Food Quality and Preference 21 (2010) 168–177

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Development of a method to measure consumer emotions associated with foods

Silvia C. King [a,*], Herbert L. Meiselman [b]

[a] McCormick and Company, Inc., 204 Wight Avenue, Hunt Valley, MD 21030, USA
[b] Herb Meiselman Training and Consulting Services, P.O. Box 28, Rockport, MA 01966, USA

ARTICLE INFO

Article history:
Received 30 October 2008
Received in revised form 9 February 2009
Accepted 13 February 2009
Available online 23 February 2009

Keywords:
Emotion
Mood
Consumer
Food

ABSTRACT

Emotion attributes have been generally associated with product brands but little work has been published to understand consumer emotions associated with the product itself. The purpose of this series of studies was to develop an emotion-specific questionnaire to test foods with consumers in person or on the internet. A list of emotion terms was screened and validated with consumers. The emotion terms selected for foods were generally positive, as compared with emotion testing originating within a clinical framework. The list of emotions was useful in differentiating between and within categories of foods. Higher overall acceptability scores correlated with higher emotions, but differences in emotion profiles did not always correlate to differences in acceptability. A description of the approach used to develop the questionnaire, questionnaire format, effect of test context, and specific applications of the method to foods are presented. This test represents a major methodological advance in consumer testing of food products in a commercial environment.

1. Introduction

Food affects the way we feel, and researchers have included mood as a key variable determining food choices. One of the clearest demonstrations of this is the Food Choice Questionnaire developed by Steptoe, Pollard, and Wardle (1995) to identify determinants of food choice. Nine factors were identified including mood, which has also been identified in a number of follow-up cross-cultural studies (Eertmans, Victoir, Notelaers, Vansant, & Van den Bergh, 2006).

Mood has also been identified as a key behavioral outcome of foods along with cognitive and physical performance (Lieberman, 2005). In fact, mood is often the easiest outcome to measure, more easily measured than physical outcomes or subtle cognitive outcomes. Much of the published food and mood research has come about as part of this tradition of looking for effects of food on human performance (Gibson, 2006; Lieberman, 2005).

Despite the evidence that food affects mood, there has been relatively little published on mood research within food product development. This can be attributed to a number of factors including the practice that food companies keep this material secret in order to gain a competitive advantage. However, another reason is the lack of a standard method or methods for measuring emotions associated with food within the product development context. This context is important because techniques which are appropriate for the academic laboratory research might not be appropriate for commercial settings of consumer laboratories. Academic laboratory research typically uses student volunteers who sometimes participate as part of course requirements. Such studies have minimal time constraints. They also have fewer constraints on the content of the questionnaire materials presented to students or the foods presented to students. There are greater constraints within commercial consumer testing: time is usually constrained, tasks must be reasonable from the consumer perspective, and foods must appear to be viable commercial products.

1.1. Distinguishing moods and emotions

When one considers measuring mood and emotion, perhaps the first issue which arises is the distinction between mood and emotion. The answer to this question is easier in theory than in practice. In theory one can distinguish at least three different affective behaviors: (1) attitudes which include an evaluative component (e.g., "I like steak."), (2) emotions, which are brief, intense, and focused on a referent (e.g., "The comment made him angry"), and (3) moods, which are more enduring, build up gradually, are more diffuse, and not focused on a referent (e.g., "I am happy.").

1.2. Lists of moods and emotions

Thus, there is some agreement on the definitions of mood and emotion, and how to distinguish them in theory. There also is some agreement on general categories of moods and emotions, and lists of moods and emotions. The number of terms to describe specific moods and emotions can be bewildering. Further, much of the

* Corresponding author. Tel.: +1 410 771 7390; fax: +1 410 527 8924.
E-mail address: silvia_king@mccormick.com (S.C. King).

0950-3293/$ - see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.foodqual.2009.02.005

research on moods and emotions and many of the resulting questionnaires were developed within a clinical psychiatric setting. The mood and emotion lists reflect this, and can appear negative and sometimes offensive to the average consumer judging a product. Such words might include tormented and destroyed.

In their recent review, Laros and Steenkamp (2005) list 173 negative and 143 positive emotions drawn from the literature (Laros and Steenkamp, Table 2, p. 1439), and further list 39 "basic emotions" also drawn from the literature. The number of basic emotions that are negative far exceeds the number of positive emotions. Laros and Steenkamp caution that their research is based on Dutch data. Rousset, Deiss, Juillard, Schlich, and Droit-Vilet (2005) report 237 French emotional words, and further, that over 50% of French people surveyed used 70 of the emotional words. Laros and Steenkamp (2005) validated the "wide divergence in the content and structure of emotions used in these studies" and attempted to provide a consumer emotions' model.

At the broadest level, one can view emotions on two dimensions: as positive versus negative (see below in our method), and pleasure or arousal versus displeasure. Laros and Steenkamp catalogue 15 different approaches to such categorizations (Table 1, p. 1438). The most common categorization was positive–negative, and Laros and Steenkamp go on to use this for their basic hierarchy of consumer emotions (Laros & Steenkamp, 2005, Fig. 1 p. 1441) Fig. 1. They used 41 terms which were reduced to 33 terms to describe emotional response to foods.

Desmet and Schifferstein (2008) have measured responses to positive and negative emotion words, which they term pleasant and unpleasant. They noted in two studies that people overwhelmingly use positive rather than negative words, whether describing recalled food experiences or describing reactions to food samples. Desmet and Schifferstein refer to this positive bias as "hedonic asymmetry", and attribute it to two things: the general "positive affective disposition towards eating and tasting food" and the fact that actual food products "are designed to appeal to consumers." Gibson (2006) has also commented on the basically positive nature of the food experience. We will return to the issue of hedonic asymmetry in the Discussion of this paper.

1.3. Standardized mood questionnaires

A number of standardized questionnaires of mood are used in research studies. However, it is important to emphasize that these questionnaires were not designed for general consumer use, and are most often applied in the clinical setting or the research clinical setting, not the food or product development laboratory. One of the oldest questionnaires is the Profile of Mood States (POMS) which has its roots in American psychology in the 1940s and 1950s. The Manual for the POMS (McNair, Lorr, and Droppleman (1971)) describes the POMS as "a rapid, economical method for identifying and assessing transient, fluctuating affective states" although the authors emphasize the clinical psychiatric goals of the method. The POMS uses 65 mood terms which are rated on a five point rating scale. The survey can be oriented towards a variety of timeframes: feelings during the past week, today, right now, and the past three minutes. The POMS measures mood on six dimensions: tension–anxiety, depression–dejection, anger–hostility, vigor–activity, fatigue–inertia, and confusion–bewilderment. The POMS has been used extensively in research and is probably the most widely used questionnaire for research in clinical and academic environments (for example, see Smit & Rogers, 2002; Lieberman, 2005; Smith, Clark, & Gallagher, 1999).

Another mood questionnaire is the Multiple Affect Adjective Check List (MAACL), which is also used extensively in clinical psychiatric settings. The MAACL was first published in 1965 (Zuckerman & Lubin, 1965), and revised as the MAACL-R in 1985 (Zuckerman & Lubin, 1985). The authors have also published an extensive bibliography of mood papers (Lubin, Swearingi and

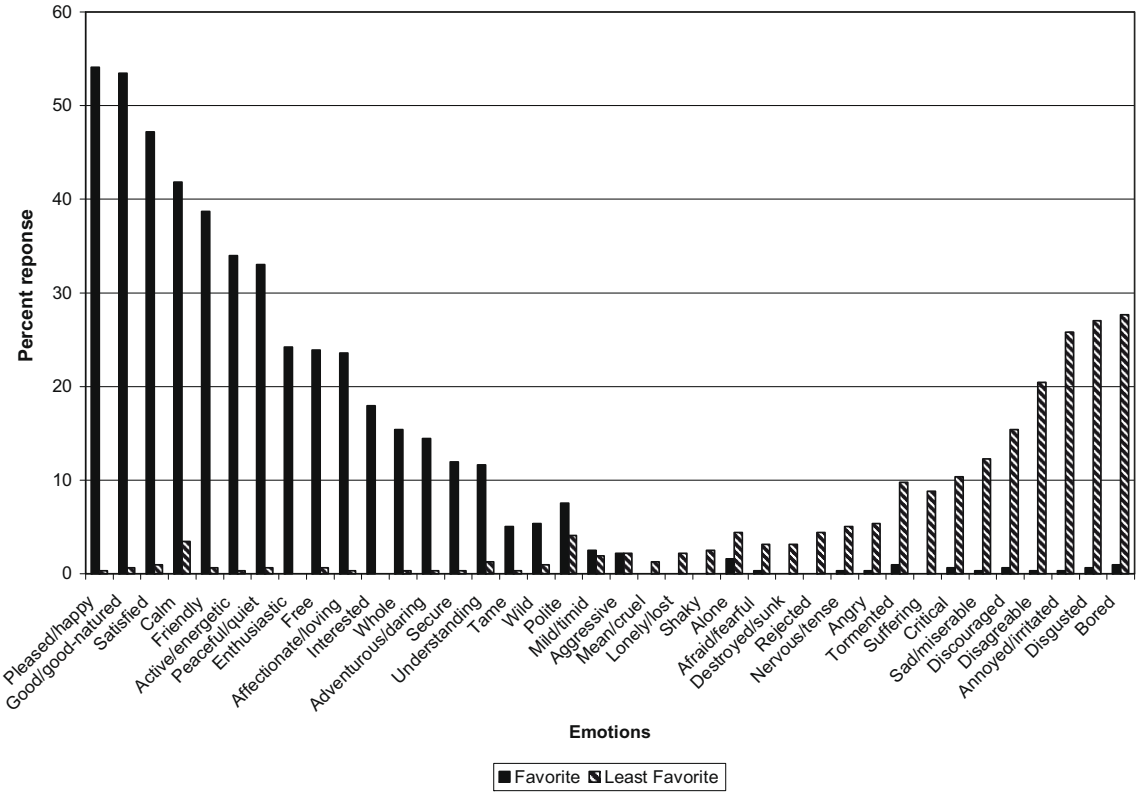


Fig. 1. Mean frequency of emotion terms describing favorite and least favorite foods with US participants ($n = 105$).

Zuckerman, 1997). The MAACL in its revised form (MAACL-R) contains five categories or scales with a total of 66 adjectives. This is a checklist and the terms are not scaled. The questionnaire can be given in a state form ("how you feel now or today"), or a trait form ("how you generally feel"). The MAACL-R has two positive scales, sensation seeking (more active) and positive affect (more passive), and three negative scales, anxiety, depression, and hostility. The authors point out the similarities between the MAACL-R and the POMS, although the correlations between the two scales can vary with instructions (state form vs. trait form):

POMS scales	MAACL-R scales
Tension	Anxiety
Depression	Depression
Anger	Hostility
Fatigue	
Confusion	
Vigor	Sensation seeking and positive affect

1.4. Facial scaling

Another approach to measuring emotions has been the use of facial scaling. A number of different systems for facial scaling have recently appeared including the following:

- **Noldus FaceReader** (2007), http://www.noldus.com (7 basic emotions, 1 positive).
- **Emotionomics** (2007), http://www.sensorylogic.com (7 basic emotions, 1 positive).
- **PrEmo** (2000), http://www.tustudiolab.nl/desmet.premo (14 basic emotions, 7 positive, 7 negative).

All of these systems have several things in common which led us to consider an alternate method. They all have a short number of emotions. Two of the systems have mainly negative emotions with only one positive emotion (happiness); the other has small numbers of both positive and negative emotions. These facial scaling systems were originally designed for consumer products other than food.

The goal of this research was the development of a questionnaire to measure emotion and mood in a commercial context. Therefore the method was aimed at product category users and product users who typically like the product. To accomplish this we conducted a series of 16 experiments using a total of 5159 subjects. The studies included both Central Location Tests (CLTs) and Internet surveys, both using standard commercial procedures. The goals of these series of studies were as follows:

1. Identify appropriate terms to measure emotions associated with foods maximizing information about the product.
2. Identify scaling approaches to measure emotions with consumers.
3. Develop a test protocol to evaluate food and measure emotions.
4. Identify method applications.

2. Method for Identifying emotion terms

2.1. Source of terms

The list of emotions to be included in the questionnaire evolved from two sources: existing mood and emotion questionnaires and feedback from consumers. Existing questionnaires included the MAACL-R (Zuckerman & Lubin, 1985) and the POMS (McNair et al., 1971). Feedback was collected from thousands of consumers via the internet, central location tests (CLT) and a focus group. A total of 81 terms were evaluated. The terms were evaluated individually and/or clustered in groups of 2–3 terms based on the similarity of their definition (the Microsoft Thesaurus was used to identify groupings).

2.2. Term identification

An internet survey was used to identify attributes used to describe a variety of foods. Respondents ($N = 105$) were asked to describe their favorite beverage, snack or dessert as well as their least favorite meal, dessert and snack. Next, they were presented with a list of emotions and asked to describe how they felt when consuming each product by selecting one or more words that described their feelings. Fig. 1 presents the results of this study. Positive emotion terms were used to describe favorite foods while negative terms were associated with least favorite foods. Positive terms were used with higher frequency. Four negative terms were selected 20% of the time or more (bored, disgusted, annoyed, and disagreeable), as compared with 10 positive terms (pleased, good, satisfied, calm, friendly, active, peaceful, enthusiastic, free, affectionate). This initial study confirmed the use of positive emotions to describe reactions to liked foods.

2.3. Term categorization and selection

In an effort to understand consumer's use of these emotion terms, we conducted an internet study in which 200 respondents were asked to categorize emotions, as they relate to food, as positive, negative, both positive and negative or neither positive nor negative. The objective of this study was to identify those terms that are more clearly understood by most consumers as compared with those terms that are unclear or may have different interpretations depending on the individual and/or situation. Terms selected >60% were categorized as positive or negative. In addition, there were terms that were less clearly positive and negative (50–59% frequency). Terms selected less than 50% of the time as positive or negative were grouped as inconclusive. The results are shown in Table 1. Of the 80 terms evaluated, 32 were positive (25 clearly positive and 7 not as clearly positive) and 27 were negative (17 clearly negative and 10 not as clearly negative), leaving 21 terms with no clear classification. These emotions were deemed unclassifiable because more than 50% of the participants rated the emotion neither positive nor negative or both positive and negative. Therefore the emotion did not clearly belong in either positive or negative categories. We concluded that people vary in their perception of emotional terms as positive or negative, making the task of developing a standard measure of emotions for consumers more challenging. We are still identifying what are the factors that may result in this disagreement, i.e.: consumer demographic and/or psychographic differences as well as the food and/or context in which the food may be consumed. The negative terms from this test used in the final questionnaire were disgusted, bored and worried; and also aggressive, mild, quiet, tame, daring, guilty and wild from the unclear classification. The negative terms selected were more frequently used by consumers. Some of the terms classified as unclear were selected based on consumer use for specific product categories/profiles (aggressive, mild, daring, wild); the other terms are part of the sensation seeking classification for the MACCL-R questionnaire which we found applicable given some of the current food trends such as bold flavors, unusual flavor combinations, novel flavors and ethnic cuisines.

The goal for questionnaire length was not to exceed 10–15 min. to complete an internet survey, and <30 min for a consumer test. The final questionnaire contained 39 emotion terms.

Table 1
Consumer classification of emotions. Consumers categorized emotions into positive, negative, both positive and negative, neither positive nor negative. The emotions were then grouped into three distinct categories: Positive, negative or unclear. **Bolded** terms are used in the current ballot.

Positive	More positive	Negative	More negative	No clear classification
Adventurous	**Active**	Angry	Afraid	**Aggressive**
Blissful	**Affectionate**	Annoyed	Alone	Bewildered
Comfortable	**Calm**	Bad	**Bored**	Craving
Content	Carefree	Cruel	Destroyed	Critical
Energetic	Irresistible	Disagreeable	Fearful	**Daring**
Enthusiastic	Satiating	Discouraged	Lazy	**Eager**
Free	**Secure**	**Disgusted**	Lost	**Guilty**
Friendly		Irritated	Nervous	**Mild**
Glad		Lonely	Tense	Naughty
Good		Mean	**Worried**	**Polite**
Good-natured		Miserable		**Quiet**
Happy		Nauseated		Shaky
Interested		Rejected		Shy
Joyful		Sad		**Steady**
Loving		Suffering		Surprised
Merry		Sunk		**Tame**
Nostalgic		Tormented		Timid
Peaceful				**Understanding**
Pleasant				Underwhelmed
Pleased				**Wild**
Relaxed				Young
Satisfied				
Tender				
Warm				
Whole				

Criteria for term selection:

(1) Frequency of use. Terms were selected based on a $\geqslant$20% frequency of use on a checklist questionnaire.
(2) Term categorization as positive or negative. Some of the terms that consumers were not able to classify as positive or negative were eliminated from the questionnaire.
(3) Consumer feedback regarding their appropriateness to food testing. Consumers provided feedback on which terms were appropriate when testing with foods as well as provided new terms that might have been missing from existing emotion questionnaires.

As testing progressed, respondents were given an opportunity to comment on the test approach. Comments associated with the test format suggested that the approach was different and fun. One or two respondents in each test (n of 100 or more) found some of the terms offensive, specifically when the original questionnaire included terms associated with depression and anxiety, and questioned the objective of the test. This small percentage of questioning responses needs to be minimized in the commercial setting. Negative terms associated with depression (alone, destroyed, lonely, lost, miserable, rejected, and suffering), hostility (annoyed, critical, cruel, disagreeable, furious, and mean) and anxiety (afraid, fearful, shaky, and tense) were excluded from the ballot. Three negative or non-classifiable terms (calm, guilty and nostalgic) were included in the ballot based on specific consumer feedback. The current emotion list of 39 terms is presented in the next section.

3. Method for scaling of emotions

3.1. Checklist questionnaire

In initial testing, consumers chose the emotions to describe their feelings about a product in the hope that this fast check-all-that-apply method would produce meaningful results in the commercial testing context (Fig. 2). The checklist approach was useful for differentiating products such as flavored crackers with different flavor profiles (Fig. 3). In this case we were able to differentiate 4 products based on their emotion profile. One of the products (Flavor 3) was clearly different using Analysis of Variance (GLM procedure) and lower in many of the emotions compared to the other products. We then experimented with a rating scale approach for emotions, in the hope that scaling emotions would provide additional information which would be useful in product development decisions.

3.2. Rating questionnaire

The next step was to measure emotion intensities using a 5-point intensity scale from 1 = not at all to 5 = extremely (Fig. 4). This ballot was designed to differentiate among products as well as within product variations and has been named the EsSense Profile™. In addition, a 9-point hedonic scale was incorporated into the ballot to evaluate overall acceptability of the product and provide an anchor to current consumer testing methods. This hedonic scale was added to both the checklist and rating ballot. This test approach was used in an internet survey with 149 participants to differentiate various product categories (Fig. 5) such as pizza, chocolate, vanilla ice cream, fried chicken and mashed potatoes and gravy. Pizza and chocolate produced the strongest emotions based on Analysis of Variance. The terms active, adventurous, affectionate, whole, and loving were highest in intensity for chocolate. Pizza was highest in satisfied, both pizza and chocolate for energetic, enthusiastic, free, friendly, good, good-natured, interested, pleased and pleasant. Mashed potatoes was lowest for guilty, while chocolate, pizza, and fried chicken were highest for guilty. This test allowed us to conclude that the rating ballot was useful in differentiating a variety of food products.

This method was also tested with variations within the same product (Fig. 6) such as salty snack crackers. In this CLT (n = 109) sample 1 resulted in higher calm and mild emotions, while samples 2 and 3 rated higher in aggressive and sample 2 rated higher in eager. The results of this test concluded that a rating ballot was useful in differentiating flavor variations of the same product. Data from this ballot were evaluated using Analysis of Variance (GLM procedure) in all future tests.

Please taste (*product name*) # xxx now.

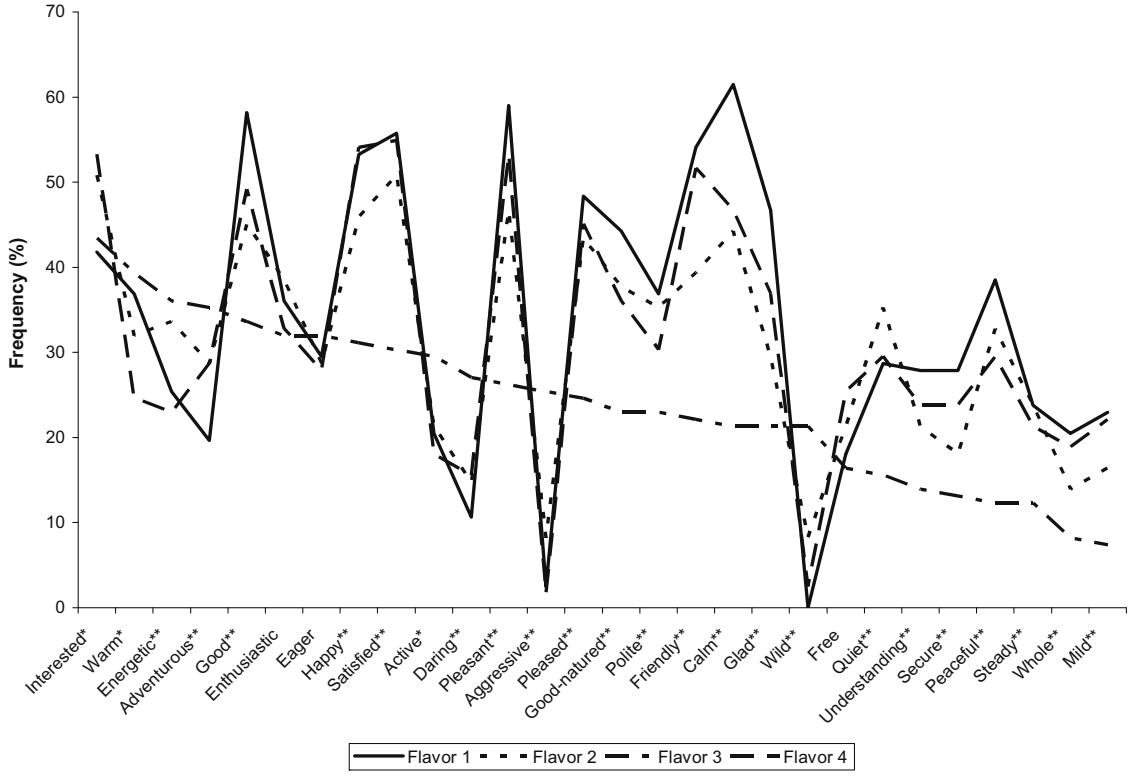
How much you LIKE or DISLIKE (*product*)?

Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
❑	❑	❑	❑	❑	❑	❑	❑	❑

Please select the words which describe how you **FEEL RIGHT NOW**. *Select all that apply.*

☐ Active	☐ Glad	☐ Pleasant
☐ Adventurous	☐ Good	☐ Polite
☐ Affectionate	☐ Good-natured	☐ Quiet
☐ Aggressive	☐ Guilty	☐ Satisfied
☐ Bored	☐ Happy	☐ Secure
☐ Calm	☐ Interested	☐ Steady
☐ Daring	☐ Joyful	☐ Tame
☐ Disgusted	☐ Loving	☐ Tender
☐ Eager	☐ Merry	☐ Understanding
☐ Energetic	☐ Mild	☐ Warm
☐ Enthusiastic	☐ Nostalgic	☐ Whole
☐ Free	☐ Peaceful	☐ Wild
☐ Friendly	☐ Pleased	☐ Worried

Fig. 2. Finalized consumer ballot including overall acceptability and emotion check list.



*, ** Indicate a significant difference at p≤ 0.05, 0.01

Fig. 3. Emotion profiles comparing four products in the same food category (flavored crackers). Study was completed via CLT using a checklist approach.

3.3. Emotion list order

The emotion terms are presented in alphabetical order (as shown in Fig. 4) so consumers can get acquainted with the ballot more quickly and shorten the task over each sample evaluation. We compared this alphabetized approach with a randomized attribute presentation and found that the results were similar (correlation coefficient = 0.99). This suggests that the order does not impact the results and we would expect that keeping the attributes in the same order would make the task easier for the participants. However, those applying this questionnaire in different contexts than we used, would want to check for order effects.

4. Consumer methods and protocols for testing emotion data

Data were collected via internet survey, CLT and home use tests. Home use tests will not be discussed in this paper.

How much you LIKE or DISLIKE (name of the product)?

Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
❑	❑	❑	❑	❑	❑	❑	❑	❑

Please taste (product name) # xxx now.

Below you will find words which describe different kinds of moods and feelings.
Using the terms listed, please describe how you ***FEEL RIGHT NOW***. Please rate each feeling.

Feeling	Not at all	Slightly	Moderately	Very	Extremely
Active	1	2	3	4	5
Adventurous	1	2	3	4	5
Affectionate	1	2	3	4	5
Aggressive	1	2	3	4	5
Bored	1	2	3	4	5
Calm	1	2	3	4	5
Daring	1	2	3	4	5
Disgusted	1	2	3	4	5
Eager	1	2	3	4	5
Energetic	1	2	3	4	5
Enthusiastic	1	2	3	4	5
Free	1	2	3	4	5
Friendly	1	2	3	4	5
Glad	1	2	3	4	5
Good	1	2	3	4	5
Good-natured	1	2	3	4	5
Guilty	1	2	3	4	5
Happy	1	2	3	4	5
Interested	1	2	3	4	5
Joyful	1	2	3	4	5
Loving	1	2	3	4	5
Merry	1	2	3	4	5
Mild	1	2	3	4	5
Nostalgic	1	2	3	4	5
Peaceful	1	2	3	4	5
Pleased	1	2	3	4	5
Pleasant	1	2	3	4	5
Polite	1	2	3	4	5
Quiet	1	2	3	4	5
Satisfied	1	2	3	4	5
Secure	1	2	3	4	5
Steady	1	2	3	4	5
Tame	1	2	3	4	5
Tender	1	2	3	4	5
Understanding	1	2	3	4	5
Warm	1	2	3	4	5
Whole	1	2	3	4	5
Wild	1	2	3	4	5
Worried	1	2	3	4	5

Fig. 4. Consumer ballot of overall acceptability and emotion ratings (EsSense Profile™).

4.1. Central location tests (CLTs)

CLTs were conducted in the typical format for McCormick and have been reported in previous publications (Henriques, King, & Meiselman, 2009; King, Meiselman, & Henriques, 2008; King, Meiselman, Hottenstein, Work, & Cronk, 2007; King, Weber, Meiselman, & Lv, 2004). Consumers were recruited according to standard consumer methodology (see Meilgaard, Civille, & Carr, 2007). The screening criteria included gender, age, product category consumption and or specific product consumption. Most CLT studies included approximately equal percentages of males and females, and the age range was from 18 to 65 years of age. Basically consumers are screened and recruited via internet and/or phone based on being a user of the specific product or the product category. Consumers report to the McCormick central test location for an assigned appointment. Testing commonly lasts from 15 to 30 min. Consumers are compensated monetarily for their participation. Consumers live in the Baltimore or southern Pennsylvania area. Samples for CLT were commercial products as well as products under development. Typically, a small portion of a product was presented to consumers; for cracker products this was typically 2–3 crackers or one biscuit depending on the size of the product. The data were collected via computer. Since emotion is an immediate response to a referent, in this case, food, we measured overall acceptability and emotions while consuming each sample, for a larger sample, or immediately after consuming a small portion of the sample. A 2–3 min break between samples is enforced, as well as palate rinsing with filtered water, and unsalted crackers. The amount of time required to evaluate each sample averaged 2–4 min.

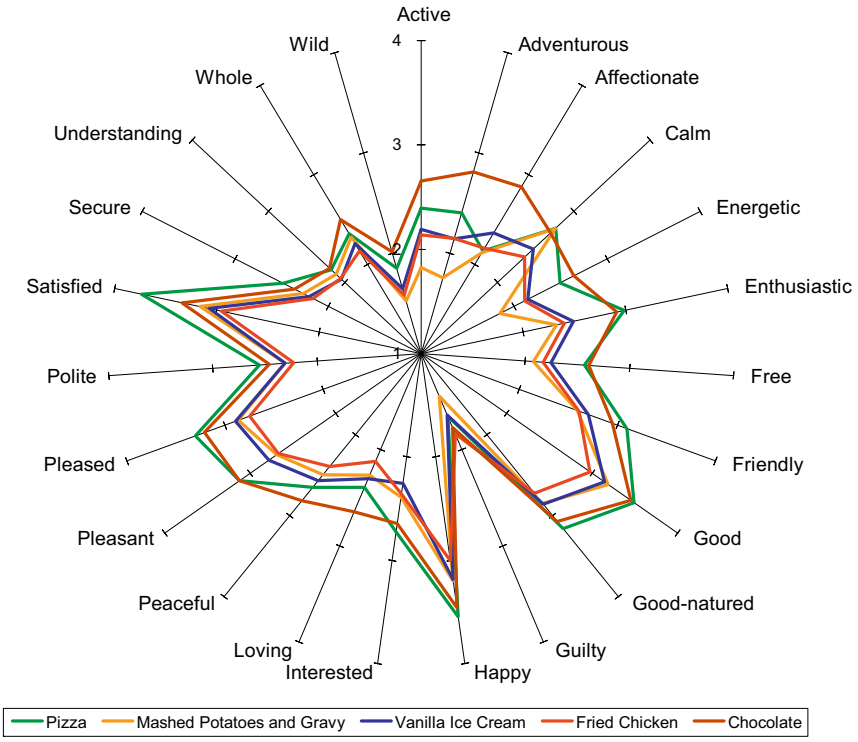
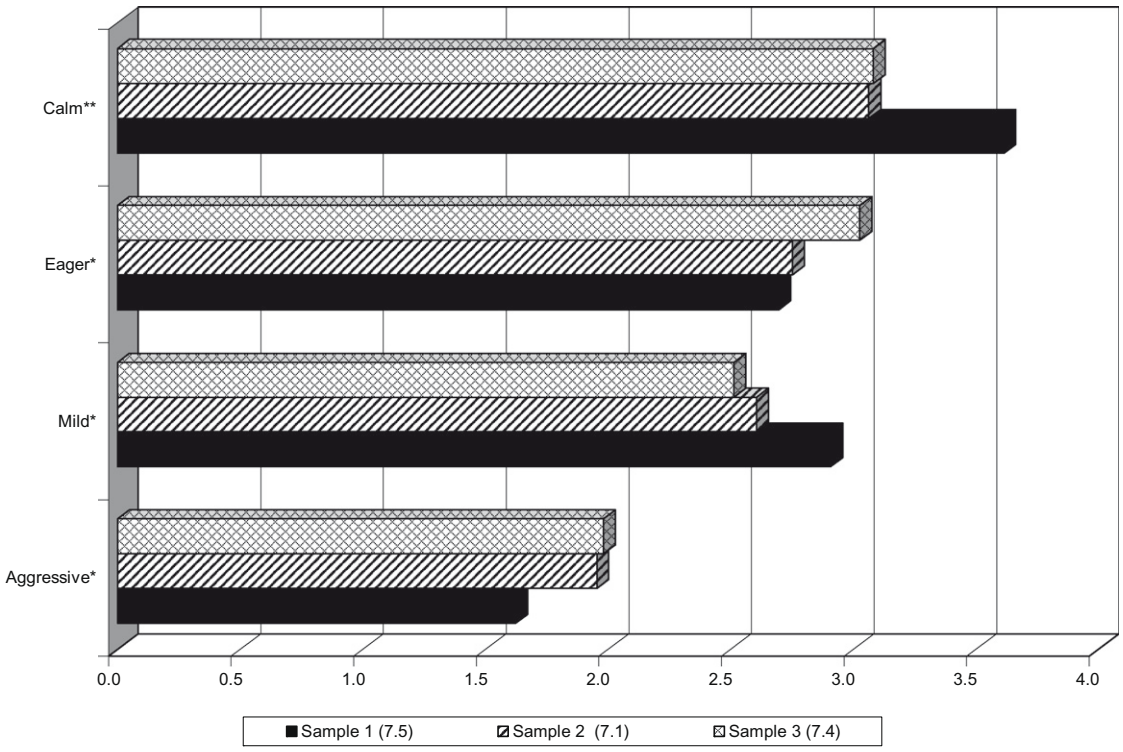


Fig. 5. EsSense Profile™ for different foods using an internet study ($n = 143$) using a rating scale where 1 = not at all and 5 = extremely. The spider chart shows those attributes that resulted in statistically significant difference among products ($p \leqslant 0.05$).



*, ** Indicate a significant difference at p ≤ 0.05, 0.01

Fig. 6. EsSense Profile™ for three flavors of salty flavored crackers. Number in parentheses next to the sample key indicates the overall acceptability score.

4.2. Internet studies

Potential participants were contacted via the internet from a consumer database developed by McCormick. Screening criteria include gender, age and product category consumption and/or product consumption. The screening criteria for product use depended on the specific product. Approximately 2000 are contacted per study from around the United States. Test completion averages

25%. Each survey lasts 10–15 min. A select number of participants are compensated monetarily or using McCormick product based on random selections.

5. Impact of product frequency of use

Emotion intensities increase as the frequency of product use increases (Fig. 7). Non-product users have a different emotion profile altogether focused on negative emotions, while product users in general have stronger positive emotions.

6. Discussion

This paper has detailed our steps in developing a questionnaire to measure emotions in a commercial setting. The process began with the identification of emotion terms and the choice of a scaling system. We then applied the questionnaire to products in a commercial setting, to demonstrate its ability to describe products and to discriminate among products. We have laid the foundation for testing and measurement of emotion for food, by modifying approaches used in the psychiatric field, and we realize that we are just beginning to understand how to measure emotions in a commercial context.

The development of a new questionnaire to measure mood and emotion in a product development situation has produced an instrument which gives new information which is not normally captured by measuring acceptability. This method has been designed to apply to commercial testing which uses product category users and/or product users and potential new product concepts. This work is therefore in line with a number of authors who have argued that measurement of acceptability is not a sufficient benchmark for product development and testing. Koster & Mojet, 2008 have argued that we need to move beyond acceptance testing, and move beyond acceptance testing within a central location test environment. The present instrument to measure emotion works within the laboratory (CLT) and also internet testing. Thomson (2008) has also argued that concepts such as satisfaction are more appropriate than simple acceptance for commercial products, and that both brand and packaging need to be considered along with the product. We suggest that the combination of emotions and acceptability taps into some of the same dimensions which produce satisfaction. Further research will be needed to relate emotions to product satisfaction.

While the measurement of emotions gives new information beyond acceptance, it is nevertheless interesting to relate emotions and acceptance. The data collected to date, not all of which is shown in this paper, suggest that emotional intensity sometimes tracks with acceptance, and sometimes differs. For example, we show an example of highly acceptable products with different emotional intensities (Fig. 6).

Thus emotions might help to explain acceptance data and why acceptance data might not always predict market success. For this product, it is suggested that the acceptance does not track with the emotion profile.

We began the search for a questionnaire useful in the commercial context by examination of standardized mood and emotion questionnaires from the clinical/psychiatric environment. We tested these emotion terms on the internet and in person with con-

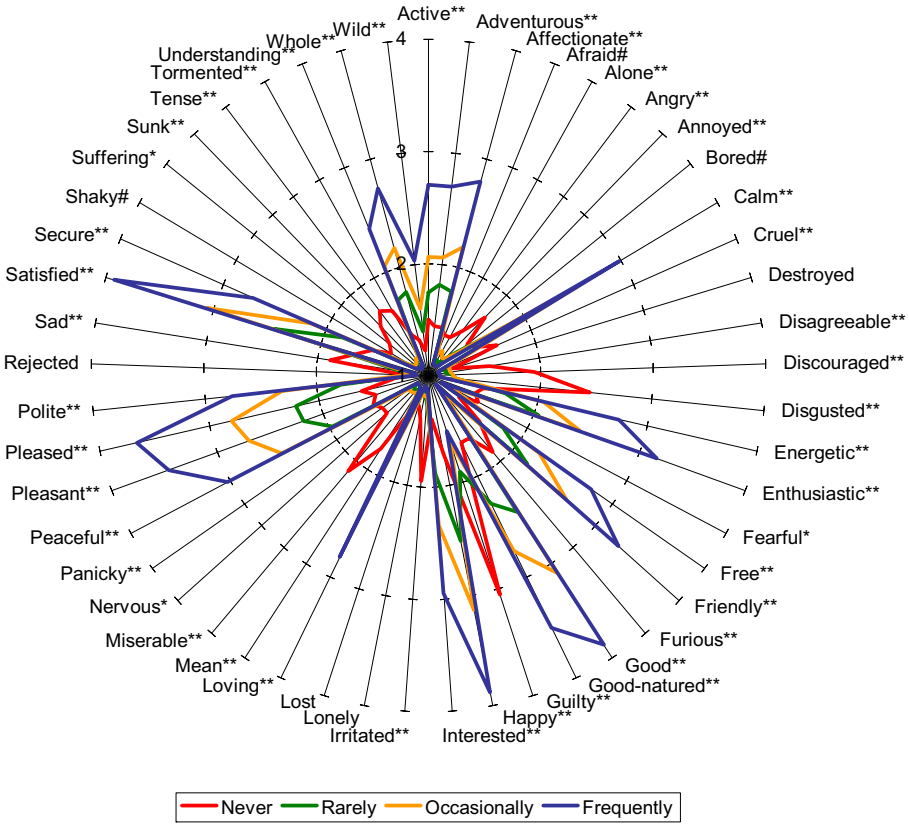


Fig. 7. Effect of frequency of use on emotion response. Consumer profiles averaged over five different products (pizza, mashed potatoes and gravy, vanilla ice cream, fried chicken, and chocolate). Non-users (shown in red) have a different and more negative emotional profile than users. Frequent users (blue) have the strongest positive emotions. Emotions were measured using the full list of emotions prior to the EsSense Profile™.

sumers. We observed a number of things. The vast majority of self reports about foods are positive. This observation is in agreement with Gibson (2006) and Desmet and Schifferstein (2008), both of whom underscored that eating is basically a positive experience for healthy people. Standardized questionnaires are a good source of emotions for developing a questionnaire. However, the standardized questionnaire terms had to be supplemented with additional terms collected from consumers thinking about or experiencing food. In addition, a number of terms from the standardized questionnaires were eliminated because they were not appropriate for foods, that is, consumers did not use them when describing their emotional reactions to foods. We do not claim that the present list is in any way the "final list of emotions" to be used with any food, or even more, with any consumer product. At present, it is not clear whether one comprehensive list of emotions will cover all food categories. Different classes of foods will require modification of the emotion terms. Some terms will need to be added and some subtracted. Researchers investigating a large range of beverages, or a large range of (simple and complex) main dishes might need to both reduce and add to this emotion list. However, this list is probably a good place to start for those who wish to study the impact of foods on emotions.

One clear outcome of the present work is that a large number of emotions appear to be needed to fully characterize the emotional response to foods. In our research we have observed as many as 36 out of 39 emotions producing significant differences between testing conditions/products. This suggests that techniques which use a small number of terms are missing potentially valuable information. This effect could be exacerbated if the short lists contain both positive and negative emotions. For example, the relatively recent facial recognition systems for emotions depend on small lists of emotions, including many negative emotions. Thus we recommend the use of a longer list of emotions when starting work with a new product category; experience-to-date suggest that this is necessary to fully present the emotional response of consumers to capture the potential emotional differences associated with the product.

The present results demonstrate that a key factor in measuring consumer emotions associated with products is whether the consumer is a product user. Commercial research depends on product users or product category users. The present results demonstrate that users produce different emotional profiles than non-users; product users have positive emotional responses to products, while non-users have more negative responses. This is in line with our results which demonstrated that consumers who like the product (score of 6 or higher in a 9-point hedonic scale) have different (and positive) emotional profiles from consumers that do not (less than 5 in the 9-point hedonic scale). These consumers have stronger negative emotional profiles. This is probably one of the main reasons that commercial emotion research should be expected to be different from academic emotion research involving products. When consumers are selected randomly or by convenience, rather than by product use, it would be expected that the consumer group would contain both users and non-users, and the emotional profile would therefore contain both positive and negative emotions.

We have also demonstrated that the measurement of emotions can provide an advanced way of describing or segmenting products. We have observed that products can be labeled by the emotions they evoke; for example, some products are calming products while others are aggressive products. In addition, emotions provide a sensitive measure which differentiates products. Sometimes these are related to acceptance and sometimes they are not as previously discussed.

The emotion questionnaire which we have developed fills a gap in the absence of a published commercial emotion test. Existing questionnaires, which largely come from clinical psychiatry do not fill that gap. The newly developed facial scales also do not fill the gap in an emotion test for commercial food testing. Food use/eating by consumers is a positive experience, and requires positive emotions for measurement. Further, the facial scales depend on a small number of emotional categories, and we recommend that a larger number of emotions provide more detail and differentiation of consumer response to food products. And finally, our method is practical in application and requires no additional equipment more than that currently used for consumer testing (paper and pencil or computerized data entry system).

For some time, sensory practitioners within the commercial sector have looked for better means to connect with marketing (Moskowitz, first Pangborn conference). The measurement of emotions might help in the further connection of sensory science and marketing. The measurement of emotions also serves as a further tool to support product development. Measurement of emotions allows us to compare existing products, and measure the emotional response to product prototypes. In these ways, the measurement of emotions can provide a common lexicon for sensory and marketing to communicate and for product development that meet a marketing need. Emotions can be the common language to bring these areas together.

Acknowledgement

We would like to thank Marianne Gillette and Hamed Faridi for their support and encouragement throughout this research. Special thanks to Denny McCafferty, Diego Serrano and Lindsay Millard for their technical collaboration in creating a practical method for use in product development. We appreciate Danielle Creighton, Nancy Lensch and Kevin Taylor for their support for all the consumer testing activities.

I would like to give special recognition to Dr John J Powers and the influence he has had on my professional career. I would like to publish this paper to acknowledge his contributions and furthering of the Sensory field. He was my mentor during my schooling years but more importantly, he has been a source of inspiration. Thank you.

References

Desmet, P. M. A., & Schifferstein, H. N. J. (2008). Sources of positive and negative emotions in food experience. *Appetite, 50*, 290–301.

Eertmans, A., Victoir, A., Notelaers, G., Vansant, G., & Van den Bergh, O. (2006). The Food Choice Questionnaire: Factorial invariant over western urban populations? *Food Quality and Preference, 17*, 344–352.

Gibson, E. L. (2006). Emotional influences on food choice: Sensory, physiological and psychological pathways. *Physiology and Behavior, 89*, 53–61.

Henriques, A. S., King, S. C., & Meiselman, H. L. (2009). Consumer segmentation based on food neophobia and its application to product development. *Food Quality and Preference, 20*, 83–91.

King, S. C., Meiselman, H. L., & Henriques, A. (2008). The effect of choice and psychographics on the acceptability of novel flavors. *Food Quality and Preference, 19*(8), 692–696.

King, S. C., Meiselman, H. L., Hottenstein, A. W., Work, T. M., & Cronk, V. (2007). The effect of contextual variables on food acceptability: A confirmatory study. *Food Quality and Preference, 18*, 58–65.

King, S. C., Weber, A. J., Meiselman, H. L., & Lv, N. (2004). The effect of meal situation, social interaction, physical environment and choice on food acceptability. *Food Quality and Preference, 15*, 645–654.

Koster, E. P., & Mojet, J. (2008). Boredom and the reasons some new products fail. In H. MacFie (Ed.), *Consumer-led product development* (pp. 262–280). Cambridge, England: Woodhead Publishing Ltd..

Laros, J. M., & Steenkamp, E. M. (2005). Emotions in consumer behavior: A hierarchical approach. *Journal of Business Research*, 1437–1445.

Lieberman, H. R. (2005). Human nutritional neuroscience: Fundamental issues. In H. R. Lieberman, R. B. Kanarek, & C. Prasad (Eds.). *Nutritional neuroscience* (pp. 3–11). New York: Taylor and Francis.

McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). *Profile of mood states*. San Diego: Educational and Industrial Testing Service.

Meilgaard, M., Civille, G. V., & Carr, T. B. (2007). *Sensory evaluation techniques* (4th ed.). New York: CRC Press.
Rousset, S., Dessi, V., Juillard, E., Schlich, P., & Droit-Volet, S. (2005). Emotions generated by meat and other food products in women. *British Journal of Nutrition, 94*, 609–619.
Smit, H. J., & Rogers, T. J. (2002). Effects of 'energy' drinks on mood and mental performance: Critical methodology. *Food Quality and Preference, 13*, 317–326.
Smith, A. P., Clark, R., & Gallagher, J. (1999). Breakfast cereal and caffeinated coffee: Effects on working memory, attention, mood, and cardiovascular function. *Physiology and Behavior, 67*, 9–17.
Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: The food choice questionnaire. *Appetite, 25*, 267–284.
Thomson, D. (2008). SensoEmotional optimisation of food products and brands. In H. MacFie (Ed.), *Consumer-led product development* (pp. 281–306). Cambridge, England: Woodhead Publishing Ltd..
Zuckerman, M., & Lubin, B. (1965). *Manual for the multiple affect adjective check list*. San Diego: Educational and Industrial Testing Service.
Zuckerman, M., & Lubin, B. (1985). *The multiple affect adjective check list revised*. San Diego: Educational and Industrial Testing Service.