The flower of emotions, a new method to quantify the consumers emotions generated by a cosmetic product

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Abstract

Since many years, product benefits can be assessed using different approaches: instrumental, clinical, sensory and consumer perception. Standard methodologies are used for decades to evaluate the consumer perception but nowadays, consumers are not only seeking for products benefits but also for an experience. Thus, the role of emotions has been gaining importance across all industries when examining consumer's behavioral decisions.

Evaluating emotions is quite complex and many types of approaches have been developed on physiological, behavioral, expressive, or subjective components. This new methodology focuses on a quantitative evaluation to easily quantify the predominance of emotions for a given cosmetic product. The validation of this methodology went through the choice of emotional terms, the scale, the protocol and the statistical validation.

In controlled conditions, consumers are asked to assess cosmetic product by scoring each of 17 emotional universes on a linear scale. If the rating is higher than ¾ of the scale for one universe, subject is asked to choose a specific emotion within this universe closest to his or her feeling.

Analysis of the rating scores allows to obtain the emotional profile of each product. Thanks to this new methodology, 9 body milks have been evaluated to support emotional claims. First, it has been showed that the body milks generate some emotional universes in common probably linked to the type of product. They also generate some specific emotions: for example, a Lavender body milk will generate a zen feeling while a Verbena body milk will generate more vitality.

Keywords: emotions, cosmetic, free sorting task, consumer test, perfumes profile

Introduction

Standard methodologies from Sensory and Consumer Science are used for decades at any time of the process development to evaluate the consumer perception. It is widely known that sensory characteristics of the product perceived by the consumer when interacting with a cosmetic product activate the sensory system. This information is then integrated so that the consumers, through this physiological process, can identify a symbolical value or feel a positive emotion [1]. Today, the efficacy of a product is still important to evaluate before launching it on the market but understanding the sensory and emotional benefits of a cosmetic product use seem to be key to differentiate product from competition. Thus, the role of emotions has been gaining importance across all industries when examining consumer's behavioral decisions.

Emotions are indeed a topic at the heart of cosmetic sales. In fact, according to studies conducted in 2019, over the next two years, skincare products will have to improve consumer well-being and health by providing a sense of relaxation, security and confidence. Depending on the country, in Europe, between 30-50% of women are interested in beauty products that reduce anxiety and stress and help them relax. In China, facial masks are frequently applied for relaxation purposes by 46% of men and 42% of women aged 25 to 29. So there is a demand for cosmetics that arouse positive emotions, erasing other negative emotions. The same source recommends playing on the format, texture and bioactive ingredients of the formula. [2]

To assess emotions in a meaningful way, it is important to understand where they come from and what they are about. Emotions can be defined as short-term affective responses to stimuli. Emotions have a basic dimension which is valence: they are positive or negative and are expressed in a fleeting manner [3]. There is a difference between mood and emotion. Mood, unlike emotion, is not associated with a referent, it is built up gradually and is more persistent than an emotion. There are several theories about the origin of emotion [4]. In the late 19th century, James and Lange's theory is to say that human emotion begins with a stimulus physiologically arousing the body and this causes the corresponding emotion. At the beginning of the 20th century, the theory of Cannon and Bard consists in saying that the emotion is provoked by the central nervous system and more particularly at the level of the

thalamus. Indeed, Demarles (2020) reports that there are two ways of analyzing emotions studied in neuroscience [5]. The irrational pathway, which is fast, goes from the thalamus to the amygdala, directly governing the motor system (for example, at the sight of a bear, an individual will run [6]. The rational pathway goes from the thalamus to the visual cortex. In this case the information is processed cognitively, from memory or learning.

Emotions then also come from a cognitive appropriation of the environment, for example you cannot be angry about what someone said if you do not understand it, or you are afraid of the bear because you have analyzed the threat it represents [7]. Emotional responses can come from learning and thus be linked to memory. If a lotion fragrance was perceived as pleasant and evokes a personal emotional memory, it will be better judged on functional and emotional attributes than a lotion that smells as pleasant but does not evoke a memory experience [8].

There are six basic emotions according to Ekman: surprise, anger, sadness, disgust, fear, joy. There are eight according to Plutchik who adds trust and anticipation to Ekman's basic emotions. Plutchik's particularity is that he proposes a dimensional representation of these eight emotions, by opposing them to each other, and by representing them from the center to the outside of figure 4, from the most intense level to the least intense. He also proposes secondary emotions as combinations of the basic primary emotions, for example optimism combining anticipation and joy.

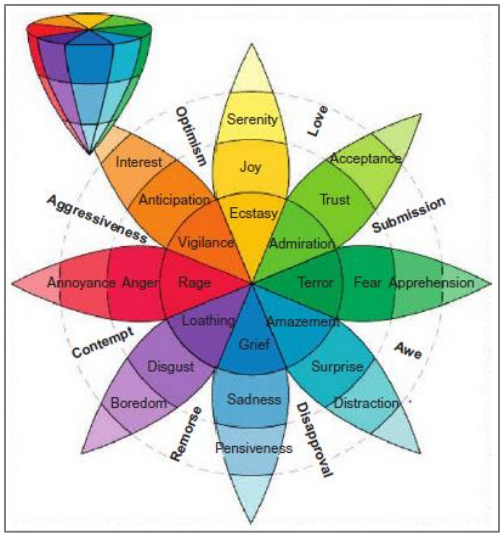

Figure 1 : The basic emotions according to Plutchik (1980) [4]

However, the number of emotions appears to be infinite, even more so if we consider international translations. Many lists of emotional terms have been developed for psychological studies and will be presented in the paragraph on the subjective measurement of emotions. Generally, the lists of emotional terms that have been generated for consumer studies (e.g., Geneva Emotion and Odour Scale (GEOS), ScentMove, EsSence, Nestle, ItalWine, Thomson's Conceptual Profile) are adapted from Laros and Steenkamp's (2005) list that provides a solid database of consumer behavior [9].

According to Dupré et al., there is a significant correlation between the emotional activation elicited by a product and the tendency of individuals to want to use that product [10]. According to Ares and Varela, authors such as Damasio, Ledoux, and Rolls have largely shown with the field of neuroscience that emotions have a role in decision making [11].

King and Meiselman have also shown that the intensity of emotions increases with the frequency of product use [12]. Non-users of the product have different emotional profiles, more focused on negative emotions, while users generally have stronger positive emotions.

Emotion can be externalized in three components, at different levels in the individual. Visibly and obviously, the behavior and facial expressions of the subject who is moved by the emotion may change. In a less visible way, physiological parameters also vary according to the emotion. Finally, the subject can formulate his or her own perception of the emotion,

which is called the subjective or cognitive expression of the emotion. Thus, Gil (2009) shows that it is possible to measure emotion according to these three components [13]:

- It is possible to interpret expressions and behaviors in response to emotion. It is a physical and spontaneous phenomenon in the individual. For interpretation, we observe, for example, the posture of the individual or the variations in the frequency and tone of his voice (prosody).

- Emotions also affect several of our organs. Thus, we can measure heart rate and respiratory rate, skin conductance also called electrodermal response, brain and muscle activity, body temperature, hormone levels. More recently, Bradley shows that the diameter of the pupil changes according to emotional stimuli [14].

- The individual who is affected by an emotion is able to interpret his or her feelings and report on his or her own emotional state. Two main types of questionnaires are known to measure the subjective component of emotion, one based on the measurement of emotional dimensions, the other based on the measurement of discrete emotions.

The first is based on the idea that emotion can be apprehended by 3 dimensions: pleasure, activation and dominance. These dimensions are independent and bipolar. Questionnaires have been proposed such as the Pleasure-Arousal-Dominance (PAD) by Mehrabian and Russell in 1974 or the Self-Assessment Manikin (SAM) by Bradley and Lang in 1994.

The second major type of questionnaire, the discrete emotion measure, is based on the presentation of emotional terms, adjectives or phrases to the subject. The subject is asked to evaluate, using scales, the degree to which he or she feels the proposed emotion. For example, the Positive and Negative Affect Scale (PANAS) developed by Watson, Clark, & Tellegen in 1988 is a self-assessment scale for positive and negative affect

For the development of this method, it has been decided to use this last type of questionnaire. We will choose this method of subjective measurement for the continuation, considering its advantages and a disadvantage which remains little important at the level of the measurement of the emotions of a consumer. The disadvantage of the subjective

measurement comes from the fact that it is based on self-evaluation: not everyone describes his emotions in the same way.

The scope of application of this declarative and verbal method is however wide, as long as one has the appropriate questioning tools. The advantage is that once the protocol has been defined, the measurements are easy and quick to set up, requiring little specific equipment apart from paper, a pen and a computer for statistical processing. This method allows for the optimization of the customer experience especially because it can measure the intensity of a large number of emotions specifically selected according to the test. Dupré et al (2018) confirm that this is a measure to be explored in order to know the role of emotions in product acceptability [15].

This new methodology offers a different approach focus on a quantitative evaluation of the emotions felt by consumers when smelling a cosmetic product. In this declarative method, the strategic steps were the choice of emotional terms, the evaluation scale, the evaluation protocol, and the statistical validation. On overall, this smart methodology will enable L'Occitane group to assess emotional profiles of cosmetic products as a routine. This tool is already helpful to develop new products to satisfy consumer needs in terms of positive emotions.

Materials and Methods

Definition of the emotional terms & groups

To select the emotional terms, a free sorting task methodology was carried out. The (French) panel was composed of 99 people: 32% men and 68% women between the ages of 22 to 60 recruited through the internal database of volunteers.

To analyze the data, the FreeSortR package of the R software was used. A Hierarchical Ascendant Classification was run with the Ward criterion as the distance indicator.

Validation of the methodology: discriminability repeatability and reproducibility

The software Fizz (Biosystemes) was used to create the questionnaire of the validation study. This study war carried out on 3 perfume samples: 1 perfume to evaluate the repeatability and the reproducibility and 2 different samples to evaluate the discriminability.

The test was run on 30 French women.

Bilateral Student's t-test with a 5% risk is used to validate:

- the repeatability comparing the rating of each emotion for 2 identical samples evaluated within the same test session
- the discriminability to compare the rating of each emotion for 2 different samples
- the reproducibility to compare the rating of each emotion for 2 identical samples evaluated at 1-week intervals

Results

Definition of the emotional terms

First, an initial set of 111 terms of emotions was selected based on the list of emotions of Laros and Steenkamp and the suitability with the cosmetic field [9]. These 111 emotions cannot be all presented at the same time to the consumer. To reduce the length of the questionnaire and to avoid saturating the perceptions, the first step of the protocol development is therefore to organize the emotions in such a way that each one is categorized in a group where the emotions are coherent with each other. This will allow the construction of a questionnaire based on a limited number of groups of emotions.

Due to the exceptional containment situation related to Covid-19, an online sorting test was proposed to reduce the number of emotions.

The number of groups formed by each participant is observed. Among the most frequently formed number of groups, 9 people form 8 groups and 11 form 14 groups. Figure 2 below describes the number of consumers who form different numbers of groups of emotional terms.

The FreeSortR package of the R software helps in this task as it formats the data. A dissimilarity matrix is obtained, counting in a table of size 111x111 the number of times the emotional terms compared two by two were not placed in the same group. It is from this matrix that the consensus partition is created. The number of groups that this partition will contain is set to 14 because this is the mode according to Figure 2.

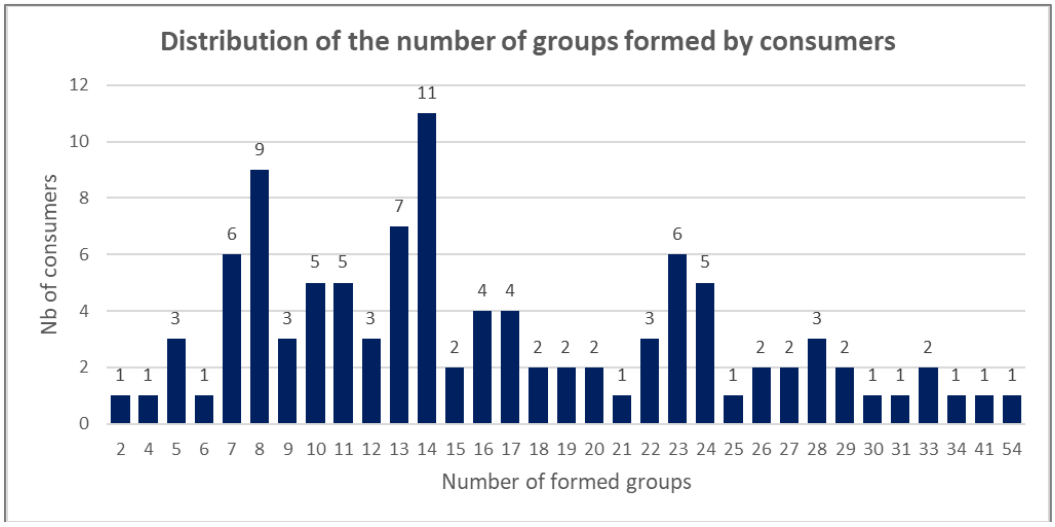

Figure 2: Distribution of the number of groups of emotions formed by consumers

The hierarchical ascending classification dendrogram of the emotional terms is obtained from the similarity matrix, according to the Ward criterion proposed in the hclust() function of the R software. The dendrogram cut is performed at h=120 and this results in 14 groups of emotions. The consensus partition based on 14 groups is also observed because it is the number of groups most frequently formed by our panel. The result obtained is close to the one obtained from the dendrogram cut. These groups seem to be consistent for interpretation.

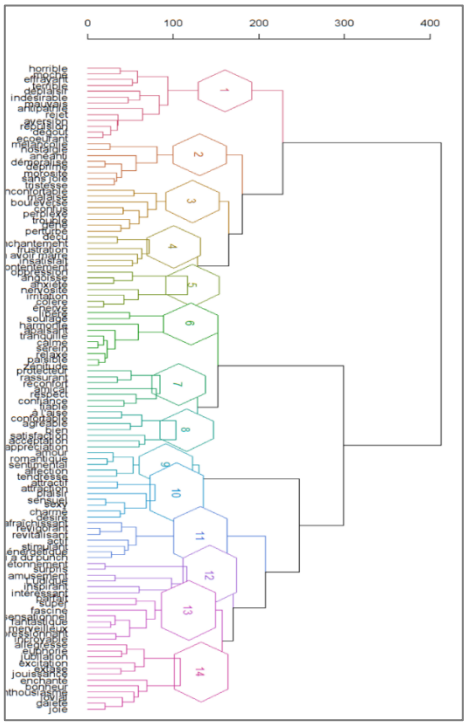

Figure 3 : Dendrogram of the emotional terms

A discussion based on the dendrogram, and internal expertise allows us to form the final partition and thus the groups that will be used in the future. Specifically in relation to figure 3, the following emotions are isolated, and we therefore have a distribution of the emotional terms into 17 groups following this step:

- Amazement and surprise were isolated from the rest of group 12,
- Oppression, anguish, and anxiety were isolated from the rest of the group 5,
- Liberated and relieved were isolated from the rest of group 6.

Then, a step of harmonization of the emotional terms was necessary to validate the emotional groups or universes with the final words which will be proposed in the protocol of test of the emotions. All nominal forms are removed in order to keep only adjectives whose priority meaning is the one appropriate in continuity of the sentence "I feel..." with a particular product. Indeed, it has been reported that adjectives are commonly recognized as the suitable terms to evoke emotions and are usually preferred to noun in studies because, according to Plutchik's work in 1980, it seems easier to associate them with an immediate emotional experience [16]. For example, for the word enthusiasm, the harmonized word is enthusiastic.

For each group, the most representative term is defined as the one that would be the closest emotional term to the others in terms of distance This representative term would be the most consensual of the group, the most unifying and perhaps also the best understood by the consumers. For each of the groups in the partition, the dissimilarity matrix between the stimuli (emotional terms) of the group is computed. The DissTot() function of the FreeSortR package was already used to obtain the dissimilarity matrix between the 111 stimuli. A few lines of programming allow to select the portions of the global matrix to obtain the matrix reduced to the stimuli of the considered group. The margin of this matrix (sum of the distances between each stimulus and the other stimuli of the group) is calculated and the stimulus that minimizes this sum of distances is selected as the one that represents the closest term to the other terms of the group. Following this methodology, the representative terms are defined for all groups in the final score.

To validate the groups of emotions formed, a questionnaire has been designed in three parts. First, the coherence of the group is evaluated. Second, the understanding of each term related to cosmetics field is validated. Finally, each term in the group is judged for its relevancy to the other terms in the group to ensure that it belongs in the group.

The results are based on the answers of 94 persons. The level of decision is prioritized by looking at the overall coherence of the group. When the group is not considered coherent for at least 60% of the respondents, the words that have an influence on the low coherence score in the group are questioned.

Visualization tool

Each of the 17 emotional universes are associated to a color. Thanks to the frequency of citation of colors for each universe in the questionnaire, it is possible to assign a color for each universe. The inspiration for representing the universes is based on Plutchik's representation proposed in 1980 [4] for which the basic emotions are declined in intensity from the center to increasingly distant concentric circles. This representation is a support that can be useful for the development and presentation of the emotion measurement protocol and it represents a complete synthesis of the data obtained previously.

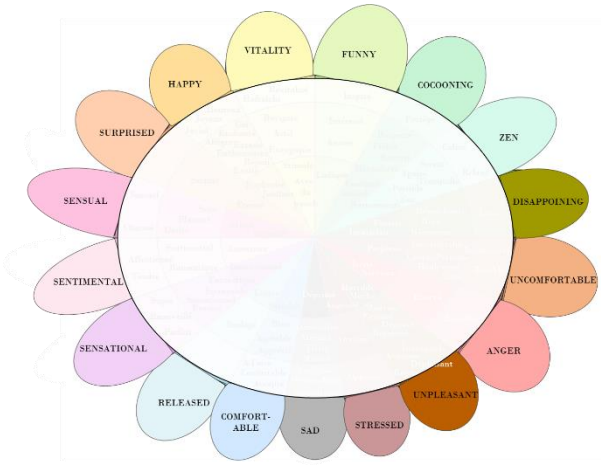

Figure 4: The flower of emotions: 17 emotional universes are represented on the outside

To build the final methodology, the elements of the bibliography relating to the definition of emotions and the development of the questionnaire proposed by King and Meiselman (2010) are reused. First, a specific study helped to select the most relevant scale. A 5-point scale has been preferred by the consumers.

Then, concerning the order of the questions, it is important to ask the consumer panelist to answer as intuitively and spontaneously as possible to the questions related to emotions. A question on the appreciation of the product is asked before using the emotional scales. In concrete terms, the volunteers give a score from 0 to 10 according to their overall appreciation of the product tested. Then, the panelist must freely position a cursor on the emotional scale for each of the emotions entitled emotional universes. For each universe, if the cursor is positioned above the anchor term "enough", an additional question is asked in the form of forced single-choice check boxes. All the terms included in the universe are then

proposed and the individual performing the test must indicate the one that comes closest to his or her feeling upon contact with the product. The questionnaire is thus designed to identify precisely the right emotion from the list of emotions initially defined and updated during the project.

Validation of the methodology: discriminability repeatability and reproducibility

The test is carried out in a cabin in the sensory analysis laboratory. This makes it possible to control the evaluation conditions to facilitate the randomization (according to a Latin square) of the 17 emotional universes, then of the emotions within the universes. The questionnaire is proposed on the Fizz sensory data acquisition software from Biosystèmes.

To validate the protocol, the emotions are evaluated on samples of perfumes. The presentation is monadic sequential. The choice of the support perfume test strips allows to homogenize the perceived odor because it can be different according to the type of skin. This choice also allows to evaluate a larger number of samples, whereas a maximum of two perfumes would be considered if they had to be evaluated on skin (one on each arm). Among the three samples of perfumes, two samples are chosen to be close to each other and the third one is different as it belongs to a different olfactory universe. They are all coded with a random number for the panel. This category of products also allows intense stimuli likely to facilitate the process of emotional evocations in the volunteer.

The recruitment of a panel of 30 women allows to validate the protocol over two weeks of testing. Moreover, to homogenize the consumption context, they are not part of any expert panel on perfume and do not do any other test on perfumes the same day of their test on emotions. The number of individuals and products presented allows us to collect enough data to evaluate the repeatability, the discriminability of the samples and the reproducibility of the tests from one week to another.

The reproducibility between 2 products from 1 week to another was verified. There was no significant difference between those two products :

Emotions rating	P1 (mean)	P1bis (mean)	Student's t-test p-value	Conclusion
Emotion 1	2,110	2,037	**0,903**	NS
Emotion 2	4,930	5,563	**0,419**	NS
Emotion 3	6,113	6,480	**0,614**	NS
Emotion 4	7,603	8,297	**0,212**	NS
Emotion 5	4,980	4,847	**0,866**	NS
Emotion 6	2,883	3,213	**0,629**	NS
Emotion 7	2,020	2,003	**0,982**	NS
Emotion 8	3,060	2,493	**0,515**	NS
Emotion 9	2,227	1,863	**0,606**	NS
Emotion 10	1,850	2,060	**0,770**	NS
Emotion 11	1,913	1,907	**0,993**	NS
Emotion 12	1,423	1,400	**0,966**	NS
Emotion 13	2,880	2,527	**0,921**	NS
Emotion 14	3,657	3,843	**0,513**	NS
Emotion 15	3,840	4,327	**0,813**	NS
Emotion 16	4,383	4,457	**0,633**	NS
Emotion 17	1,423	1,400	**0,171**	NS

The repeatability was also verified following the same methodology on samples tested within the same session:

Emotions rating	P2 (mean)	P2bis (mean)	Student's t-test p-value	Conclusion
Emotion 1	5,56	4,20	**0,111**	NS
Emotion 2	4,29	4,38	**0,912**	NS
Emotion 3	5,93	5,58	**0,624**	NS
Emotion 4	6,23	6,33	**0,882**	NS
Emotion 5	4,92	4,49	**0,543**	NS
Emotion 6	5,19	5,15	**0,966**	NS
Emotion 7	1,56	1,98	**0,588**	NS
Emotion 8	1,53	2,00	**0,551**	NS
Emotion 9	1,32	1,63	**0,667**	NS
Emotion 10	1,40	1,61	**0,780**	NS
Emotion 11	1,10	1,88	**0,279**	NS
Emotion 12	1,40	1,25	**0,789**	NS
Emotion 13	5,92	5,76	**0,837**	NS
Emotion 14	4,64	4,89	**0,739**	NS
Emotion 15	5,13	4,38	**0,314**	NS
Emotion 16	5,76	4,96	**0,363**	NS
Emotion 17	5,38	5,07	**0,695**	NS

Following the results, the methodology allows to discriminate 2 products. It is acceptable that the statistical differences were not significant for all the emotions, but we could validate that the products can be differentiated on 4 to 6 emotions.

Emotions rating	Product A (mean)	Product B (mean)	Student's t-test p-value	Conclusion
Emotion 1	4,20	2,11	**0,009**	Sig. Difference
Emotion 2	4,38	4,93	**0,485**	NS
Emotion 3	5,58	6,11	**0,475**	NS
Emotion 4	6,33	7,60	**0,071**	Limit Sig. Difference
Emotion 5	4,49	4,98	**0,519**	NS
Emotion 6	5,15	2,88	**0,007**	Sig. Difference
Emotion 7	1,98	2,02	**0,959**	NS
Emotion 8	2,00	3,06	**0,222**	NS
Emotion 9	1,63	2,23	**0,407**	NS
Emotion 10	1,61	1,85	**0,738**	NS
Emotion 11	1,88	1,91	**0,966**	NS
Emotion 12	1,25	1,42	**0,764**	NS
Emotion 13	5,76	4,38	**0,084**	Limit Sig. Difference
Emotion 14	4,89	3,84	**0,157**	NS
Emotion 15	4,38	3,66	**0,325**	NS
Emotion 16	4,96	2,88	**0,020**	Sig. Difference
Emotion 17	5,07	3,03	**0,015**	Sig. Difference

Discussion

The project led to a reliable categorization of emotions thanks to the high number of people who participated in the free sorting test and the few differences that existed in the way the proposed emotions were grouped. The containment situation related to the Covid-19 epidemic did not hinder the progress of the beginning of this project, but it did allow a considerable progress, as it revealed that it was possible to obtain reliable data online on different types of tests than the standard questionnaires already widely mastered in a digital format.

This project answers the initial problem because the developed protocol allows a subjective measurement of emotions for cosmetic products and the results are repeatable, reproducible, and discriminating from one product to another.

Thanks to this new validated methodology, 9 body milks have been evaluated to support emotional claims. First, it has been showed that the body milks generate some emotional universes in common (probably linked to the type of product). They also generate some specific emotions: for example, a Lavender body milk will generate a zen feeling while a Verbena body milk will generate more vitality.

To go further, it could be interesting to apply this methodology to other categories of products (hand creams, face creams or even rinsed-off products...). Moreover, deploying the methodology in other countries would be useful for next product development. For example,

a Chinese population would be more likely targeted in the first instance because of its high consumption of cosmetic products. The translation of emotions from French to Chinese confirms that there can be from 0 to 5 possible translations depending on the emotional terms. After translation and back-translation, there will be two less emotional terms in the list. This is because two word pairs each form only one emotion in Chinese. However, it will be necessary to ensure that this translation is also an emotion perceptible by the Chinese and whose feeling is coherent with cosmetics. To finalize the validation of the methodology, a study could be proposed in China to measure the feeling during the cosmetic consumption experience, testing the possibilities of translating the emotional terms one by one. It would also be necessary to verify if the associations made between emotions and colors are still relevant in the Chinese culture.

Conclusion

On overall, we developed a new methodology that will allow to assess emotional profiles of cosmetic products as a routine. This tool is already helpful to develop new products to satisfy consumer needs in terms of positive emotions.

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Conflict of Interest Statement. NONE

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