic approach.

2.4 Method

2.4.1 Participants

A convenience sample was recruited at the ETH Zurich. In total, 269 persons completed the survey in full. The data preparation step resulted in a final, homogenous sample of 246 participants (56% female). The average and median age was 22 (range: 15-36), and 217 of the participants indicated they spoke only German and/or Swiss German as their native language. The remaining participants had one or two additional first languages. More than half of the

sample (51.6%) had an upper secondary school degree, 32.5% had finished college or university and 15.9% had attended only compulsory education.

2.4.2 Design, procedure and data analysis

The test material for the categorization task were the 272 candidate terms assembled in Study 1. The design, procedure and data analysis were similar to the method used in the first study. The following modifications were applied: The 272 terms were randomly divided into eight word lists. Each version consisted of 2x17 different words, which were presented in two subsequent blocks. There were 30 to 33 participants per version. For each participation, the order of the words within one block was randomized.

Each word block was introduced by the task to classify different words: “Please indicate for each word if the word describes an emotion or feeling that is “positive,” “negative,” “positive or negative” or “neither positive nor negative”. “Positive or negative” indicates emotions or feelings that can be positive or negative, depending on the situation. If you do not know a word, please classify it as “I do not know this word.””. Except for the “unknown” option, the response categories were chosen following King and Meiselman (2010). In contrast to the method applied by King and Meiselman (2010), the task was intentionally unrelated to the food domain because the 272 candidate terms were selected based on food-unspecific criteria as well. Otherwise, several terms (e.g. *abandoned* [*alleingelassen*], *intimidated* [*eingeschüchtert*], *torn* [*zerrissen*]) could not have been used and categorized in relation to a food-related context.

The data were analyzed by counting the frequency of each chosen category per word. For similar reasons mentioned in Study 1, the counts for the “do not know” option were neglected. The two response options “positive or negative” and “neither positive nor negative” were pooled as “unclear categorization” (King & Meiselman, 2010). The terms were finally assigned to the category that was most often selected. If the distribution was bimodal (difference between two response categories $\leq 5\%$), the term was deemed not clearly categorizable.

2.5 Results

The results of the categorization task are shown in Table 2.3 and in the supplementary material (Table S2.1), where the symbols "+", "-" and "u" denote a positive, negative or an unclear categorization, respectively. Of the 49 most approved words (Table 2.3), 34 terms were categorized as positive, 12 as negative and 3 had no clear categorization. Even more prominent is the positive dominance in the top 10: 80.0% of the descriptors have a positive meaning. This result is especially interesting because there are 16.5% more negative than positive expressions among the 272 candidate words. Furthermore, in contrast to the predominance of the positive valence among the highly approved terms, the least approved ones (approval frequency below 10%) show an opposite pattern: 22 of the 24 terms are negative (see Supplementary material, Table S2.1). This phenomenon is illustrated in Figure 2.2.

Several descriptors were often checked as unknown: *Consternated* [*konsterniert*], *haggard* [*abgespannt*] and *ecstatic* [*ekstatisch*] were not known to 40.0%, 30.0% and 20.0% of the respondents, respectively. There were further terms that were not understood by several participants, for example, *worn out* [*ermattet*] (16.7%), *agile* [*agil*] (13.3%), *buoyant* [*springlebendig*] (10.0%), *wistful* [*wehmütig*] (10.0%) and *sheepish* [*belämmert*] (9.4%).

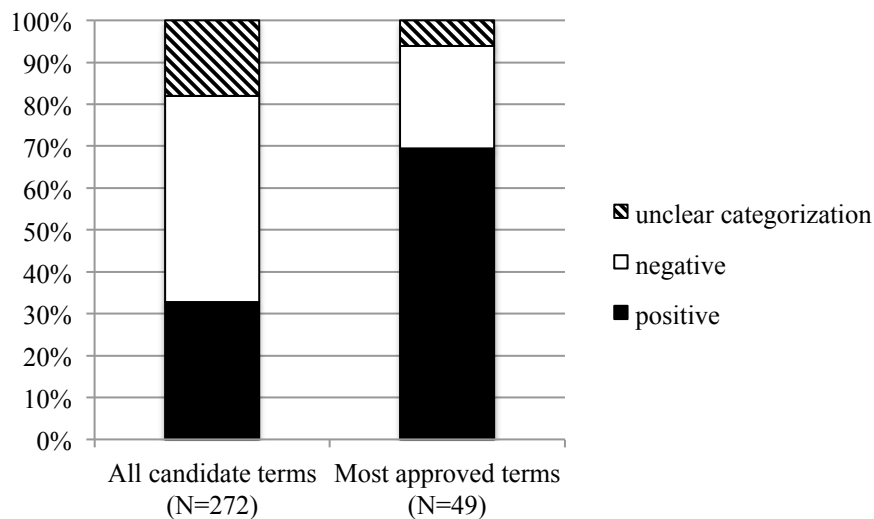


Figure 2.2. Percentage distribution of all candidate and most approved terms concerning their positive-negative categorization (n=18-33). "N" denotes the number of considered terms.

2.6 Discussion

The novel, systematic and linguistic-based approach applied to the German language in Study 1 was useful to identify 49 terms that according to the opinion of German-speaking consumers are the most appropriate for describing emotions or feelings linked to the consumption of food products. Although several of our most appropriate words have similar meanings, the relatively large number of clearly approved descriptors and the high approval frequency of several differentiated emotion words (e.g. *refreshed* [*erfrischt*], *exuberant* [*begeistert*]) is consistent with the features of existing emotion lists in sensory science (e.g. Chrea et al., 2009; King & Meiselman, 2010; Thomson & Crocker, 2013). The positive-negative-neutral categorization of the 272 candidate terms in Study 2 confirmed the results of Thomson and Crocker's (2013) research that people seem to have more words to communicate their negative emotional states in everyday situations. Nevertheless, the final food-related 49 terms generated by means of the linguistic-based approach encompass predominantly positive expressions. This finding is also common to other emotion lexicons (e.g. Ferrarini et al., 2010; King & Meiselman, 2010, Ng et al., 2013) and supports the idea of an existing hedonic asymmetry toward eating and drinking (Desmet & Schifferstein, 2008).

The most approved terms in the present research reflect diverse emotional experiences in a food consumption context. Besides very frequent positive emotional states, represented by the expressions *well* [*wohl*], *delighted* [*beglückt*] or *happy* [*glücklich*], our approach identified terms such as *efficient* [*leistungsfähig*], *invigorated* [*energiegeladen*], *strengthened* [*gestärkt*] and *refreshed* [*erfrischt*], which emphasize the main function of food consumption. The main function is providing energy and fluid to keep our body healthy, similar to the function of odorant substances (Chrea et al., 2009; Ferdenzi et al., 2013; Ferdenzi et al., 2011). Other highly approved words describing different satisfaction degrees or expressing a state of surprise (e.g. *astounded* [*erstaunt*], *content* [*zufrieden*], *disappointed* [*enttäuscht*], *dissatisfied* [*unbefriedigt*]) indicate, however, that consumers also want to be pleased with the food they eat. This often implicates demands toward food products, including expectations concerning the sensory properties, the quality and/or the consequences of consuming food or beverages (Desmet & Schifferstein, 2008). For example, we might be pleasantly surprised after the consumption of an inexpensive food product because the product tasted better than expected. In contrast to these positive effects, interactions with food may have a negative component (Desmet & Schifferstein, 2008; Manzocco, Rumignani, & Lagazio, 2013). This is confirmed by our most endorsed terms, *nauseated/disgusted* [*angeekelt*], *nauseated* [*angeekelt*] or *uneasy* [*unwohl*]. In the interaction with food products, disgust is an expression

for individual disliking (Desmet & Schifferstein, 2008) and may help in avoiding unpleasant experiences.

Although other lexicons in the sensory science literature also contain words representing the aforementioned types of emotional experiences, the overlap of identical words between our lexicon and the compared lists is relatively small (Table 2.3). This is particularly prevalent in the case of evaluative words (e.g. *good* [*gut*], *wonderful* [*wundervoll*]), which were only sparsely present in other lexicons. The low agreement between our most approved terms and the two selected lexicons replicates the inhomogeneities between preexisting emotion lexicons in the sensory science literature and lists from the psychological literature (Ferdenzi et al., 2011; Ferdenzi et al., 2013; Laros & Steenkamp, 2005, Table 2, p.1439; cf. Table 2.2). We found various reasons that may have contributed to this finding. In addition to possible translation inhomogeneities, one explanation may be the application of distinctive approaches: Our systematic approach starts from the language of the country under investigation and is based on actual language use data. Other procedures were not very systematic and used mainly terms from previously published word lists; the approaches contained different reduction steps, evaluation tasks or selection criteria, which may have been promoted by the lack of a uniform definition for the term “emotion” (Kleinginna & Kleinginna, 1981; Scherer, 2005). As an example, we included linguistic-based criteria, which is in contrast to most other approaches; the applied methods differed further in the presentation of the stimuli. The candidate emotion terms in Chrea et al.’s (2009) approach were rated in response to physical odor stimuli. Our method contained consumers’ judgments on surveys and, lastly, the approaches focused on different domains.

We expected that the percentage amount of matching terms compared to our most approved expressions would be larger in the case of the EsSense Profile™. However, the GEOS and EsSense Profile™ contain a similar percentage amount although we used a less rigorous comparison approach for the EsSense Profile™. To our surprise, several terms from our most approved expressions were present in King and Meiselman’s (2010) initial word compilation but were subsequently excluded (Table 2.3). In the reverse case, some terms contained in King and Meiselman’s (2010) list and among our 272 candidate terms (e.g. *aggressive* [*aggressiv*], *bored* [*gelangweilt*], *wild* [*ungezähmt*]) seem to be less relevant for German-speaking consumers to describe emotions induced by food exposure. Furthermore, a recently published study (Jaeger et al., 2013) about the consumer-centric perspective on emotion questionnaires carried out with the EsSense Profile™ showed that several terms of the EsSense Profile™ had the potential to be hardly understood by the New Zealand

participants. Our findings support the relatively low applicability of some specific expressions from the EsSense ProfileTM for studies in Switzerland, either because they were not found through inquiries in the German language use data or were excluded through the chosen approach. This concerns especially the expressions Jaeger et al. (2013) revealed as critical (e.g. *mild, tame*). However, King and Meiselman (2010) reported that they had included terms related to specific product categories or current food trends. Our approach did not consider product-specific aspects or trends. We do not doubt that some of King and Meiselman's (2010) descriptors will find a use in specific contexts or with specific products or consumers. Furthermore, the EsSense ProfileTM was developed with product users, which was not controlled by our approach. It has been shown that emotion profiles depend on the frequency of product use (King & Meiselman, 2010).

A second explanation for the observed small overlaps may be assigned to cultural specificities. For example, there are semantic inequalities or differences in the evoked emotional responses between two different cultures (cf. Ferdenzi et al., 2011; Ferdenzi et al., 2013). Interestingly, the GEOS was developed in the French-speaking region of Switzerland. Although we assume that most of the participants were Swiss, there are even cultural differences between the French- and German-speaking regions of Switzerland. However, the discrepancies are probably smaller than between Switzerland and the United States, where the EsSense ProfileTM was designed. Ferdenzi et al.'s (2013) intercultural study showed that closer geographic proximity was linked to an increase in more similar emotional responses. As an additional result, the EOSs established in Switzerland and the US did not cluster together in the two-dimensional space of the six analyzed term categories.

The following limitations of our approach should be addressed: First, one could question to what extent our terms represent emotions. In general, we used the term "emotion" in a broad sense and decided to define it by the applied selection criteria and therefore the actual language use of such terms. Additionally, we share the doubts of other researchers (King & Meiselman, 2010) that a single emotion list is applicable to all research questions, products or consumers. For example, non-product users reported more negative and less intense emotions than product users (King & Meiselman, 2010). During our survey, we did not control for the instances or products our participants thought about in their minds. We assume that our approach probably neglected rare or more negative situations (Chrea et al., 2009) as well as emotions experienced with less often consumed products. Reasons may be that they were not remembered or due to the preexisting hedonic asymmetry (Desmet, 2003). More negative emotions would probably have to be included to measure emotions from

unsatisfied consumers, emotions elicited by new or unknown products or production technologies (Desmet, 2003; Laros & Steenkamp, 2005) and individuals who do not like the product or have an aversion to eating (e.g. bulimics). A recent study (Jaeger et al., 2013) further indicated that using product-specific lists is important in promoting a less time-consuming and confusing task because participants rated some of the emotion terms in relation to the consumption of a specific product as less relevant. Similar to the statement of King and Meiselman (2010) in the case of the EsSense ProfileTM, it is necessary to investigate if our emotion lexicon has to be reconsidered according to the product (category) or consumer group under study. As a further validation step, future studies need to investigate if the identified terms are also appropriate to describe emotions elicited through facing or tasting actual food products. An additional limitation is that our study could not determine the extent of the influence derived by cultural or methodological aspects on the resulted low overlap (e.g. impact of passive language use versus active language use data on the resulting lexicon). Additionally, although other studies (Jaeger et al., 2013; Ng et al., 2013) indicate that considering the consumers' language in the development approach is important, we did not investigate if our resulted lexicon is more applicable or more accepted in studies with consumers. These aspects could be investigated by applying our approach to the English language. A possible limitation of Study 2 could be that the terms were not categorized in relation to the food context. However, whether or not the emotional valence changes depending on the context (everyday- versus food-related) needs further research.

2.7 Conclusions

The presented novel development approach was successfully applied to the German language to design a food-related emotion lexicon. The procedure and the identified German emotion terms make several contributions to the sensory and consumer literature. First, the proposed linguistic-based approach can be used to systematically develop a food-related emotion vocabulary. A key advantage of the procedure is that it starts with comprehensive actual language use data and takes the consumers' active language use of emotion terms into account. This allows us to capture cultural and linguistic nuances. Therefore, the application of the resulting lexicon is assumed to be more applicable and accepted in future studies with consumers. Second, our approach requires no translation steps and can be implemented in other languages. Translation of single words always includes the uncertainty of not being used in the same way. Third, we created the first food-specific and comprehensive emotion lexicon

in German, which can be used as a starting point for measuring food-associated emotions and developing product-specific lexicons. Fourth, this study indicates that German-speaking consumers actively use very differentiated and also evaluative words to communicate their emotional states in response to food stimuli. Fifth, our linguistic-based approach was able to generate an emotion vocabulary that confirms the hedonic asymmetry reported by other researchers (Desmet & Schifferstein, 2008; Ferrarini et al., 2010; King & Meiselman, 2010). Sixth, a comparison between our list and other emotion lexicons, however, revealed a small overlap. This may have resulted from divergences in the approaches or cultural determinants.

Overall, by emphasizing and extending the conclusions of other scientists, proper results and conclusions can best be achieved by measuring food- or odor-related emotions with domain-, culture- and language-specific word lists (Chrea et al., 2009; Ferdenzi et al., 2013; Ferdenzi et al., 2011) that are tailored to the consumers' active language use. Our new approach and the resulting lexicon are therefore valuable tools to deepen our understanding of the role that emotions play in food consumption experiences.

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Supplementary material

Table S2.1

Evaluated candidate terms with their approval frequencies depicted in decreasing order (n=50–57)

Rank	German ^a	English (approx.)	% approval
1	erfrischt ⁺	refreshed	98.2
2	hervorragend ⁺	outstanding, terrific	98.2
3	gut ⁺	good	94.7
4	begeistert ⁺	exuberant, excited	94.5
5	frisch ⁺	fresh	94.5
6	gestärkt ⁺	strengthened	94.5
7	überrascht ^u	surprised	94.5
8	schlecht ⁻	bad	89.1
9	herrlich ⁺	glorious	87.7
10	wunderbar ⁺	wondrous	87.7
11	ausgezeichnet ⁺	excellent	87.3
12	grossartig ⁺	grand	87.3
13	zufrieden ⁺	content	86.0
14	fabelhaft ⁺	fabulous	85.5
15	sensationell ⁺	sensational	83.6
16	beschwingt ⁺	exhilarated	82.5
17	göttlich ⁺	divine	81.8
18	energiegeladen ⁺	invigorated, energetic	80.7
19	kräftig ⁺	hearty	80.7
20	unwohl ⁻	uneasy	80.0
21	angeregt ⁺	aroused	78.9
22	befriedigt ⁺	satisfied, fulfilled	78.9
23	entspannt ⁺	relaxed	78.9
24	himmlisch ⁺	heavenly	78.2
25	leistungsfähig ⁺	efficient	78.2
26	wundervoll ⁺	wonderful	77.2
27	wohl ⁺	well	76.8
28	einzigartig ⁺	unique	76.4
29	feurig ⁺	impassioned	76.4
30	lustvoll ⁺	lusty	76.4
31	unbefriedigt ⁻	dissatisfied	76.4
32	enttäuscht ⁻	disappointed	75.4
33	eklig ⁻	icky, revolting	74.5
34	entzückt ⁺	enchanted	74.5
35	merkwürdig ⁻	strange	74.5
36	vital ⁺	vital	74.5
37	überwältigt ⁺	overwrought	74.1
38	abscheulich ⁻	horrid	73.7
39	glücklich ⁺	happy	71.9
40	miserabel ⁻	miserable	70.9
41	beglückt ⁺	delighted	70.4
42	angewidert ⁻	sickened, grossed out	69.1
43	schrecklich ⁻	dreadful	69.1
44	fürchterlich ⁻	horrible	67.9
45	beflügelt ⁺	energized	67.3
46	munter ⁺	chipper	67.3
47	angeekelt ⁻	nauseated, disgusted	66.7
48	erstaunt ^u	astounded	66.7
49	verblüfft ^u	astonished	66.7

^a "+", "-" and "u" denote "positive", "negative" and "unclear" categorization, respectively.

Table S2.1 (continued)

Rank	German ^a	English (approx.)	% approval
50	erfreut ⁺	pleased	65.5
51	feierlich ⁺	solemn	65.5
52	schläfrig ^u	drowsy	65.5
53	unzufrieden ⁻	displeased, malcontent	65.5
54	behaglich ⁺	cozy	64.9
55	fit ⁺	fit	63.6
56	gierig ⁻	greedy	63.6
57	müde ⁻	tired	63.6
58	seltsam ⁻	odd	63.6
59	animiert ⁺	animated	61.8
60	begierig ^u	eager	61.8
61	motiviert ⁺	motivated	61.8
62	prächtigt ⁺	magnificent	61.4
63	vergnügt ⁺	cheery	60.7
64	fröhlich ⁺	joyous	60.0
65	lebendig ⁺	alive	60.0
66	dankbar ⁺	thankful	59.6
67	schlaff ⁻	limp	59.6
68	sinnlich ⁺	sensuous	59.6
69	verzückt ⁺	thrilled	59.3
70	inspiriert ⁺	inspired	57.9
71	benommen ⁻	dazed	56.4
72	froh ⁺	glad	56.4
73	schlapp ⁻	listless	56.4
74	schwach ⁻	weak	56.4
75	matt ⁻	weary	56.1
76	erregt ^u	charged	54.5
77	langweilig ⁻	boring	54.5
78	träge ⁻	torpid	54.5
79	verwundert ^u	amazed	54.5
80	brillant ⁺	brilliant	52.7
81	minderwertig ⁻	inferior	52.6
82	irritiert ⁻	irritated	50.9
83	lustig ⁺	amusing	50.9
84	quicklebendig ⁺	sprightly	50.9
85	ruhig ^u	quiet	50.9
86	schlimm ⁻	lousy	50.9
87	unbeschwert ⁺	carefree	50.9
88	wach ⁺	alert	50.9
89	energieelos ⁻	unenergized	49.1
90	furchtbar ⁻	terrible	49.1
91	aktiv ⁺	active, energized	47.4
92	hellwach ⁺	wide awake	47.3
93	jung ^u	young	47.3
94	kraftlos ⁻	feeble	47.3
95	unbehaglich ⁻	uncomfortable	47.3
96	wild ^u	uninhibited	47.3
97	elend ⁻	wretched	45.6
98	aufmerksam ⁺	attentive	45.5
99	befreit ⁺	liberated	45.5
100	schwerfällig ⁻	labored, sluggish	45.5
101	sehnsüchtig ^u	yearning	45.5
102	frustriert ⁻	frustrated	43.9
103	abgeschreckt ⁻	scared	43.6
104	enthusiastisch ⁺	enthusiastic	43.6
105	misstrauisch ⁻	suspicious, mistrustful	43.6
106	mutig ⁺	courageous	43.6
107	sprachlos ^u	speechless	43.6
108	ekstatisch ^u	ecstatic	41.2
109	belämmert ⁻	sheepish	41.1
110	geschwächt ⁻	debilitated	41.1

^a "+", "-" and "u" denote "positive", "negative" and "unclear" categorization, respectively.

Table S2.1 (*continued*)

Rank	German ^a	English (approx.)	% approval
111	erleichtert ⁺	relieved	40.0
112	erlöst ⁺	redeemed	40.0
113	gelassen ⁺	calm	40.0
114	jugendlich ⁺	youthful	40.0
115	lebhaft ⁺	lively	40.0
116	sauber ⁺	clean	38.6
117	aufgeweckt ⁺	stimulated	38.2
118	entflammt ⁺	inflamed, warmed	38.2
119	ermutigt ⁺	encouraged	38.2
120	sexy ⁺	sexy	38.2
121	unbekümmert ⁺	lighthearted	37.0
122	angespornt ⁺	heartened	36.8
123	erotisch ⁺	erotic	36.8
124	ärgerlich ⁻	annoyed	36.4
125	getröstet ⁺	comforted	36.4
126	krass ^u	stark	36.4
127	unruhig ⁻	restless	36.4
128	springlebendig ⁺	buoyant	35.8
129	verstimmt ⁻	upset	35.7
130	locker ⁺	unconstrained	35.2
131	ausgelassen ⁺	frisky, frolicsome	35.1
132	alt ^u	old	34.5
133	aufgeregt ^u	excited	34.5
134	erholt ⁺	revived	34.5
135	gelangweilt ⁻	bored	34.5
136	schockiert ^u	scandalized	34.5
137	bewegt ^u	moved	33.3
138	frei ⁺	free	33.3
139	friedvoll ⁺	peaceful	33.3
140	mächtig ^u	potent	33.3
141	verärgert ⁻	exasperated	33.3
142	beschissen ⁻	crummy	32.7
143	geil ⁺	lustful	32.7
144	scheisse ⁻	crappy	32.7
145	verdutzt ^u	baffled	32.7
146	verunsichert ⁻	uncertain	32.7
147	ermattet ⁻	worn out	32.1
148	berührt ⁺	touched	31.6
149	aggressiv ⁻	aggressive	30.9
150	besudelt ⁻	grimy	30.9
151	faul ⁻	lethargic	30.9
152	gereizt ⁻	aggravated	30.9
153	knurrig ⁻	grumpy	30.9
154	neidisch ⁻	envious	30.9
155	nervös ⁻	nervous	30.9
156	todmüde ^u	dead tired	30.9
157	wertlos ⁻	worthless	30.9
158	irrsinnig ^u	crazy	29.8
159	gerührt ⁺	stirred	29.6
160	geschockt ⁻	shocked	29.1
161	leer ⁻	empty	29.1
162	stolz ^u	proud	29.1
163	verwirrt ⁻	confused	29.1
164	wehmütig ^u	wistful	29.1
165	uralt ^u	ancient	28.1
166	ausgelaugt ⁻	drained	27.3
167	ingeschränkt ⁻	restrained	27.3
168	peinlich ⁻	embarrassing	27.3

^a "+", "-" and "u" denote "positive", "negative" and "unclear" categorization, respectively.

Table S2.1 (continued)

Rank	German ^a	English (approx.)	% approval
169	ausgeruht ⁺	rested	25.5
170	beunruhigt ⁻	unsettled	25.5
171	traurig ⁻	sad	25.5
172	zittrig ⁻	tremulous	25.5
173	übermütig ^u	high spirited	25.0
174	würdevoll ⁺	stately	24.1
175	konsterniert ⁻	consternated, anxious	24.0
176	angespannt ⁻	tense	23.6
177	besinnungslos ⁻	senseless	23.6
178	deprimiert ⁻	depressed	23.6
179	erschöpft ⁻	exhausted	23.6
180	schuldig ⁻	guilty	23.6
181	stutzig ^u	perplexed	23.6
182	sicher ⁺	sure	22.8
183	angeschlagen ⁻	groggy	21.8
184	besorgt ^u	worried	21.8
185	entsetzt ⁻	appalled	21.8
186	übellaunig ⁻	crabby	21.8
187	überfordert ⁻	overextended	21.8
188	wütend ⁻	furious	21.8
189	genervt ⁻	vexed	21.1
190	blockiert ⁻	obstructed	20.0
191	demotiviert ⁻	demotivated	20.0
192	geladen ^u	incensed	20.0
193	getrieben ^u	driven	20.0
194	haltlos ⁻	ungrounded	20.0
195	männlich ^u	masculine	20.0
196	niedergeschlagen ⁻	despondent, dejected	20.0
197	ungezähmt ^u	wild	20.0
198	unglücklich ⁻	unhappy	19.3
199	angestachelt ^u	piqued	18.5
200	alleine ^u	lonesome	18.2
201	ausgebrannt ⁻	burned out	18.2
202	ausgepumpt ⁻	pooped, beat	18.2
203	bedrückt ⁻	downcast	18.2
204	ergriffen ^u	ardent	18.2
205	erwachsen ^u	grown up	18.2
206	fassungslos ^u	stunned	18.2
207	unsicher ⁻	unsure, insecure	18.2
208	verstört ⁻	distraught	18.2
209	zornig ⁻	irate	18.2
210	erzürnt ⁻	enraged	17.5
211	ungeduldig ⁻	impatient	17.5
212	agil ⁺	agile, spry	17.0
213	entrüstet ⁻	indignant	16.7
214	rabiat ⁻	violent	16.7
215	bekümmert ⁻	troubled	16.4
216	inaktiv ^u	inactive	16.4
217	gestresst ⁻	stressed	15.8
218	abgespannt ^u	haggard	14.5
219	aufgebracht ⁻	outraged	14.5
220	beschmutzt ⁻	soiled	14.5
221	entmutigt ⁻	discouraged, disheartened	14.5
222	missmutig ⁻	discontented	14.5
223	ohnmächtig ⁻	impotent	14.5
224	selbstbewusst ⁺	self-confident	14.5
225	stürmisch ^u	tumultuous	14.5
226	ungebunden ^u	disengaged, uncommitted	14.5

^a "+", "-", and "u" denote "positive", "negative" and "unclear" categorization, respectively.

Table S2.1 (continued)

Rank	German ^a	English (approx.)	% approval
227	unschuldig ^u	innocent	14.5
228	verlegen ^u	bashful	14.5
229	betrüb ^t	aggrieved	14.3
230	ehrfürchtig ^u	reverent, awestruck	14.3
231	erstarr ^u	numbed	14.0
232	niedergedrückt ^t	in low spirits	14.0
233	angepis ^t	disgruntled	12.7
234	beengt ^t	cramped, confined	12.7
235	erdrückt ^t	overwhelmed	12.7
236	ernst ^u	serious, earnest	12.7
237	mutterseelenallein ^t	forlorn, all alone	12.7
238	verbitter ^t	embittered	12.7
239	bestürzt ^t	dismayed	12.5
240	einsam ^t	lonely	12.3
241	erschütter ^t	shaken, shocked	11.1
242	tapfer ^u	brave	11.1
243	angezogen ^u	drawn in, enamored	10.9
244	schwermütig ^t	melancholy	10.9
245	stinksauer ^t	livid	10.9
246	unfrei ^t	inhibited	10.9
247	verängstigt ^t	frightened	10.9
248	tieftraurig ^t	disconsolate	10.5
249	wüst ^t	desolate	9.4
250	befangen ^t	timid	9.1
251	erbo ^t	angry	9.1
252	gehemmt ^t	hindered	9.1
253	hysterisch ^t	hysterical	9.1
254	zerrissen ^t	torn	9.1
255	eifersüchtig ^t	jealous	7.4
256	ingeengt ^t	restricted	7.4
257	alleingelassen ^t	abandoned	7.3
258	erschrocken ^u	alarmed	7.3
259	grimmig ^t	fierce	7.3
260	verzweifelt ^t	despairing	7.0
261	verschüchtert ^t	terrified	5.7
262	demütig ^t	humble	5.6
263	trübsinnig ^t	gloomy	5.6
264	bedroht ^t	threatened	5.5
265	hasserfüllt ^t	hateful	5.5
266	schadenfroh ^t	spiteful	5.5
267	anstößig ^t	nasty, repugnant	5.4
268	unmännlich ^t	effeminate, unmanly	5.4
269	betroffen ^u	taken aback	5.3
270	ingeschüchtert ^t	intimidated	3.6
271	feige ^t	cowardly	3.6
272	unweiblich ^t	unfeminine	3.6

^a "+" , "-" and "u" denote "positive", "negative" and "unclear" categorization, respectively.

CHAPTER III

Application of the elaborated German Food-related Emotional Evaluation List in the context of Coca-Cola and Pepsi

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Abstract

Different verbal measurement instruments were developed to assess the food emotions evoked by intrinsic and extrinsic stimuli (e.g., packaging/brand). A food-related lexicon was recently designed through the application of a systematic, linguistic-based approach (Gmuer, Nuessli Guth, Runte, & Siegrist, 2015). This lexicon features a high percentage of similar expressions and has never been used. Study 1 extended the approach by applying an additional step of a similarity sorting task (N=50/task) to 134 negative, 89 positive, and 49 neutral candidate emotion terms. Hierarchical cluster analyses and the application of an adjusted selection criterion resulted in a more diverse and shorter German Food-related Emotional Evaluation List (G-FEE-List). In Study 2, 152 respondents stated in an online survey how strongly they associated the 39 terms of the G-FEE-List with the brands Coca-Cola and Pepsi. Results showed that, compared to Pepsi, Coca-Cola elicited significantly more intense positive and less intense negative emotional associations.

Overall, this research extended an existing approach to design food-related emotional evaluation lists and demonstrated the usefulness of the resulting more practical list to assess emotions in the context of food.

3.1 Introduction

“Open happiness” was a marketing campaign launched by Coca-Cola in 2009 (Pendergrast, 2013). The latest findings from sensory and consumer research have revealed that intrinsic and extrinsic properties (e.g., packaging/branding) of food products also trigger a diverse range of other emotions, such as excitement, satisfaction, surprise, an energetic feeling, and “happy memories” (e.g., King & Meiselman, 2010; Ng, Chaya, & Hort, 2013a, 2013b; Spinelli, Masi, Dinnella, Zoboli, & Monteleone, 2014; Spinelli, Masi, Zoboli, Prescott, & Monteleone, 2015). To assess food-related emotions, various verbal measurement instruments have been developed. One of these is a lexicon that was recently designed through the application of a systematic, linguistic-based approach (Gmuer et al., 2015). Because the list resulting from this approach features a high percentage of similar expressions, the aim of the present research was to extend the proposed approach in order to reduce the semantic similarities among the lexicon items. In addition, the final list was applied for the first time by assessing the emotional associations people have with the beverage brands of Coca-Cola and Pepsi.

3.1.1 Effects of intrinsic stimuli and packaging/branding on food emotions

Emotions and feelings have the potential to occur in all food consumption experiences (Blackwell, Miniard, & Engel, 2006). Each food product leaves an individual “emotional footprint.” Although food can occasionally trigger negative emotions (e.g., disappointment because the wine is corky or disgust caused by a disliked product), positive food-related emotions have more often a higher prevalence and intensity (Cardello et al., 2012; Desmet & Schifferstein, 2008; Ferrarini et al., 2010; King & Meiselman, 2010; Manzocco, Rumignani, & Lagazio, 2013; Ng et al., 2013a; Rousset, Deiss, Juillard, Schlich, & Droit-Volet, 2005; Schifferstein, Fenko, Desmet, Labbe, & Martin, 2013). Literature calls this phenomenon “hedonic asymmetry” and elucidates two main reasons for its existence: First, food companies seek to market products that attract consumers. Second, it is suggested that healthy subjects are positively affectively disposed towards food consumption because they are likely to choose to eat products that are expected to induce positive emotions (Desmet & Schifferstein, 2008). However, emotional experiences related to food often have a relatively low (i.e. not above moderate) intensity (Cardello et al., 2012; Desmet & Schifferstein, 2008; King & Meiselman, 2010; Ng et al., 2013a; Spinelli et al., 2014). One possible explanation for this is

that the contribution of food emotions to life goals in Western cultures is usually relatively small (Schifferstein & Desmet, 2010).

Assessing specific emotional states is beneficial because the gained information goes beyond traditional hedonic measures, such as liking data (King & Meiselman, 2010; Spinelli et al., 2014) or data on positive and negative affect (Laros & Steenkamp, 2005). On the one hand, emotional responses may provide explanations for observed liking patterns within product categories (Bhumiratana, Adhikari, & Chambers IV, 2014; King & Meiselman, 2010; Spinelli et al., 2014; Spinelli et al., 2015). On the other hand, although liking scores are often positively correlated with intensities of several positive emotions and negatively with intensities of negative emotions (Cardello et al., 2012; Ng et al., 2013a; Spinelli et al., 2014), emotional responses provide a more differentiated picture of products in the same category than liking scores do (Bhumiratana et al., 2014; King & Meiselman, 2010; Ng et al., 2013a; for an odor-related example, see Porcherot et al., 2010; Spinelli et al., 2014). This is of great importance because marketed products have converged in quality, price (Schifferstein et al., 2013), and liking (Cardello et al., 2012). It is assumed that knowledge about the emotions products evoke may play a crucial role in helping industries gain differential advantage (Ng et al., 2013a; Schifferstein et al., 2013). Additional results have shown that stated emotional intensities also differ across food categories (Cardello et al., 2012; King & Meiselman, 2010).

Most studies in food emotion research have been conducted with blind testing to explore intrinsic-related emotions. It has long been known, however, that extrinsic factors, such as branding, influence consumers' hedonic judgments of food products (e.g., Allison & Uhl, 1964; Lange, Martin, Chabanet, Combris, & Issanchou, 2002; Makens, 1965). As a prominent example, McClure et al. (2004) investigated whether brand information of cola beverages (i.e., Coca-Cola versus Pepsi) had an effect on expressed preferences or on functional magnetic resonance imaging (fMRI)-measured brain activity. The results showed that, in the anonymous tasting condition, there was no difference in the number of participants who preferred Coca-Cola or Pepsi and both drinks evoked neural responses in the ventromedial prefrontal cortex. In the semi-anonymous tasting task, in which one of the two samples was brand-cued, the brand-cued sample was preferred, even though both samples contained the same beverage. Additionally, the brand-cued delivery increased activity in diverse brain regions. Interestingly, these semi-anonymous task findings were observed only for Coca-Cola, and not Pepsi, indicating a clear brand effect.

To our knowledge, profound investigations into brand effects have gained little attention in food-related emotion research. The most recent studies have revealed how

emotional evaluations or conceptualizations might change across different food product stimuli by providing only intrinsic stimuli (blind tasting), intrinsic and extrinsic stimuli (informed tasting), and/or by presenting only the packaging/brand¹ (Ng et al., 2013b; Spinelli et al., 2015; Thomson & Crocker, 2015). Although packaging/branding might also trigger emotions, initial results indicate that intrinsic attributes have a greater effect in determining the emotions evoked during informed tasting (Ng et al., 2013b; Spinelli et al., 2015).

3.1.2 Verbal emotion measurement tools in food emotion research

Profound research in food-evoked and food-associated emotions has been mostly conducted by means of verbal tools. The most groundbreaking measuring instrument for such research is the EsSense ProfileTM (ESP), which was developed by King and Meiselman (2010). The ESP encompasses 39 English terms (3 negative, 25 positive, 11 unclassified) to assess product category users' emotions induced by food. In addition to other developed general food emotion lexicons, various food product-specific lists were designed (Bhumiratana et al., 2014; Spinelli et al., 2014; for a compilation of different food- and odor-related emotion lists, see Gmuer et al., 2015, Table 1). The emotion term lists that exist in sensory science literature have been developed through different approaches. To overcome some of the limitations of existing development procedures, we recently proposed a three-step systematic and linguistic-based approach and applied it to the German language (Gmuer et al., 2015)². The first two steps of the approach identified 272 candidate emotion terms. The terms' appropriateness for describing food-evoked emotional experiences served as a further selection criterion, resulting in 49 German terms that were approved by at least two-thirds of the participants. Thirty-four expressions were positive in nature, 12 were negative, and 3 were categorized as either "positive or negative" or "neither positive nor negative" (summarized as "neutral"). It should be noted that there is still no uniform definition of the term "emotion" (Kleinginna & Kleinginna, 1981; Scherer, 2005) and that the distinction between emotions and moods is blurred (King & Meiselman, 2010; Thomson & Crocker, 2013). Therefore, we do not claim that these expressions are definite emotions. However, the expressions were identified as terms appropriate for describing emotional states. The list encompasses highly differentiated expressions (e.g., *disappointed* [*enttäuscht*], *vital* [*vital*]) and less differentiated, so-called evaluative words that indicate overall emotional states (e.g., *bad* [*schlecht*], *good* [*gut*])

¹ It is not clear whether the observed effects were due to the brand influence, the packaging influence, or a combination of both since there was no distinction between these two elements (which often go hand in hand) (Spinelli et al., 2015).

² Interested parties are referred to our latest article (Gmuer et al., 2015) for a detailed discussion about the main advantages and disadvantages of existing approaches and the proposed systematic and linguistic-based approach.

(Gmuer et al., 2015).

A comparison between the 49 expressions and the ESP showed a small overlap (see Gmuer et al., 2015, Table 3), which may be due to methodological or cultural differences (Gmuer et al., 2015). For the former, our approach involved screening language data to detect a vast range of possible emotion terms. As a consequence, the word pool and final list included a high number of similar expressions representing many linguistic nuances (e.g., *glorious* [*herrlich*], *outstanding*, *terrific* [*hervorragend*], *sensational* [*sensationell*], *wondrous* [*wunderbar*] or *astonished* [*verblüfft*], *astounded* [*erstaunt*], and *surprised* [*überrascht*]). In non-linguistic research areas, evaluations of numerous similar expressions provide no deeper insight than assessments of fewer but more diverse terms. Thus, the 49-term list could be made more practical through a reduction in its number of similar expressions.

3.1.3 Objectives and overview of present research

The objective of the present research was two-fold: 1) to extend the approach proposed in our earlier paper (Gmuer et al., 2015) by adding an approach step in order to decrease the number of similar terms and therefore increase the quality of the resulting list and 2) to test the usefulness of the ultimate list to assess emotional states associated with cola beverages.

In Study 1, the positive, negative, and neutral terms of the 272 candidate emotions identified by Gmuer et al. (2015) were subjected to a free similarity sorting task, followed by the application of a selection criterion that led to the ultimate list. Free-sorting is a popular method in a diverse range of disciplines (see Coxon, 1999, Table 4 for a review) and has already been successfully used to cluster semantically similar affective terms (Shaver, Schwartz, Kirson, & O'Connor, 1987; Storm & Storm, 1987). Even consumer researchers have used similarity sorting to develop a feeling taxonomy (Thomson & Crocker, 2013). Because free-sorting is a part of humans' natural mental processes, people are familiar with the activity. Moreover, free-sorting is widely applicable, adaptable (e.g. free-sorting can be done with more than 100 objects), easy, quick, and usually fun (Coxon, 1999). The rationale behind using all 272 candidate terms instead of only the 49 expressions was methodological. The resulting classification may be a good starting point for other researchers who seek to develop or adjust (our) lexicons.

In Study 2, the 39 terms resulting from Study 1 were used in a positive food consumption context in order to explore the emotional associations people have with Coca-Cola and Pepsi. Comparing those products is an optimal application case because they are stereotypic, widely known, and similar in their sensory profiles (McClure et al., 2004). The

main reason for choosing those products, however, was that, compared to Pepsi, brand knowledge for Coca-Cola has been shown to increase brain activity and to have a positive impact on hedonic judgment (preference) (McClure et al., 2004, see section 1.1. for more details on this study). Based on these findings, we derived the hypothesis that, compared to Pepsi, people have more intense positive emotional associations and less intense negative associations with Coca-Cola.

Study 1: Semantic similarity reduction via free similarity sorts of candidate emotion terms

3.2 Methodology

3.2.1 Subjects

Students (*mean age*: 23.5 years, *SD*=2.7 years; *range*: 18 – 36 years) with (Swiss-) German as a first language were recruited in June/July 2014 via snowball and convenience sampling (e.g., student mailing lists, online ads on message boards and Facebook) and a participant pool from the University of Zurich to take part in one of three similarity sorting tasks (negative, positive or neutral terms). The final sample consisted of 50 subjects per task (50% female). Participants were compensated with 10 CHF each.

3.2.2 Material

134 negative, 89 positive, and 49 neutral German candidate emotion terms were taken from Gmuer et al.'s (2015) supplementary material. Each word was printed on a separate 5.3 by 3.1 cm card. Each card included a randomly assigned, two-letter identification code located on the bottom right corner to facilitate the cards' presentation order (i.e., either alphabetical or analphabetic code order) and the recording of results.

3.2.3 Procedure

A maximum of four subjects participated at the same time. The participants were placed at individual tables and sat either back to back or at least two meters apart from one another. As the participants gave informed consent to participate in the study, a pack of either positive, negative or neutral word cards was placed by the experimenter in the top right corner of each table. Once the informed consent forms were handed in, the task description and a reminder

aid were provided. The participants were asked to attentively read the instructions. In addition, they were told that the reminder aid included the most important points. The instructions informed the participants that the emotion words on the stack are used in the sentence construction “*I feel/I am* + [word].” They were invited to take as much time as they needed to sort words that described the same emotion into the same group, while thinking of food and beverage products. More than two and fewer than 133, 90³, or 49 groups (for the negative, positive, and neutral words, respectively) had to be formed. Each word could be a member of only one group. Participants were further instructed that every word had to be allocated to a group, unless they thought that a word should build a separate group (for similar procedures, see Connor & Siegrist, 2013; Storm & Storm, 1987; Thomson & Crocker, 2013). If a word was unknown, participants could place it in a cell labeled “unknown word” in the upper right corner of the table. The reminder aid emphasized that the participants should sort the words describing the same emotion into the same group, while thinking of food and beverage products⁴. After completing the sorting task, participants provided demographic information and were thanked and rewarded for their participation.

3.2.4 Statistical analysis

The data were analyzed using the IBM SPSS Statistics software (version 22). In the individual sorting data, identical assigned numbers indicated that words had been allocated to the same group. Each expression that was unknown to the participant was treated as a separate group. By including all cases, a 133 x 133, 90 x 90, and 49 x 49 similarity matrix was built for the negative, positive, and neutral terms, respectively. Each matrix cell stated the number of subjects that grouped two terms together. Agglomerative hierarchical cluster analyses were performed on the calculated dissimilarity matrices. Various clustering methods and solutions were compared to find satisfactory solutions (with the exclusion of the term *restrained* [*eingeschränkt*]; see Footnote 3). Dissimilarity matrices were used because the application of

³ Originally, there were 134 negative and 89 positive terms (see 2.2. Material). However, the negative term *restrained* [*eingeschränkt*] was falsely presented to the participants as a positive expression due to a misattribution. The cluster analysis with the single linkage method for positive terms correctly identified the term *restrained* as an outlier. The cluster analysis was, therefore, again performed with this expression excluded. It should be noted that this exclusion did not impact the final list. The term would also have been excluded from the list at a later stage because of the applied selection criteria (approval frequency $\geq 50\%$, see section 3. Results).

⁴ There exist food product-specific and food product-unspecific emotion term lists in literature. However, the level of the emotion list development approach at which the product-specific aspect must be considered has not yet been extensively explored. Similarity sorting tasks constitute a possible method for reducing the amount of semantic similarity within a word list. As a subsidiary study objective, we therefore examined whether the perceived similarities and categorizations of emotion terms differ between a food product-specific task (thinking of the product chocolate) and a food product-unspecific task (thinking of food and beverage products) (see also Connor & Siegrist, 2013, for a similar experimental design). A two-sided Mantel test calculated a Pearson coefficient across the two obtained similarity matrices in order to determine the similarity between the sorting data that resulted from the two different tasks. A relatively large, positive, and significant Pearson correlation coefficient ($r=0.853$, $p<0.001$) indicated that 1) categorizations between the two conditions were similar, 2) the perceived similarity of emotion terms seems not to be food product-specific, and 3) the product-specific aspect does not have to be considered during emotion sorting tasks that are used to design food emotion term lists. Based on this knowledge, only product-unspecific procedures for the negative and neutral term groups were conducted. For the positive word group, the data resulted from the food product-specific and food product-unspecific task were pooled.

the centroid, median, and Ward method requires distance measures (Backhaus, Erichson, Plinke, & Weiber, 2006). The complete linkage method and a classification of 54 negative, 32 positive and 24 neutral clusters resulted in reasonable and satisfactory solutions for reducing the number of similar terms and obtaining a list with a focus on positive emotional states.

3.3 Results

In the following, the original German terms are indicated in square brackets. Participants built, on average, 25 negative groups (range: 3–68), 15 positive groups (range: 5–36), and 14 neutral groups (range: 5–33). The dendrograms and the 54-, 32- and 24-cluster solutions are depicted in the supplementary material (Figures S3.1-S3.3). A representative word was selected from each cluster to determine the final list. The food-related criterion “approval frequency” of Gmuer et al.’s (2015) research served as the selection criterion. That is, the words selected from each cluster were judged as more appropriate for describing emotions or feelings evoked in a food or beverage consumption context than the remaining expressions in the cluster. Where the difference between two terms from the same cluster was less than or equal to an arbitrary 5.4%, the word that was less ambiguous and most capable of increasing the diversity of the final list was chosen. This occurred in seven word groups: *animated* [*animiert*]/*motivated* [*motiviert*]; *delighted* [*beglückt*]/*happy* [*glücklich*]; *dreadful* [*schrecklich*]/*horrid* [*abscheulich*]; *enchanted* [*entzückt*]/*overwrought* [*überwältigt*]; *fresh* [*frisch*]/*refreshed* [*erfrischt*]; *icky, revolting* [*eklig*]/*sickened, grossed out* [*angewidert*]; and *limp* [*schlaff*]/*tired* [*müde*]. There were two additional term pairs (*drowsy* [*schläfrig*]/*tired* [*müde*] and *eager* [*begierig*]/*greedy* [*gierig*]) in which the terms were extremely similar but had different valences (negative or neutral) (Gmuer et al., 2015, Study 2). As a result, the terms (e.g., *drowsy* [*schläfrig*] and *tired* [*müde*]) were part of different similarity sorting tasks and could not be grouped together. Again, for these cases, the word with the unambiguous valence (i.e., negative valence) was included in the list.

To further reduce the number of terms, a cut-off criteria had to be set. In our previous research, we decided to use an approval frequency of 66.7% (Gmuer et al., 2015). Applying the same critical level would have resulted in a final list of 26 expressions (53.1% of the initial 49 term list). However, the original goal was to design a food product-unspecific list that could be used with different food categories and assesses positive and negative induced emotional states in a satisfactory manner. Therefore, the cut-off point was lowered to 50%. This added some important expressions. The final German Food-related Emotional

Evaluation List (G-FEE-List), containing 39 expressions (14 negative, 22 positive, 3 neutral), is shown in Table 3.1. The meaning correspondence between the list and the food product-unspecific ESP is at least 25.6% (10 terms; depicted with a superscript in Table 3.1). The overlap would have been 28.2% (11 terms) if we had counted the correspondence with *merry* (ESP) two times (since *merry* could correspond to either *chipper* [*munter*] or *cheery* [*vergnügt*] from the G-FEE-List). Because of translational challenges (Gmuer et al., 2015), the number of overlapping term is not definite.

Table 3.1

German Food-related Emotional Evaluation List (G-FEE-List)

Negative		Positive		Neutral	
German	English (approx.)	German	English (approx.)	German	English (approx.)
schlecht	bad	angeregt	aroused	erregt	charged
langweilig	boring ^a	vergnügt	cheery	ruhig	quiet ^a
benommen	dazed	munter	chipper ^a	überrascht	surprised
enttäuscht	disappointed	zufrieden	content ^a		
unbefriedigt	dissatisfied	beschwingt	exhilarated		
schrecklich	dreadful	begeistert	exuberant, excited ^a		
gierig	greedy ^a	gut	good ^a		
minderwertig	inferior	glücklich	happy ^a		
irritiert	irritated	feurig	impassioned		
angewidert	sickened, grossed out ^a	energiegeladen	invigorated, energetic ^a		
merkwürdig	strange	lustvoll	lusty		
müde	tired	motiviert	motivated		
träge	torpid	hervorragend	outstanding, terrific		
unwohl	uneasy	überwältigt	overwrought		
		erfrischt	refreshed		
		entspannt	relaxed		
		feierlich	solemn		
		gestärkt	strengthened		
		dankbar	thankful		
		einzigartig	unique		
		vital	vital		
		wohl	well		

^a indicates a meaning correspondence with an expression from the ESP developed by King and Meiselman (2010).

Study 2: First application of the final list to assess emotional associations with two cola brands

3.4 Web-based survey

3.4.1 Participants

Potential respondents were contacted during February/March 2015 via two different participants databases: one from ETH Zurich (Group Consumer Behavior) and the other from the University of Zurich. In total, 183 people completed the survey⁵. Members of the first database were not compensated, and the response rate was 64.7% after one reminder. Members of the second database obtained a gift upon random selection (response rate=6.7%). Five subjects who completed the questionnaire in less than half of the median of the total survey duration were excluded based on the assumption that these cases did not take the survey seriously (Hartmann, Shi, Giusto, & Siegrist, 2015; Siegrist, Shi, Giusto, & Hartmann, 2015). A further 26 cases were deleted because the respondents had never tasted Pepsi (Original). The final sample comprised 152 respondents (59.2% female). The mean age was 48.7 years ($SD=18.0$ years; *age range*: 18 – 85 years), and 92.1% of the respondents had at least (Swiss-) German as a first language. The education levels were distributed as follows: 2.6% of the sample had completed compulsory education, 37.5% had attended upper secondary school, 19.1% had finished a higher vocational education, and 40.8% held a college or university degree.

3.4.2 Questionnaire

After giving informed consent, respondents filled in one of two questionnaire versions, to which they were randomly but equally assigned. Half of the sample answered questions concerning normal Coca-Cola (Original) first and questions concerning Pepsi (Original) second, and the other half of the sample completed these sections in reverse order.

The following description refers to the section on normal Coca-Cola (Original). The Pepsi (Original) section was designed in the same way. To ensure that respondents were thinking of the intended Coca-Cola product, respondents were shown a picture of a Coca-Cola

⁵ Double participations were identified among the initial 185 participations by means of their Internet protocol (IP) addresses. If the demographic information for both cases was the same, the data recorded at the later date were excluded ($N_{\text{excluded}}=2$). In the case of different demographic information, both cases were retained.

(Original) can, along with the following note: “In the following, questions concerning the normal Coca-Cola (Original) will be asked.”

Consumption frequency was then assessed on a 7-point scale: “daily,” “4-6 times/week,” “1-3 times/week,” “1-3 times/month,” “less often,” “never, but I have previously tasted the normal Coca-Cola (Original)”, and “I have never tasted the normal Coca-Cola (Original)” (Hartmann, Dohle, & Siegrist, 2013). Consumers’ liking of the product was reported by means of a 7-point scale using numerical labels from -3 to +3. The end points of the scale were additionally labeled as “*do not like at all*” [in German: *überhaupt nicht gern*] and “*like extremely*” [*ausserordentlich gern*].

The G-FEE-List (39 German terms from Study 1) was used to collect the respondents’ emotional evaluations. The expressions were randomly divided into two blocks (with 20 and 19 words, respectively). For each respondent, terms were arranged randomly within each block. The blocks were presented on two separate pages and introduced by the task: “In the following, different words are listed. Think of the normal Coca-Cola (Original). Please indicate how strongly you associate these words with the product.” The 6-point answering scale was numerically labeled. In addition, the end-points had verbal anchors (*1=not at all* [in German: *überhaupt nicht*]; *6=extremely strongly* [*ausserordentlich stark*]). The picture of the Coca-Cola (Original) can was simultaneously displayed.

At the end of the questionnaire, questions about demographic variables, such as age, gender, native tongue, and education, as well as two further questions concerning the respondents’ favorite Coca-Cola and Pepsi drink(s) were asked.

The reason for assessing the emotional associations respondents had with the original cola drinks, rather than their individually preferred cola beverages (e.g., Coca-Cola Zero or, Coca-Cola Light), was the differences in the marketing concepts of the various products, which may also have different emotional association profiles.

The questionnaire format was developed following the findings of King, Meiselman, and Carr (2013) concerning how to conduct emotion questionnaires. Specifically, the sensitivity of rating scales was shown to be greater than that of check-all-that-apply tasks – and is, therefore, more appropriate for testing very similar products. Moreover, the respondents’ liking of the products and the intensities of their scaled emotional responses significantly increased when liking was recorded before emotional responses. Finally, the random presentation of the emotional terms resulted in significantly higher scaled intensities for approximately one-third of the presented terms. As a result, ratings scales were used,

liking was recorded before emotional associations, and emotional terms were presented randomly in the present study.

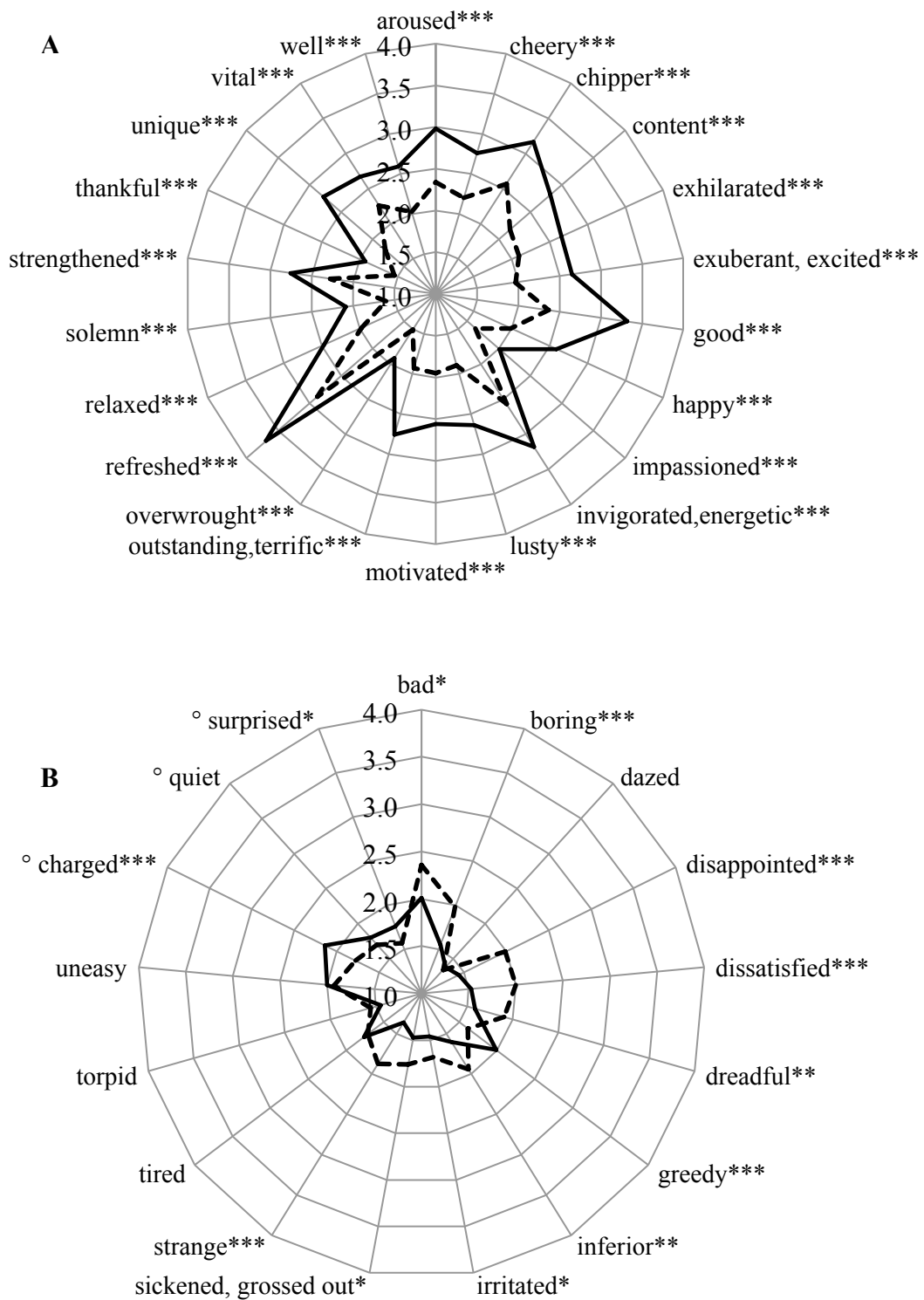
3.4.3 Statistical analysis

The data were analyzed using IBM SPSS Statistics software (version 22). Two-tailed t-tests were applied to compare the mean emotional association intensities of Coca-Cola and Pepsi. Before the analysis of the liking ratings, scores were recoded from a scale from -3 to +3 to a scale from 1 to 7. To explore the correlational relationship between the liking data and the intensities of the emotional associations, Pearson's correlation coefficients were calculated for each product. The significance level was set at $\alpha=.05$.

3.5 Results

The distribution of respondents' consumption frequencies for Coca-Cola (Original) was as follows: 1.3% of the subjects were frequent consumers ($\geq 4x/week$), 35.5% were occasional consumers ($\geq 1x/month$), 39.5% consumed the drink more rarely ($< 1x/month$), and 23.7% never drank Coca-Cola (Original) but had tasted it in the past. The mean liking for Coca-Cola (Original) was 4.6 ($SD=1.8$, value range: 1 - 7). The calculated Spearman's correlation coefficient for consumption frequency and liking was $r_s=0.65$ ($p<0.001$). With regard to their most preferred Coca-Cola drink (several answers were possible), 55.3% of the respondents liked Coca-Cola (Original) best. This was followed by Coca-Cola Zero (26.3%), none (15.8%), Coca-Cola Light (12.5%), other (3.9%), and Coca-Cola Zero caffeine-free (0.7%). Three participants (2.0%) did not respond to the question about favorite Coca-Cola beverage; their responses were labeled as missing information.

The distribution of consumption frequencies for Pepsi (Original) was as follows: 0.0% frequent consumers ($\geq 4x/week$), 2.0% occasional consumers ($\geq 1x/month$), 25.0% rare consumers ($< 1x/month$), and 73.0% non-consumers who had tasted Pepsi (Original) at least once in the past. The mean liking for Pepsi (Original) was 3.4 ($SD=1.6$, value range: 1 - 6). The calculated rank correlation coefficient for consumption frequency and liking was $r_s=0.48$ ($p<0.001$). With regard to their favorite Pepsi beverage, 56.6% participants did not like any specific Pepsi drink best, and Pepsi (Original) was indicated to be the favorite Pepsi drink by 28.9%. This was followed by Pepsi Light (11.2%), Pepsi MAX (5.3%) and other Pepsi drinks (0.7%) (several answers were possible). Four cases were labeled as missing.



Figures 3.1 A and B. Comparison of the mean positive emotional association intensities (A) and neutral (°) and negative emotional association intensities (B) between Coca-Cola (solid line) and Pepsi (dashed line) (N=152). Terms were originally presented in German. Ratings were recorded on a scale ranging from 1=not at all to 6=extremely strongly. *, **, *** indicate significant differences at $p \leq 0.05, 0.01, 0.001$.

In the following, the original German terms are indicated in square brackets. Figures 3.1A and 3.1B show that there were significant differences between Coca-Cola and Pepsi in 34 of the 39 expressions. All 22 mean intensities for the positive expressions were significantly higher in the case of Coca-Cola (Figure 3.1A). Despite their highly similar positive emotional association profiles, the difference between the two products ranged from 0.39 (*impassioned* [*feurig*], *thankful* [*dankbar*]) to 0.98 (*unique* [*einzigartig*]). The profiles for the neutral and negative terms were more different between Coca-Cola and Pepsi (Figure 3.1B). Specifically, there were 10 significant differences among the negative associations, with Coca-Cola having a significantly higher value only for the negative term *greedy* [*gierig*]. The neutral expressions *charged* [*erregt*] and *surprised* [*überrascht*] were also rated significantly higher for Coca-Cola. The smallest and largest significant differences for the neutral and negative terms were 0.19 (*surprised* [*überrascht*]) and 0.55 (*disappointed* [*enttäuscht*]), respectively.

King and Meiselman (2010) elucidated that the positive emotion profiles of product likers are not congruent with the emotions reported by product dislikers. Because our sample is biased towards Coca-Cola (Original) likers, a comparison of the emotional association intensities of the preferred product was conducted to investigate whether the observed findings are a matter of the skewed sample or whether they may occur due to a possible brand effect. Specifically, the emotional association intensities Coca-Cola-preferring people have with Coca-Cola were compared to the emotional association intensities Pepsi-preferring people have with Pepsi. Product preference was determined based on the difference between the respondents' Coca-Cola liking and Pepsi liking scores. Independent, two-tailed t-tests provided similar results: The shapes of the positive emotional association profiles of Pepsi and Coca-Cola were virtually the same, but people who preferred Coca-Cola over Pepsi (N=85) reported a higher intensity for all positive associations with Coca-Cola than Pepsi-preferring people (N=10) did with Pepsi. A significant differences were found in thirteen positive associations, such as in the case of *aroused* [*angeregt*], *happy* [*glücklich*], *refreshed* [*erfrischt*], *unique* [*einzigartig*], *well* [*wohl*], and *outstanding, terrific* [*hervorragend*]. Again, the profiles for the neutral and negative expressions showed greater product variation and the negative emotional association intensities with Pepsi were mostly higher. However, significance was only reached for two negative expressions (*greedy* [*gierig*] and *tired* [*müde*]) and one neutral word (*charged* [*erregt*]), with Coca-Cola showing higher values. Overall, the significant differences ranged from 0.57 *tired* [*müde*] to 1.75 *outstanding, terrific* [*hervorragend*].

Because a comparison with a sample of 10 Pepsi-preferring individuals is restricted in terms of generalizing conclusions to the population, additional paired, two-sided t-tests were applied to a subsample consisting of 57 subjects (64.9% female) who did not differ in their liking of the two products. Twenty-one positive and eight negative emotional associations were rated more intensely in the case of Coca-Cola. However, significantly higher values for Coca-Cola were only found for five expressions, which are listed according to the increasing magnitude of their differences: *solemn* [*feierlich*] ($\Delta=0.21$); *good* [*gut*]; *invigorated*, *energetic* [*energiegeladen*]; *unwell* [*unwohl*]; and *unique* [*einzigartig*] ($\Delta=0.54$). These differences, except that for *unwell* [*unwohl*], were already significant for the full dataset (N=152, see above).

The correlational relationships between liking scores and emotional association intensities for each product are shown in Table 3.2.

3.6 Discussion

The aim of the present research was methodological, since the study extended an existing approach to design food-related emotional evaluation lists and tested the final lexicon for cola brands.

The additional approach step – the similarity sorting task, followed by an adjusted selection criterion – yielded a satisfying final 39-term list, which is intended to measure emotional states evoked by or associated with food products. Compared to the 49 terms produced by the initial three-step approach (Gmuer et al., 2015), the ultimate list is shorter and contains fewer similar expressions. As a result, the latter list is assumed to be more useful to interested parties who call for less resource-consuming (e.g., in terms of time or money) and participant-friendly (i.e., less confusing or boring) tools. It is further suggested that lists that contain fewer similar terms might have higher discriminating power and a broader application range. Moreover, although our study's aim was not to develop a taxonomy for candidate emotions terms, as has been done by other researchers (e.g., Shaver et al., 1987; Storm & Storm, 1987; Thomson & Crocker, 2013), a byproduct of this study is a rough, low-level classification of the more than 200 candidate emotion terms from which the ultimate list was derived. This classification shows the semantic associations among these terms – and, compared to lexicons derived from the initial approach, should make it easier to adjust the final list depending on the research question (e.g., by adding words or taking other clusters into account).

Table 3.2
Pearson's correlation coefficient r between liking data and emotional association intensities ($N=152$)

G-FEE-List		Pearson's correlation coefficient ^a	
German	English (approx.)	Coca-Cola	Pepsi
Positive			
angeregt	aroused	0.292***	0.430***
vergnügt	cheery	0.427***	0.363***
munter	chipper	0.362***	0.411***
zufrieden	content	0.505***	0.498***
beschwingt	exhilarated	0.318***	0.367***
begeistert	exuberant, excited	0.455***	0.403***
gut	good	0.655***	0.587***
glücklich	happy	0.385***	0.411***
feurig	impassioned	0.267***	0.159*
energiegeladen	invigorated, energetic	0.305***	0.307***
lustvoll	lusty	0.429***	0.322***
motiviert	motivated	0.430***	0.394***
hervorragend	outstanding, terrific	0.533***	0.523***
überwältigt	overwrought	0.355***	0.242**
erfrischt	refreshed	0.468***	0.416***
entspannt	relaxed	0.353***	0.256***
feierlich	solemn	0.338***	0.296***
gestärkt	strengthened	0.328***	0.353***
dankbar	thankful	0.373***	0.214**
einzigartig	unique	0.386***	0.322***
vital	vital	0.465***	0.407***
wohl	well	0.459***	0.464***
Negative			
schlecht	bad	-0.458***	-0.445***
langweilig	boring	-0.122	-0.203*
benommen	dazed	0.037	0.082
enttäuscht	disappointed	-0.218**	-0.375***
unbefriedigt	dissatisfied	-0.376***	-0.331***
schrecklich	dreadful	-0.293***	-0.385***
gierig	greedy	0.104	0.070
minderwertig	inferior	-0.315***	-0.371***
irritiert	irritated	-0.175*	-0.216**
angewidert	sickened, grossed out	-0.410***	-0.336***
merkwürdig	strange	-0.146	-0.318***
müde	tired	0.092	0.061
träge	torpid	-0.011	-0.097
unwohl	uneasy	-0.264***	-0.105
Neutral			
erregt	charged	0.223**	0.294***
ruhig	quiet	0.227**	0.140
überrascht	surprised	0.239**	0.270***

^a *, **, *** indicate significant differences at $p \leq 0.05, 0.01, 0.001$ (two-tailed).

As a consequence of these merits, we highly recommend using the extended approach, which consists of the following elements: 1) term collection, 2) identification, 3) characterization, 4) classification, and 5) food-related evaluation (for more details about steps 1), 2), and 5), see Gmuer et al., 2015). Characterizing the terms (step 3) concerning their valence (Gmuer et al., 2015, Study 2) is a necessary prerequisite to the classification step (similarity sorting tasks), since it makes the sorting task more feasible by conducting one similarity sorting task per valence group. Compared to the initial three-step approach, the food-related evaluation step was moved to the end for logistic reasons.

Like the initial 49-term list (cf. Gmuer et al., 2015), the ultimate 39-term list corresponds to other lists in food and odor emotion research (see Gmuer et al., 2015, Table 1) in its number and nature of expressions. Existing lists vary from 16 wine-specific terms (Ferrarini et al., 2010) to 44 coffee-specific expressions (Bhumiratana et al., 2014), and they often feature a predominance of positive terms (Chrea et al., 2009; Ferrarini et al., 2010; King & Meiselman, 2010; Spinelli et al., 2014). Not unexpectedly, the meaning correspondence between the G-FEE-List and the most popular food product-unspecific 39-term lexicon, the ESP, showed only a marginal increase (10 to 11 terms, 25.6 to 28.2% overlap, cf. terms with superscripts in Table 3.1) over the match between ESP and our initial 49-term lexicon (8 terms, 20.5%). This indicates that the difference between the ESP and the initial 49-term list cannot only be ascribed to the high amount of similar expressions. On the contrary, it reinforces the conclusions drawn in our earlier study (Gmuer et al., 2015), which suggests that methodological and cultural differences are responsible for the low meaning correspondence. It might be argued that the low overlap can be predominantly attributed to the considerable number of negative expressions that were included in the G-FEE-List. The ESP was created to explore the emotion profiles of, particularly, product (category) likers. As a result, only three descriptors in the ESP have a negative valence (King & Meiselman, 2010). However, without lowering the cut-off level in the present study from $\geq 66.7\%$ to $\geq 50\%$ approval frequency, and comparing only the remaining 18 positive expressions from the G-FEE-List and the 25 positive terms from the ESP, there still is a substantial difference (overlap in only 6 terms).

Compared to other lexicons, the advantage of the G-FEE-List arises primarily from the applied approach. The approach differs from other development procedures and features several advantages: First, it is systematic and addresses the development of emotion lists from a linguistic perspective. For this purpose, a large set of actual language use data, rather than other emotion term lists (for examples, see Ferrarini et al., 2010; King & Meiselman, 2010;

Rousset et al., 2005), was screened to collect terms. As a result, translational obstacles were overcome and articulation difficulties of participants often observed in free-listing approaches (e.g., Ng et al., 2013a) were circumvented. Moreover, the resulting culture-specific G-FEE-List is based on terms people actively use in their verbal communications – and, therefore, is assumed to be more applicable in verbally measuring emotional states (Gmuer et al., 2015). Because of the higher number of negative expressions in the G-FEE-List compared to the popular food product-unspecific ESP, the G-FEE-List is further assumed to be more widely applicable, including the exploration of negative food-related emotional states. Considering the negative emotions of (non)-users may be important for marketers during, for example, the optimization of existing products (examples are given by Desmet & Schifferstein, 2008), prototypes or food produced by modern techniques. A demonstration of the last of these was shown by Laros and Steenkamp (2005), who used genetically modified food as a negative emotion source. An additional advantage of the G-FEE-List compared to the food product-unspecific ESP is, as already mentioned, that the terms in the G-FEE-List reference a rough classification, a feature that the ESP lacks (King & Meiselman, 2010).

This study successfully demonstrated the usefulness of the food product-unspecific G-FEE-List in a positive food context. More specifically, the G-FEE-List revealed the emotional associations people have with cola brands and indicated that the intensities of emotional associations may differ between two highly similar brands. Confirming our hypothesis derived from McClure et al.'s (2004) research, the emotional association profiles (Figures 3.1A and B) suggest that people have stronger positive and less intense negative emotional associations with Coca-Cola than with Pepsi, with the exception of the term *greedy* [*gierig*]. An additional analysis that compared evaluations of preferred products revealed similar findings: People who preferred Coca-Cola rated their preferred product more positively than participants who preferred and rated Pepsi. Given the low number of Pepsi-preferring subjects and the finding that Coca-Cola was only rated significantly better for four emotional associations by people who had no preference, additional research is needed to conclude that the observed results can be attributed to a brand effect. However, due to the similarity in the products' chemical composition, and educing McClure et al.'s (2004) findings, it can be suggested that the differences are not generated by the products' diverging sensory characteristics. Furthermore, one may argue that the sample represents the marketing share in Switzerland, where the present study was conducted. This might already indicate a brand effect.

Although the emotional association profiles of the two products were very similar, the magnitude of the differences between the emotional association pairs varied, with some terms being non-discriminating between the brands. This indicates that the differences between profiles did not only occur on a valence basis. For example, the term *unique* [*einzigartig*] was one of the evaluations most strongly affected by the stimuli. In all considered samples, *unique* was more strongly associated with Coca-Cola, with the intensity of the association varying between 0.5 and a substantial 1.5 scale-points, depending on the analyzed sample. These results entail several things: 1) The G-FEE-List not only showed that Coca-Cola was more positively perceived, but also illuminated in more detail which positive emotional associations were especially pronounced for the case of Coca-Cola. This finding provides additional information to the differences in brain activity and behavioral preferences observed by McClure et al. (2004). 2) Assessing specific emotional associations, even between similar product brands, might be more informative than measuring positive-negative affect and liking alone. 3) Emotional associations may be used to differentiate between strong brands from the same product category. The findings are in line with the literature showing the additional benefits of measuring more specific affective states (Laros & Steenkamp, 2005; Spinelli et al., 2014) and the ability of emotional evaluations to discriminate between products of the same category (King & Meiselman, 2010; Ng et al., 2013b; Spinelli et al., 2014; Spinelli et al., 2015).

In addition to the differentiating ability of the G-FEE-List, the usage of the G-FEE-List in the context of cola brands further confirmed observations that have already been elucidated in the literature for other food items: a hedonic asymmetry effect (Cardello et al., 2012; Desmet & Schifferstein, 2008; Ferrarini et al., 2010; King & Meiselman, 2010) and relatively low rating intensities (cf. Cardello et al., 2012; King & Meiselman, 2010; Ng et al., 2013a) with *refreshed* [*erfrischt*], *invigorated*, *energetic* [*energiegeladen*], *chipper* [*munter*], *good* [*gut*], and *aroused* [*angeregt*] being the five most important for cola brands. Furthermore, in agreement with other studies (Cardello et al., 2012; Ng et al., 2013a; Spinelli et al., 2014), there was a positive correlational relationship between product liking and positive or neutral expressions for both products, indicating that the neutral expressions of the G-FEE-List might be more positively connoted in the context of cola beverages (Ng et al., 2013a). However, the negative correlations between liking and negative expressions were less strongly marked. For both products, no significant correlation coefficient was found for *dazed* [*benommen*], *tired* [*müde*], and *torpid* [*träge*]. Unexpectedly, the reported emotional intensity of *greedy* [*gierig*] also seemed to be independent of product liking in the context of cola

drinks; these results conflict with those of an earlier study, in which, following tastings of blackcurrant squashes, a similar emotional state (*eager*) was shown to be liking-related (Ng et al., 2013a). A possible explanation may be that the term *eager* was classified as a neutral emotion. In contrast, the term *greedy* [*gierig*] of the G-FEE-List was categorized as negative, and, therefore, perhaps less related to liking (see Gmuer et al., 2015). In the context of drinks, it may be further possible that *eager* or *greedy* may be more prominent after having tasted the liked product. In addition, emotional associations encompass a wider spectrum of situations and emotion sources that do not necessarily have to be product-related or liking-related. In the case of the terms *tired* [*müde*] and *torpid* [*träge*], it is likely that participants associated the terms with the less liking-related act of drinking cola to wake up. However, it should be noted that the terms *dazed* [*benommen*], *tired* [*müde*], and *torpid* [*träge*] all had relatively low intensities and did not discriminate across cola brands. They may therefore be less relevant for describing cola-related emotional associations.

3.6.1 Limitations and further research

The presented research has several restrictions that are worth to be considered in future studies. First, although the optimized list was useful for measuring the emotional associations people have with cola brands, the performance of the list with other food products or research questions needs to be tested. Because of the G-FEE-List's relatively large number of negative expressions, it would be especially interesting to apply the tool in a food context, in which the occurrence of negative emotional states is more probable (e.g., in the case of new products, Desmet & Schifferstein, 2008). Second, depending on the research question or product under investigation, specific terms may need to be added (see also Gmuer et al., 2015). For example, *guilty* [*schuldig*] has been shown to be important in the context of food products (Bhumiratana et al., 2014; Macht & Dettmer, 2006; Rousset et al., 2005; Steenhuis, 2009). Although product-specific lists might overcome the problem of missing product-specific expressions, they often must be developed from scratch. In contrast, more general lists, such as the G-FEE-List or the ESP, may be used directly or adjusted (King & Meiselman, 2010; Spinelli et al., 2014). For a discussion of the advantages and disadvantages of product-specific and product-unspecific lists, see Spinelli et al. (2014).

Although the G-FEE-list was useful for revealing differences in the emotional associations people have with cola brands, the main limitation of Study 2 is that the sample consisted of more Coca-Cola-preferring people, as well as subjects who more often drink Coca-Cola than Pepsi. Instead of a brand effect, an alternative explanation for the observed

results may be that product users have more positive emotional profiles than product non-users (King & Meiselman, 2010). Because the market share in Switzerland may be biased towards Coca-Cola, it would be interesting to replicate the study in countries in which the market shares of Coca-Cola and Pepsi are at least equal in order to make a conclusive statement about the occurrence of a brand effect.

Additionally, it might be interesting for marketers to know the specific emotional association source. The present findings do not provide information on whether the emotional associations arose from the remembered products' sensory attributes, packaging, brand, or advertisements. Following other studies (Ng et al., 2013b; Spinelli et al., 2015), future research could explore the individual impacts of the packaging/branding or sensory attributes of cola beverages on the evoked emotions.

3.7 Conclusions

Building on our earlier proposed approach to design food-related emotional evaluation lists (Gmuer et al., 2015), we presented an extended approach to increase the quality of the resulting list and demonstrated the usefulness of the shorter, ultimate German Food-related Emotional Evaluation List (G-FEE-List) to assess emotional associations we have with cola brands. Furthermore, the list was able to discriminate between highly similar brands and revealed information on differences in emotional associations that go beyond the measurement of positive-negative affect. Enhanced knowledge and understanding of the distinct differences in emotional associations between two products might be especially interesting for guiding marketers in marketing activities.

In addition to this intended methodological contribution, the research indicates 1) that strong brands may have an influence on our emotional associations – and, therefore, that emotional associations may be useful to differentiate brands of the same product category – and 2) that cola beverages may open more than happiness. However, additional research is needed to confirm the assumed brand effect.

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Supplementary material

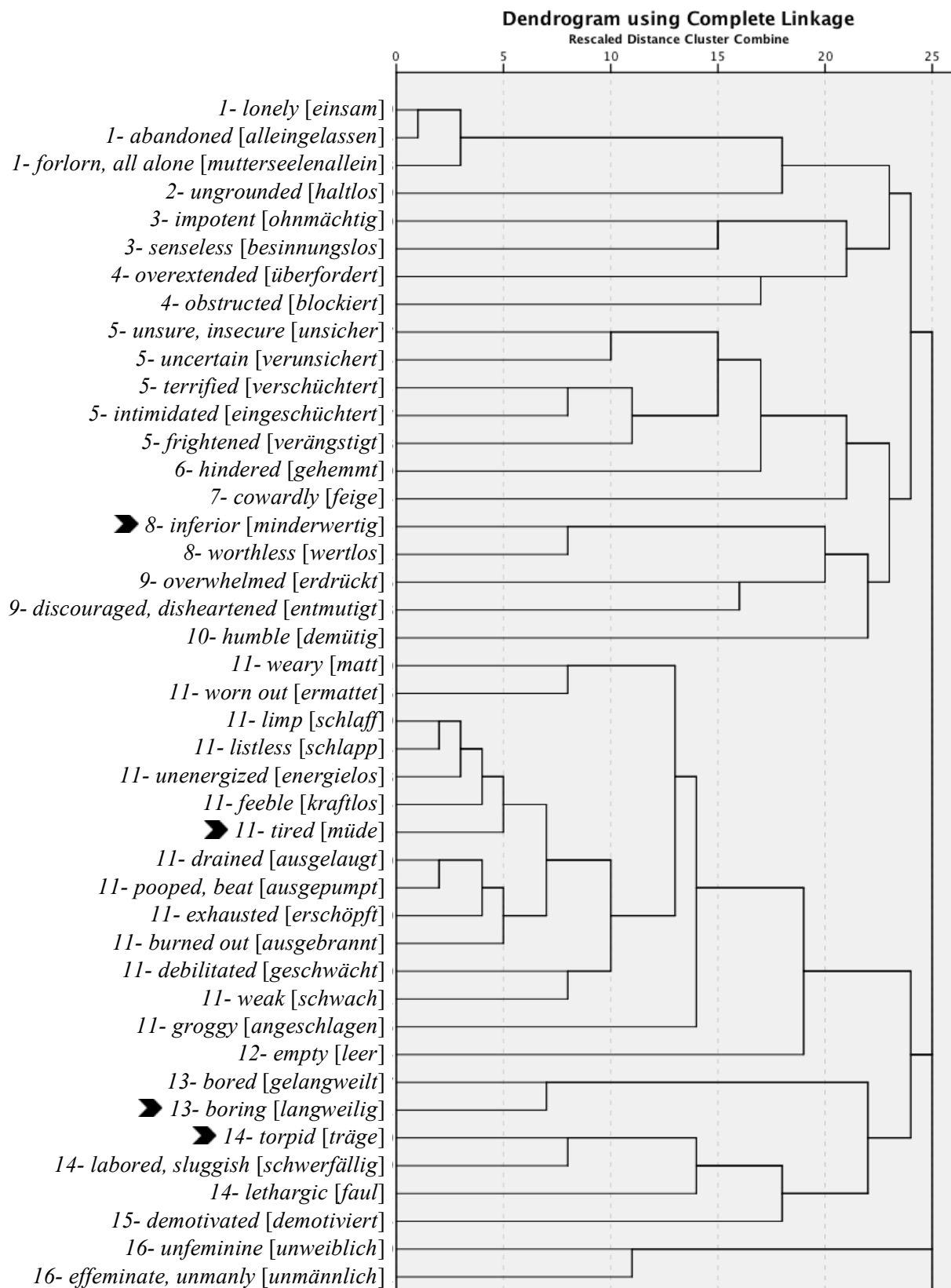


Figure S3.1. Dendrogram for the negative terms without the expression *restrained* [eingeschränkt] (N=51). Numbers to the right of the word indicate group affiliation. The representative terms included in the final list are indicated (▶). German terms are in brackets.

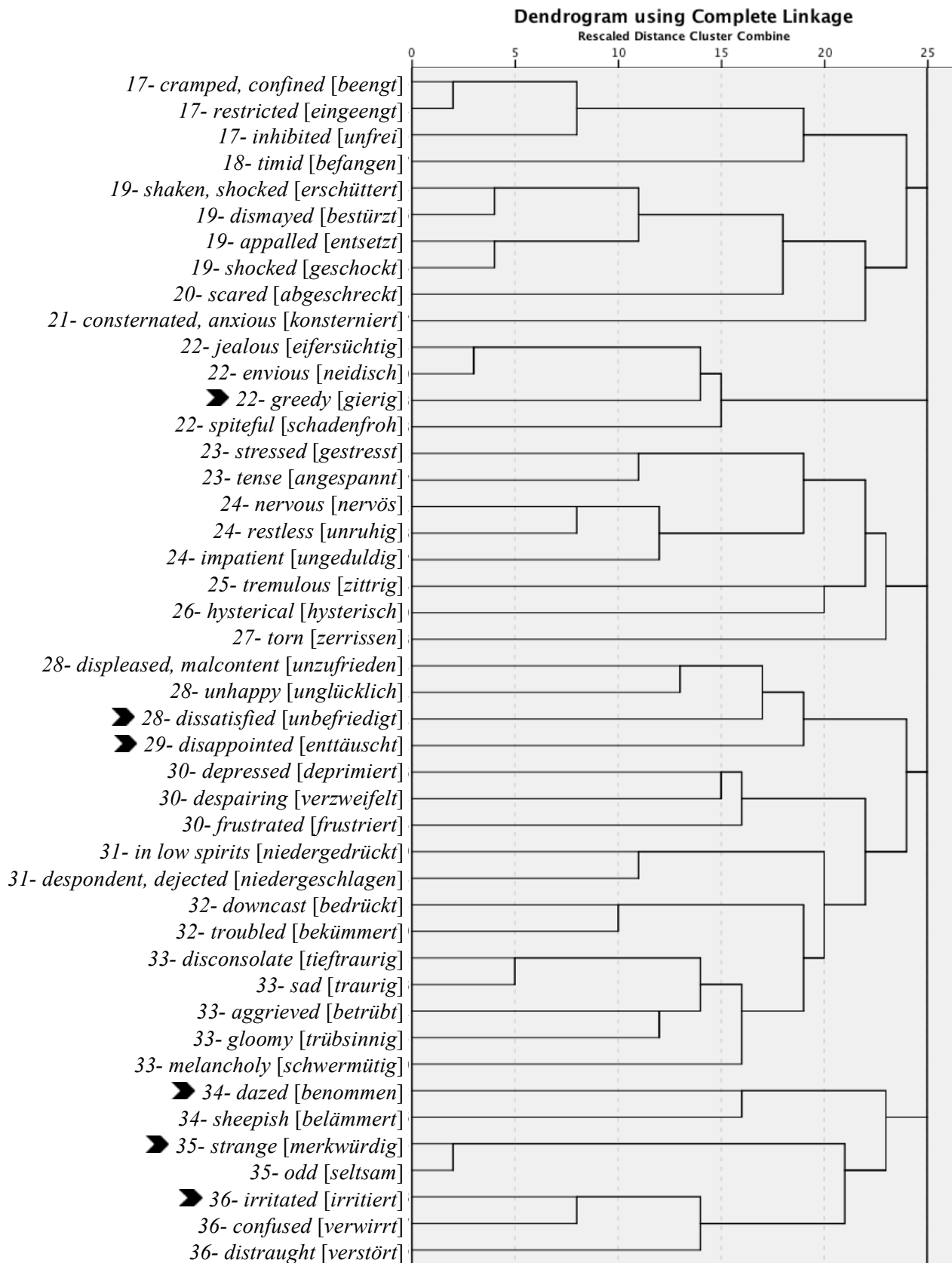


Figure S3.1. (continued)

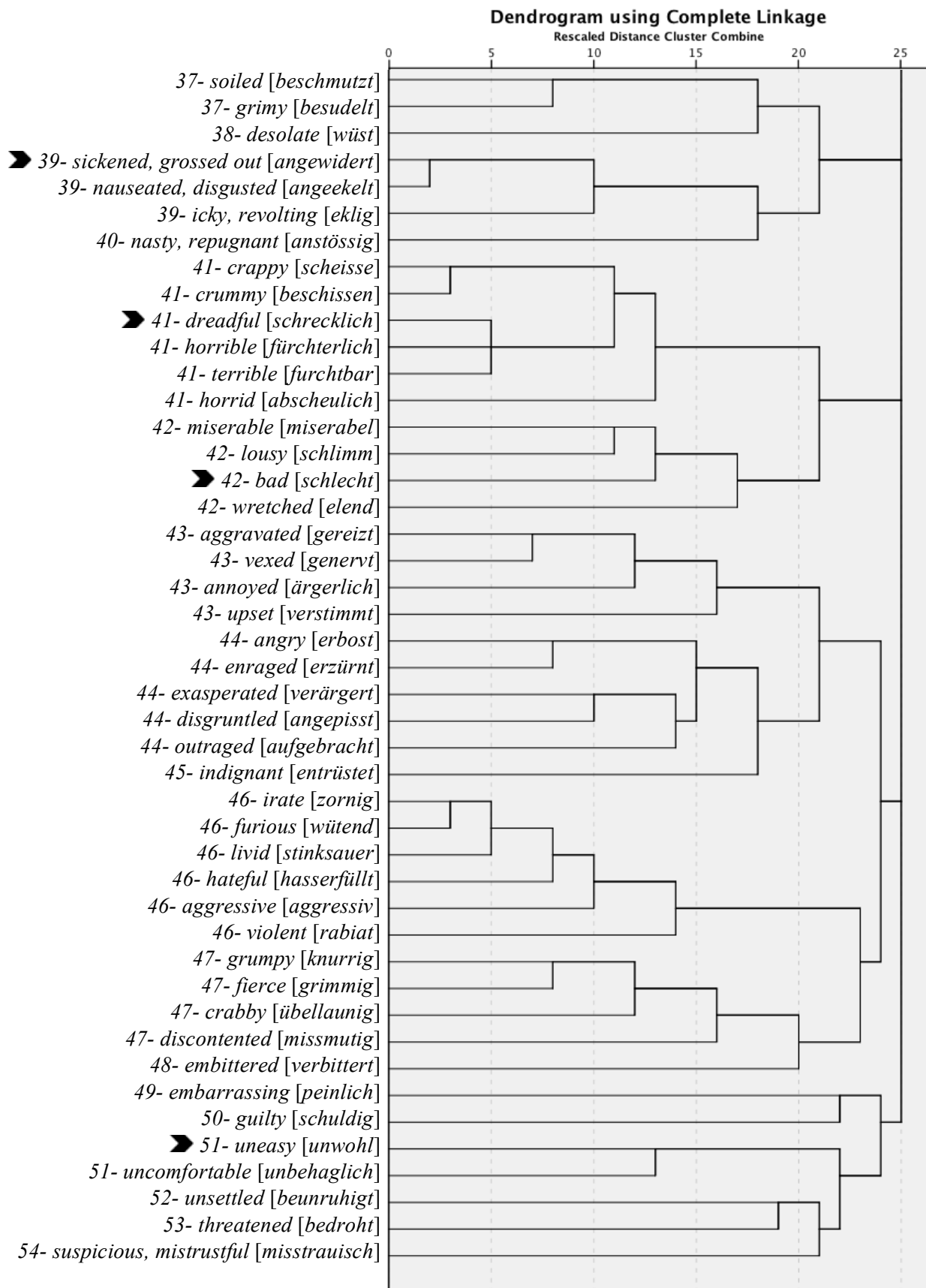


Figure S3.1. (continued)

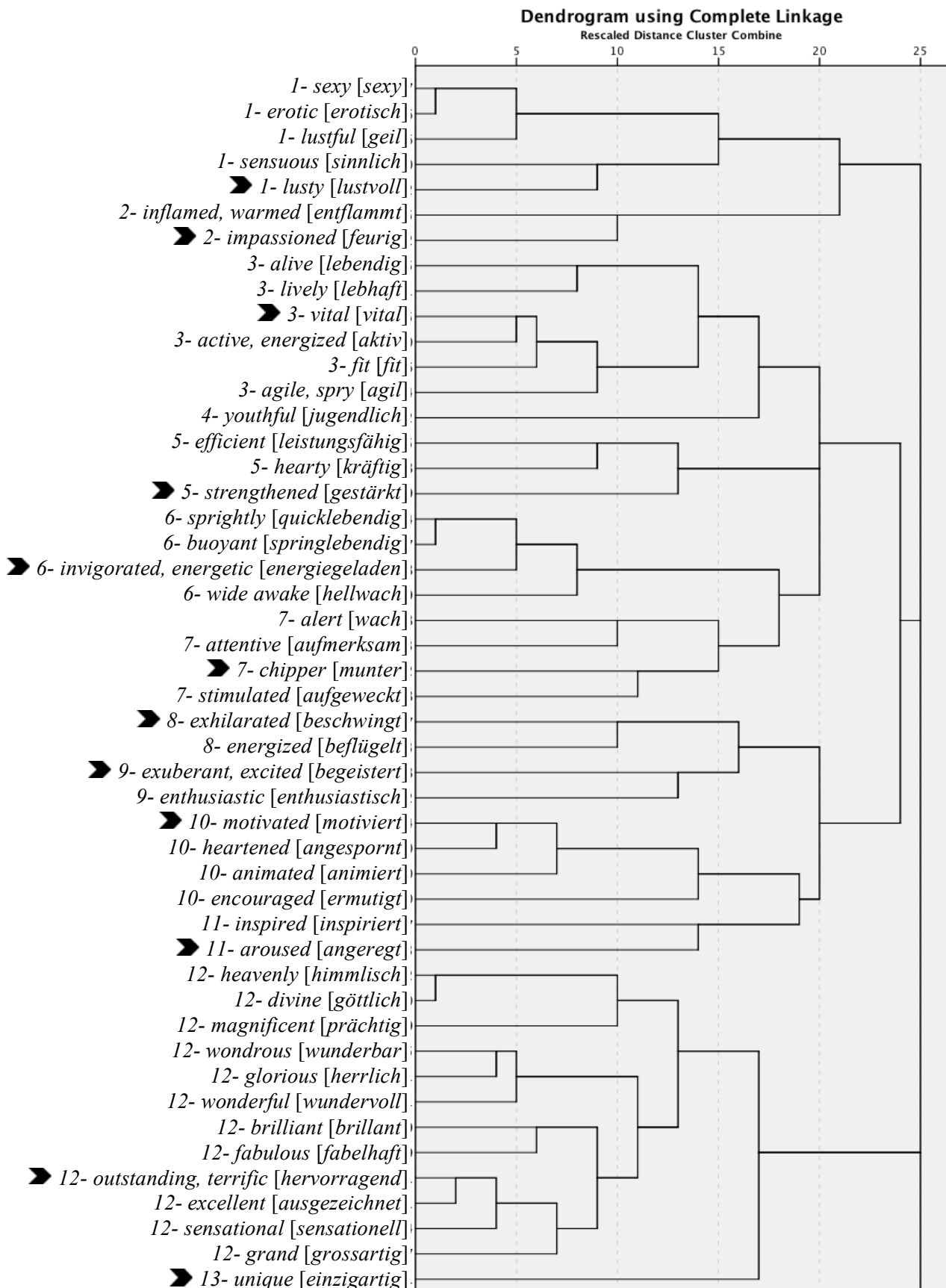


Figure S3.2. Dendrogram for the positive terms without the expression *restrained* [eingeschränkt] (N=50). Numbers to the right of the word indicate group affiliation. The representative terms included in the final list are indicated (➤). German terms are in brackets.

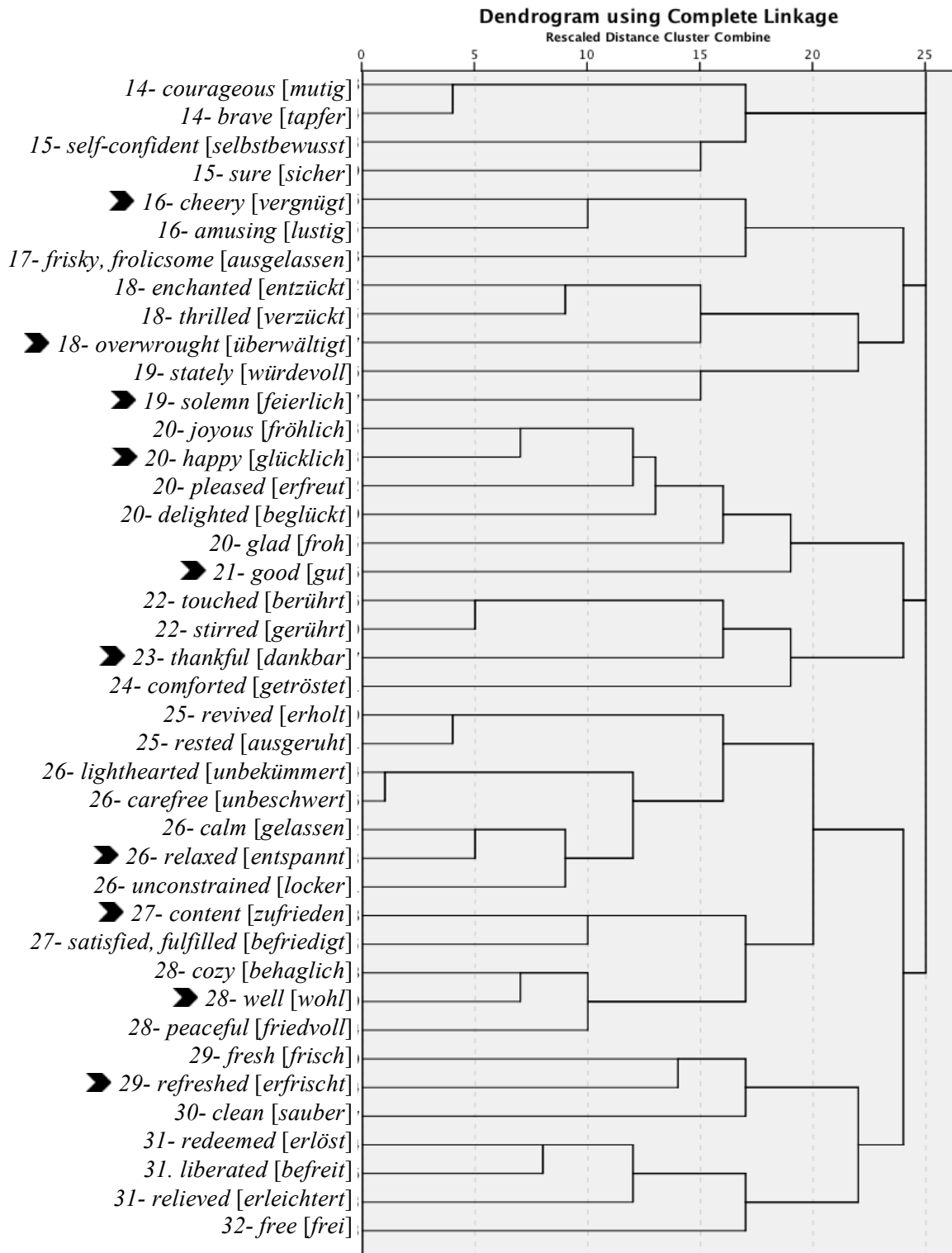


Figure S3.2. (continued)

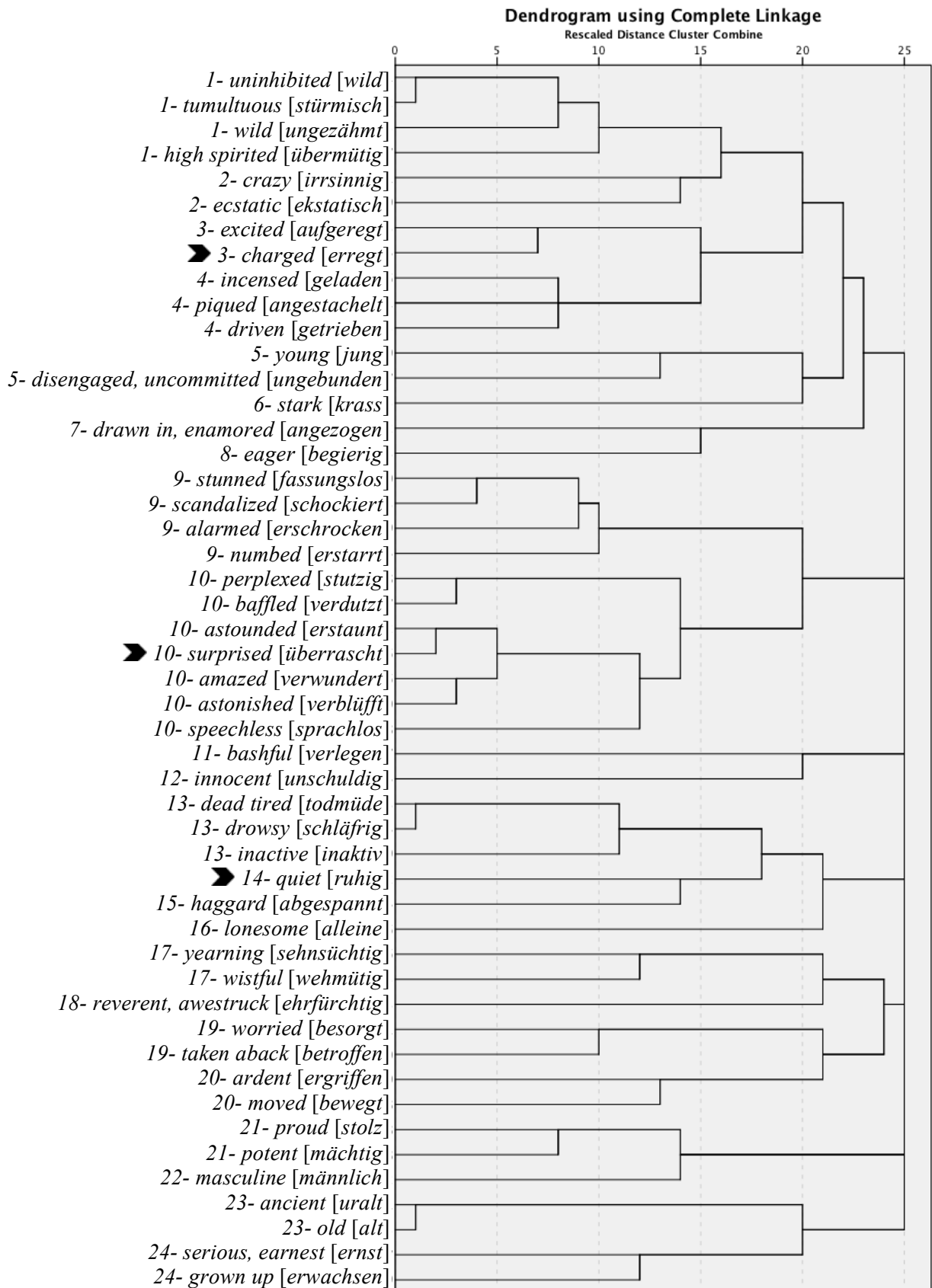


Figure S3.3. Dendrogram for the neutral terms (N=50). Numbers to the right of the word indicate group affiliation. The representative terms included in the final list are indicated (➤). German terms are in brackets.

CHAPTER IV

More than disgust? Emotional associations evoked by snacks that contain insects

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Abstract

The aim of this online survey was to explore in depth the emotional associations that are evoked by snacks that contain insects. Furthermore, we investigated whether evaluations change for four insect-containing snacks or compared to a familiar equivalent product that does not contain insects. The insect-containing snacks differed in the visibility and in the degree of processing of the insect ingredient: tortilla chips made of cricket flour (“flour”), tortilla chips containing deep-fried cricket bits (“bits”), a snack consisting of tortilla chips and deep-fried crickets (“mix”), and deep-fried crickets (“crickets”). In a mixed-subject design, Swiss respondents (N=428) evaluated 39 emotional associations, willingness to eat, and expected liking of a non-insect-containing snack and of one of four insect-containing snacks. Results showed that, in general, the insect-containing products were evaluated negatively and that the negative emotional associations they evoked went beyond disgust. Although the “mix” and “cricket” products were rated worse than the other two, the observed significant differences arose primarily from the “mix” product, which was rated more negatively than the “flour” or “bits” products. It is assumed that the “mix” product may have reminded the Swiss participants of contaminated food.

Based on the present research, it is recommended to market insect products that do not elicit associations with contamination and that contain less visible insect ingredients. However, the negative overall ratings and the comparison between the cricket flour-containing and the non-insect-containing familiar snack indicate that there are large barriers to overcome in marketing insect-containing products in the future.

4.1 Introduction

The idea of insects as food is growing, because it promises several advantages for health, the environment, and people's livelihood (van Huis et al., 2013). However, Western people often respond to insect food with disgust¹ (Rozin & Fallon, 1987) and negative assessments (Hartmann, Shi, Giusto, & Siegrist, 2015; Schösler, de Boer, & Boersema, 2012). A more searching exploration of the willingness to eat (WTE) and the hedonic responses of Western individuals toward different insect or insect-containing products may therefore provide valuable information for product development and the introduction of these products into Western markets. The primary aim of the present research was to study the emotional associations that are triggered by innovative snacks varying in the degree of processing of the insect ingredient, and how such emotional associations and WTE may change for the insect-containing snacks or compared to a familiar equivalent product that does not contain insects.

4.1.1 Insects as human food and Western consumers' reactions

The eating of insects is called "entomophagy" (van Huis et al., 2013). Human entomophagy has a long history (Bodenheimer, 1951), and is still practiced by around 2 billion people around the globe (e.g. in Africa, Asia, America) (Ramos-Elorduy, 1997; van Huis et al., 2013). Delicacies range from ants, bees, beetles, and butterflies to grasshoppers and crickets (Ramos-Elorduy, 1997; Tan et al., 2015), and they are prepared in various ways (Chen, Feng, & Chen, 2009; Tan et al., 2015). Because of present and future challenges in food sustainability, insects as food and feed have been discussed and promoted among scientists for several decades (Belluco et al., 2013; Deroy, Reade, & Spence, 2015; Ramos-Elorduy, 1997; van Huis et al., 2013; Vane-Wright, 1991; Verkerk, Tramper, van Trijp, & Martens, 2007; Yen, 2009). More recently, insects as food are also a common topic in the media.² It is estimated that the global population will increase to 9.1 billion by 2050. This will be accompanied by urbanization and rising incomes that require changes in the food supply, such as a massive increase of an estimated 200 million tons in meat production (Food and Agriculture Organization of the United Nations, 2009), which in turn will generate higher food prices and an elevated environmental load (van Huis, 2013; van Huis et al., 2013).

¹ Because there are two meanings of the English term *disgust* ("Disgust", 2015), note that, in the present article, we use the term *disgust/disgusted* interchangeably with *sickened*, *grossed out* rather than to signify a feeling of annoyance and anger.

² E.g. *BBC*: <http://www.bbc.com/future/story/20141014-time-to-put-bugs-on-the-menu>. Retrieved on 8 August 2015; *Die Welt*: <http://www.welt.de/regionales/hamburg/article142797530/Heuschrecken-schmecken-nussig-Grillen-wie-Haehnchen.html>. Retrieved 8 August 2015; *Financial Times*: <http://www.ft.com/cms/s/2/bc0e4526-ab8d-11e4-b05a-00144feab7de.html#slide0>. Retrieved on 8 August, 2015; *Tagesanzeiger*: <http://www.tagesanzeiger.ch/wirtschaft/unternehmen-und-konjunktur/Insekten-und-Wuermer-im-Supermarkt/story/15795619>. Retrieved 8 August 2015; *The Sun*: <http://www.thesun.co.uk/sol/homepage/woman/health/health/5955954/Insects-food-of-the-future.html>. Retrieved 08. August 2015.

Therefore, interest in alternative protein sources such as insects (Verkerk et al., 2007), which provide high-quality animal protein (Ramos-Elorduy et al., 1997), is high. Furthermore, the farming and eating of insects can have additional health, environmental, and social/economic benefits (see, for some overviews, Ramos-Elorduy, 1997, Table X; van Huis et al., 2013, p. 2). However, Westerners regard eating insects as primitive behavior (Hartmann et al., 2015; Ramos-Elorduy, 1997; Vane-Wright, 1991), and the conscious consumption of insects as a part of a daily diet is not yet well established in Western societies (Deroy et al., 2015; Pascucci & de-Magistris, 2013; van Huis et al., 2013).

Westerners' reactions toward insect food and the factors that influence such reactions have been probed within diverse disciplines, especially in the last few years, revealing that Western consumers have a rather negative perception of insect products. Several authors specifically explored Westerners' assessments of insect products as a meat/protein substitute or in comparison to their ratings for alternatives (de Boer, Schösler, & Boersema, 2013; Schösler et al., 2012; Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013; Verbeke, 2015). Preference, willingness to pay a premium price, and various evaluations (e.g., attractiveness, acceptability, or goodness) were lower for insect products than for alternatives (de Boer et al., 2013; Schösler et al., 2012; Vanhonacker et al., 2013). Willingness to eat insect-containing products, either as a meat substitute or in general, was also rather low (Hartmann et al., 2015; Vanhonacker et al., 2013; Verbeke, 2015), but seemed to vary with the consumers' demographic characteristics, individual traits, and attitudes toward insect products. Two valuable recent surveys (Hartmann et al., 2015; Verbeke, 2015) showed that WTE was higher among people who were male, had a low food neophobia score, and had already tasted insect products in the past or had a high awareness about the idea of eating insects. Higher taste expectations and perceiving insect products as a civilized rather than a primitive food further contributed to a greater willingness to eat (Hartmann et al., 2015). Moreover, attractiveness ratings for insect products tended to be higher in people who had an adventurous taste (Schösler et al., 2012).

Westerners' evaluations may also depend strongly on the visibility or recognizability of the insect-containing ingredient (Hartmann et al., 2015; Schösler et al., 2012; Tan et al., 2015). Compared to unprocessed, more visible insect products (e.g. deep-fried crickets), willingness to eat and the reported attractiveness of insect products were higher if the insect ingredient was highly processed and therefore less visible (e.g. cookies containing cricket flour) (Hartmann et al., 2015; Schösler et al., 2012).

4.1.2 Emotions in food research

Emotional responses to food constitute a burgeoning research topic, and valuable knowledge has been generated by a huge number of studies in the last few years. Using food product-specific verbal instruments (Bhumiratana, Adhikari, & Chambers IV, 2014; Ferrarini et al., 2010; Ng, Chaya, & Hort, 2013a; Spinelli, Masi, Dinnella, Zoboli, & Monteleone, 2014; Thomson, Crocker, & Marketo, 2010) or more general product-unspecific assessment tools (King & Meiselman, 2010; Rousset, Deiss, Juillard, Schlich, & Droit-Volet, 2005), researchers have revealed that food has the potential to evoke differentiated and multifaceted emotions. For example, we may be energetic or merry after eating hazelnut and cocoa spreads (Spinelli, Masi, Zoboli, Prescott, & Monteleone, 2015) or we may feel happy or pleased after eating potato chips (Cardello et al., 2012).

In 2008, Desmet and Schifferstein (2008) reported that emotional experiences in the food context are more often of a positive nature. This phenomenon was defined as “hedonic asymmetry,” and a series of studies confirmed the higher intensity or prevalence of positive emotions with various food products (Cardello et al., 2012; Ferrarini et al., 2010; Gmuer, Nuessli Guth, Runte, & Siegrist, 2015; King & Meiselman, 2010; Manzocco, Rumignani, & Lagazio, 2013; Ng et al., 2013a; Rousset et al., 2005). Although people choose to eat those products that they associate with positive emotional expectations (Desmet & Schifferstein, 2008), both product users and non-users inevitably experience negative emotions with regard to food from time to time (King & Meiselman, 2010; Manzocco et al., 2013; Ng, Chaya, & Hort, 2013b; Spinelli et al., 2015). Examples of negative emotions triggered by food are boredom, disappointment and dissatisfaction (Desmet & Schifferstein, 2008). The latter two are relevant in informing marketers about the fulfillment of expectations (Desmet & Schifferstein, 2008). Disgust is a further strong negative emotion that is well known in connection with food products. In a study conducted with young women, this emotion was shown to have the highest power to discriminate between different foods, presented in the form of images to the participants, compared to 25 other assessed emotions (Rousset et al., 2005). Disgust was reported to be experienced particularly with least favorite foods (King & Meiselman, 2010; Manzocco et al., 2013) and bad product quality (Desmet & Schifferstein, 2008; Manzocco et al., 2013). In addition, disgust seems to be triggered by aversive textural food properties (Martins & Pliner, 2006) and reminders of animal origins or livingness (Martins & Pliner, 2006; Rozin & Fallon, 1987), and was more strongly related to novel animal food than to non-animal food (Pliner & Pelchat, 1991). In the case of novel insect food, Western consumers commonly respond with negative feelings (Caparros Megido et al.,

2014), including disgust or fear (Desmet & Schifferstein, 2008; Looy & Wood, 2006; Pascucci & de-Magistris, 2013; Rozin & Fallon, 1987; Tan et al., 2015). This could hamper the introduction of such products to Western markets. However, the literature also reports curiosity and interest on the part of Western people toward insect food (Looy & Wood, 2006; Tan et al., 2015; Yen, 2009).

In food-related emotion research, most studies focused on familiar products that are expected to evoke positive emotions. Conversely, little work has been conducted on the emotion profiles of more unfamiliar and innovative food products. It is assumed that the hedonic asymmetry effect observed with familiar food products may not prevail with new products (Desmet & Schifferstein, 2008) or products that have been produced with innovative food technologies. Relatively intensive negative emotions are likely to be evoked by products of this type. As an example, one study showed that genetically modified food evoked significantly more intense negative emotions, such as anger and fear, and less happiness and contentment than functional, organic, and regular food (Laros & Steenkamp, 2005). Knowing the negative emotions that product users or non-users may experience is helpful for marketers wishing to optimize existing and new products. Furthermore, assessing food emotions may be of benefit in gaining competitive advantage (Ferrarini et al., 2010; Ng et al., 2013a) in a market where products have become similar and often no longer diverge on a liking level (Cardello et al., 2012). Food-related emotions have been shown to differentiate between products of the same product category, and in some cases, emotion measurement tools discriminated even better than traditional liking scales (Bhumiratana et al., 2014; King & Meiselman, 2010; Ng et al., 2013a).

4.1.3 Scope of the present work

Information about the emotional associations people have with insect-containing food products may be useful in gaining further understanding of consumers' reactions, potential barriers, and opportunities during product development and commercialization of such products. To our knowledge, no research has investigated whether insect-containing food may evoke emotional responses other than disgust and, further to the findings of Hartmann et al. (2015), whether the degree of processing of the insect ingredient has an impact on the emotional association profiles. Furthermore, no study has investigated whether or not hedonic asymmetry can be observed with exotic, unfamiliar food products that are most likely to induce negative emotional associations.

Therefore, the objectives of the present work are as follows: First, the study explores the emotions that are associated with insect-containing snacks and illuminates whether the emotional associations, WTE, and expected liking differ between insect-containing snacks in which the insect ingredient is processed to varying degrees. Second, we explore to what extent the emotional association profile differs between a new, unfamiliar insect-containing snack and a non-insect-containing, familiar reference snack. Third, the present study shows whether the hedonic asymmetry effect reported in the literature may disappear with unfamiliar food products. Lastly, the relationship between WTE, expected liking, and emotional associations with new, unfamiliar products is investigated.

We hypothesized that insect-containing products may evoke more than disgust. Based on Hartmann et al.'s (2015) findings, we further expected that, the higher the processing degree of the insect ingredient (i.e., the less visible), the higher the WTE, expected liking, and reported intensities of positive emotional associations, and the lower the intensities of negative emotional associations. Moreover, it was assumed that the emotional association profile would be more negative in the case of an insect-containing product than that of a non-insect-containing, familiar equivalent and that no hedonic asymmetry effect may be observed among unfamiliar, new products. Because liking and positive emotion ratings were shown to positively correlate (Cardello et al., 2012; Ng et al., 2013a; Spinelli et al., 2014), a positive relationship between WTE, expected liking, and positive emotional associations was expected in the present study.

To assess the emotional associations people have with the snacks, our earlier developed German Food-related Emotional Evaluation List (G-FEE-List) seemed to be appropriate, because the lexicon was not designed in relation to a specific food product, it contains a substantial number of negative expressions (14 out of 39 terms), and was already proven useful for assessing the emotional associations people have with cola brands (Gmuer, 2015). Therefore, a subordinate objective of the present research was to test the usefulness of the G-FEE-List with innovative food products.

4.2 Methodology

4.2.1 Sample

Subjects were recruited via the panel provider Respondi AG, whose Swiss citizen pool consists of approximately 20,000 members (Respondi, 2014). Participants received a financial

incentive for completing the online survey. A gender quota was set (50% female). Only fully completed questionnaires were considered. Fifteen cases whose survey duration was equal to or less than half of the median of the total survey duration were excluded, because it was assumed that these subjects did not answer the questions seriously (Hartmann et al., 2015; Siegrist, Shi, Giusto, & Hartmann, 2015). Additionally, five subjects were eliminated because they indicated that their diet prevented them from eating insects (e.g., vegan). Furthermore, one participant noted that it was not possible for her/him to rate expected feelings or emotions by using only pictures. Therefore, this person was also excluded. The final 428 individuals (50.9% female) had a mean age of 45.2 years ($SD=12.7$, $min=20$, $max=70$ years). Educational attainment was distributed as follows: 5.8% compulsory education, 54.7% upper secondary school, 16.4% higher vocational education, and 22.9% college or university. One person reported having failed to complete any education. The percentage of participants who were native (Swiss-)German speakers was 94.6%.

4.2.2 Design and products

Tortilla chips were chosen as the product and “crickets” as the insect ingredient. In a mixed-subject design, all participants assessed the non-insect-containing, regular tortilla chips (“reference”). However, subjects were randomly but approximately equally allocated to one of four cricket-containing products that differed in the degree of processing of the insect ingredient: tortilla chips made of cricket flour (“flour”, $N=108$), tortilla chips containing deep-fried cricket bits (“bits”, $N=103$), a snack consisting of tortilla chips and deep-fried crickets (“mix”, $N=109$), and deep-fried crickets (“crickets”, $N=108$). Each product was presented to the participant as a picture (Figure 4.1). For the “flour”, “bits,” and “mix” conditions, a tortilla chips image, which was similar to the reference product image, was used and altered according to the condition. For the “snack consisting of tortilla chips that contain insect flour,” the unaltered image was shown. For the “snack consisting of tortilla chips that contain deep-fried cricket bits,” black spots were added on the chips. For the “snack consisting of tortilla chips and deep-fried crickets,” whole crickets were added to the picture. For the “snack consisting of deep-fried crickets,” a handful of whole crickets was shown. The wings and legs were less prominent in the picture, because we assumed that their absence might increase willingness to eat (cf. Tan et al., 2015).

Cricket flour tortilla chips (Six Foods LLC, 2014) and whole (fried) crickets (Thailand Unique, 2015) are products that are available on the market. To our knowledge, the other two insect-containing products (“bits” and “mix”) are fictive products. The “mix” product was inspired by Zweifel’s Secrets Chips product, which consists of potato chips and air-dried tomato slices (Zweifel Pomy-Chips AG, n.d.).

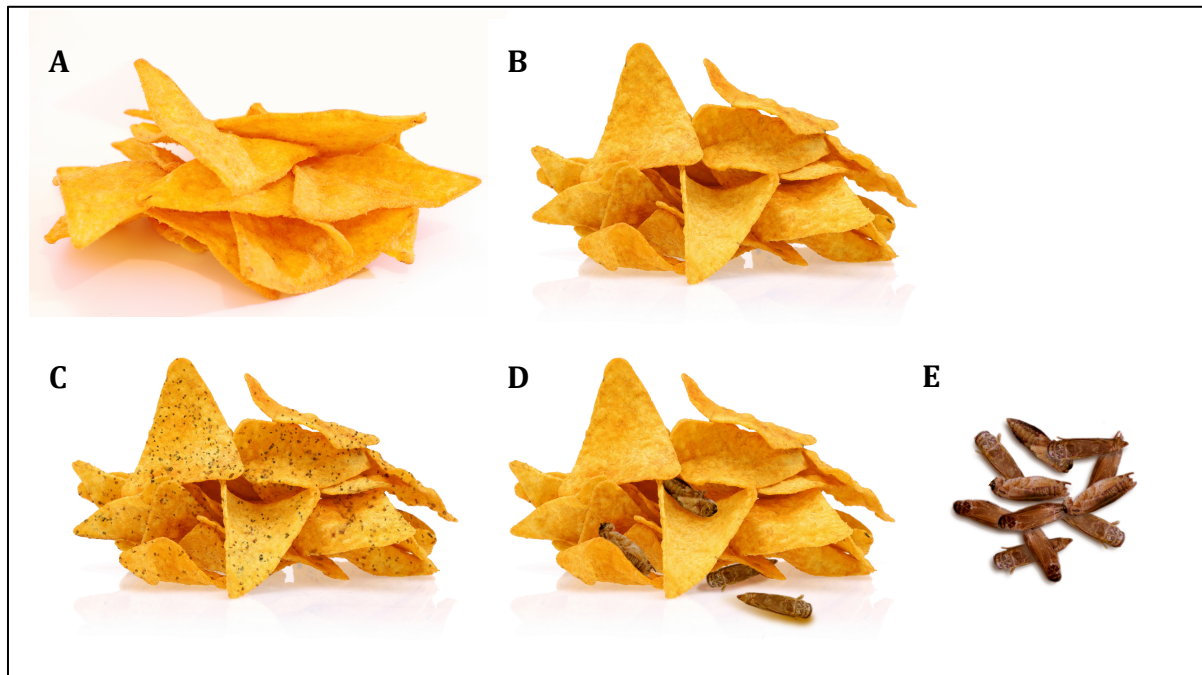


Figure 4.1. Stimuli material used in the present study: (A) “reference,” (B) “flour,” (C) “bits,” (D) “mix,” (E) “crickets” product.

4.2.3 Procedure

After providing demographic information (i.e., gender, age, mother tongue, and education level), participants completed the following four question modules. The original German labels of the scales are given in square brackets.

Diet. Respondents answered 10 statements to assess the degree of food neophobia. The scale was a German version (Siegrist, Hartmann, & Keller, 2013) of the original food neophobia scale that was developed by Pliner and Hobden (1992). Answers were collected on a numerically labeled 7-point scale with endpoints -3 (= *does not apply at all [trifft gar nicht zu]*) to 3 (= *fully applies [trifft voll und ganz zu]*). Participants answered additional questions regarding consumption frequency (“daily,” “4-6x/week”, “1-3x/week”, “1-3/month”, “more rarely”, “never, but I have already tasted tortilla chips”, “I have never tasted tortilla chips”)

and general liking of tortilla chips (-3=*do not like at all* [*überhaupt nicht gern*]; 3=*like extremely* [*ausserordentlich gern*]).

Reference product. In the second module, all questions referred to a picture of the reference tortilla chips (Figure 4.1, product A). Participants indicated 1) their WTE the snack, on a 10-point scale (Hartmann et al., 2015), 2) expected liking (-3=*do not like at all*; 3=*like extremely*), and 3) how strongly they thought the listed 39 emotions or feelings would be elicited by eating this snack (1=*not at all* [*überhaupt nicht*]; 6=*extremely strongly* [*ausserordentlich stark*]). Expected liking and emotional responses were introduced by the request to imagine that they were eating the illustrated snack. The emotional terms were taken from the G-FEE-List (Gmuer, Nuessli Guth, & Siegrist, 2016), which consists of 39 German expressions (14 negative, 22 positive, 3 neutral). It should be noted that the emotion "disgust" is represented by the terms *sickened*, *grossed out*. All terms were split into two word blocks, each of approximately 20 expressions. The words were randomly presented in each word block for each participant.

Insect consumption. The third module was introduced by the statement "In the last few months, eating insects and products that contain processed insects, has been frequently discussed in the media and science. Therefore, the following questions refer to insects or products that contain processed insects." This statement was made in order to deter participants from thinking that the products were far-fetched interventions. To assess previous experience of and familiarity with insect food, participants had to indicate 1) whether they regularly eat insects or products that contain processed insects, and 2) whether they have ever eaten insects or products that contain processed insects. The answers were to be given in binary response formats, "yes/no" (see also Hartmann et al., 2015).

Insect-containing product. In the last module, one insect-containing product was illustrated together with a product description. Subjects answered the same questions as they had for the reference product. In the "mix" condition (Figure 4.1, product D), participants were requested to rate the snack as a whole, i.e., the tortilla chips together with the deep-fried crickets. The pictures were shown throughout the whole module.

4.2.4 Statistical analysis

After the five reversed items of the food neophobia scale had been recoded, all items were additionally recoded from a scale ranging from -3 to +3 to a scale ranging from 1 to 7. The latter recoding was also applied to the liking scores. The scores of the individual food neophobia scale items were added for every participant. Following other studies (Pliner &

Hobden, 1992; Tuorila, Lähteenmäki, Pohjalainen, & Lotti, 2001), participants were allocated to one of three food neophobia groups: low (10-18.9), middle (18.9-37.7), and high (37.7-70). The cut-off points for the groups were selected by using the mean value \pm one standard deviation. Cronbach's alpha for the food neophobia scale was 0.82. The corrected item-total correlations were 0.30 for item 3 and between 0.43 and 0.61 for the remaining items.

One-way Analyses of Variance (ANOVA) with each emotional response as a dependent variable and the processing degree as a between factor (levels: flour, bits, mix, crickets), followed by Tukey's post-hoc tests, were conducted to compare the emotional responses among the four products containing insects. To reveal the differences in emotional association profiles that can occur between an insect-containing product and a reference product, two-tailed paired t-tests were conducted on the data for the "flour" and "reference" conditions. There were two reasons for comparing the insect flour product with the reference product. First, insect flour-containing products such as tortilla chips (<http://www.sixfoods.com/#products>, retrieved on 15 July 2015) or cookies (<http://bitty.myshopify.com/collections/frontpage>, retrieved on 15 July 2015) already exist on the market. Second, the insect flour-containing tortilla chips were expected to be and actually were the most positively assessed of the insect-containing products, except for the product containing insect bits. Therefore, the insect flour versus reference comparison might be of greatest interest. Two further one-way ANOVAs, with the processing degree as the between factor (levels: flour, bits, mix, crickets) and WTE or expected liking as dependent variables, followed by Tukey's post-hoc tests, were conducted. Pearson's correlation coefficients r and two-tailed tests of significance were conducted for each product to explore the relationship between the emotional responses, WTE, and expected liking.

4.3 Results

The total FNS score ranged from 10 to 70 between the participants. The distribution of the individual scores was as follows: 15% of the participants were allocated to the low food neophobia group (10-18.9), the majority of the participants (69%) was allocated to the middle food neophobia group (18.9-37.7), and 16% of the participants were allocated to the high food neophobia group (37.7-70).

A minority of the sample (0.7%) reported eating tortilla chips very often (4-6x/week). Most of the participants (51.6%) reported eating tortilla chips rarely. The mean liking of the subjects who had previously eaten tortilla chips ($N=406$) was 5.0 ($SD=1.5$) on a 7-point scale.

Six subjects (1.4%) were regular consumers of insects or products that contain processed insects, and 18.9% of subjects reported having eaten insects or products that contain processed insects in the past.

4.3.1 Emotional association profiles between insect-containing products

In the following, the original German terms are indicated in square brackets. Over all products, the ten emotions that the participants most strongly associated with the consumption of the insect-containing products were predominantly negative: *strange* [*merkwürdig*], *sickened*, *grossed out* [*angewidert*], *irritated* [*irritiert*], *uneasy* [*unwohl*], *dreadful* [*schrecklich*], *surprised* [*überrascht*], *bad* [*schlecht*], *unique* [*einzigartig*], *dissatisfied* [*unbefriedigt*], and *disappointed* [*enttäuscht*]. In all cases, the least important emotional associations were *greedy* [*gierig*] and *solemn* [*feierlich*] or *tired* [*müde*]. The emotional association profiles of the insect-containing products are depicted in Figure 4.2. The exact values and results of the paired comparisons between the products are shown in Table 4.1.

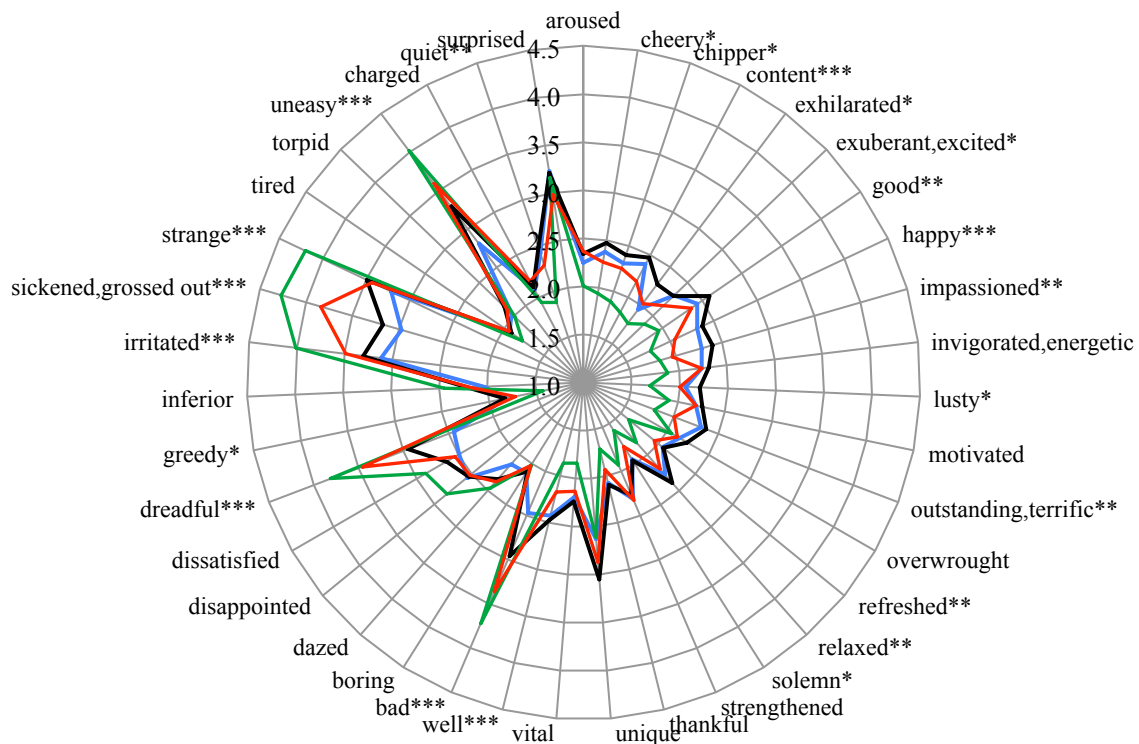


Figure 4.2. Positive (*aroused* – *well*), negative (*bad* – *uneasy*), and neutral (*charged* – *surprised*) emotional associations for the four insect-containing products: “Flour” (blue, N=108), “bits” (black, N=103), “mix” (green, N=109), “crickets” (red, N=108). Terms were originally presented in German. Ratings were recorded on a 6-point response scale (1=*not at all*, 6=*extremely strong*). *, **, *** indicate significant differences at $p \leq 0.05$, 0.01, 0.001.

Table 4.1

Mean scores, standard deviations (SD), degrees of freedom (df), F- and p-values of the 39 emotional associations for the „flour“ (N=108), „bits“ (N=103), „mix“ (N=109), and „crickets“ (N=108) product

G-FEE-List ^a		Flour		Bits		Mix		Crickets		ANOVA results		
German	English (approx.)	Mean	SD	Mean	SD	Mean	SD	Mean	SD	df	F-value	P-value ^b
Positive												
angeregt	aroused	2.25	1.32	2.34	1.35	2.01	1.20	2.37	1.38	3	1.677	0.171
vergnügt	cheery	2.38 ^{AB}	1.31	2.47 ^A	1.32	1.94 ^B	1.19	2.27 ^{AB}	1.51	3	3.246	0.022
munter	chipper	2.31 ^{AB}	1.32	2.40 ^A	1.22	1.89 ^B	1.06	2.25 ^{AB}	1.40	3	3.406	0.018
zufrieden	content	2.39 ^A	1.30	2.47 ^A	1.33	1.82 ^B	0.98	2.19 ^{AB}	1.31	3	5.904	0.001
beschwingt	exhilarated	1.95 ^{AB}	1.05	2.28 ^A	1.33	1.77 ^B	0.98	2.03 ^{AB}	1.29	3	3.463	0.016
begeistert	exuberant, excited	2.31	1.23	2.30	1.29	1.88	1.14	2.16	1.35	3	2.722	0.044
gut	good	2.44 ^A	1.31	2.59 ^A	1.30	1.95 ^B	1.20	2.36 ^{AB}	1.42	3	4.676	0.003
glücklich	happy	2.31 ^A	1.21	2.37 ^A	1.30	1.77 ^B	1.05	2.05 ^{AB}	1.25	3	5.598	0.001
feurig	impassioned	2.28 ^{AB}	1.32	2.40 ^A	1.29	1.83 ^C	1.08	1.96 ^{BC}	1.20	3	5.036	0.002
energiegeladen	invigorated, energetic	2.24	1.20	2.31	1.33	1.88	1.18	2.24	1.36	3	2.539	0.056
lustvoll	lusty	2.06 ^{AB}	1.24	2.21 ^A	1.33	1.69 ^B	0.96	2.00 ^{AB}	1.35	3	3.454	0.017
motiviert	motivated	2.19	1.21	2.26	1.40	1.91	1.20	2.19	1.35	3	1.581	0.193
hervorragend	outstanding, terrific	2.31 ^A	1.26	2.36 ^A	1.30	1.79 ^B	1.05	2.01 ^{AB}	1.29	3	5.081	0.002
überwältigt	overwrought	2.15	1.18	2.24	1.32	2.06	1.29	2.13	1.37	3	0.379	0.768
erfrischt	refreshed	2.06 ^A	1.14	2.07 ^A	1.19	1.61 ^B	0.86	1.95 ^{AB}	1.22	3	4.177	0.006
entspannt	relaxed	2.28 ^A	1.20	2.39 ^A	1.23	1.83 ^B	1.03	2.20 ^{AB}	1.35	3	4.412	0.005
feierlich	solemn	1.94	1.13	1.96	1.15	1.59	0.90	1.78	1.13	3	2.74	0.043
gestärkt	strengthened	2.31	1.25	2.27	1.19	1.93	1.14	2.33	1.43	3	2.474	0.061
dankbar	thankful	2.07	1.21	2.09	1.27	1.71	1.00	1.93	1.18	3	2.479	0.061
einzigartig	unique	2.63	1.41	3.05	1.80	2.61	1.68	2.87	1.78	3	1.678	0.171
vital	vital	2.19	1.24	2.24	1.21	1.84	1.07	2.13	1.33	3	2.323	0.074
wohl	well	2.42 ^A	1.33	2.47 ^A	1.29	1.86 ^B	1.10	2.17 ^{AB}	1.24	3	5.312	0.001
Negative												
schlecht	bad	2.47 ^C	1.57	2.96 ^{BC}	1.78	3.72 ^A	1.96	3.36 ^{AB}	1.84	3	9.618	<0.001
langweilig	boring	2.11	1.16	2.09	1.22	2.01	1.39	2.02	1.35	3	0.166	0.92
benommen	dazed	2.13	1.22	2.34	1.50	2.46	1.64	2.37	1.54	3	0.954	0.414
enttäuscht	disappointed	2.56	1.60	2.54	1.53	2.83	1.87	2.52	1.67	3	0.793	0.498
unbefriedigt	dissatisfied	2.49	1.56	2.64	1.64	2.89	1.91	2.54	1.65	3	1.2	0.309
schrecklich	dreadful	2.44 ^C	1.60	2.95 ^{BC}	1.76	3.81 ^A	1.94	3.46 ^{AB}	1.86	3	12.073	<0.001
gierig	greedy	1.82 ^A	1.04	1.83 ^A	1.07	1.43 ^B	0.76	1.72 ^{AB}	1.14	3	3.642	0.013
minderwertig	inferior	2.03	1.36	2.20	1.35	2.45	1.77	2.17	1.46	3	1.498	0.214
irritiert	irritated	3.12 ^B	1.76	3.31 ^B	1.69	4.01 ^A	1.80	3.49 ^{AB}	1.68	3	5.257	0.001
angewidert	sickened, grossed out	2.97 ^B	1.80	3.17 ^B	1.77	4.27 ^A	1.78	3.84 ^A	1.84	3	11.923	<0.001
merkwürdig	strange	3.21 ^B	1.69	3.49 ^B	1.70	4.20 ^A	1.72	3.43 ^B	1.78	3	6.751	<0.001
müde	tired	1.93	1.07	1.91	1.15	1.77	1.15	1.94	1.22	3	0.494	0.686
träge	torpid	2.04	1.23	2.14	1.18	1.99	1.46	2.10	1.43	3	0.253	0.859
unwohl	uneasy	2.81 ^C	1.77	3.29 ^{BC}	1.73	4.02 ^A	1.81	3.59 ^{AB}	1.82	3	8.877	<0.001
Neutral												
erregt	charged	2.09	1.34	2.12	1.35	1.94	1.25	2.19	1.47	3	0.695	0.556
ruhig	quiet	2.42 ^A	1.33	2.48 ^A	1.32	1.88 ^B	1.08	2.29 ^{AB}	1.37	3	4.728	0.003
überrascht	surprised	3.23	1.55	3.21	1.63	3.16	1.69	2.98	1.67	3	0.522	0.667

^a Emotional associations were recorded on a 6-point rating scale (1=*not at all*, 6=*extremely strong*).

^b P-values printed in bold reached significance level at $p \leq 0.05$.

^{ABC} Means with different letter codes in a row are significantly different based on Tukey's mean comparisons.

Although the emotional association profiles were similar between the products, significant differences were found in 7 negative terms, 12 positive terms, and 1 neutral term. The post-hoc tests revealed that the products “flour” and “bits” never significantly differed in the values of the emotional ratings. Similarly, the product “crickets” only significantly differed in one rating from the “mix” product (i.e., *strange* [*merkwürdig*]). The observed significances mostly occurred between the “mix” product and the product “flour” and/or “bits,” with the “mix” product receiving a more negative rating than the other two products. Additionally, the participants expected to feel bad [*schlecht*], dreadful [*schrecklich*], sickened [*angewidert*], uneasy [*unwohl*] to a greater degree and impassioned [*feurig*] to a lesser degree, when imagining themselves eating the “crickets” product than the “flour” and/or “bits” product.

4.3.2 Comparison of emotional association profiles between cricket flour-containing chips and reference chips

The cricket flour-containing chips and reference chips differed considerably in their emotional association profiles (Figure 4.3). A comparison of the intensity ratings between the two products showed that, except for one term (*unique* [*einzigartig*]), all positive expressions had significantly lower values in relation to the cricket flour-containing chips than to the reference chips. The opposite was true for the negative terms. Among the 11 significant differences, all values were significantly higher for the “flour” compared to the “reference” condition, with the exception of *greedy* [*gierig*]. The largest difference between the profiles was found for the terms *irritated* [*irritiert*], *sickened*, *grossed out* [*angewidert*], *content* [*zufrieden*], and *strange* [*merkwürdig*].

The difference in the emotional association profiles was evident not only in the magnitude of the intensity ratings but also in the markedly different shapes of the profiles. In regard to the reference product, nine out of the ten highest rated emotional associations were positive. Among the ten strongest emotional associations for the cricket flour-containing product, seven were negative.

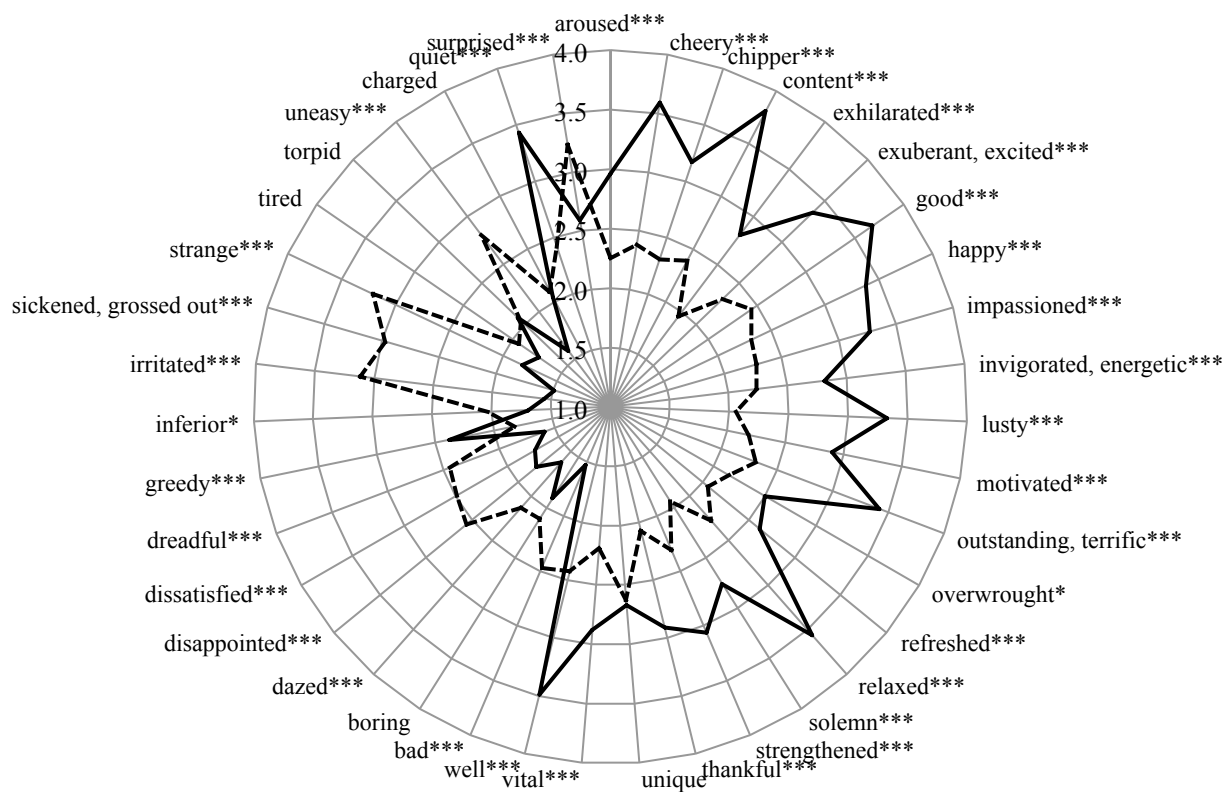


Figure 4.3. Comparison of the positive (*aroused* – *well*), negative (*bad* – *uneasy*), and neutral (*charged* – *surprised*) emotional associations between cricket flour-containing tortilla chips (dashed line) and reference tortilla chips (solid line), N=108. Terms were originally presented in German. Ratings were recorded on a 6-point response scale (1=*not at all*, 6=*extremely strong*). *, **, *** indicate significant differences at $p \leq 0.05$, 0.01, 0.001.

4.3.3 Relationships between WTE, expected liking, and emotional responses

The mean WTE and the expected liking score for the reference product were 8.3 ($SD=2.0$) and 5.4 ($SD=1.3$), respectively. Mean values for the WTE and expected liking of all insect-containing products are depicted in Table 4.2. Again, the ratings were most negative for the “mix” product, and the “flour” and “bits” products did not differ significantly. The WTE and expected liking scores correlated significantly for each tested product, with $r_{reference}=0.64$; $r_{flour}=0.80$; $r_{bits}=0.78$; $r_{mix}=0.79$; and $r_{crickets}=0.78$ (all $p < 0.001$). The Pearson’s correlation coefficients for the WTE ratings and the emotional associations are shown in Figure 4.4. All correlation coefficients were significantly different from 0, with the exception of 17 cases (8.7%, indicated with blank triangles in Figure 4.4). All positive and the majority

of the neutral evaluations of the products were significantly and positively correlated with the WTE ratings. There were significant negative relationships between the negative emotional associations and the WTE data, with the exception of *greedy* [*gierig*], which was positively correlated. Interestingly, the variation in the magnitude of the coefficients between the products was larger for the positive terms than for the negative terms. Furthermore, with regard to the positive expressions, the “reference” product had smaller coefficients than the insect-containing products. Similar results were obtained for the correlational relationship between expected liking and emotional associations (results not shown).

Table 4.2

Compared willingness to eat (WTE) and expected liking (EL) mean scores with standard deviations (SD), degrees of freedom (df), F- and p-values for the four insect-containing products

	Flour (N=108)		Bits (N=103)		Mix (N=109)		Crickets (N=108)		One-way ANOVA results		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	df	F-value	P-value
WTE ^a	4.86 ^{AB}	3.04	4.93 ^A	3.42	3.20 ^C	2.79	3.81 ^{BC}	2.78	3	8.374	<0.001
EL ^b	3.76 ^A	1.75	3.61 ^{AB}	1.76	2.55 ^C	1.65	3.10 ^{BC}	1.66	3	11.140	<0.001

^a WTE was indicated on a 10-point response scale (Hartmann et al., 2015).

^b Expected liking was rated on a 7-point scale.

^{ABC} Means with different letter codes in a row are significantly different based on Tukey's mean comparisons.

4.4 Discussion

The present research confirms findings in the literature (Hartmann et al., 2015; Schösler et al., 2012) that Westerners have a rather negative perception of insect food, and illuminates the issue from an emotional perspective. Swiss people had low WTE scores and predominantly expected that consumption of the presented insect-containing snacks would trigger intense negative emotions. One of the most intensively rated emotional association was *sickened*, *grossed out* [*angewidert*]. This is in line with other studies that reported disgust-related emotional reactions in response to consumption of insects (Desmet & Schifferstein, 2008; Rozin & Fallon, 1987; Tan et al., 2015). However, in the present study, negative emotional associations were not confined to the emotion “disgust” alone, but also included other negative emotional states such as *strange* [*merkwürdig*], *irritated* [*irritiert*], *uneasy* [*unwohl*], and *dreadful* [*schrecklich*]. These emotional reactions are not surprising, because Western cultures often associate insects with dirt or disease (Looy, Dunkel, & Wood, 2014). In addition, eating insects raises concerns about food safety (Tan et al., 2015). The latter may be reinforced by the fact that, in Switzerland, where the present study was conducted, insect products are not listed in the food laws and are not to date sold in supermarkets.

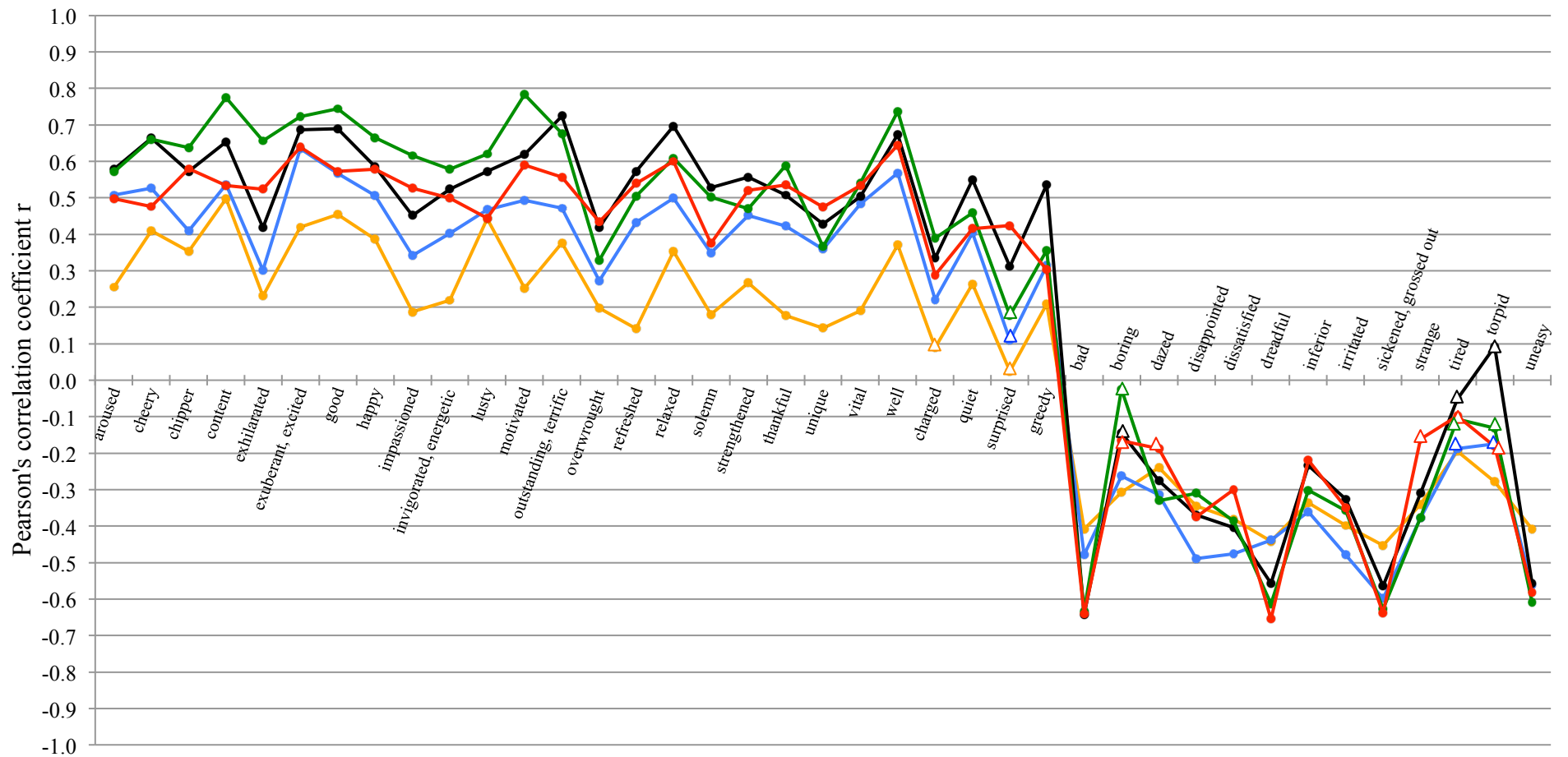


Figure 4.4. Pearson's correlation coefficients r for the relationship between emotional associations and WTE for the "flour" (blue, N=108), "bits" (black, N=103), "mix" (green, N=109), "crickets" (red, N=108), and "reference" product (orange, N=428). Blank triangles indicate coefficients that were not significantly different from 0.

Moreover, some subjects remarked, “I would not mind tasting insect food, but is insect food really necessary in Europe?” or “Why should I eat cricket flour-containing food? A possible reason would be if the cricket flour improves the taste. Otherwise, I would not eat it.” This indicates that not everybody is aware of the advantages of eating insect-containing products. Reactions toward insect food are therefore likely to be colored with negative evaluations, such as irritation.

The prevalence of negative emotions further shows that the hedonic asymmetry effect observed with relatively familiar food (Desmet & Schifferstein, 2008; Ferrarini et al., 2010; King & Meiselman, 2010) would not necessarily occur with new, unfamiliar products, as other researchers have assumed already (Desmet & Schifferstein, 2008). However, we would not claim the absence of a hedonic asymmetry effect. We would rather argue that the hedonic asymmetry effect observed with more unfamiliar innovative products (in the present case, insect-containing products) shows a reversed pattern. Therefore, we postulate the following distinction with regard to hedonic asymmetry effects: on the one hand, a positively skewed hedonic asymmetry (skewed toward more positive emotions), and, on the other hand, a negatively skewed hedonic asymmetry (skewed toward more negative emotions). The former was reported in the literature and attributed to consumers’ behavior and the nature of the products sold. Consumers are naturally inclined to eat those products that they expect to trigger positive emotions. This results in a “positive affective disposition towards eating or tasting food” (Desmet & Schifferstein, 2008, p.299). In addition, food industries aim to produce goods that are pleasant (Desmet & Schifferstein, 2008). By contrast, a negatively skewed hedonic asymmetry effect was observed with insect food, because people expected particularly negative emotions to be intensively triggered by its consumption.

In spite of the negative emotions that were rated with higher intensities, the emotions *surprised* and *unique* were among the ten most intense assessments, and several positive expressions had an overall mean value above 2. There are two possible explanations for this finding: Because the majority of the participants were unfamiliar with the taste and nature of the products presented and no doubt assumed that food manufacturers sell products that are appealing and evoke positive emotions (Desmet & Schifferstein, 2008), they may have thought that, if the insect products are sold on the market and eaten by other people, they probably also evoke positive emotions, even if their first reaction was an expression of disgust or irritation. Furthermore, some participants mentioned being curious and interested in tasting the products. This is consistent with other studies that emphasized the curiosity of Westerners

about eating insects (Tan et al., 2015; Yen, 2009) and may have further contributed to the unexpectedly high positive evaluations in the present study.

The initially stated hypothesis, that, the higher the degree of processing of the insect ingredient, the higher would be the WTE, expected liking, and reported intensities of the positive emotional associations and the lower would be the intensities of the negative emotional associations, was not fully confirmed. There were some emotions that did not differentiate between the products, based on paired comparisons. As examples, *tired* [*müde*] and *thankful* [*dankbar*] received relatively low ratings and may therefore be less relevant in the context of insect products. On the other hand, the non-discriminating terms *disappointed* [*enttäuscht*] and *dissatisfied* [*unbefriedigt*] were among the most intensely rated terms and seemed to be important in relation to all the insect products presented. However, several terms in the G-FEE-List proved to be appropriate for discriminating between the tested insect-containing products, indicating that emotions are useful to differentiate not only relatively familiar food products (Bhumiratana et al., 2014; King & Meiselman, 2010; Ng et al., 2013a; Spinelli et al., 2014) but also unfamiliar products.

As we expected, the products containing the less visible, more processed insect ingredients (“flour” and “bits”) tended to be more positively evaluated in relation to WTE, expected liking, and emotional associations than the products that contained whole crickets (“mix” and “crickets”). This is in agreement with other studies (Hartmann et al., 2015; Tan et al., 2015), in which the WTE scores were higher for familiar products with less visible insect ingredients than for products with whole, incorporated insect bodies. The more negative ratings for the products containing whole insects (“mix” and “crickets”), which were especially pronounced with significantly higher scores for the emotional association *sickened*, *grossed out* [*angewidert*], may be explained by the fact that the products were a reminder of their animal origin or livingness, which was reported to be a latent variable for disgust ratings (Martins & Pliner, 2006). However, against our expectations, there were only four further negative emotional associations that differed significantly between the “crickets” and either the “flour” or the “bits” product and only one significant difference compared to the “mix” product. This indicates that the “crickets” product was assessed less negatively than expected. Again contrary to our expectations, the insect-flour-containing snack and the tortilla chips that contained visible cricket bits did not differ significantly in any of the evaluations. Research (Tan et al., 2015) has shown that the appropriateness of the preparation method plays an important factor in Westerners’ reaction to insect food. Bearing in mind that the snack that contained cricket bits looked like tortilla chips containing herbs, it may be that the familiar

appearance contributed to the more positive evaluation of the “bits” product. The appropriateness of the preparation method may also have contributed to the finding that the snack that consisted of a mix between tortilla chips and deep-fried crickets was evaluated as the most negative. The most apparent explanation is that the “mix” product reminded the participants of a contaminated product. This negative association was already observed in one recent study, in which one stimuli was muffins containing mealworms (Tan et al., 2015).

The correlation coefficients between WTE/expected liking and emotional associations in the present research further show that there is a clear linear relationship. Hitherto, emotional ratings were most often related to liking values, but not to behavioral intentions. In line with these studies (Cardello et al., 2012; Ng et al., 2013a; Spinelli et al., 2014), almost all positive emotion terms correlated positively and all negative emotion terms correlated negatively with the WTE and expected liking ratings for every tested product. For the insect-containing products, the correlational coefficients were on average higher for positive emotional associations than for negative ones, indicating that consumers must expect to experience positive emotions in order to be more willing to eat the insect products. The lower correlational coefficients for the negative emotions may reflect the fact that even people who declared themselves more willing to taste the products out of curiosity were not immune to a perception of disgust or uneasiness. A similar phenomenon was observed during a tasting session with European consumers (Tan et al., 2015). This indicates that first efforts to market insect-containing products should not only decrease associations with feeling bad, dreadful, or disgusted but should simultaneously try to convince the consumer that insect food evokes positive emotions, in order to increase WTE. A further result was that the magnitude of the correlational coefficients varied between the products in the case of positive emotional associations, the coefficients being lower for the reference product. We suggest that the lower coefficients for the reference product may be attributable to individual experiences, which may be independent of WTE the reference product if requested to do so. Some participants may have expected highly positive emotions, whereas others did not have such strong expectations, based on past experiences of eating tortilla chips. With regard to insect-containing products of which participants had no personal experience, the positive emotional expectations were stronger related to behavioral intentions. In contrast, there were smaller differences between the correlational coefficients of the different products presented with regard to negative emotions. One possible explanation is that, if a consumer expects bad feelings to be evoked by the consumption of a food product, it is very likely that he or she will avoid eating the food.

Overall, corroborating other findings (Hartmann et al., 2015; Tan et al., 2015), the present research indicates that, first, insect products that contain less visible insect ingredients may have a better chance of finding approval among Western consumers, and, second, care must be taken to ensure that insect-containing products will not evoke associations of contamination, because this will cause Westerners to reject them. These recommendations aside, it should be noted that, independent of the degree of processing of the insect ingredient, consumers had intense negative emotional associations with the insect-containing products presented. The extent of the negative associations became especially apparent if the cricket flour-containing product was compared to a non-insect-containing, familiar equivalent. The WTE and expected liking of the familiar snack were much larger than those of the insect-containing products. In addition, the most intense emotions associated with the familiar snack were overwhelmingly positive, confirming the positively skewed hedonic asymmetry effect with products that are sold on the market. This indicates that not only a negative emotional barrier has to be overcome in the future. Additional efforts need to be made to improve positive emotional expectations, if insect-containing food is to become acceptable to western consumers.

4.4.1 Limitations, future research and perspectives

Certain limitations have to be considered by drawing conclusions from the present findings. Although the terms on the G-FEE-List were appropriate for revealing differences between the products, the list lacked some expressions that might have been highly important in the context of new and innovative products. Research has shown that people are curious, interested, or react with fear toward eating insects (Desmet & Schifferstein, 2008; Looy & Wood, 2006; Tan et al., 2015). These are all expressions that were not on the G-FEE-List. Therefore, marketers of insect products are recommended to adapt the G-FEE-List before they use it, for example, by adding negative terms from the G-FEE-List pool (see supplementary material from Gmuer et al., 2016). Furthermore, participants were presented with photos. Asking subjects to indicate emotions that may be evoked by the consumption of a product they have never tasted or even actually seen was bound to cause some difficulties. It would be interesting to know whether the emotional profiles or WTE ratings would be different when the subjects have the insect products right in front of them or have tasted them. We might assume that the evaluations would be more negative, especially of the snack consisting of whole crickets.

Based on the literature and the present research, we think that there is the potential for insect products to find a way into the Westerners' diet. However, it is questionable whether consumers can be persuaded to eat insects because of their high protein content (Deroy et al., 2015). The study conducted by Hartmann et al. (2015) revealed that nutritional value is not a predictor for WTE and that the most important factor is positive taste expectations. Therefore, promotional strategies should emphasize the unique taste of insect food, rather than, their nutritional benefit (Hartmann et al., 2015). Two further important tactics may be providing products that are pleasing (see also Deroy et al., 2015) and reducing negative emotional expectations while elevating positive ones. One possibility may be to combine insect ingredients with a familiar food product (Hartmann et al., 2015). However, the present study showed that care must be taken when incorporating whole insect bodies into a familiar product if the insect ingredient reminds people of a contaminated product. Other research has not hitherto paid much attention to this possible association. As a result, and in agreement with Tan et al.'s (2015) conclusions, we suggest that more research is required in order to explore which products would appeal to Western consumers and evoke less disgust and irritation and fewer associations with contamination. Because whole crickets are rather perceived as exotic (Hartmann et al., 2015), it would be interesting to explore whether insect-containing products find greater approval and evoke more positive emotional associations if the insect is incorporated into an exotic but familiar food matrix such as sushi. Furthermore, studies that involve tasting sessions are necessary, as most of the research mentioned used surveys to assess Westerners' reactions. The few authors who focused on Western consumers' reactions on actually tasting insect products showed that Western palates may potentially like insect products (Caparros Megido et al., 2014; Lensvelt & Steenbekkers, 2014). However, the liking ratings were dependent on the way of preparation (Caparros Megido et al., 2014). Apart from the importance of taste, we think that texture may play an important part in acceptance of insect-containing products. Because aversive textural properties of food products are related to disgust reactions (Martins & Pliner, 2006), further research should explore the influence of insect-containing products' texture on liking and emotional assessments. In addition, sensory profiling of insects would provide information on new, unknown flavors that could be used by the food industry in countries where insect ingredients in food are allowed.

Finally, it should be remembered that increasing consumer acceptance of new, unfamiliar food sources takes time, and repeated exposure is a necessary part of this process. Therefore, repeated tasting sessions offered in supermarkets or organized by food

manufacturers may contribute to reducing the disgust and irritation factor and to familiarizing consumers with the product. This would be similar to the “bug banquets” proposed in the literature (Looy & Wood, 2006). In the end, food scientists, consumer researchers, and policy makers have to collaborate in order to satisfy the various requirements for making insects acceptable as food in Western culture (an overview of the different factors that might impact on consumers' acceptance of eating insect food is given by Lensvelt & Steenbekkers, 2014).

4.5 Conclusions

The present research illuminated Westerners' negative perceptions of insect food from an emotional perspective by exploring the influence of the degree of processing of the insect ingredient on WTE, expected liking, and emotional associations, which Swiss residents have. The study makes several contributions to consumer and sensory research by providing general knowledge about emotional associations and their ability to discriminate in the context of new, unfamiliar products. In addition, and corroborating other findings (Hartmann et al., 2015; Tan et al., 2015), the present research recommends designing and marketing insect products that have no association with contamination and that contain rather less visible insect ingredients. However, the findings further indicate that future activities will have to cope with reactions that go beyond disgust. This may be achieved by collaborating among diverse institutions, which will establish strategies to overcome initial reactions of disgust and irritation, while elevating positive emotional expectations and providing Westerners with opportunities to taste the products.

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CHAPTER V

General Discussion

5 General Discussion

The present thesis introduced a new linguistic-based, systematic approach to designing Food-related Emotional Evaluation (FEE) lists and presented a first application of the approach to the German language. In two further studies, the usefulness of the resulting final list was demonstrated in both a positive and a negative food context. In addition to the designed tools, the results provide novel knowledge about the emotional associations people have with familiar, culturally accepted products (i.e. the strong cola brands of Coca-Cola and Pepsi) and unfamiliar, novel products (i.e. products containing insect ingredients).

In the following sections, the main findings are summarized and discussed, and further research avenues are proposed. Because the development of the approach was not completed after the first research activity (Chapter II), but continued over the first part of the second research activity (Chapter III), the main findings and discussion are not structured according to chapter. Instead approach-related findings from Chapters II and III are presented together in the first section (5.1.1). The second section (5.1.2) discusses the findings of the application of the final list. A further section (5.1.3) elucidates the methodological considerations across several subsections. The general discussion ends with a summary of future research avenues (Section 5.1.4) and an overall conclusion (Section 5.2). Because food-related emotional evaluations were the main topic of the present thesis, the issue of insects as food and its future prospects (cf. Chapter IV) are not discussed again.

5.1 Discussion of the main results, implications, and future research

The central findings of the different research activities are summarized in Table 5.1. Some important details concerning the cola and insect studies are also given in this table.

5.1.1 A new and valuable approach and lexicon to study food-related emotional evaluations

The main finding of the present thesis is methodological. First, we presented an emotional evaluation list development approach that was applied to the German language; second, we provided the resulting German lexicon, which can be used to assess emotional states in a food context.

Table 5.1

Overview of the thesis' main findings

Chapter	Topic	Main findings	Some specifications	
			Cola study (Chap. III)	Insect study (Chap. IV)
Chapters II and III	Development and application of an approach to designing food-related emotional evaluation lexicons	<ul style="list-style-type: none"> ○ A linguistic-based, systematic approach to designing FEE-Lists was developed ○ The successful application of this approach to the German language resulted in a 39-term German FEE-List (G-FEE-List) ○ The predominance of a (positively skewed) hedonic asymmetry in a general food context was confirmed with the new approach ○ Evaluative and differentiated expressions are important for labeling food-related emotional states in the German-speaking part of Switzerland ○ The low overlap between the G-FEE-List and other lists was related to methodological, cultural, or translational aspects 		
Chapters III and IV	Application of the G-FEE-list in the context of cola brands and snacks containing insects	<ul style="list-style-type: none"> ○ The G-FEE-List proved to be useful for measuring emotional associations in a positive (cola brands) and a negative (snacks containing insects) food context ○ Hedonic asymmetry effects <ul style="list-style-type: none"> ▪ A positively skewed hedonic asymmetry with familiar products (cola brands or a familiar snack) was observed ▪ A negatively skewed hedonic asymmetry with unfamiliar, new snacks containing insects was observed ○ Differentiating ability <ul style="list-style-type: none"> ▪ Emotional associations differentiated within familiar, highly similar brands and within unfamiliar, innovative products ▪ Emotional associations strongly discriminated between a familiar snack and an unfamiliar snack containing insects ▪ Emotional associations provided information not captured by assessing the positive-negative affect alone ○ Emotional associations and liking or willingness to eat (WTE) <ul style="list-style-type: none"> ▪ Liking or WTE scores positively correlated with intensities of neutral and positive emotional association terms and negatively correlated with intensities of negative terms 	<p><i>Positive emotions went beyond happiness</i></p> <p><i>Compared to Pepsi, Coca-Cola elicited significantly more intense positive and less intense negative emotional associations</i></p>	<p><i>Negative emotions went beyond disgust</i></p> <p><i>Products containing whole insect bodies were rated more negatively than products containing processed insects</i></p>

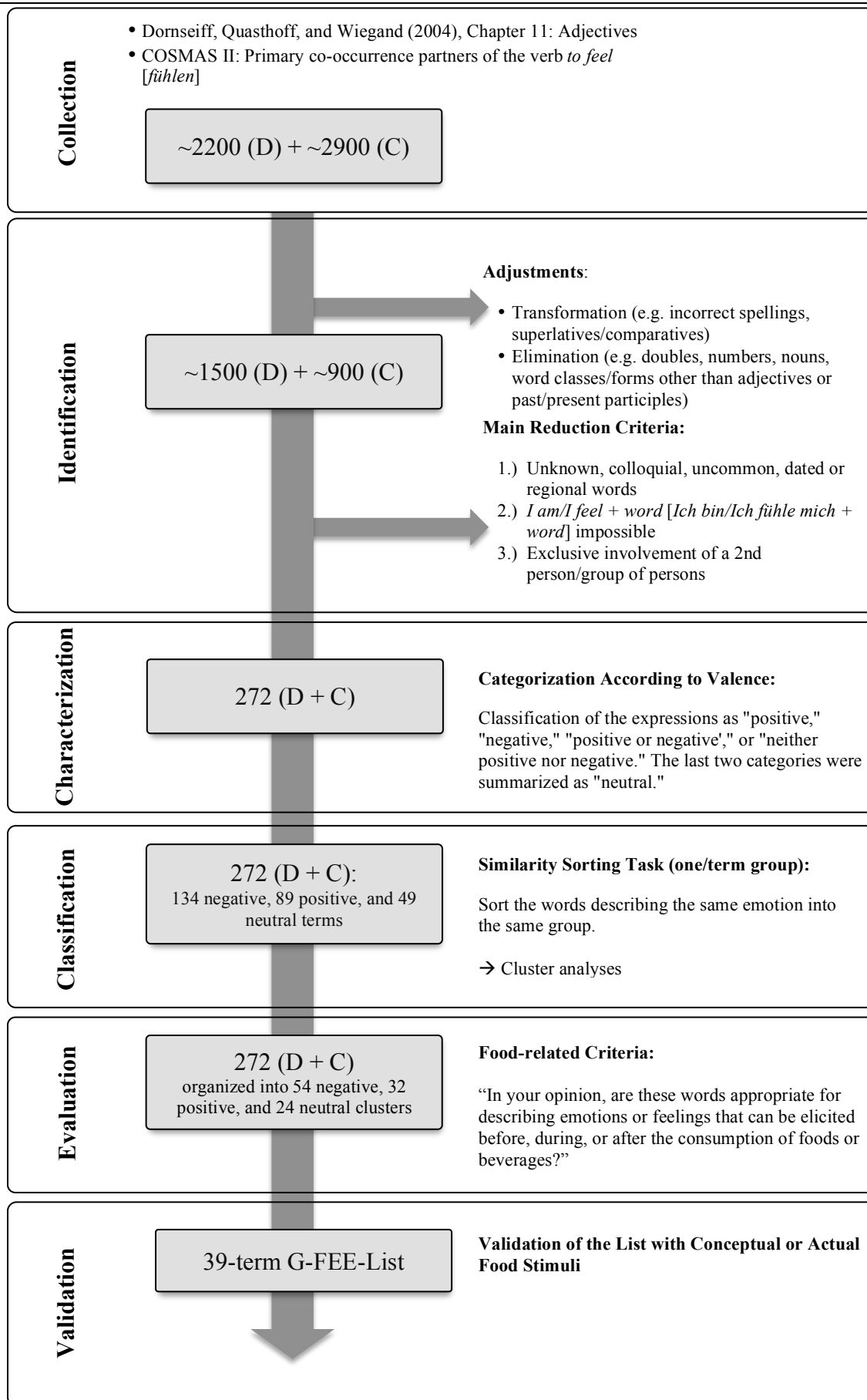


Figure 5.1. Six-step, linguistic-based, systematic approach exemplified for the German language in order to develop FEE-Lists. *D* indicates terms taken from the Dornseiff. *C* represents terms resulting from queries in the *Deutsche Referenzkorpus* via COSMAS II.

Starting with an initial three-step approach in Chapter II, the subsequent study (Chapter III) extended the procedure to five steps to reduce the number of similar expressions in the resulting list. This yielded a more widely applicable and resource-efficient food-related emotional evaluation lexicon. Because a further step was required to test the usefulness of the lexicon, the final proposed approach includes six steps (Figure 5.1). This approach encompasses steps similar to other approaches applied in the literature (see Figure 1.3 in Chapter I), such as a reduction step or a valence categorization. However, the novel procedure and the resulting list differ substantially from several pre-existing approaches and lists by providing the following benefits:

Systematic and linguistic-based. The approach is systematic in that it starts from scratch and is independent of any existing emotion term list. By taking consumers' language into account, the resulting FEE-List is language- and culture-specific. Unlike approaches that use emotion lists published in languages other than the research language, our new approach requires no translation step. Furthermore, the lexicon resulting from the present approach represents emotional terms actively used by laypeople to describe their emotional states. This was especially indicated by the higher percentage of evaluative terms in the G-FEE-List (e.g. *good* [gut], *outstanding*, *terrific* [hervorragend]) than other lexicons. Because a person's active vocabulary includes more familiar expressions (Corson, 1995), it is assumed that the expressions resulting from our approach are better understood by laypeople and that it is easier to match emotional states with more familiar terms. Moreover, the recent approaches also involving the consumers' active language via one-to-one elicitation interviews or free-listing approaches (Jaeger, Cardello, & Schutz, 2013; Ng, Chaya, & Hort, 2013a) are restricted to the ability of respondents to articulate their emotions (Ng et al., 2013a). The use of large actual language data, as is done in the present approach, provides a good alternative to collect candidate emotion terms. Another possibility was presented by Spinelli, Masi, Dinnella, Zoboli, and Monteleone (2014), who also collected terms from consumers during interviews. However, participants could use an aid – a term list – to report their emotional responses during one session. The latter results were then compared to the interview results, which were obtained without using an aid, to verify that no semantic category was missing and that the respondents understood the words. In this way, the consumers' active language use was considered, and articulation challenges were avoided.

Characterized and classified. The proposed approach provides the researchers with a valence-characterization and a semantic classification of the gained emotional evaluation terms (in the presented application: 272 German terms). The term groups help to adjust the

list as necessary and to interpret the gained results in further studies. In addition, by selecting terms based on a classification scheme, the list covers more semantically distinct expressions and the classification provides information on whether the selected term appropriately represents the broad range of relevant terms (Thomson & Crocker, 2013).

Widely applicable. A relatively wide application range of the FEE-List is assumed because this list was not developed in relation to a specific food product and because it contains a substantial number of negative terms. The application of the list in two completely different food contexts was demonstrated in Chapters III and IV. The list was helpful in measuring the emotional associations that people have with cola brands and products containing insects and illuminated fine-grained differences within the tested product categories. The importance of including negative expressions in food-related emotional evaluation term lists was also revealed during the development of the consumer-driven lexicons (Ng et al., 2013a; Spinelli et al., 2014). In addition, the approach can be applied to develop emotional evaluation term lists related to products other than food by modifying the task used during the evaluation step (approach step 5).

To our knowledge, there is no verbal measurement instrument, other than the G-FEE-List, to assess food-related emotional evaluations that offers all of the above-elucidated benefits. Furthermore, the presented list is the first food-related emotional evaluation list in the German language. Therefore, the G-FEE-List and its approach are valuable contributions to consumer, sensory, and nutrition science for both academic and marketing purposes.

A further conclusion that can be drawn from the present research is that future developments of food-related emotional evaluation term lists should also consider negative expressions, as well as the culture and active language of the population under investigation. A comparison of the natures of terms in existing lists or of the G-FEE-List and the EsSense ProfileTM resulted in a low overlap. This finding has been attributed to methodological, translational, or cultural aspects. Although the present research could not provide information on the relative impact of language on the resulting list, we believe that the culture –and, therefore, the language– of the population under investigation, is an important aspect in the general development of verbal emotion measurement tools and should not be factored out. This has already been emphasized by other authors conducting emotion research in sensory science (Ferdenzi et al., 2013; Ferdenzi et al., 2011). These studies have shown that, although the underlying dimensions of the odor-related EOSs were similar across different cultures (e.g., all countries experienced happiness with odors), the individual dimensions consisted of different emotions terms, indicating a culture effect (Ferdenzi et al., 2013).

Moreover, lists based on the consumers' active language have been shown to be more discriminating (Ng et al., 2013a; Spinelli et al., 2014). However, their conclusions were not drawn from a design in which only the language factor of the lexicon was varied; therefore, their results could also be attributed to other aspects. Future research could provide information on the relative impact of language on the resulting list by applying the presented approach to other languages. For example, in the American English language, the Corpus of Contemporary American English (<http://corpus.byu.edu/coca/>) could be screened to collect potential emotional evaluation terms. In addition, further studies should explore the benefits of utilizing actively used expressions compared to terms taken from existing emotion lists from the respondent's perspective with regard to the familiarity, comprehensibility, and ease of describing emotional states. This could be conducted in a way similar to that used by Jaeger et al. (2013) (e.g. by using think-aloud protocols).

5.1.2 More than liking, happiness, or disgust?

The two application contexts (Chapters III and IV) revealed further interesting insights into food-related emotional associations and showed that, first, it is important to assess not only positive emotional states, but also negative emotional states with food products. Second, there is more than liking, or the prototypically known emotions of happiness and disgust related to food.

5.1.2.1 Positive versus negative emotional experiences

So far, most studies in emotion research have confirmed the occurrence of a hedonic asymmetry effect in a food context (Cardello et al., 2012; Ferrarini et al., 2010; Gutjar, de Graaf, et al., 2015; King & Meiselman, 2010; Schifferstein, Fenko, Desmet, Labbe, & Martin, 2013). However, the present research and other studies have revealed or emphasized that negative emotions may be evoked (Desmet & Schifferstein, 2008; King & Meiselman, 2010; Manzocco, Rumignani, & Lagazio, 2013; Ng et al., 2013b; Spinelli et al., 2015) and should be considered in assessing products' emotional performance (Ng et al., 2013a; Spinelli et al., 2015; van Zyl & Meiselman, 2015). Some relevant examples are given below:

- **Explanations for acceptability ratings:** It might be useful for companies to know whether a disliked or unaccepted product evokes feelings of disgust or irritation in

order to optimize the product and/or reach non-consumers. From past experiences, we know that consumers who are disappointed or dissatisfied can do tremendous damage to a company's image or resources through negative word-of-mouth communication (i.e. consumers discussing their experiences with the product) or lawsuits (Blackwell, Miniard, & Engel, 2006). Thus, it is important to assess the negative emotional profiles of products both before and after product launches.

- **Changes in emotional profiles over time:** There may be instances in which a product recipe (e.g. for chocolate) is altered. The product may still be liked and may still trigger positive emotions (e.g. happiness). However, the consumer may now also be dissatisfied. Köster, Mojet, and MacFie (2007) explained that, after some time, product boredom and slowly rising aversion may increase towards products that were initially well accepted. Therefore, it is recommended that product boredom and aversion be assessed to ensure long-term survival of products.
- **Changes in emotional profiles between packaging and blind tasting:** Comparisons of the emotional profiles evoked by blind tasting (i.e. the product package is not presented) and informed tasting (in which the product package is presented simultaneously) have shown that packaging can increase or decrease negative emotions (Spinelli et al., 2015). Furthermore, during product development, it is important to know whether a food package evokes negative emotional expectations.
- **Changes in prevailing emotional states:** Product users may profit not only from an increase in positive emotions via eating or drinking a liked product, but also from a decrease in prevailing negative emotions or moods (Porcherot et al., 2015; van Zyl & Meiselman, 2015).
- **Differential advantage:** Negative emotions have been shown in both the present studies or previous work (Spinelli et al., 2014) to discriminate between products of the same product category. This knowledge might play an important role in helping a company gain a differential advantage over its competitors.

This has prompted the question of whether negative emotions have a more significant impact on acceptance ratings or consumer behaviors (Köster & Mojet, 2015). Moreover, so far, the literature only defines the occurrence of more positive emotions as “hedonic asymmetry.” However, the present thesis shows that, with specific food products (such as innovative, unfamiliar snacks containing insects), the prevalence of positive emotions gives way to negative ones (Chapter IV). Thus, future research should differentiate between a positively

skewed hedonic asymmetry (skewed towards positive emotions) and a negatively skewed hedonic asymmetry (skewed towards negative emotions). Based on this knowledge, we would recommend that future studies should explore more deeply the negative emotions people have for specific products. However, investigating negative emotional states necessitates an appropriate context for eliciting such emotions (Chrea et al., 2009).

5.1.2.2 Emotions versus liking

Confirming other studies in the literature (Cardello et al., 2012; Gutjar, de Graaf, et al., 2015; King & Meiselman, 2010; Ng et al., 2013a, 2013b; Spinelli et al., 2014; Spinelli et al., 2015), participants in the present studies used many terms to describe their emotional associations, which went beyond the prototypically known food-related emotions of happiness and disgust. Two further findings, which were in line with other studies, were that emotional evaluations discriminated between the tested products (Bhumiratana, Adhikari, & Chambers IV, 2014; King & Meiselman, 2010; Ng et al., 2013a; Spinelli et al., 2014; Spinelli et al., 2015) and that the liking and WTE scores correlated positively with the intensities of the positive emotions and negatively with the intensities of the negative emotions (Cardello et al., 2012; Ng et al., 2013a; Spinelli et al., 2014) in both case studies.

What can we conclude from these findings? First, although the participants used several terms, it is still not definitively clear whether so many terms are actually needed to comprehensively capture the emotional consequences of consuming a product, and whether assessing a smaller number representing the underlying dimensions of the terms would be sufficient. Given that people are often either vague or ambivalent in communicating their emotions (Wallace & Carson, 1973) or are not even aware of their emotional states (Thomson, 2010), whether participants are able to differentiate between fine-grained terms and, therefore, emotional states is an open question. For example, are people capable of, or do they differentiate between, the emotional states *torpid* [*träge*] and *tired* [*müde*], which are both included in the G-FEE-List? Respondents' challenges in differentiating among the meanings of terms in the EsSense Profile™ (e.g. *happy* versus *free*) have already been reported (Jaeger et al., 2013). Jaeger et al. (2013) further showed that other hedonically connoted words (e.g. sensory attributes, liking terms) were elicited when participants were asked to free-list emotion and feeling terms, indicating that people even have difficulties distinguishing between emotions/feelings and other hedonically connoted words. This reinforces the assumption that people also cannot differentiate among fine-grained emotional states (although there may be inter-individual differences). Moreover, assessing a change in

emotions requires people to fill in a questionnaire both before and after the consumption of a product. In the case of the G-FEE-List, this would require participants to twice rate 39 expressions for a single product. The number of terms in emotion term lists is a general problem because long lists can cause negative feelings in respondents, potentially creating a demand effect (Jaeger et al., 2013). Furthermore, faster methods are desirable in commercial research and screening tests (Porcherot et al., 2010). If more than two products need to be tested, which is often the case, a list of 39 expressions has been reported to be insufficiently feasible (Nestrud, Meiselman, King, Leshner, & Cardello, 2016). The initial literature results indicated that shorter versions of emotion term lists may lead to results similar to those found for longer versions (Porcherot et al., 2010). Recently, the EsSense ProfileTM was reduced to a shorter version. A comparison of the performance of the two scales revealed that a reduction may be feasible and lead to similar results concerning semantic sorting, underlying dimensions, and intensity ratings (Nestrud et al., 2016). However, it was also indicated that the meanings of some terms were more distinct in the shorter list. Because only 3 out of the 25 terms were affected by changes in meaning, the magnitude of the impact seems rather small. The researchers concluded that the longer list should be applied in cases requiring a comprehensive emotional profile. Further research is required to reveal additional advantages and disadvantages of using longer versus shorter emotion term lists. An alternative could be to apply CATA response formats if long lists are used, because CATA response formats are easier to use (Ng et al., 2013a) and less time-consuming (King, Meiselman, & Carr, 2013) than rating scales. However, because statistical analysis methods are broader when rating scales are used, Ng et al. (2013a) recommended using the rate-all-that-apply procedure. In this procedure, all applicable attributes are checked and additionally rated on a scale (Ng et al., 2013a).

Secondly, independent of the number of emotions that need to be included in a questionnaire, one may argue that it is not necessary to capture emotions because there are correlational associations between liking and emotional responses. According to the classification provided by Cohen (1977), correlational relationships can be divided into three groups: strong ($r > 0.5$), moderate ($r = 0.3-0.5$), and small ($r = 0.0-0.3$). Emotions that are not strongly related to liking may provide information that is not gained by measuring liking (Gutjar, de Graaf, et al., 2015). In the present research, several emotional evaluations of the familiar cola brands (Chapter III) and the familiar tortilla snack (Chapter IV) were moderately related to liking. In the case of the unfamiliar insect snacks, a larger number of the correlational coefficients between liking/WTE and products were strong. This is to be

expected, since most participants did not have any experience with insect food. The findings suggest that the assessment of emotional evaluations in addition to the assessment of liking provided more information in the cola study than in the insect food study. Furthermore, the present study and other studies have shown that emotions differentiate between and within product categories. Some studies have even revealed that products that do not differ in the liking scores show varying emotional profiles (Gutjar, de Graaf, et al., 2015; King & Meiselman, 2010; Ng et al., 2013a; Porcherot et al., 2010; Spinelli et al., 2014). Because the products have become similar and cannot be differentiated based on their liking ratings (Cardello et al., 2012), companies must fall back on other hedonic responses in order to gain a differential advantage (Ng et al., 2013a; Schifferstein et al., 2013). This may be especially important with new products, such as the insect products used in the present thesis (Chapter IV). The expected liking ratings for the product consisting of whole crickets and the product containing insect bits were not statistically different. Assuming that there would be no statistically significant differences in liking after tasting, there is a possibility that participants will feel more disgusted before or during the consumption of the whole crickets than before or during the consumption of the other product. This would be important knowledge in the development and marketing of insect products.

A further argument against the beneficial role of additionally assessing emotions rather than assessing liking alone is that differences within the product category are often related to intensity (Cardello et al., 2012; Gutjar, de Graaf, et al., 2015; Spinelli et al., 2014). Differences in intensity ratings between different products have typically been around one scale point (on a 5-point scale), above or (for more emotional evaluations) below (e.g., Ng et al. [2013], comparisons made from Table 4; Spinelli et al. [2014], comparisons made from Table 3 and 4, without including the very distinct product E). As an example from the present study, the significant differences between Coca-Cola and Pepsi were always below one scale point if all cases were included (on a 6-point rating scale). The comparison of the evaluations for the preferred drink showed that 13 out of the 39 emotional evaluations had differences above one scale point, and 3 expressions had differences of 1.5 scale points or above. For differences between an unfamiliar snack containing insects and a familiar snack, 15 out of the 39 tested emotional evaluations had significant differences larger than one scale point. However, most tested products in the literature on sensory science have generally been found to not evoke completely different emotion profiles. This was also the case in the cola study. Exceptions were the unfamiliar insect products (Gmuer, Nuessli Guth, Hartmann, et al., 2015)

that evoked a more negative emotion profile than a familiar product, and an innovative product that had a sensory profile distinct from common products (Spinelli et al., 2014).

This prompts the question of whether the observed differences are strong enough to impact consumer behavior. The relation between emotional responses and consumer behavior, product survival, and differential advantage is a crucial aspect that has received little attention. Researchers from the Wageningen University in the Netherlands (Dalenberg et al., 2014; Gutjar, Dalenberg, et al., 2015; Gutjar, de Graaf, et al., 2015) revealed initial insights into the relationship between emotions and food choice and further confirmed that measuring emotions in addition to liking is beneficial. More specifically, in these studies, food choice was determined in two contexts: Either participants had the opportunity to taste the products and choose their favorite product after reporting the emotions evoked by blind tasting or participants saw the product packaging and chose their preferred product after reporting the emotions evoked by the packaging. In the former condition, the predictive value of food choice was increased if both liking and the emotional dimension (valence) (compared to liking alone) were included in the model. In the packaging condition, food choice was better predicted if liking scores and two emotional dimensions (valence and arousal) were included. This indicates that people choose liked products that evoke positive emotions and, in the case of the packaging condition, emotions with positive arousal (e.g., active).

So far, we can conclude that future research undoubtedly needs to further investigate the benefits of assessing emotions and the relations among emotions, liking, and behavioral intentions. Furthermore, although the ability to discriminate within and between food product categories has been repeatedly shown, some studies have chosen products from the same product category that represent the “whole span of” sensory variety (Gutjar, de Graaf, et al., 2015; Ng et al., 2013a; Spinelli et al., 2014; Spinelli et al., 2015). By comparing products with divergent sensory profiles, one would expect differences in the shapes of the emotion profiles or the emotion intensities. Different from these findings, some studies were unable to detect differences in emotional profiles between two tasted breakfast drinks from the same brand with highly similar sensory profiles (Gutjar, de Graaf, et al., 2015), a tasted milk chocolate and dark chocolate sample, or tasted regular chips and BBQ chips (which presumably differed in their sensory profile; Cardello et al., 2012). It should be noted that, unlike former studies that found significant differences across samples, these two studies used food product-unspecific tools to assess emotions. Differences in emotional profiles between tasted products with highly similar sensory profiles can perhaps only be revealed with food product-specific lists. Examples for lists of this type include the blackcurrant-squash-specific

list (Ng et al., 2013a) and the hazelnut- and cocoa-spread-specific lexicons (Spinelli et al., 2014). Thus, future research is needed to explore the effectiveness of emotions in discriminating products with highly similar sensory profiles and the requirements lexicons must meet in order to reveal comprehensive information on food-related emotional responses.

5.1.3 Methodological considerations

In addition to the mentioned benefits of the proposed approach and the emotional evaluation term list, there are several methodological considerations directly related to the procedure and the resulting list that should be addressed.

5.1.3.1 Approach-related considerations

Similar to the majority of other approaches in the literature, the approach introduced in the present thesis is time-consuming and requires some expertise in conducting inquiries in the text collections via the used user interface (for the German language: COSMAS II). Therefore, it is highly recommended to collaborate with linguists by applying the presented approach in order to achieve the best results and knowhow. It has to be noted that to explore the intercultural differences between food-related emotional evaluation lexicons by applying the presented approach in a different language, a different user interface and corpus are required. However, differences in the inquiries and specifications of the co-occurrence analysis and differences in the translation step, which would be necessary to compare the two lists, might contribute to divergences between the lists.

Another limitation of the presented approach is that the application of the linguistic-based criteria during the identification step was conducted by only one researcher. Because the judgment may sometimes depend on the gut feeling of the researcher (e.g. in eliminating traits), a further application of the approach to other languages may benefit from having two researchers independently rate the terms. The results of these researchers could then be compared by calculating the inter-rater reliability (e.g. using Cohen's kappa). In cases in which the two researchers do not agree, the terms could be discussed.

A third limitation is that asking people via a survey whether a term is appropriate for describing food-related emotions or feelings (step 5 of the approach) means that the researcher cannot control for the source of the participants' emotions. On one hand, this might be an advantage because participants consider not only the emotions evoked by actually consuming a specific product, but also emotional associations evoked by diverse other

contexts. On the other hand, since the emotional profiles of several products (e.g. an alcoholic beverage and potato chips) might be quite different, and since people prefer to recall positive experiences due to the prevalent hedonic asymmetry effect (Desmet & Schifferstein, 2008), negative or less frequently experienced emotions might be underrepresented (Chrea et al., 2009). This aspect is related to a limitation of general verbal assessment tools: The lists may miss important expressions.

5.1.3.2 List-related considerations

i) Food product-specific versus food product-unspecific lists

There are two possible reasons the product-unspecific G-FEE-List misses several essential expressions. First, the used emotion term sources did not provide specific terms. For example, the terms *curious* [*neugierig*] and *nostalgic* [*nostalgisch*] were not among the terms collected by using actual language use data in the present approach. The expression *curious* [*neugierig*] was an important missing expression during the assessment of the emotional association profiles in response to the novel, unfamiliar, insect-containing products, and it has also been shown to be evoked by other food products (Ng et al., 2013b; Spinelli et al., 2014). Second, product-unspecific lists have to include enough terms to cover various food contexts. On the other hand, the number of included terms is restricted by practical reasons. As a result, the following question must be posed: Should researchers choose to develop or use food product-specific lists or product-unspecific lists? As elucidated by Spinelli et al. (2014), both approaches have their strengths and weaknesses. The greatest advantage of product-unspecific lists is that they do not have to be designed from scratch for each food product category and resources (e.g. in terms of time and money) can be saved. Furthermore, comparisons of emotional profiles of different food categories are possible. This might be especially interesting in a diet context in studies exploring, for example, the emotions that may drive food choices or be evoked by consuming high-calorie versus low-calorie food in order to better understand the prevalent obesogenic epidemic (World Health Organization, 2015). In addition, the application of food product-unspecific lists has been proven useful for differentiating within food product categories (Gmuer, Nuessli Guth, Hartmann, et al., 2015; King & Meiselman, 2010; Ng et al., 2013a; Spinelli et al., 2014). Especially with new, innovative food products that are not yet on the market, the usage of a food product-unspecific list may provide an additional advantage over food product-specific lists because the knowledge of possible emotional experiences is absent. For example, we think that the probability of the expression *irritated* [*irritiert*] being included in a tortilla chips-specific list

is rather small; however, the term was shown to be highly relevant for describing the emotional associations people have with cricket-flour-containing tortilla chips.

One disadvantage of food product-unspecific lists is that they have to be longer in order to cover the emotional dimensions of different food products (Spinelli et al., 2014). In general, a long list of emotion terms has been reported to be exhausting and boring for participants and to lead to a decrease in concentration and elicitation of negative feelings (Jaeger et al., 2013; Ng et al., 2013a; see also Spinelli et al., 2014). Therefore, because not every term on food product-unspecific lists is relevant for every food product, the resources of both the researcher and the participant are spent unnecessarily if the terms are not appropriate for a specific food product. A consumer-centric investigation recently revealed that participants felt frustrated or annoyed if the words were not at all appropriate for the food product under study (Jaeger et al., 2013). The application of the developed G-FEE-List to cola beverages and insect-containing products showed that the emotional associations *dazed* [*benommen*], *tired* [*müde*], and *torpid* [*träge*] had very low intensities and did not always discriminate between the tested products. As a result, these terms were less relevant for the tested products and might not have been included if the list had been designed for the product under investigation. It is assumed that *tired* [*müde*] and *torpid* [*träge*] might be more important after consumers have eaten filling food. *Dazed* [*benommen*] may be especially relevant in the context of alcoholic beverages. Moreover, the comparison of terms from a food product-unspecific list- the EsSense ProfileTM- and a list developed specifically for the product category under study have shown that the product-unspecific list misses expressions that appear in food product-specific lists (Jaeger et al., 2013; Ng et al., 2013a; Spinelli et al., 2014). In addition, the discrimination power of the product-unspecific terms is lower than that of the terms on food product-specific lists (Ng et al., 2013a; Spinelli et al., 2014)¹.

In summary, further research is required to reach a final conclusion about the need to develop and extent to develop food product-specific lists. The choice to use either a food product-specific or a food product-unspecific list may, in the end, also depend on the research goal and the available resources. To choose the appropriate method, the researcher or marketer should be aware of these two aspects. However, we doubt that one food-related emotion term list is sufficient to cover all research questions. Terms may need to be added or subtracted. Thus, existing lists, such as the G-FEE-List, may be a good starting point (see also King & Meiselman, 2010). If food-related emotion researchers or marketers aim to develop

¹ It should also be noted that these differences could be attributed to the culture- and language-specific approaches used to design the food product-specific lists in these studies.

food product-specific lists, the introduced linguistic-specific approach can be adjusted in the following two ways: (i) during the food-related evaluation step, instead of asking people whether the terms are appropriate for describing food-related emotions or feelings, the task could be referred to a specific food product, and (ii) food product-specific expressions collected from an additional linguistic-based step could be added to the FEE-List. Following other studies on food-related emotion research, an adapted version of the Repertory Grid method or the free-listing of emotional expressions could be applied to a specific food product in order to collect product-specific, consumer-driven terms (Jaeger et al., 2013; Ng et al., 2013a; Spinelli et al., 2014). Although no detailed information is available, Storm and Storm's (1987) 525-term taxonomy indicates that the free-listing and labeling of feelings results in a substantial number of expressions. Following the application of such an additional step, the linguistic-based criteria from the second approach step (Figure 5.1) could be used to identify potential emotion terms among the collected expressions. The frequency with which the collected terms were mentioned could serve as a selection criterion. The limitation of this suggested additional step is that it results in a longer final list. To avoid increasing the number of emotion terms in the final list, the 50% approval frequency cut-off criterion applied in the fifth approach step could be increased.

ii) Number of emotion terms

The issue concerning the length of emotion lists has already been explained above. Because of the disadvantages related to longer lists, future research should examine whether a reduction of the G-FEE-List would make sense. One possible strategy could be the one used in research on odor-related emotion scales (Porcherot et al., 2010): The initial 36 odor-related-term list was reduced through empirical data and a factor analysis to six underlying dimensions. From each dimension, three terms were selected. The shortened list consisted of six scales comprising three terms each (e.g. *happiness*, *well-being*, and *pleasantly surprised*). Each scale needed to be rated. However, one concern may be that summarizing terms that differ in their meanings, such as *happiness* and *pleasantly surprised*, could lead to a loss of information because they may be related differently to consumer behavior. One alternative would be to separately present the 18 terms selected from the underlying dimensions.

iii) Ambiguous terms

A further consideration when developing emotion term lists and interpreting the results is the ambiguity of some expressions. This was also highly discussed during the present project and

by other authors (Spinelli et al., 2014). The problem of ambiguity is worsened by setting no context. As an example, the term *feurig* [*impassioned*] from the G-FEE-List could be understood when related with food as *hot*, *spicy*, or *impassioned*, depending on the set context. The term *surprised* [*überrascht*] could have a positive or negative connotation. This could lead to irritation, false results (see Jaeger et al., 2013), or falsely drawn conclusions. The magnitude may be worse if one aims to measure emotions that are directly elicited by a product compared to emotional associations. For example, “*I feel strange because of the eaten food*” and “*I feel unique*” may mean something different from “*The food is strange*” or “*The food is unique.*” The terms *strange* [*merkwürdig*] and *unique* [*einzigartig*] were included in the G-FEE-List. However, it is not clear what respondents in the cola and insect studies understood and in which context the subjects placed the terms.

Possible solutions are provided by the literature. Instead of presenting the descriptor alone, the term can be additionally presented in a real sentence. As an example from Spinelli et al. (2014), the term *relaxed* was presented together with the sentences “*It is an anti-stress: it calms me, it soothes me, it reassures me.*” Another possibility would be to present an expression together with similar terms (Desmet & Schifferstein, 2008). Expressions that may have a positive or negative connotation could be provided with an adjunct (e.g., *positively surprised* and *negatively surprised*). Think-aloud protocols conducted with consumers or using dictionaries could be helpful to better understand the meaning of emotion terms and could be useful in determining the right context (i.e., exemplifying sentences or similar expressions) in which the word will be presented. The disadvantage of these proposals is that the number of terms in the list or the time needed to read the sentences increases. In the latter case, the task would then perhaps be less intuitive, too rational, and may involve more cognitive processes. This in an aspect that was generally mentioned as a disadvantage of assessing emotions because emotions are irrational (Thomson, 2010). Nevertheless, including unambiguous emotion expressions, or making the expressions less ambiguous, is highly recommended. Furthermore, the valence of the term may depend on the set context; further research is need to investigate the influencing factors (King & Meiselman, 2010).

iv) Emotions versus emotion terms

As already stated in the main part of the thesis, it is questionable how many of the terms selected from the applied approach are real emotions. This is a general problem in the literature because there is still no uniform definition of the term *emotion* (Kleinginna & Kleinginna, 1981; Scherer, 2005) and, as a result, it is unknown how many different emotions

can be experienced (Jaeger et al., 2013; Scherer, 2005). From the component model definition provided by Scherer (2005), the terms that were assessed during the present research might be the subjective experience component and the cognitive representation of an emotion (i.e. feelings). Feelings can only be measured by verbal self-reports (Desmet, 2003; Scherer, 2005). However, Scherer (2005) clearly states that using the term *feeling* instead of *emotion* might be misleading. This brings up the question of whether and how these two phenomena are distinguished in language. We assume that lay people do not differ between these two affective phenomena during the communication of their emotional states. Thus, it is questionable whether a fine-grained distinction is necessary.

In the present research, emotional associations were assessed. Thus, one could also argue that these emotional evaluations are “emotional conceptualizations” or “conceptualizations that have an emotional connotation.” The following explanations are taken from Thomson et al. (2010) and Thomson (2010). Conceptualization is “the process of attaching meaning to what we experience” (Thomson, 2010, p. 220). There are three conceptualization types: abstract (e.g., “The Audi (car) is classy”), functional (e.g., “It will make me slim”), and emotional (e.g., “It will make me happy”). Abstract conceptualization may also impact our emotions. For example, if someone thinks the brand Audi is classy, driving an Audi would make him or her personally feel classy. Abstract conceptualizations of this type were defined as conceptualizations that have an emotional connotation. According to Thomson (2010), most emotion measurement tools do not assess the evoked emotions (i.e., the effect of the product on the subject) but rather emotional conceptualizations (i.e., how the object is conceptualized by the subject) because a product does not always have an immediate impact on a subject’s emotions, people are not aware of the impact, or subjects have difficulties in labeling their emotional experiences. As a result, Thomson et al. (2010) emphasize that in future studies, it will be important to distinguish between emotions and conceptualizations because conceptual profiling might differ from emotional profiling. Thus, researchers should consider using the theory elucidated by Thomson et al. (2010) in future studies on food-related emotions. Additional reasons are that, firstly, we do not assume that in the next few years a consensus will be found concerning the definition of what an emotion is and how emotion or feeling terms can be clearly distinguished from other affective phenomena, such as traits (e.g., *nervous* can be a trait or an emotion), and second, the theory is broader than classical emotion theories; it leaves a certain margin and refers to a more practical interpretation (Jaeger et al., 2013). Information on conceptualizations and cases of its applications are found in the literature (Ng et al., 2013b; Thomson, 2010; Thomson &

Crocker, 2015; Thomson et al., 2010). However, it is questionable whether emotional and conceptual profiling can be distinguished in a strict way because some conceptualizations may be built upon personal experiences (see Thomson et al., 2010).

Besides all of these theories, and because our approach was based on a linguistic perspective, the most appropriate definition would be that the terms from the G-FEE-List are words that people use to express emotional states or states with emotional connotations. These are mood, feeling, and emotion terms. Differentiated and also evaluative terms that do not designate a distinct emotion, such as *bad* [*schlecht*] or *good* [*gut*], are included because people use these terms to express their emotional states (see also Storm & Storm, 1987). However, further research is required on which of the terms of the G-FEE-List are related to experienced emotions. Furthermore, it would be very interesting to know the frequency with which people use evaluative and differentiated emotional terms to express food-related emotional states in spoken or written language.

v) Validity and reliability of the G-FEE-List and the first application results

A methodological consideration when conducting studies is the recruitment method and the participants' characteristics. Table 5.2 gives a summary of the study samples used in the present thesis and their characteristics. The demographics of the general Swiss population are depicted in the lower part of the table. The data were retrieved from the Swiss Federal Statistical Office (Federal Statistical Office, 2016a, 2016b, 2016c). The mean age was calculated using the age "105" for the age category "105 years plus." For the age class "0 years," the age of 0.1 years was used. The majority of the conducted studies in the present thesis included participants who were 18 years old or older. Because the mean age of the Swiss population substantially differs if individuals below 18 years are considered, both mean ages were calculated and depicted in Table 5.2. The depicted demographics of the Swiss population remained constant over the years 2013–2015, in which the studies of the present thesis were conducted.

One considerable characteristic of the present samples is that they all consisted of native (Swiss) German-speaking participants. This was particularly necessary during the development of the list. However, the findings from the approach and the G-FEE-List are not inevitably representative of the French-speaking part of Switzerland or Germany. By comparing the Spanish-speaking countries Mexico and Spain, van Zyl and Meiselman (2015) have shown that culture has an effect on emotional responses despite the fact that the countries have the same language. Differences in the nature of terms were also observed by

comparing the EOSs of different English-speaking regions (Ferdenzi et al., 2013). Research is needed to explore whether there are differences in the terms used to express emotional responses between the German-speaking part of Switzerland and Germany before using the G-FEE-List in Germany.

By comparing the study participants with the general Swiss population (≥ 18 years), it is apparent that the samples did not always match the mean demographic data. One prominent characteristic is that the education level was higher in the majority of the conducted studies (Table 5.2) compared to the Swiss population. One possible explanation could be that more highly educated people have a greater interest in taking part in research activities. From Table 5.2, it is further apparent that a limitation of the valence categorization (Study 2, Chapter II) and the similarity sorting tasks (Study 1, Chapter III) is the usage of relatively homogeneous convenience samples having a lower mean age and higher education level than the general Swiss population. By applying the described approach above, researchers may consider using a more representative sample instead of convenience samples in future studies.

Because the insect study was conducted in the German-speaking part of Switzerland, the findings may not absolutely hold true for the French-speaking part. People from the French-speaking part of Switzerland were shown to be significantly less reluctant to eat and/or avoid novel food (i.e., less food neophobic, Pliner & Hobden, 1992) than the population from the German-speaking part of Switzerland (Siegrist, Hartmann, & Keller, 2013). Moreover, food neophobia was shown to have a negative impact on the willingness to try unfamiliar as well as familiar food products (Tuorila, Lähteenmäki, Pohjalainen, & Lotti, 2001). The impact of food neophobia scores on emotional evaluations, WTE, and expected liking was not investigated in the present thesis and requires further exploration. We would expect that the French-speaking Swiss population may be more willing to eat insect food and may have less intense negative emotional associations and more intense positive emotional associations with insect food than the German-speaking Swiss. Furthermore, the Swiss law does not allow for marketing insect products thus far (see Chapter IV), and eating insect food is a hot topic in the Swiss media. Therefore, the findings of the insect study may not absolutely apply to other Western countries where eating insect food is not publicly discussed, insect food is already sold on the market, or the diet of the population largely differs from the Swiss diet.

Table 5.2

Overview of the participant samples that participated in the present thesis and data on the Swiss population

Chap.	Study	Year	Recruitment method	Final sample					
				N	Women [%]	Mean/median age (range) [years]	Education level [%]	Native (Swiss) German speakers[%]	Additional
II	Study 1: Appropriateness of terms for describing food-elicited emotions (Step 3)	2013	Participant pool (ETH Zurich)	222 (N=54–57 per version)	46	54/54 (23–91)	(1) 42; (2) 24; (3) 32; (4) 1; (5) 1	100	
II	Study 2: Valence characterization of terms	2013	Convenience sample recruited at ETH Zurich	246 (N=30–33 per version)	56	22/22 (15–36)	(1) 32; (2) 0; (3) 52; (4) 16; (5) 0	100	
III	Study 1: Semantic similarity task	2014	Snowball and Convenience sampling (e.g. mailing lists, Facebook, etc.) and participant pool of University of Zurich	151 (50/task)	50	24/23 (18–36)	student status	100	
III	Study 2: First application of the final list to assess emotional associations with two cola brands	2015	Participants databases (ETH Zurich and University of Zurich)	152	59	49/51 (18–85)	(1) 41; (2) 19; (3) 37; (4) 3; (5) 0	92	Mean liking for Coca-Cola: 4.6 and Pepsi: 3.4 Coca-Cola-preferring: N=85; Pepsi-preferring: N=10
IV	Study 1: Effects of the degree of processing of insect ingredients in snacks on expected emotional experiences and willingness to eat	2015	Panel provider (Respondi AG)	428 (103–109/product)	51	45/45 (20–70)	(1) 23; (2) 16; (3) 55; (4) 6; (5) 0	95	Total FNS score ranged from 10 to 70; Distribution of individual scores was as follows: low (10–18.9): 15%; middle (18.9–37.7): 69%; high (37.7–70): 16%
				N <i>N</i> ≥ 18 y.	Women [%] <i>Women</i> ≥ 18 y.	Mean age (range) <i>Mean age, if</i> ≥ 18 y.	Education level [%] (age: 25–64 years)		
Swiss Federal Statistical Office		2013	Data collection different for different variables (see http://www.bfs.admin.ch)	8139631 6667327	51 51	41 (0.1–105) 49 (18–105)	(1) 25; (2) 14; (3) 48; (4) 13; (5) 0 <i>n.d.</i>	<i>n.d.</i> <i>n.d.</i>	- -
Swiss Federal Statistical Office		2014		8237666 6755656	51 51	41 (0.1–105) 49 (18–105)	(1) 26; (2) 14; (3) 48; (4) 12; (5) 0 <i>n.d.</i>	<i>n.d.</i> <i>n.d.</i>	- -
Swiss Federal Statistical Office		2015		8325200 <i>n.d.</i>	50 <i>n.d.</i>	<i>n.d.</i> <i>n.d.</i>	(1) 27; (2) 15; (3) 47; (4) 12; (5) 0 <i>n.d.</i>	<i>n.d.</i> <i>n.d.</i>	- -

Notes. Educational levels are coded as follows: (1) college or university; (2) higher vocational education; (3) upper secondary school; (4) compulsory education; (5) no education; Mean likings for Coca Cola or Pepsi were measured on a 7-point scale. The data on the Swiss population were calculated by using the data on. "n.d." = no data available.

Exploring the influence of demographic and personal characteristics on emotional responses was not an aim of the present thesis but is worth considering. The sample of the cola study was biased by consisting of subjects who drink Coca-Cola more often than Pepsi. Because the consumption frequency is positively correlated with the intensity of positive emotions and negatively correlated with the intensity of negative emotions (King & Meiselman, 2010), the suggested brand effect in the cola study could also be attributed to the distribution of the consumption frequencies of the sample (Chapter III). Therefore, future studies should replicate the cola study with a sample that is balanced for Coca-Cola and Pepsi consumers. In addition, future researchers need to be aware of which characteristics the sample has to fulfill. Research has shown that age (den Uijl, Jager, de Graaf, Meiselman, & Kremer, 2016), gender, and probably individual differences in emotional intensity and private body consciousness (Jaeger & Hedderley, 2013) have an impact on emotional responses. Further research is recommended to consider some of these influencing factors when exploring food-related emotional evaluations. However, assessing 39 emotional terms requires time, and long emotional term lists impact the state of participants if they have to evaluate a large number of products (cf. Section 5.1.3.2). As already mentioned, it was recommended that two products are optimal if 39 emotional terms are assessed (King et al., 2013). The testing of two products already requires the assessment of more than 70 terms. Therefore, the researcher is often restricted and cannot freely include many other demographic questions or personal trait questionnaires because they often consist of an additional substantial number of terms. Depending on the research question, future research is recommended to weigh which demographic or personal assessments need to be included in each study. For example, if the study objective is to assess emotional responses to chocolate, it would be important to also explore the dietary behaviors of the respondents because people who are obese or try to lose weight may have other emotional responses to chocolate than people who are not concerned about gaining weight.

Future research is encouraged to test the G-FEE-List with other food products and use it to assess emotions with tasted food stimuli and/or packaging. This would also provide information about whether and how the G-FEE-List has to be adjusted depending on the context and food product. Following other studies (Ng et al., 2013a; Richins, 1997; Spinelli et al., 2014), a comparison between the performance of other lists (e.g., EsSense ProfileTM) and the G-FEE-List would be another possible way to validate the list. However, translations would be needed, which could already lead to uncontrolled differences between the lists. Moreover, the relation of the data obtained from the G-FEE-List and other dependent

variables, such as liking or behavioral intentions, could be explored. Finally, the ability of the G-FEE-List to discriminate between consumers could be tested. Inspired by recently presented research (den Uijl, Jager, Zandstra, de Graaf, & Kremer, 2015), it would, as an example, be interesting to explore whether the terms are useful to discriminate between young and old consumers in regard to diverse product variations. In addition to determining the validity, a further research avenue is to assess the reliability (e.g., inter-rater reliability or test-retest reliability) of the emotional responses measured by the G-FEE-List.

5.1.4 Further research

We agree with researchers (King & Meiselman, 2010; Spinelli et al., 2015) who recently stated that we are just at the beginning of our expedition in the world of food-related emotions. There are many further research avenues regarding the appropriate measurement tools and factors influencing emotional responses. A summary of different possibilities is given in Table 5.3. Most of the possibilities have been explained already in the former sections of the general discussion, and some possible future areas of important research will be shortly elucidated in this section. The last column of Table 5.3 shows references for the first results on each specifically listed topic. Most of the given references have been published recently, and there is still a great deal of work to undertake on each topic. Additional ideas for research on consumer emotions were provided by Richins (1997, Exhibit 1). Moreover, a review on the measurement of food-related emotions in consumer research was recently written by Köster and Mojet (2015), who further elucidated several open questions related to the “how and when” food-related emotions should be assessed.

Thus, future researchers should first undertake further studies to explore and determine the important elements of verbal measurement tools (e.g., the length of the list). Furthermore, the measurement of emotions should move beyond laboratory conditions. Emotions depend on the context (Richins, 1997). In the case of insects, we assume that depending on whether people are on vacation and eat an insect product in a culinary restaurant where it is normal to eat insects, or they are willing to try the product in a laboratory setting, it may result in different intensities of evoked emotions. To study the impact of the context, home-use tests, inviting people to an experimental restaurant (Porcherot et al., 2015), or imaging tasks (Piqueras-Fiszman & Jaeger, 2014a) are good opportunities. Comparing findings under controlled conditions (laboratory) and in a more natural, uncontrolled environment was suggested and would further provide information on the stability of the observed effects in the laboratory (Porcherot et al., 2015). Home-use tests

would perhaps also require new measurement devices, such as a smartphone app that reminds participants to assess their emotions while eating in an everyday context. Piqueras-Fizman and Jaeger recently shed some light on the influence of the context on emotional responses (Piqueras-Fizman & Jaeger, 2014a, 2014b, 2014c).

A further focus should be the investigation of the emotions evoked by the packaging, sensory attributes, or by the combination of the two product aspects. Emotions evoked by the packaging are more relevant during purchase decisions and perhaps influence expectations. Emotions triggered by the combination of the packaging and sensory attributes are more relevant during the consumption of the product. Some studies have compared emotional profiles evoked by different conditions and revealed that emotions triggered by both stimuli (sensory attributes and packaging) can differ from emotions that are stimulated by tasting alone (Spinelli et al., 2015). Furthermore, initial results have indicated that the emotional profile that is evoked by the product experience (sensory attributes and packaging) is primarily determined by the sensory aspects (Ng et al., 2013b).

A third important future research avenue lies in cultural differences in emotional reporting and experiences. At the latest Pangborn Sensory Science Symposium in Gothenburg, Sweden, in 2015, cross-cultural investigations (not only emotion-related) were a central topic in several presentations. In food-related emotion research, it has been shown that culture has an impact on emotional responses (van Zyl & Meiselman, 2015).

A further aspect that is considered important is the relationship between emotions, behavioral intentions and product success, as it would further provide information on the relevance of measuring emotions in a commercial context.

Table 5.3

Future research avenues in the field of odor-related and food-related emotions

Topic	Specification	Possible research questions/objectives	References
Measurement tools			
	Language	<ul style="list-style-type: none"> • Further investigate the importance of language in developing verbal emotion measurement tools • Explore the benefits of using actively used expressions compared to terms taken from existing emotion lists • Apply the presented linguistic-based approach in other languages 	Gmuer, Nuessli Guth, Runte, and Siegrist (2015), Ng et al. (2013a), Spinelli et al. (2014)
	Optimization	<ul style="list-style-type: none"> • Explore the advantages and disadvantages of longer versus shorter emotion term lists • Investigate how the valence of the terms depends on the context (King & Meiselman, 2010) • Are check-all-that apply (CATA), rate-all-that apply (RATA), or ratings scales more appropriate to assess emotions? • Explore the advantages and disadvantages of product-specific versus product-unspecific emotion term lists 	Nestrud et al. (2016), Porcherot et al. (2010) Ng et al. (2013a)
	Other devices	<ul style="list-style-type: none"> • Develop electronic tools (e.g., apps) to assess emotions in an everyday context instead of assessing emotions in the laboratory 	Jaeger et al. (2013), Ng et al. (2013a), Spinelli et al. (2014)
	G-FEE-List	<ul style="list-style-type: none"> • Exploring the validity and reliability of the G-FEE-List (e.g., by using other products) 	
Emotions and language			
		<ul style="list-style-type: none"> • When and how do consumers talk about their food-related emotions? Do they use differentiated or evaluative expressions? 	
Factors influencing emotional responses			
	Demographics	<ul style="list-style-type: none"> • Influence of demographic variables on emotional responses 	Jaeger and Hedderley (2013)
	Culture	<ul style="list-style-type: none"> • Are there cultural differences in experiencing food-related emotions with food products (e.g., Asian countries versus European countries with regard to insect products)? • Do food emotion sources differ between cultures? 	Ferdenzi et al. (2013), Piqueras-Fiszman and Jaeger (2014a), Chollet, Lelièvre, Abdi, and Valentin (2011)
	Temporal dynamics	<ul style="list-style-type: none"> • Do emotions experienced with a product change over time (e.g., after several weeks of usage)? • How does the emotion profile relate to the survival of a product? • Assessing the temporal dominance of emotions while tasting products 	Köster et al. (2007) Jager et al. (2014)

Table 5.3 (continued)

Topic	Specification	Possible research questions/objectives	References
Factors influencing emotional responses	Internal states	<ul style="list-style-type: none"> How do emotional responses change with the hunger state (Desmet & Schifferstein, 2008)? 	
Emotional sources	Non-food products	<ul style="list-style-type: none"> Develop and apply comprehensive emotion measurement tools with products from the non-food domain (e.g., with cars, Richins (1997) or jewelry) 	
	Product aspects (e.g., branding, packaging, sensory attributes)	<ul style="list-style-type: none"> Exploring the emotions that are evoked by specific sensory attributes (e.g., Gujar, Dalenberg, et al. (2015), Ng, Chaya, and Hott (2013b), Spinelli, Masi, Zoboli, Prescott, and Monteleone (2015), Thomson, Crocker, and Marketo (2010) Which emotions are triggered by the product packaging? Can the hedonic asymmetry be confirmed with food packaging? How do the emotional profiles from packaging correspond to emotions triggered by blind tasting? And does this influence product success? How do specific factors of the product... 	<p>Desmet and Schifferstein (2008), Liao, Corsi, Chrysoschou, and Lockshin (2015), Porcherot, Delplanque, Gaudreau, and Cayeux (2013)</p>
	Context	<ul style="list-style-type: none"> Impact of context variables on emotional responses Investigate whether findings from the lab are consistent in the field and <i>vice versa</i> 	<p>Piqueras-Fiszman and Jaeger (2014 a,b,c) and Porcherot, Petit, Giboreau, Gaudreau, and Cayeux (2015)</p>
Emotions and other dependent variables	Liking	<ul style="list-style-type: none"> Investigate the relative importance of evaluative and differentiated emotion terms in relation to liking Explore the (predictive) effects of emotions on liking How do expectations and emotions relate? 	
	Expectations	<ul style="list-style-type: none"> Investigate the relationship between emotions and consumer behavior (e.g., Dalenberg et al. (2014), Gmuer, Nuessli, intentions, differential advantage 	<p>Dalenberg et al. (2014), Gmuer, Nuessli, intentions, differential advantage in a comprehensive manner</p>
	Behavioral intentions, differential advantage	<ul style="list-style-type: none"> Investigate the relationship between emotions and consumer behavior (e.g., Dalenberg et al. (2014), Gmuer, Nuessli, intentions, differential advantage 	<p>Gujar, Dalenberg, et al. (2015)</p>

Table 5.3 (continued)

Topic	Specification	Possible research questions/objectives	References
Emotions of specific consumer groups			
	Consumer segmentation	<ul style="list-style-type: none"> Do emotions differ between consumer groups that differ in their psychological characteristics (e.g., food neophobia, personality (Big5)) or have different food behaviors (e.g., restrained eaters versus non-restrained eaters)? Do emotional profiles differ within senior, adult, or teenager groups? How can we design products that have a satisfying emotional impact, and do these products have to differ between different age groups? How do the emotional profiles of a specific product differ between age groups (e.g., for Red Bull)? 	Jaeger and Hedderley (2013) den Uijl, Jager, de Graaf, Waddell, and Kremer (2014), den Uijl et al. (2015)
	Anosmia, ageusia	<ul style="list-style-type: none"> How intensely do people who have lost their smell or taste ability experience food-related emotions, and which emotions do they experience? Do these ratings differ from people who are able to taste and smell? 	
Positive and negative emotions			
	Relevance	<ul style="list-style-type: none"> Focus on the differentiated negative emotions of product users and non-users Explore the relative importance of positive and negative emotions in consumer behavior (e.g., willingness to buy) and on acceptance ratings 	Gmuer, Nuessli Guth, Hartmann, et al. (2015), (Gmuer, Nuessli Guth, Hartmann, et al., 2015); Ng et al. (2013a), Spinelli et al. (2014), van Zyl and Meiselman (2015)
	Benefits	<ul style="list-style-type: none"> Investigate the differentiating effectiveness of emotions within products that are highly similar in their sensory profile 	Gutjar, de Graaf, et al. (2015), Ng et al. (2013a)
	Hedonic asymmetry	<ul style="list-style-type: none"> The positively skewed hedonic asymmetry was mainly related to healthy individuals (Desmet & Schifferstein, 2008). Does a negatively skewed hedonic asymmetry occur with unhealthy individuals? 	

5.2 Conclusions

Exploring food-related emotions is a relatively new topic in the field of sensory science, and new knowledge has been obtained through the use of food product-specific and –unspecific emotion lists. However, there are many still may unanswered questions related to the development of appropriate measurement tools and the benefits of assessing food-related emotions. Because the existing development approaches and emotion lists have several disadvantages, the present thesis has introduced a new approach to designing food-related emotional evaluation lists. The approach was applied to the German language, and the resultant G-FEE-List was found to be useful for assessing the emotional associations that people have with familiar cola drinks and unfamiliar products containing insects.

Based on the present thesis, we can draw several conclusions: First, the verbal assessment of emotions, whether related to food-related or another object, is challenging. We think that this will not change in the near future because defining, perceiving, and expressing emotions are well-known difficulties. Therefore, it is important to reduce the ambiguity of used terms as much as possible to obtain precise results. Second, using development approaches or existing lists that are not language- or culture-specific has several limitations. Applying the development approach presented here is a good option for overcoming some of these limitations because it is linguistic-based and systematic. Third, based on the present work and other research, we think that the assessment of emotions provides important information regarding food products that goes beyond traditional hedonic ratings. Thus, we suggest that emotion assessment tools have potential to become a standard measurement procedure in marketing and product development. However, further research is needed to explore the advantages and disadvantages of using large lists of emotional terms. Although the number of terms used depends on the research question and available resources, we are of the opinion that the use of lists comprising less than 39 expressions and RATA response formats would be more practical for familiar products. Fourth, food-related emotion researchers should also consider negative food-related emotions, especially in the context of unfamiliar, innovative products. Fifth, future research is needed to explore additional aspects that should be considered in assessing food-related emotions, and the assessment of emotions should move beyond laboratory conditions. Moreover, it is necessary to further examine the benefits of assessing food-related emotions and the relevance of these emotions to consumer behavior.

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Summary

In the last few years, measuring food-related emotions in the field of sensory science has gained momentum. However, food-related emotions are most often assessed by lists that have been developed in a less systematic way and without the inclusion of consumers' active language. Additionally, most studies have been conducted with food products that are familiar and generally liked. Therefore, the objective of the present thesis has been to develop and apply a new, systematic and linguistic-based approach to design food-related emotional evaluation lists by using actual language use data. The usefulness of the resulting German list was tested in a positive context (cola brands) and in a negative context (food that contains insect ingredients) of food.

The results of the conducted studies showed that (i) the proposed approach and resulting German Food-related Emotional Evaluation List (G-FEE-List) are useful tools for exploring food-related emotions; (ii) the overlap between existing emotion lists is small. This may be related to methodological, translational, or cultural aspects; (iii) in the German language, evaluative and differentiated expressions are important for labeling food-related emotional states; (iv) the emotional associations that people have with a familiar, generally liked stimuli (cola brands) are predominantly positive, while the emotional associations that people have with unfamiliar food products (food containing insects) are predominantly negative; and (v) the emotions assessed in the present thesis differentiated between the tested food products and provided information that went beyond traditional hedonic ratings.

The present thesis makes several contribution to consumer and sensory research, firstly, by providing a valuable development approach and emotion list that can be used in future research activities and, secondly, by providing new knowledge on food-related emotions.

Further research that elaborates on tools that can be used to examine food-related emotions and explores the benefits of assessing these emotions is necessary to deepen our understanding of the role that emotions play in buying and consuming products and in coloring our everyday lives.

Zusammenfassung

In den letzten paar Jahren hat das Erfassen von Emotionen, welche mit Lebensmitteln in Verbindung gebracht werden, im Bereich der Sensorik zugenommen. Emotionen, welche durch Lebensmittel ausgelöst werden, wurden jedoch oft mittels Listen gemessen, welche auf eine weniger systematische Weise und ohne Berücksichtigung des aktiven Sprachgebrauchs des Konsumenten entwickelt wurden. Das Ziel der vorliegenden Dissertation war daher die Entwicklung und Anwendung eines neuen, systematischen und sprach-basierten Ansatzes, um emotionelle Bewertungslisten, welche mit Lebensmitteln verwendet werden können, zu entwickeln. Dies erfolgte durch die Verwendung von Daten, welche Informationen zum tatsächlichen Sprachgebrauch von Wörtern enthielten. Des Weiteren wurde die Nützlichkeit der resultierenden deutschen Liste in einem positiven Lebensmittelkontext (Cola Marken) und einem negativen Lebensmittelkontext (Lebensmittel, welche Insekten als Inhaltsstoff enthalten) getestet.

Die Resultate der durchgeführten Studien zeigten, dass (i) der Ansatz und die daraus resultierte *German Food-related Emotional Evaluation List (G-FEE-List)* nützliche Instrumente sind, um Emotionen, welche mit Lebensmittel in Verbindung gebracht werden, zu messen; (ii) die Gemeinsamkeiten zwischen existierenden Listen ist klein. Methodische sowie kulturelle Unterschiede oder Unterschiede in der Übersetzung könnten mögliche Gründe für dieses Ergebnis sein; (iii) in der deutschen Sprache sind bewertende und differenzierte Wörter wichtig, um Emotionen, welche mit Lebensmittel in Verbindung gebracht werden, zu benennen; (iv) Personen haben hauptsächlich positive emotionale Assoziationen mit einem vertrauten, im Allgemeinen gemochten Stimuli (Cola Marken). Mit unvertrauten Lebensmittelprodukten (Lebensmittel, welche Insekten enthalten) haben Personen hingegen hauptsächlich negative emotionale Assoziationen; und (v) gemessene Emotionen differenzierten zwischen den getesteten Lebensmittelprodukten und lieferten Informationen, welche über traditionelle hedonische Bewertungen hinausgingen.

Die vorliegende Dissertation leistet diverse Beiträge zur Konsumenten- und Sensorikforschung. Erstens liefert sie einen nützlichen Ansatz und eine nützliche Emotionsliste, welche in zukünftigen Forschungsaktivitäten genutzt werden können. Zudem liefert die präsentierte Arbeit neues Wissen über Emotionen, welche mit Lebensmittel in Verbindung gebracht werden.

Weitere Forschung sollte Emotions-Messinstrumente ausarbeiten und den Nutzen, welcher das Messen von Emotionen im Lebensmittelbereich mit sich bringt, weiter erforschen. Dies ist notwendig, um eine vertiefte Erkenntnis über die Rolle, welche

Emotionen während dem Kauf oder dem Konsum von Produkten und im alltäglichen Leben spielen, zu erlangen.