Comparing a standardized to a product-specific emoji list for evaluating food products by children

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Abstract

There is a growing interest in the emotional associations of children to food products in order to better understand their preferences. Recently, emoji were suggested as a novel way to assess these emotional associations. In this study, 172 children aged 8-11 years evaluated the emotional profile of five biscuits in a check-all-that-apply task, where half of the subjects (n=87) evaluated the applicability of 38 emoji obtained from a standardized emoji list, while the other half (n=85) worked with 20 emoji from a product-specific emoji list. A similar average number of emoji were used by the participants for the emotional profiling of the samples in both approaches. Results showed that the product-specific emoji list was better able to discriminate between product samples compared to the standardized emoji list. Several emoji were even discriminating between similarly liked samples when using a product-specific emoji list, while only one emoji was able to discriminate between equally-liked samples when using a standardized emoji list. Both approaches produced similar emotional spaces and product configurations, although one needs to consider that the first dimension of the correspondence analysis for the product-specific emoji list explained over 90% of the total variance against 60% for the standardized list. While more research is recommended, this study indicates that a product-specific emoji list could facilitate the emotional product discrimination by children.

Keywords

Child; Biscuit; Emoji; Check-all-that-apply (CATA); Hedonic

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Introduction

Sensory and consumer research has a growing interest in the measurement of emotions in order to have a broader perspective on consumer's food experience (Cardello, et al., 2012; Meiselman, 2015; Thomson, Crocker, & Marketo, 2010). These measurements might discriminate between food products when the sensory acceptability is similar (King & Meiselman, 2010; Ng, Chaya, & Hort, 2013; Schouteten, et al., 2015b; Spinelli, Masi, Zoboli, Prescott, & Monteleone, 2015). Moreover, research has suggested that the inclusion of emotional conceptualizations helps to better predict actual food choice in blind and informed evaluation conditions (Dalenberg, et al., 2014; Gutjar, et al., 2015).

Self-reported measurements have been primarily applied to study food-evoked emotions using Check-All-That-Apply (CATA)-based questionnaires (Lagast, Gellynck, Schouteten, De Herdt, & De Steur, 2017). These word-based questionnaires either work with a standardized term list or use a product-specific term list (Schouteten, et al., 2015b). The EsSense Profile™ (King & Meiselman, 2010), containing a list of 39 terms to measure consumers' emotional responses to food products, is currently the mostly used standardized list (Lagast, et al., 2017). Although it has been originally developed on snack products (e.g. chocolate, crackers, pizza, ice cream), it has been applied to a variety of food products during the last couple of years such as blackcurrant squashes (Ng, et al., 2013), kiwifruit (Jaeger, Cardello, & Schutz, 2013), coffee (Bhumiratana, Adhikari, & Chambers Iv, 2014), breakfast drinks (Gutjar, et al., 2015) and green tea beverages (Pramudya & Seo, 2017). Product-specific lists on the other hand, are consumer-defined lists obtained though first selecting emotional terms during a pretest (Ng, et al., 2013). These product-specific, consumer-defined lists have been applied to a wide range of food products such as chocolate (Thomson, et al., 2010), black-currant squashes (Ng, et al., 2013), (Bhumiratana, et al., 2014), orange juice (Thomson & Crocker, 2014), cheese (Schouteten, et al., 2015a) and burgers (Schouteten, et al., 2016).

However, several points of concerns have been raised concerning the ecological validity of using word-based questionnaires. First, prior research pointed out that although most participants found it intuitive and easy to associate words with food products, some participants found it rather a strange task to perform(Jaeger, et al., 2013). Moreover, some participants are not aware of certain emotions and do not fully comprehend the meaning of the listed emotional terms (Jaeger, et al., 2013; Köster & Mojet, 2015). Consumers also seldom use words to express their emotions of food products (Köster & Mojet, 2015). Therefore, recently emoji have been introduced as an alternative way to assess food-elicited emotions by consumers (Jaeger, Vidal, Kam, & Ares, 2017). Moreover, Swaney-Stueve, Jepsen, and Deubler (2018) showed that emoji can be applied as an alternative form of a facial scale to assess children's liking of food products.

Given that emoji are widely used nowadays on a wide variety of mobile devices and are even used in popular culture (e.g. The Emoji Movie, Sony Pictures Animation), the use of emoji also provides opportunities for research with children, whom often are accustomed to express their feelings with these icons in real-life communication. Gallo, Swaney-Stueve, and Chambers (2017b) examined which emoji best expressed how they felt in response to self-selected favorite, least favorite, and "just okay" foods before, during, and after recalled consumption occasions. Moreover, children evaluated the applicability of several emoji on food product packages and food products. Based upon these data and focus group discussions, Gallo, et al. (2017b) distilled a list of 38 emoji which were considered appropriate for food evaluations by children. In a follow-up study, Gallo, Swaney-Stueve, and Chambers (2017a) compared the use of emoji by children to evaluate food images versus actual tasting of food products. They found that tasting the foods resulted in increased use of positive emoji and decreased use of negative emoji. Schouteten, Verwaeren, Lagast, Gellynck, and De Steur (2018) showed that emoji could be applied to obtain discriminatory emotional profiles between similar samples within a product category (namely, speculoos biscuits) when working with a children population. Moreover, they found that including emoji measurements help to better predict actual food choice of the children compared to the sole inclusion of overall liking.

The growing interest in the use of emoji of food products bears the questions whether a standardized list or a product-specific list should be preferred when working with children. A standardized list has the advantage that it is cheaper to use and saves time, but normally contains many items so that no potentially relevant items may be missed. Jaeger, et al. (2013) stipulated that standardized verbal lists could generate a lower quality of data compared to product-specific lists, due to boredom and fatigue of adult respondents. Given the lower attention span of children and need for age-appropriate methods to examine children's food preferences (Laureati, Pagliarini, Toschi, & Monteleone, 2015), the goal of this study is to compare the performance of a standardized emoji list with a product-specific emoji list using a children population.

2. Materials and methods

2.1. Experimental design

This study opted to work with a between-subjects design. The first group of children evaluated their emotional response using a standardized list of 38 emoji based upon research from Gallo, et al. (2017b). A second group of children from the same school used a product-specific emoji lexicon (20 emoji) which was established after a pretest with prior research. This pretest was a two-step procedure in which children first indicated the applicability of emoji for a range of biscuits and thereafter researchers made the final selection (see 2.4.). For both groups, the CATA approach was used whereby children were asked to check all the emoji they found applicable to describe how they felt after consuming a particular sample. Children were assigned to one of the two groups based upon their school class, while school classes were randomly assigned to each condition.

2.2. Participants

Children from the 4th, 5th and 6th year (8-11 years old) of an elementary school located in Belgium were recruited for this test. A signed parental informed consent was necessary to be eligible to participate in this study and the child had the opportunity to withdraw at any time of the study. Moreover, only children who did not have any allergies to the ingredients of speculoos (wheat, soy and gluten) were considered suitable as participants. Testing took place in the refectory of the school, with one class at the time.

In total, 87 children fully completed the questionnaire with the standardized emoji lexicon and 85 children fully filled in the questionnaire containing the product-specific emoji list. Socio-demographic variables and information about the internet usage, number of mobile devices owned and emoji usage of each population sample are listed in Table 1. Statistical analyses showed no significant differences between the two groups for any socio-demographic or behavioral characteristic.

Insert Table 1 around here

2.3. Product samples

The focal product of this study were speculoos biscuits, a traditional biscuit in Belgium prepared with several spices including cinnamon. Five commercially available samples were selected based upon prior research to represent the range of sensory variability in the Belgian market. While speculoos biscuits are traditionally prepared with wheat flour, the last years speculoos came available made with whole wheat or multigrain wheat as response to the request for more healthy food products. The researchers selected three samples of speculoos biscuits made with wheat (W1, W2 and W3), one sample made with whole wheat (WW) and a multigrain sample (M) containing wheat, rye, spelled, oats and barley. Samples were from the same batch and had a similar shelf-life to limit potential product differences between the participants. All samples were bought in local supermarkets.

The samples were served in odor-free transparent plastic containers (coded with 3-digit random numbers) at room temperature (21 °C ± 1 °C) following a design balanced for presentation order and carry-over effects (Williams Latin Square design) (MacFie, Bratchell, Greenhoff, & Vallis, 1989). Serving size was sufficient to allow three bites per sample and water was available for rinsing.

2.4. Product-specific emoji lexicon development

Prior to the main test, a product-specific emoji lexicon was developed. For the selection of emoji a similar procedure was applied as when selecting emotional verbal terms (De Pelsmaeker, Schouteten, & Gellynck, 2013; Jiang, King, & Prinyawiwatkul, 2014). First, a group of 20 children (10 boys and 10 girls aged 7-12 years old) individually indicated which emoji they found applicable (CATA) for describing how they felt for each of five speculoos biscuits. The CATA-list with emoji during the pretest was obtained from previous research containing all emoji from two prior research studies with emoji (Gallo, et al., 2017b; Jaeger, Lee, et al., 2017). Also, children had the opportunity to add any missing emoji and provide written feedback. After the individual assessment of the speculoos samples, the children were grouped in 3 groups to shortly provide feedback on the task. Next, the researchers (J.J. Schouteten and X. Gellynck) made the final selection to obtain the product-specific emoji lexicon. The main criteria were the number of participants selecting an emoji (≥10%) and the ability of the emoji to discriminate between the different products (e.g., not same frequency for each product) which have been applied in previous research with children (De Pelsmaeker, et al., 2013; Schouteten, De Steur, Lagast, De Pelsmaeker, & Gellynck, 2017). Also, when children indicated that emoji had a similar meaning for them (e.g. 😜, 😛 and 😝) the most common emoji (based upon feedback of the children during the focus groups) was used. The researchers included positive, negative and neutral emoji in the final selection in order to have a complete overview of how children experienced the samples (Gallo, et al., 2017b). Based upon the selection, a final product-specific lexicon of 20 emoji was obtained (see Figure 1b). Permission was obtained from Apple Inc. to use these emoji for scientific research.

Insert Figure 1a and 1b around here

2.5. Questionnaire

Children were first introduced to the task by the researchers and each child completed the questionnaire individually. Before starting, the children were informed of the anonymity of the research and were guided through the questionnaire question by question by the researcher. This was done to ensure that every child had sufficient time to complete and understand the questionnaire. Also, the teacher of each class was present during the task to ensure that children were less distracted and to enable them to feel more at ease during the task.

The children were first asked how often they consume speculoos using 6 scale labels ranging from “never” to “daily” (Schouteten, De Steur, Lagast, et al., 2017). Next, participants answered three questions related to internet and emoji usage (Jaeger, Vidal, et al., 2017). They were asked how many devices they owned (desktop computer, laptop computer, tablet/IPad and/or smartphone), how often they used the Internet in general and how frequently they used emoji when sending / posting a message (Table 1).

Children were instructed to take a first bite of a sample to indicate their overall liking of a sample on a 9-point hedonic scale ranging from 1 –dislike extremely to 9 - like extremely. Previous research indicated that children of a similar age to the present study are able to work with this 9-point overall liking scale (Laureati, et al., 2015). Following the hedonic assessment, children were instructed to take another bite of the speculoos sample before checking all the applicable emoji for that particular product sample (Figure 1a and 1b). The instruction for emotional profiling task with emoji was 'Please take another bite of sample XXX. Please check the emoji which you find applicable to describe how you feel right now after consuming sample XXX. (Multiple emoji might be checked)'. . The order of the emoji was not randomized in order to facilitate the task for the children and avoid fatigue. Based upon their class group, they assessed either the standardized or the product-specific emoji list for all product samples during this task. Children were instructed to rinse their mouth with water between tasting the different product samples. Finally, the respondents indicated their age and gender.

2.6. Data analysis

2.6.1. Overall liking data

Linear mixed modelling was performed to uncover significant differences in hedonic ratings across experimental treatments (standardized vs. product-specific emoji list). Treatments, samples and their interaction were specified as fixed effects, whereas consumer was specified as a random effect.

Furthermore, ANOVA was applied on overall liking data for the two questionnaires separately, considering sample as a fixed source of variation and consumer as a random effect. A significance level of 5% was considered. When differences among samples were found, Tukey's test was used for post hoc comparison of means.

2.6.2. Emotional response

The data obtained by the emoji list were analyzed using standard procedures for CATA approach (Meyners, Castura, & Carr, 2013) using SPSS Statistics 25 (IBM, United States of America). Cochran's Q test was used to examine for significant differences in usage frequency for each emoji between the different product samples. If Cochran's Q test revealed a significant difference, a McNemar test was performed to pairwise assess between which samples significant differences in emoji usage frequencies occurred.

Pearson correlation coefficients were computed to examine the relationship between mean overall liking scores and emoji frequency counts.

Correspondence analysis (CA) was carried out to examine the relationship between the samples and the emoji from the CATA questions for the standardized and product-specific list separately (Hair, Black, Babin, & Anderson, 2009). CA was carried out on the frequency table containing the samples and the total frequency of each emoji, considering mean overall liking scores as a supplementary variable. Given that CA only considers overall frequency counts, multiple correspondence analysis (MCA) was carried out in order to also consider individual data from the respondents (Hair, et al., 2009). MCA was performed separately for the data obtained from the standardized and product-specific emoji list. For the MCA, a contingency table was constructed whereby rows represented each consumer assessing each of the 11 products across the 36 emotions (columns) (Ng, et al., 2013).

The Pearson correlation analysis, CA and MCA were performed with R 3.4.2 (R Core Team, 2014) using the R-package FactoMineR version 1.34 for the CA and MCA (Lê, Josse, & Husson, 2008).

2.6.3. Comparison of emotional response between emoji lists

Multiple factor analysis (MFA) was applied to compare the data sets obtained from the standardized and product-specific emoji lists and examine for patterns of attribute correlations (Lê, Pagès, & Husson, 2008; Morand & Pagès, 2006). XLSTAT (Version 2015.1.03.15473, Addinsoft, USA) was used to examine the multivariate product configurations of both datasets for similarities and differences.

3. Results

3.1. Standardized emoji lexicon

3.1.1. Overall liking

Product differences were found in overall liking scores (p<0.001) (Table 2). Product groupings based upon Tukey's HSD multiple comparison test indicated one group of highly liked samples consisting of W2 and W3. Samples W1 and M were moderately liked by the children. Lastly, the wholegrain sample WW (mean value 5.9) was slightly liked by the children but not significantly less compared to the multigrain sample M (mean value 6.3).

Insert Table 2 around here

3.1.2. Emotional response

On average, children used 2.8 emoji (7.5%) for describing how they felt after consuming a sample. The average emoji usage frequency was lowest for the least liked sample WW with 2.5 emoji, and highest for the most-liked sample with 3.3 emoji. On aggregate level, considering all samples, usage frequencies for a specific emoji varied from 0.23 % (😥) to 31.03 % (😜). Given that 😥 was only used once by a single person, this emoji was excluded for further data analysis.

Significant differences between the usage frequency of the emoji were found for 6 of 38 emoji (16%). Mainly positive emoji were discriminative between the different speculoos samples (😜, 😎, 😍, 😋), next to one negative emoji (😖) and one neutral emoji (😑). It is interesting to note that the emoji 😍 was significantly more used for sample W3 compared to sample W2, which shows that this emoji was able to discriminate between these equally high-liked samples.

Insert Table 3 around here

High positive correlations were found between overall liking of the samples and positively valenced emoji (Table 4). Negative correlations were found for neutral and negatively valenced emoji. Overall, the correlation of only 9 emoji with overall liking reached significance (p<0.05). Significant correlations were primarily obtained by positive emoji (😜, 😎, 😛,😉, 😍,😋) with only 2 negative emoji (😩, 😣) and one neutral emoji (😕) showing significant correlations with overall liking scores.

Insert Table 4 around here

The first two dimensions of the CA on the frequency table for the emoji explained over 77% of the inertia. Positively associated emoji were mainly situated on the left side of the CA plot, while the right side of the CA plot contained primarily negative emoji (Figure 2). Therefore, the first dimension of the CA is linked to the valence (positive vs. negative) of the emoji. The spread across the second dimension of the CA is more difficult to interpret. The CA plot shows that the three wheat samples are closely linked with one another at the left part of the plot and closely linked with positive emoji such as 😍 and 😜. The multigrain sample is more linked to neutral emoji (e.g. 😶 and 😦). The lowly liked whole-wheat speculoos is more associated with several negatively valenced emoji (e.g. 😡, 😳 and 😨).

Insert Figure 2 around here

Given that CA only includes the total frequencies of the emoji, MCA was used to also consider individual responses to each emoji and the product configuration. Similar to the CA plot, the first dimension distinguishes according to the valence of the emoji (Figure 3). In contrast to the CA plot, it is more clear in the MCA plot that the second dimension is related to the arousal for the negative emoji. Negative emoji which are more activated (e.g. 😤, 😭) were situated higher compared to lower-activated emoji such as 😞 and 😟. Moreover, it should be noted that negative emoji were situated higher than the neutral emoji. Furthermore, only three emoji (😕, 😊 and 😀) were located in the lower quadrants.

Insert Figure 3 around here

3.2. Product-specific emoji lexicon

3.2.1. Overall liking

As with the standardized emoji lexicon group, significant differences were found in consumers' overall liking for the products ($p < 0.001$) (Table 2). Product groupings indicated by the Tukey's HSD multiple comparison tests were similar, albeit that it should be mentioned that the mean overall liking of the wholegrain sample WW (mean overall liking: 5.9) was significantly higher than the multigrain sample M (mean overall liking: 4.9). Moreover, a linear mixed model found no effect of the type of list (standardized or product-specific) on the overall liking scores ($p = 0.086$).

3.2.2. Emotional response

On average, children used 3.0 emoji (15.2%) to describe their feelings after eating a speculoos biscuit. The average emoji usage frequency was the lowest for the least liked sample WW with 2.5 emoji and the highest for the most liked sample W3 with an average use of 3.9 emoji. Average usage percentages are similar to those obtained from the standardized list. When considering all samples, children used 😩 the least (5.9%) and 👍 the most (36.5%).

Out of the 20 emoji of the list, only three were not able to discriminate between the samples, showing that more emoji of the product-specific list are discriminating compared to the standardized list (85 % vs. 16%). All 6 emoji which were discriminating in the standardized list were also discriminative in the product-specific list. Furthermore, several emoji (😜, 😊, 😐, 👎) were able to discriminate between samples with similar overall liking scores.

Insert Table 5 around here

Similar as with a standardized list, positive emoji were positively correlated with overall liking while negative emoji were negatively correlated with overall liking (Table 6). Only one neutral emoji was listed in the product-specific emoji list (😐), which was negatively correlated with the overall liking. The correlation with overall liking was not significant for only 3 emoji (😊, 😉, 😆) and these were all positively valenced.

Insert Table 6 around here

The CA plot was mainly unidimensional, as the first dimension explained over 90% of the variance (Figure 4). The first dimension divided the emoji according to the valence, with the positive emoji situated on the right and the negative emoji on the left of the CA plot. On the right side, the three biscuits made with wheat were present. These 3 samples were closely associated with positive emoji such as ❤️, 👍 and 😁. The multigrain sample was placed rather in the middle of the plot, without any close links to any emoji. The less-liked whole-wheat sample was located on the left, mainly associated to the neutral emoji 😐. Also, the negative emoji such as 👎 and 😖 were situated closest by the whole-wheat sample.

Insert Figure 4 around here

The MCA explained over 90% of the adjusted inertia (Greenacre & Blasius, 2006), of which 82 % in the first dimension and 9.4 % in the second dimension. Similar as with a standardized list, the first dimension was associated to the valence of the emoji with the neutral emoji located on the left of the MCA plot and the positive emoji grouped on the right of the MCA plot.

Insert Figure 5 around here

3.3. Product configurations

Statistical comparison of the two product configurations (one by the standardized and one by product-specific list) was obtained by applying MFA. Figure 6 shows the variable correlation circle obtained by the MFA comparing emotional responses for the speculoos samples of the standardized and product-specific emoji lists. The first two dimensions of the MFA explained over 75% of the total variance, indicating a good agreement between both approaches. The first dimension was related to the valence of the emoji, with more negatively valenced emoji situated on the left side of the MFA plot while the positively valenced emoji were located on the right of the MFA plot. Samples W2 and W3 showed the largest variance between the two methods across both axes, mainly in terms of product positioning along the second dimension (Figure 7).

Insert Figure 6 and Figure 7 around here

4. Discussion

The objective of this paper was to compare the performance of a standardized and a product-specific emoji list. Overall, the results indicate that a product-specific emoji list is able to obtain more discriminating profiles between the samples.

The standardized emoji list used in this study is based upon 3 focus groups presented in the study of Gallo, et al. (2017b). This list only included facial emoji, consisting of 17 positive emoji, 17 negative emoji and 4 more neutral emoji (😑, 😕, 😶, 😮). As such, it is a more balanced list for the valence compared to the product-specific list. This product-specific list, obtained using a pretest with 20 Belgian children, contained 15 positive emoji, 3 negative and 2 neutral emoji. The criteria for selecting the emoji (selection frequency, discriminatory ability and inclusion of positive, negative and neutral emoji) are similar to those in previous research examining the self-assessed emotional response of food products by children (De Pelsmaeker, et al., 2013; Schouteten, De Steur, Lagast, et al., 2017; Schouteten, et al., 2018). When asking the children about the number of emoji during the pretest, they indicated during the pretest that a list should not contain more than 25 items (some younger children even mentioned around 20). In order to keep the list down to 20 items, only the most common emoji was used when several emoji had a similar meaning according to the children of the pretest (e.g. 😜, 😛 and 😝). A direction for future research is to examine if certain emoji could be grouped in clusters of similar meaning to facilitate the shortlisting of emoji. Given that commercial samples were used in this pretest, it is rather normal that the products are more associated with positive emotions and emoji (Gallo, et al., 2017b; Meiselman, 2015). This product-specific list also contained several non-facial emoji such as ❤️ and 👍. These non-facial emoji are more intuitive, which is interesting when working with (young) children as the meaning of facial emoji might not always be clear (Schouteten, et al., 2018). Moreover, previous research with adults indicated that non-facial emoji (👍 and 👎) were the most frequently used emoji to indicate how they perceive food products (Jaeger, Lee, et al., 2017). However, one needs to consider that these non-facial emoji might be more related to the hedonic appraisal of a product than resembling an emotion. Future research is therefore recommended to examine the impact of non-facial emoji on assessing children's evoked emotions. One non-facial emoji (👎) was also able to discriminate between equally liked samples, but future research is needed to examine the potential influence of non-facial emoji on the overall acceptance and the possibility to discriminate between samples.

In the product-specific emoji group, the overall liking score of the multigrain sample significantly differed from all the wheat samples which was not the case in the standardized emoji group. ~~Thus, it appears that children discriminate slightly better for hedonic liking when using a product-specific list~~However, it should be noted that the ranking of the samples does not change and there is no significant effect of the cluster thus this difference is likely due to the difference in composition of the panels. Overall, it can be concluded that there is no effect of type of list on the overall liking. While research with adults found little evidence that asking emotional associations (with words) could influence hedonic liking (King, Meiselman, & Carr, 2013; Schouteten, Gellynck, et al., 2017), it is unclear if this is the case when working with emoji and especially using a children population. In this study, hedonic liking was assessed before the emotional profiling task as recommended by King, et al. (2013) in order to limit the potential influence of the emoji on the hedonic liking. It could be that the proportion of positive and negative emoji played a role in discriminating the samples regarding overall liking as the product-specific list contained mainly positively valenced emoji (15) while the standardized list had a balanced number of positively and negatively valenced emoji. Nevertheless, more research is recommended to examine if (certain types of) emoji questions might influence the hedonic scores of food products when working with children.

The standardized list contained 38 emoji (Gallo, et al., 2017b) whereas the product-specific list, established after a pretest with children, contained 20 emoji. While the average usage frequencies of the emoji differed, with 15.2% emoji used of the product-specific emoji list against 7.5% emoji of the standardized list, it appears that the average number of emoji is similar regardless of type of list (product-specific: 3.0 vs. standardized: 2.8). The average number of used emoji is also similar to a previous study with biscuits (Schouteten, et al., 2018). The other two studies using emoji to assess children's food product evaluations did not report the average usage frequencies, which does not make a comparison possible (Gallo, et al., 2017a, 2017b). The study of Schouteten, De Steur, Lagast, et al. (2017) reported that children used 3.8 emotional words to describe how they felt when consuming speculoos biscuits during a blind evaluation condition. This is higher than the scores reported here when working with emoji, but might be the result of working with a lower number of items (only 16 emotional words) or that only four products were assessed.

This study supports earlier findings that emoji can be used to obtain discriminatory sensory profiles when working with samples of the same product category (Schouteten, et al., 2018). Furthermore, the discriminatory ability is in line with those of two other CATA studies for emotional profiling with children, a study which linked emotional terms to flavored milk brands (De Pelsmaeker, et al., 2013) and a paper reporting the associations of emotions with sandwich pictures (Jervis, Jervis, Guthrie, & Drake, 2014). Although children used a similar number of emoji for the samples, this study found that the emoji of the product-specific emoji list are better able to discriminate between the samples than the standardized emoji list. Moreover, only 😍 was able to partially discriminate between equally highly-liked samples when using the standardized list. In contrast, 4 out of 20 emoji (😜, 😊, 😐,👎) were able to discriminate between samples with similar overall liking scores when using the product-specific emoji list. As a standardized list is normally longer because it contains many items in order to not miss out any important items, this might have led to a lower quality of the data due to fatigue or boredom (Jaeger, et al., 2013; Spinelli, et al., 2015), or due to a wider spread of the children's answers over multiple emoji of similar meanings. Moreover, using more items could also result in a higher use of certain items related to performing the task (e.g. 👎) instead of selecting emoji related to the food tested (Schouteten, et al., 2015b). However, more research is needed to confirm if the discriminatory ability between equally liked samples is indeed better when working with a product-specific emoji list, across diverse product types.

High positive correlations were found between overall liking scores and positive emoji while negative correlations were established between overall liking and negative emoji. Moreover, negative correlations were also found for neutral emoji. This supports previous findings by Schouteten, et al. (2018) that neutral emoji might be experienced as more negative by children compared to adults (Jaeger & Ares, 2017). Furthermore, it is important to mention that more correlations were significant when working with a product-specific list (17 out of 20) compared to a standardized list (8 out of 38) advocating that higher quality of data was obtained when using a product-specific emoji list.

The first dimension of the CA plot of both the standardized and product-specific emoji list is clearly based upon the valence of the emoji (Figure 2 and 4). Also, the neutral emoji were often located between the positive and negative emoji in the CA plot, albeit that most of the neutral emoji were closer to the negative emoji. This is in line with previous research with children (Schouteten, et al., 2018) and adults (Jaeger, Lee, et al., 2017). Previous studies suggested that the second dimension of the CA plot with emoji is based upon arousal (Jaeger, Lee, et al., 2017; Schouteten, et al., 2018), but this was less pronounced in this study. Moreover, the second dimension of the CA plot of the product-specific emoji only explained 3% of the total variance displaying the limited relevance of that dimension. But one needs to bear in mind that the selection of the samples could have contributed to the rather low arousal (Jaeger, Lee, et al., 2017). Furthermore, the fact that over 90% of the variance is explained in the first dimension when working with a product-specific emoji list could be related to the inclusion of the different thumbs emoji (e.g. 👍 and 👎) These emoji are actually an expression of liking and not of emotions. As such, they might contribute to the higher explained variance, but all on the valence dimension. Therefore, more research is needed with other food product categories and experimental product development samples which might also be less liked. In this study, we opted to work with commercial samples but such commercial products are normally associated with more positive or neutral emotions and emoji (Gallo, et al., 2017b; Jiang, et al., 2014; Meiselman, 2015). It should be noted that with the whole-wheat and multigrain biscuits two less-liked samples were included which were associated with more negative emoji. Moreover, the inclusion of little liked samples might lead to children not willing to complete the test.

The MCA plot of the product specific list explained over 90% of the total variance while the MCA plot of the standardized list was of a lower quality given that it only explained 62% of the total variance. The first dimension of the MCA plot of both the standardized and product-specific emoji lists divide the emoji according to their valence. Moreover, the MCA plot of the product-specific emoji list is rather similar to the one obtained from a previous study using a list of 33 facial emoji (Schouteten, et al., 2018).

Although the MFA showed that that emotional responses obtained from the standardized and product-specific emoji list were similar, the product positions differed for the W1 and W2 along the second dimension. This second dimension is traditionally associated with the level of arousal / engagement when using self-report emotional questionnaires (Jiang, et al., 2014), but the meaning of the second dimension was less clear in the current study. Nevertheless, given that main differences were observed in the product positioning along the second dimension, it appears that there might be a difference in the capability of the standardized and product-specific emoji list to measure differences along the second dimension. More research is recommended to see to which extent these differences persist with other products and using a broader consumer sample, or if these results were directly caused by the low usage frequencies of some emoji in the standardized emoji list.

This study opted to work with a between-subjects design, a design which has been previously applied in the field of consumer and sensory science when comparing the performance of two approaches to measure consumer's emotional associations of food products (Ng, et al., 2013; Spinelli, Masi, Dinnella, Zoboli, & Monteleone, 2014). As such, this study eliminates within-subjects factors that may play a role when consumers evaluated the samples under two different conditions (e.g. carry-over effects). Although future research might opt to use a within-subjects design in order to control for potential between-subjects effects, one needs to bear in mind that no significant differences were found in several key parameters (demographics, consumption, and internet and emoji usage) of the two sample groups in this study.

The researchers opted to not randomize the order of emoji in order to facilitate the task for the children. Previous research with adults found little impact of the order on the emotional profiling task and concluded that the absence of randomization does not invalidate the outcome (King, et al., 2013). However, more research is needed to examine if order effects occur when using emoji to assess consumer's emotional associations with food products.

The experiment took place at school, which is an asset when conducting research with children and is also a realistic consumption environment (Laureati, et al., 2015). However, previous research with adults indicated that the research setting might influence the results when asking for the emotional associations of food products (Danner, et al., 2016; Schouteten, De Steur, Sas, De Bourdeaudhuij, &

Gellynck, 2017). Interesting future research possibilities lie in comparing context effects at laboratory context, natural eating context (e.g. at school, at home) and even virtual evaluation context.

4. Conclusion

Recent research indicated that including emoji measurements might help to better predict children's actual food preference, yet there is still little research carried out using emoji with children. This study contributes to the current literature by showing that a product-specific list might provide better product discrimination than a standardized emoji list. This study also found that non-facial emoji such as ❤️ and 👍 have rather high usage frequencies, advocating the inclusion of such emoji in future studies with children. However, one needs to consider that this study focused on a familiar food product and only included commercial samples.

Future research might compare the performance of an emoji list with a word list, to examine the best method to obtain discriminatory emotional profiles of product samples according to the purpose of the research. Moreover, since children may not be able to verbalize how they experience a food product, the use of emoji may bring new potential in sensory and emotion research with children.

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Table 1. Socio-demographic characteristics of the sample groups

	Standardized lexicon (N=87)	Product-specific lexicon (N=85)
Mean age in years (S.D.)	10.1 (0.9)	10.0 (0.9)
Gender (% females)	47.1	51.8
Speculoos consumption frequency (% respondents)		
Less than once a month	21.8	21.2
Monthly	26.4	31.8
Weekly	26.4	18.8
Multiple times a week	18.4	22.4
Daily	6.9	5.9
Internet usage (% respondents)		
Less than every two weeks	3.4	3.5
Once every two weeks	2.3	3.5
Once a week	13.8	10.6
Multiple times a week	31.0	27.1
Daily	49.4	55.3
Mobile devices owned (% respondents)		
0	0	0
1 device	14.9	14.1
2 devices	27.6	24.7
More than 2 devices	57.5	61.2
Emoji usage in messaging communication (% respondents)		
Never	10.3	4.7
Almost never	10.3	5.9
Sometimes	26.4	35.3
(Almost) everytime	52.9	54.1

Table 2. Mean overall liking of the samples from the standardized lexicon (n = 87) and product-specific lexicon (n = 85) experiments

	Standardized lexicon (n = 87)	Product-specific lexicon (n = 85)
W1	6.9b	6.6b
W2	7.7a	7.2a
W3	7.8a	7.7a
WW	5.7c	4.9c
M	6.3bc	5.9b

Table 3. Frequency (%) in which each emoji was used by the children to describe the samples using the standardized emoji list and p-value of the Cochran's test of each emoji (n = 87).

Emoji	Mean usage frequency	W1	W2	W3	WW	M	p
😋	33.8	32.2ab	43.7a	42.5a	25.3b	25.3b	**<0.001**
😜	31.0	27.6b	42.5a	46.0a	23.0b	16.1b	**<0.001**
😀	29.9	33.3	34.5	31.0	21.8	28.7	0.250
😎	21.1	19.5b	31.0a	24.1ab	12.6b	18.4ab	**0.011**
😍	17.0	16.1b	19.5b	27.6a	10.3b	11.5b	**0.002**
😊	16.1	13.8	17.2	24.1	11.5	13.8	0.087
😉	12.6	12.6	14.9	17.2	6.9	11.5	0.137
😝	12.4	9.2	17.2	12.6	11.5	11.5	0.301
☺️	8.5	10.3	8.0	9.2	5.7	9.2	0.821
😆	8.3	8.0	9.2	8.0	9.2	6.9	0.966
😌	7.8	8.0	5.7	12.6	6.9	5.7	0.312
😛	6.1	16.1	19.5	20.7	12.6	11.5	0.108
😱	5.1	4.6	4.6	6.9	3.4	5.7	0.785
😕	4.6	4.6	1.1	2.3	9.2	5.7	0.073
😑	4.6	2.3ab	3.4ab	0.0b	8.0a	9.2a	**0.012**
😶	4.4	8.0	1.1	4.6	2.3	5.7	0.187
😮	4.1	4.6	3.4	6.9	4.6	1.1	0.372
😚	3.7	2.3	1.1	6.9	4.6	3.4	0.241
😖	3.7	1.1ab	0.0b	2.3ab	6.9a	8.0a	**0.014**
😨	3.4	2.3	2.3	4.6	4.6	3.4	0.753
😦	3.2	2.3	3.4	2.3	4.6	3.4	0.910
😳	3.0	2.3	3.4	2.3	4.6	2.3	0.822
😤	3.0	2.3	4.6	2.3	4.6	1.1	0.513
😬	3.0	3.4	3.4	0.0	2.3	5.7	0.260
😩	3.0	2.3	2.3	0.0	5.7	4.6	0.158
😢	2.5	2.3	1.1	1.1	3.4	4.6	0.519
😭	2.5	0.0	3.4	1.1	2.3	5.7	0.116
😟	2.3	2.3	0.0	0.0	3.4	5.7	0.061
😔	2.1	2.3	0.0	2.3	2.3	3.4	0.588
😡	2.1	1.1	2.3	1.1	3.4	2.3	0.800
😴	1.8	2.3	3.4	1.1	1.1	1.1	0.525
😒	1.8	2.3	0.0	1.1	2.3	3.4	0.446
😞	1.6	2.3	1.1	0.0	3.4	1.1	0.446
😰	1.1	0.0	1.1	0.0	2.3	2.3	0.406
😣	0.9	1.1	0.0	0.0	2.3	1.1	0.478
😧	0.9	1.1	0.0	2.3	1.1	0.0	0.478
😠	0.7	0.0	0.0	1.1	2.3	0.0	0.255
😥	0.2	0.0	0.0	0.0	1.1	0.0	0.406

Table 4. Correlation coefficients between emoji of the standardized list and mean overall liking scores (n = 87). Significant correlations are in bold (p <0.05).

Emoji	Correlation	p
😜	0.891	**0.043**
😑	-0.839	0.075
😝	0.541	0.346
😞	-0.810	0.097
😩	-0.928	**0.023**
😀	0.829	0.083
😦	-0.698	0.190
😣	-0.975	**0.005**
😨	-0.293	0.633
😊	0.853	0.066
😢	-0.857	0.064
😎	0.908	**0.033**
☺️	0.500	0.390
😬	-0.412	0.490
😉	0.970	**0.006**
😛	0.936	**0.019**
😭	-0.248	0.688
😆	0.057	0.928
😶	0.077	0.902
😳	-0.485	0.408
😱	0.611	0.273
😟	0.219	0.723
😴	0.501	0.390
😠	-0.448	0.450
😮	0.410	0.493
😔	-0.551	0.336
😡	-0.698	0.190
😍	0.912	**0.031**
😌	0.488	0.404
😋	0.959	**0.010**
😤	-0.042	0.947
😚	-0.001	0.999
😒	-0.757	0.139
😖	-0.810	0.097
☹️	-0.827	0.084
😰	-0.735	0.157
😕	-0.974	**0.004**

Table 5. Frequency (%) in which each emoji was used by the children to describe the samples using the product-specific emoji list and p-value of the Cochran's test of each emoji (n = 85).

Emoji	Mean usage frequency	W1	W2	W3	WW	M	p
👍	36.5	31.8bc	44.7ab	52.9a	17.6d	28.2cd	**<0.001**
👌	29.4	31.8ab	42.4a	35.3a	16.5c	21.2bc	**<0.001**
😋	28.0	22.4b	36.5a	43.5a	16.5b	21.2b	**<0.001**
👏	20.7	20ab	24.7ab	29.4a	14.1b	15.3b	**0.021**
😜	19.1	22.4a	21.2ab	31.8a	8.2c	11.8bc	**<0.001**
😀	17.6	15.3ab	21.2a	27.1a	9.4b	15.3ab	**0.007**
😐	16.7	15.3b	4.7c	4.7c	30.6a	28.2a	**<0.001**
😁	15.8	15.3ab	23.5a	23.5a	4.7b	11.8b	**<0.001**
😎	15.1	17.6a	20.0a	22.4a	4.7b	10.6ab	**0.003**
😍	13.6	10.6b	21.2ab	24.7a	4.7c	7.1b	**<0.001**
❤️	13.6	11.8ab	18.8a	21.2a	7.1b	9.4b	**0.002**
😊	12.0	16.5ab	7.1b	17.6a	11.8ab	7.1b	**0.041**
😛	11.8	11.8ab	12.9ab	18.8a	5.9b	9.4ab	**0.040**
👎	10.6	4.7b	1.2b	2.4b	27.1a	17.6a	**<0.001**
😉	9.2	10.6	8.2	14.1	5.9	7.1	0.274
😖	7.8	7.1b	0.0c	0.0c	23.5a	8.2b	**<0.001**
😞	7.3	3.5bc	1.2bc	1.2c	20.0a	10.6ab	**<0.001**
😆	6.6	8.2	10.6	7.1	2.4	4.7	0.112
☺️	6.6	9.4	8.2	8.2	1.2	5.9	0.099
😩	5.9	3.5bc	0.0c	1.2bc	16.5a	8.2ab	**<0.001**

Table 6. Correlation coefficients between emoji of the product-specific list and mean overall liking scores (n = 85). Significant correlations are in bold (p <0.05).

Emoji	Correlation	p
😜	0.884	**0.046**
😞	-0.956	**0.011**
😩	-0.966	**0.007**
😊	0.181	0.770
😀	0.931	**0.021**
😎	0.973	**0.005**
☺️	0.834	**0.079**
😁	0.999	**<0.001**
❤️	0.963	**0.008**
😉	0.727	0.164
😆	0.871	0.055
😖	-0.956	**0.011**
😐	-0.970	**0.006**
😛	0.902	**0.036**
😍	0.951	**0.013**
😋	0.927	**0.023**
👎	-0.955	**0.011**
👌	0.953	**0.012**
👍	0.970	**0.006**
👏	0.938	**0.018**

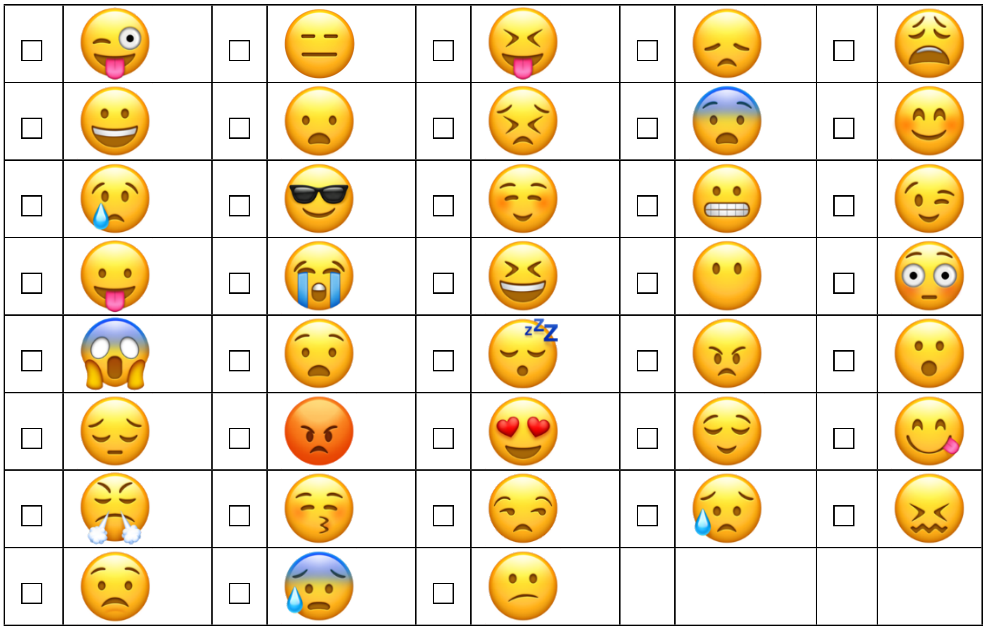

Figure 1a. Overview of the standardized emoji list (Gallo, et al., 2017b)

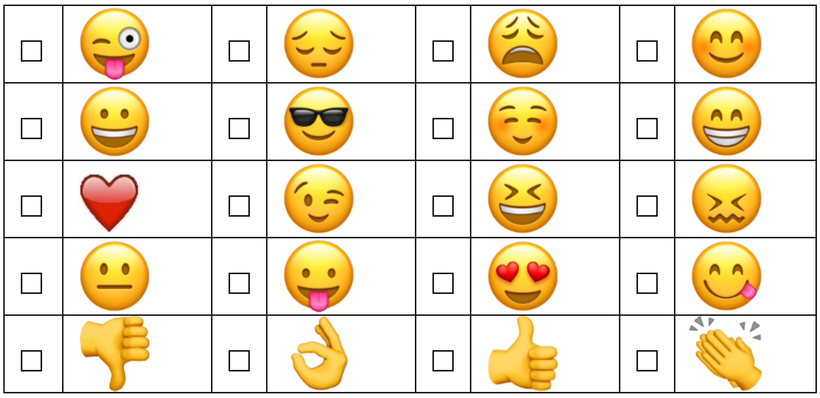

Figure 1.b. Overview of the product-specific emoji list

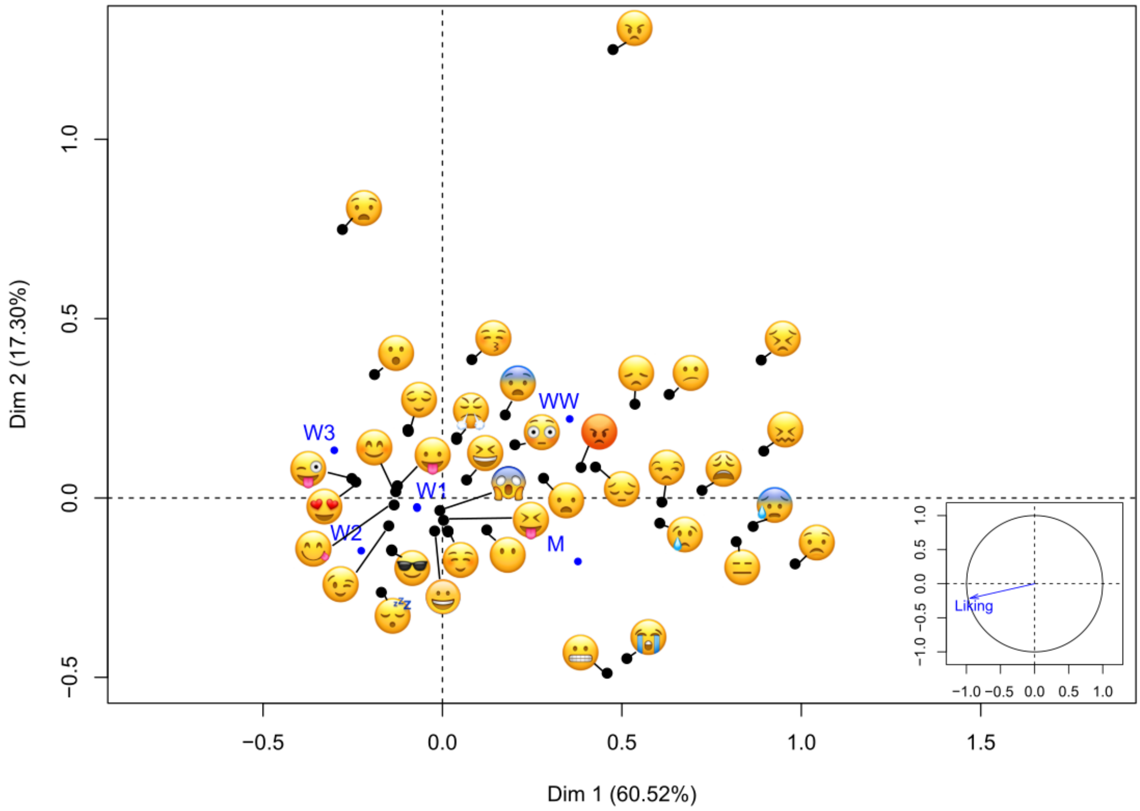

Figure 2. Representation of the samples and the emoji in the first and second dimensions of the correspondence analysis obtained from the standardized emoji CATA total frequency counts (n = 87).

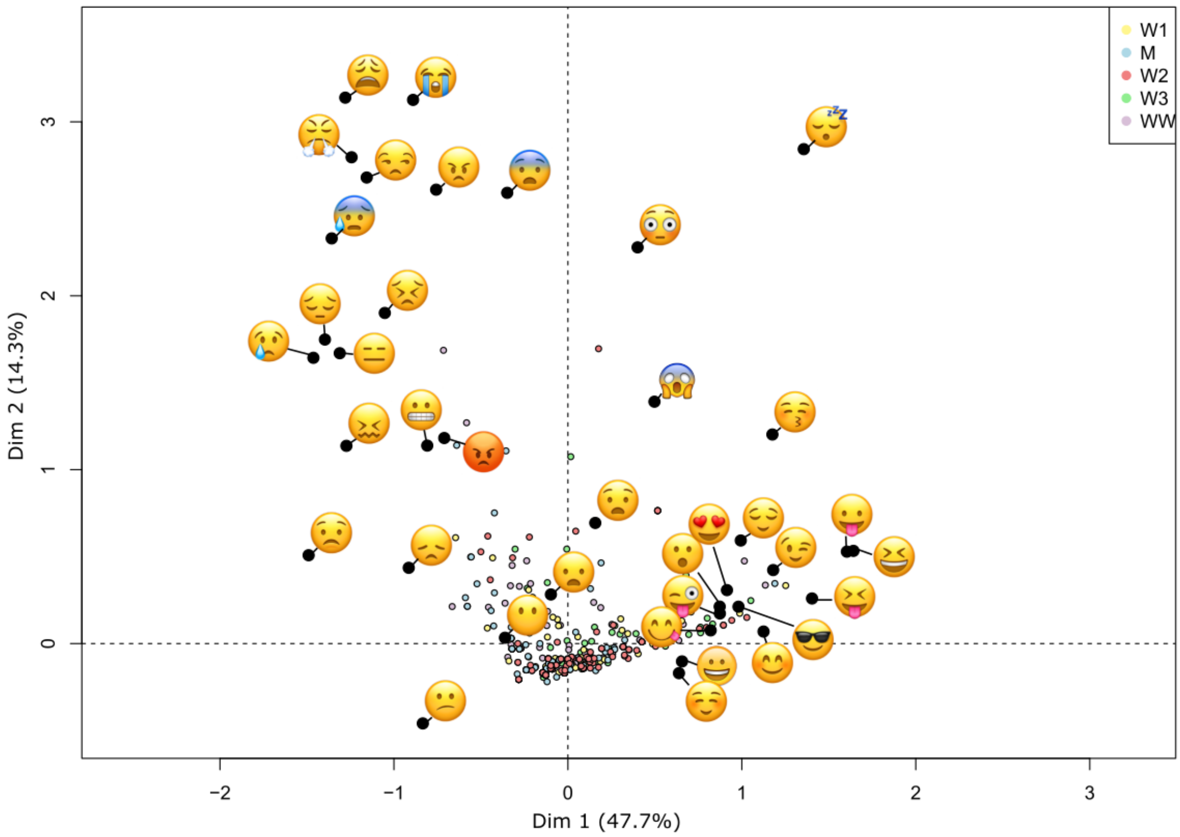

Figure 3. Representation of the samples and the emoji in the first and second dimensions of the multiple correspondence analysis obtained using the emoji CATA individual consumer responses of the standardized list (n = 87).

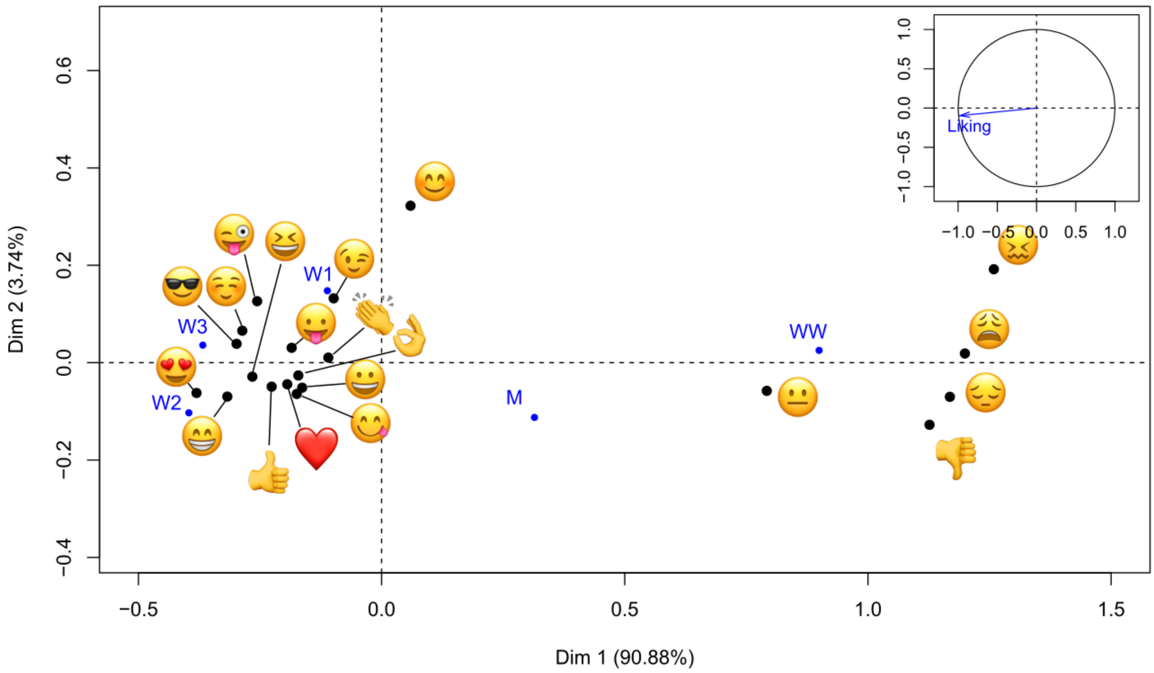

Figure 4. Representation of the samples and the emoji in the first and second dimensions of the correspondence analysis obtained from the product-specific emoji CATA total frequency counts (n = 85).

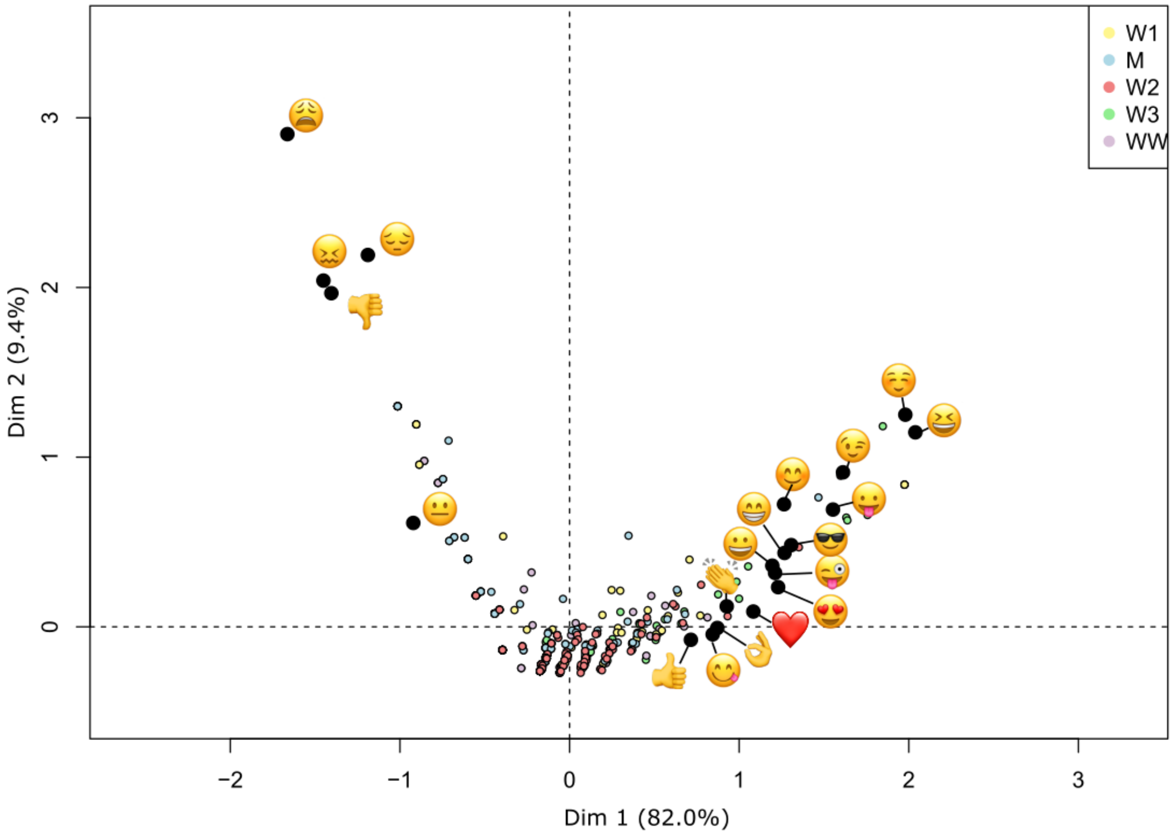

Figure 5. Representation of the samples and the emoji in the first and second dimensions of the multiple correspondence analysis obtained using the emoji CATA individual consumer responses of the product-specific list (n = 85).

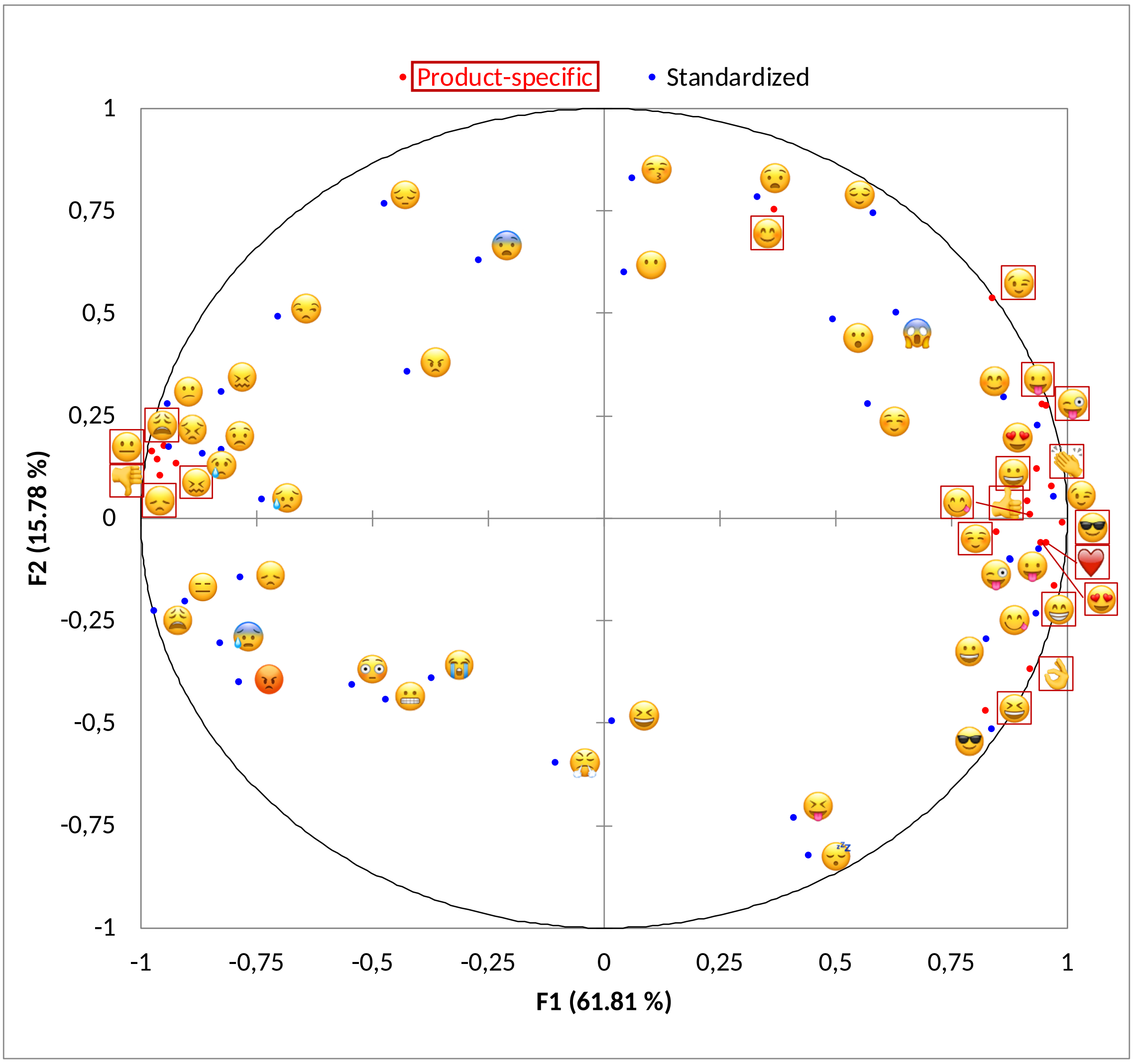

Figure 6. Representation of the emoji in the first and second dimensions of the multiple factor analysis using the data from the standardized (n = 87) and product-specific emoji list (n = 85).

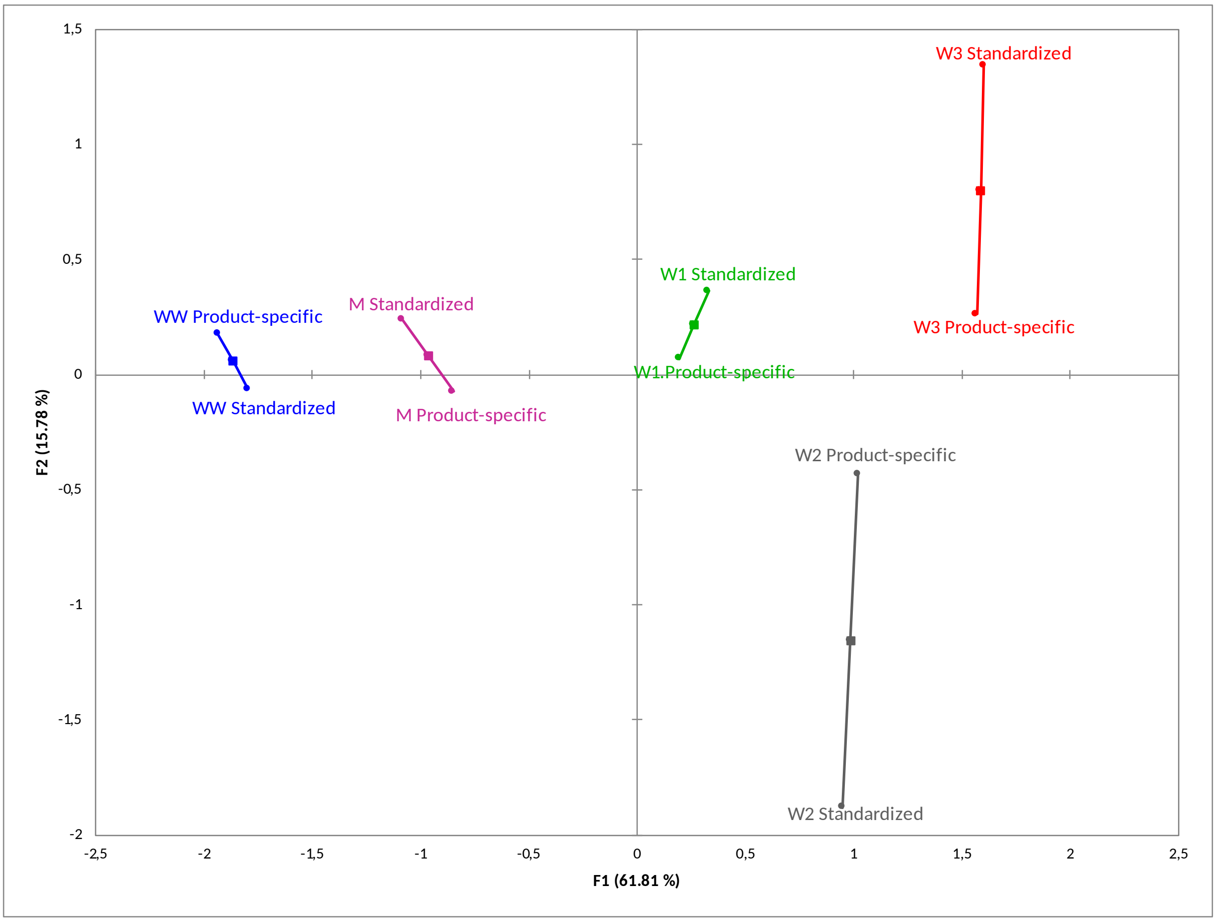

Figure 7. Representation of the samples in the first and second dimensions of the multiple factor analysis using the data from the standardized (n = 87) and product-specific emoji list (n = 85). Each product is represented using two points corresponding to each method (Standardized and product-specific), and its compromise position in the middle.