



EEG approach in detecting emotions induced by skin care products

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Introduction of research

Skin care products differ in textures, format and composition which can influence consumer perception and trigger emotional response. By assessing the emotional responses of these products on skin, it may reveal how ingredients of these formulations influence emotions and this can be a valuable source of information for product development that goes beyond traditional sensory and acceptability measurements. Therefore, it is important to obtain valid and reliable (combinations of) measurements of emotions.

In this study, we have developed a non-bias measurement of emotions and combine it with explicit measures to cross-validate results.

Background and Objectives

The sensorial feel of a cosmetic product is crucial to consumers as it triggers emotional response. Cosmetics products differ in textures, format, and composition. By having a good understanding of the impact of texture on consumer perception and their emotional responses, this will enable formulators to develop products to optimize consumer experience.

There is no “golden standard” to assess or measure emotions at this moment yet. Till date, verbal self-reporting questionnaires are most commonly used to measure emotional responses. However, they have specific shortcomings, including emotions being difficult to verbalize, and self-reports only assess the conscious/decision-making level of emotional processing.

Thus, we have been developing non-bias measurement like physiological one and combine them with explicit measures to eventually cross-validate results. Non-verbal, implicit measurements can complement verbal self-report questionnaires to better understand individual’s emotions evoked by skincare products.

In this project, two types of methods were explored. The first involved a physiological measurement at unconscious emotional processing namely electroencephalography (EEG). Event-related EEG measures the EEG responses following the presentation of a stimulus, which can be indirectly associated with emotions. The second is cognitive measurement with conscious level of emotional processing called “Rate-all-that-apply (RATA)”. RATA is commonly used techniques to measure responses in sensory evaluation towards attribute characterization, due to their ease of application and cost-effectiveness. In this project, they were used in emotion evaluation.

The 3 main objectives in this study: (1) To compare the measurement of emotional responses from EEG and RATA. (2) To determine the degree of agreement of EEG with RATA. (3) To determine the relationship between the sensory attributes and the emotion measurements elicited.



Materials and Methods

Twelve oil-in-water emulsifiers of different chemical natures, with the same simple base formulation, were selected since emulsifier is a key ingredient to drive the initial sensory feel of skin care products.

The study was conducted using 10 Singapore consumers in 2 phases: First phase consisted of testing the samples using RATA method, in which the consumer panel evaluated the samples by selecting and rating the intensity of emotion attributes using, a 10-point scale. The second phase involved testing the samples with EEG using the 128-Hz Emotiv EPOC+ system consisting of 14 saline-based electrodes with a wireless amplifier, according to the international 10-20 system. The acquired EEG signal was filtered using the EEGLAB toolbox for MATLAB to remove signal artifacts. The power spectral density of the artifact-free EEG was extracted using Fast Fourier Transform (FFT) to obtain the EEG power of alpha and beta frequency bandwidths from frontal lobe EEG channels that are closely associated with elicited emotions. The EEG processing of valence and arousal was based on method from the study as described by Ramirez and Vamvakousis [1] and involved a two-dimensional valence-arousal design as elaborated by Russel [2].

Results

Figure 1 shows the 12 emulsifiers presented in a two-dimensional valence-arousal model. Machine learning was applied to classify these EEG signals into high/low arousal and positive/negative valence, which were denoted as Q1 to Q4. There is a good alignment of 83% when the emotion responses of EEG were compared with those from RATA. The emotional responses of 10 out of 12 samples were aligned between RATA and EEG. At individual panelist level, 16 out of 20 subjects have an agreement of more than 50% in their emotion response when tested for EEG and RATA. In addition, the 4 quadrants were associated with consumer sensory attributes like “quick-to-absorb”, “light”, “thick” and “rich”.

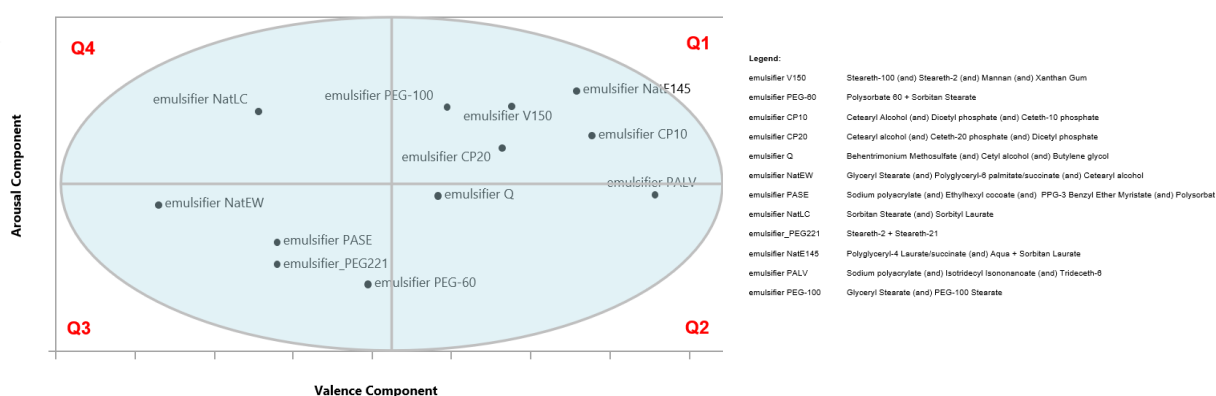


Figure 1: Clustering of emotions detected by EEG during the application of the 12 emulsifiers in 20 subjects. Q1: Positive valence, high arousal; Q2: Positive valence, low arousal, Q3: Negative valence, low arousal; Q4: Negative valence, high arousal



Conclusion

The study has shown that EEG can be a good tool in studying the emotion of consumers while applying skin care products. There is relatively good alignment with conventional sensory methods like RATA. In addition, EEG can be used in the measurement of consumer emotion as it removes the biases that other explicit methodologies entailed. Further experiments can be carried out to capture the emotions of consumers on more diversified textures from other chassis ingredients.

References

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About the speaker



Dr. Jasmine Leong has more than 20 years of experience in sensory evaluation in food and non-food area. She is currently the Technology Development Manager (Consumer Care) at the Centre of Innovation of Sensory Science, Croda Singapore. In her current role, she builds and manages the sensorial panel, establishing best practices for sensory evaluation and analysis of skin care formulations. Her recent research at Croda involves consumer sensory neuroscience research using implicit and explicit methodologies. This includes interpreting sensory and neuroscience research into relevant business recommendations. Before joining Croda, she was the Sensory and Consumer Insight Research Manager at Symrise (Asia Pacific) - Flavor Division. She was also the Regional Sensory Manager (Fragrances) with IFF, she set up the Fragrance sensory facilities in Singapore and implemented the sensory protocols for assessing the performance of fragrance in personal wash, beauty care and homecare categories.