Evolution of makeup attributes - Sensations and emotions studied by neuroscience

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Abstract

Background:

Consumers have looked for different textures that can bring a different experience during application and use. Since this need in other markets, (textiles, food, and automotive) is demonstrated as differentiated textures, as greater consumer interests in the product and, consequently, consumption need.

Another interesting and growing factor in the consumer market is smell. Fragrances can convey different sensations and emotions in the consumer and reactions as an example of well-being.

Methods:

This research consisted in evaluating 07 formulations, regarding their performances and texture, through application and product validation by an expert team.

Fragrances and colors were evaluated by Implicit Association Test (IAT) method, which consists of the psychological testing methodology developed and validated in academic research for uncovering mental biases and associations that cannot be articulated and participants are not aware of. Also, we applied another methodology called Self-Assessment Manikin (SAM) Overview, which is based on the PAD (pleasure-arousal-dominance) theory of emotion. SAM is a non-verbal test measuring the dimensions of pleasure, arousal, and dominance to detect emotional reactions.

Results:

Respondents felt happier and more excited when they smelled the most fragrances.

Other moods such as confidence, relaxation, fun, romantic and sensual were evaluated in prototypes not only for lip products but other makeup products as well.

Conclusion:

An understanding of texture associated with fragrance and color can be well accepted and arouse feelings and emotions for the consumer, what is important and makes difference in the choice and satisfaction during the application and permanence with the product.

Keywords:

Moods & sensations; Neuroscience; Happiness Lipstick; Implicit Association; Color cosmetics

Introduction

The use of neuroscience to complement consumer research using traditional self-report continues to grow in popularity [1]and is expected to hold an important position in neuroergonomics [2]. This growth has been fueled by the hope that as brain data does not rely on self-report or conscious behavioral responses, it will be less influenced by cognitive biases, fabrication et cetera and further catalyzed by several findings that have found a link between brain activity with a particular neural structure and some commercially relevant outcome such as purchase behavior [3].

The texture of cosmetic products is an important factor in consumer satisfaction. It is considered that the texture originated from various physical properties [4].

For the color cosmetics science, it is an increasing desire for scientists to be always evolving regarding the evaluation of textures, colors, and innovative fragrances that are applied in the products. With these innovations, we can bring differentiated communication and focus on new attributes to be explored in color cosmetics.

Modern cosmetics are associated with beauty and well-being. Beauty has been appreciated since the beginning of civilization, and the development of cosmetics has progressed with

human history, drawing on both scientific and cultural evolution. The cosmetic sector is highly competitive and industries related to this area have, more than ever, the challenge of expanding the market through innovation. Integral to the development of better cosmetic products is the ability to quantify the interaction with the senses when a consumer is faced with a set of stimuli produced by a cosmetic product. Therefore, we use neuroscience as an essential tool to understand the different physiological reactions that occur with the consumer of colored cosmetics when products with different textures, colors, and new smells are exposed.

In this present work, we evaluated how consumers' senses can trigger different sensations when applying and using a cosmetic.

This study, aimed, mostly, to identify fragrances that convey the mood happiness to consumers, in addition to other moods and sensations. Going beyond traditional hedonic tests and evaluations. Fragrances were also tested via behavioral neuroscience methodologies through implicit associations and non-verbal associations.

Materials and Methods.

Formulas Development

The team of scientists with in-depth technical knowledge developed 07 different textures that can be applied to different types of makeup such as face foundation, makeup, primer, lipstick, and lip gloss. We name the textures as follows:

- Cloud Texture - Ref.: 2020.930.005.06
- Creamy Texture - Ref.: 2020.930.010.01
- New Jelly Texture - Ref.: 2020.970.001.03
- Melting Wax Texture - Ref.: 2020.930.006.01
- Water Soft Texture - Ref.: 2020.930.008.04
- Oil Gel Infused Texture - Ref.: 2020.982.003.01
- Gel to Glass Texture - Ref.: 2020.982.004.02

For each of the formulations developed, it was necessary to survey with cosmetic consumers to understand which textures the Brazilian consumer could please the most.

The evaluation of trends and analysis of market products (benchmark) was also necessary because we know that the beauty market is very busy and needs to be evaluated

frequently so that we have news, so this evaluation and analysis of products were carried out by a group of scientists dedicated to the study and with the knowledge to choose the best opportunities.

After this step, it was necessary to search for innovative raw materials with sensorial characteristics according to each texture. There is a multitude of formulation possibilities available in the materials market and it was necessary to evaluate which raw materials could meet the texture challenge that we set out to develop.

Among the raw materials evaluated during the formulation research, the main ones that contributed to the innovation factor in the textures were:

- **Carbomer** – of all the carbomers available on the market found one that is a cross-linked acrylic water-soluble resin, which was developed based on high polymer technology and shows excellent thickening effects even at low concentration by neutralizing with adequate alkalis. Unlike other soluble resins, this solution has a thixotropic character as well.
- **Hydrogenated Farnesene -** Farnesene is a combination of isomeric compounds between them. For this ingredient, natural farnesenes are combined, which can be extracted from the coating of fruits, or also from the constitution of essential oils. It has incredible emollient and skin conditioning properties, giving it a light finish and a very smooth texture.
- **Butylene Glycol** – Practically odorless and hygroscopic liquid with good solubility in water and slightly soluble in ether. This raw material is insoluble with hydrocarbons, so it was necessary to be careful in the formulation. It is an excellent humectant, thus inhibiting the drying of cosmetic products.
- **Silica** – Used in cosmetics are hollow ellipsoids of highly porous silica. Silica Microspheres have a very high absorption capacity, up to 5 times their weight. To prevent the absorption of formula ingredients by the silica shells, these can be pre-loaded with a volatile liquid, such as esters or silicones for example. When applied to the skin, silica contributes a sensation and has the characteristic of absorbing oil from the skin, thus leaving a dry touch sensation.

As with any development of new formulations, it was necessary to carry out a stability study by the ANVISA Cosmetic Products Stability Guide (National Health Surveillance

Agency - BR) and compatibility between raw materials and fragrances to ensure that each of the formulations did not lose their attributes, smell and benefits in terms of the desired texture.

In total, 32 formulations were developed until we selected the 07 best ones for fragrance application. Remember that each of the formulations has a different texture and an exclusive sensory appeal. Thus, the emotions and sensations aroused by each of the formulations are different between them.

Neuroscience evaluation

Fragrances and colors (Figure 1) were evaluated by neuroscience, by using the Implicit Association Test (IAT) method. Previous to IAT, the Self-Assessment Manikin (SAM) Overview was applied to participants. This methodology is based on the PAD (pleasure-arousal-dominance) theory of emotion. SAM is a non-verbal test measuring the dimensions of pleasure, arousal, and dominance to detect emotional reactions. Implicit Association Testing (IAT) is a System 1 psychological testing methodology developed and validated in academic research for uncovering mental biases and associations that cannot be articulated and participants are not aware of. Using implicit System 1 methodologies, it is possible to assess holistic consumer product perceptions for cross-modal associations.

In this study, the IAT was designed to assess consumer associations between 6 test fragrances and 10 colors for particular moods and attributes. In the IAT, participants were exposed (for 1000 milliseconds) to each descriptor and asked to decide whether they matched (i.e. how they felt while smelling a test fragrance and the descriptor “tranquil”). The faster the response, the stronger the association between the concept and descriptor. Participants could also choose not to respond, meaning no association.

After a few trials of these pairings, final implicit scores were calculated and ranked for each fragrance, color, mood, and fragrance and color descriptor, to reveal high/medium/low strengths of association. High/medium/low assignments are calibrated at the participant level, within each mood. A high ranking indicates a strong relationship between the concept or fragrance/color and a descriptor. A medium ranking indicates there is some association, but not strong. A low ranking indicates there is little to no association

between that concept or fragrance/color and the descriptor. Emphasis should be placed on the attributes with high associations.

Implicit Scores are analyzed for significant differences by fragrance/color and attributes at 95% and 90% confidence intervals. High associations are those attributes ranking in the 80th percentile or higher for that perceptual area.

The study was conducted as described in Figure 2.

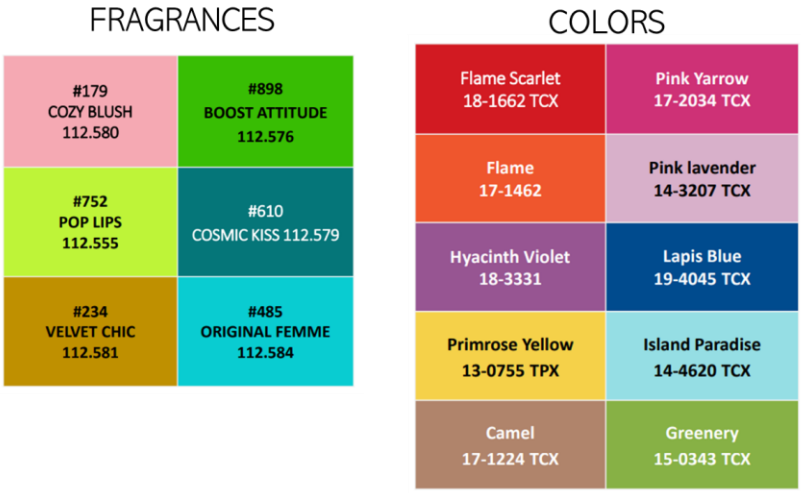

Figure 1: Fragrances and colors evaluated in this study.

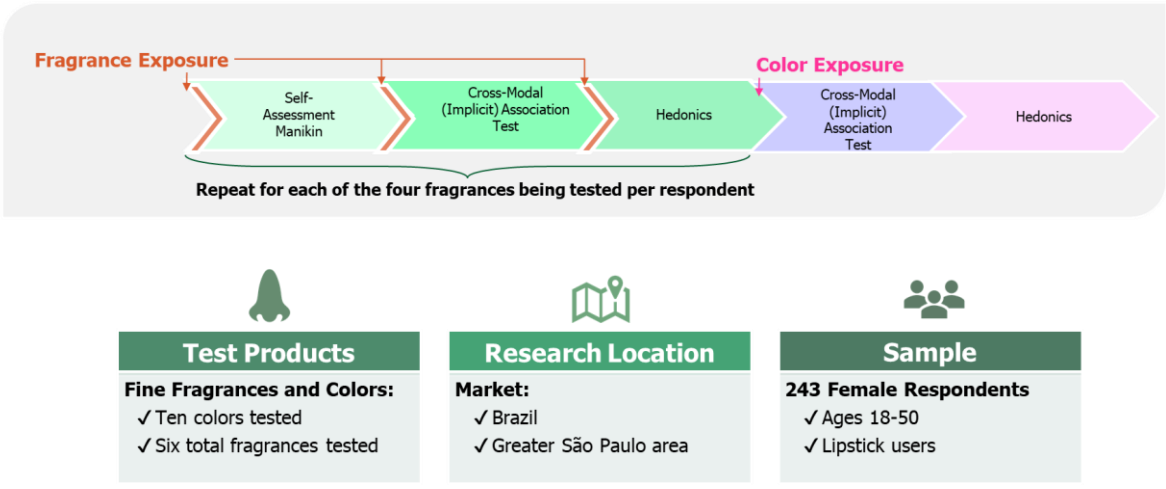

Figure 2: Test design and methodologies that were carried out in order to evaluate the fragrances and colors by neuroscience.

The main objective of this study was to find the best fragrances and colors associated with the mood of *Happiness*.

Psychometric Assessment

Our study was conducted by a team of specialists in sensory evaluation, and expert in the makeup category, where they performed a psychometric evaluation of the 07 textures developed regarding their performance, according to the way of use, through the application of the products. The 07 textures were evaluated separately to determine which sensations were aroused by each one of them, following the CATA technique (Check-AllThat-Apply). Sensory analysis is a tool that uses the sense organs to evaluate products. Several techniques are used, including the Check-AllThat-Apply (CATA), a method used to collect information about consumers' perception of the sensory characteristics of products. It is effective to describe and discriminating samples. The CATA methodology evaluates products in a monadic way, being an affective sensory technique widely used due to its simplicity and a high potential for sample description.

The performance of cosmetic products can be evaluated in several ways and the need for technical support for the products developed increasingly characterizes a need for the support of techniques that strengthen and help the development of products. In this scenario, the intervention of expert analysis was observed, which uses the senses and human response to characterize a product under evaluation.

The objective was to technically assess whether the samples, according to the panel's consensus, delivered the attributes presented below in Table 1.

Results:

Formula Development

As a result of the study, research, and development of formulas, it was possible to obtain 07 new products that can be applied in the cosmetic market.

1. **Cloud Texture –** For this texture, we chose a facial foundation formulation with a high percentage of water in the formulation, 41%. This high concentration of water in a water-in-silicone emulsion was made possible by a balance of emulsifiers, emollients, and treated pigments that are compatible with this texture.

The final texture was left with a light and velvety touch on the skin. Its high concentration of pigment provided a result of high coverage and can be applied both as a face foundation and as a concealer.

And for our communication text, we used the following sentence: “This is our invitation to take a ride in the heights, the feeling of the horizon on the skin. Waking up in the clouds brings an energetic moment with the refreshing water vapor in the palm of your hands.”

We chose the mood of confidence and colors like gold and yellow. Yellow is perhaps the most energetic of the warm colors. And its representation in gold translates the sophistication of glamour.

2. **Creamy Texture –** For this texture, we chose an anhydrous formulation but developed with silicones and with almost 50% of Caprylic/Capric Triglyceride, which provided a dry sensorial. This type of formulation developed made it possible to make a product that can be used in any area of the face, even the lips. It can be a good texture for face illuminators, eyeshadows, and lip balm.

This developed structure also allows the high concentration of pigments and mica in its formulation (between 10 and 15%) without compromising the final texture.

And for our communication text, we used the following sentence: “The internal is externalized in an exciting and radiant sensation. Vitality at your fingertips.”

We chose the mood happy and colors like coral and orange to complement the texture. A mix of orange + red. The orange side surrounds us with a feeling of vitality and happiness. While the power of red awakens attraction, it draws attention.

3. **New Jelly Texture –** For this texture, we chose a gelatinous and fun formulation, due to its thixotropic characteristics. This also contains a large amount of water in its formulation and can be applied using dyes (in low concentration) or shimmering pigments. This type of formulation developed made it possible to make a product that can be used in any area of the face if the dyes and their application are respected. When developed only with shimmering pigments, it can be a great choice for a highlighter for summer use. And with dyes like being used as a blush.

And for our communication text we use the following sentence: “Have fun! Life is like that, it allows us. Be allowed! Feel on your face the touch that blushes, that caresses, that makes

you close to those you love. And so! Simple and practical". We chose the mood of joy, fun, and colors like red for being attractive.

4. **Melting Wax Texture –** For this texture, we chose an anhydrous formulation, rich in vegetable waxes, butters, and Hydrogenated farnesene. This combination results in a product with a low melting point, which can melt when applied to the skin. Therefore, it is a great option for makeup removers because we can reach a powerful structure even to remove waterproof makeup. It is a formulation that allows the use of vegetable oils and butters, thus leaving final sensory skin care with a sensation of hydration. We choose to leave the formulation without the addition of pigments, but we can apply it if we wish. The formulation itself is white.

And for our communication text, we use the following sentence: "It is in unexpected moments that a surprise becomes an experience. When you remove your makeup, it transforms and provides a feeling of melting and cleaning".

We chose the mood relaxing and colors like green. Green is the color of prosperity and abundance, it is related to stability and resistance. Giving us the persistence and strength to deal with adversity.

5. **Water Soft Texture –** Among all the textures this was the most challenging. After all, for this texture, we chose a formulation with a high concentration of water (72%) but with a silicone elastomer sensory. For this, after a lot of research, we found a differentiated carbomer in the raw material market that allowed us to achieve the desired texture. This formulation can be quite interesting for the use of actives that help in the treatment of the skin. It can also be a product for both day and night use. It is possible to add shimmering pigments to the formulation without altering the velvety and watery sensorial.

And for our communication text, we used the following sentence: "The day was full, but the time has come to take care of yourself, disconnect to connect with more of what makes you feel good. Enjoy this time. After all, we are almost just water and emotions!".

We chose the mood relaxation and left the product colorless.

6. **Oil Gel Infused Texture –** For this texture, we chose an anhydrous and gelatinous formulation, rich in vegetable oils and waxes. This combination results in an oily, high-gloss product that can be easily applied as a liquid lipstick or gloss. This structure allows

the incorporation of pigments dispersed in vegetable oil and sparkling pigments that make it possible to develop a great possibility of colors.

And for our communication text, we use the following sentence: “Your touch, your body, your thoughts slide as recognition. Enough is the moment, the future, slips away with the sensation of the most precious oil that reflects the best: you!”.

We chose the mood of sensuality and colors like brown. Brown makes you feel down to earth. Creates a sense of stability and support.

7. **Gel to Glass Texture –** For this texture we chose an anhydrous, oily formulation, rich in vegetable oils and velvety touch emollients. This combination results in an oily product with a very high shine, so it can be easily applied as a gloss that can have a color or be colorless. The colorless version allows a glass finish (due to its high shine) on the lips.

And for our communication text, we use the following sentence: “Awaken your most romantic side where you are not content to love and be loved halfway. Put love at your feet, invest in the vitrified shine and the fragrance that expresses your romanticism.”

We chose the mood romantic and colors like pink. Pink represents femininity and romance, sensitivity, and tenderness. It's inherently sweet, cute, and charming.

Neuroscience evaluation

The 6 fragrances, named #179 Cozy Blush, #898 Boost Attitude, #752 Pop Lips, #610 Cosmic Kiss, #234 Velvet Chic, and #485 Orginal Femme, and the 10 colors named Flame Scarlet, Pink Yarrow, Flame, Pink lavender, Hyacinth Violet, Lapis Blue, Primrose Yellow, Island Paradise, Camel, and Greenery were evaluated and the results indicated what moods which one of them was associated with (Figure 2 and Figure 3).

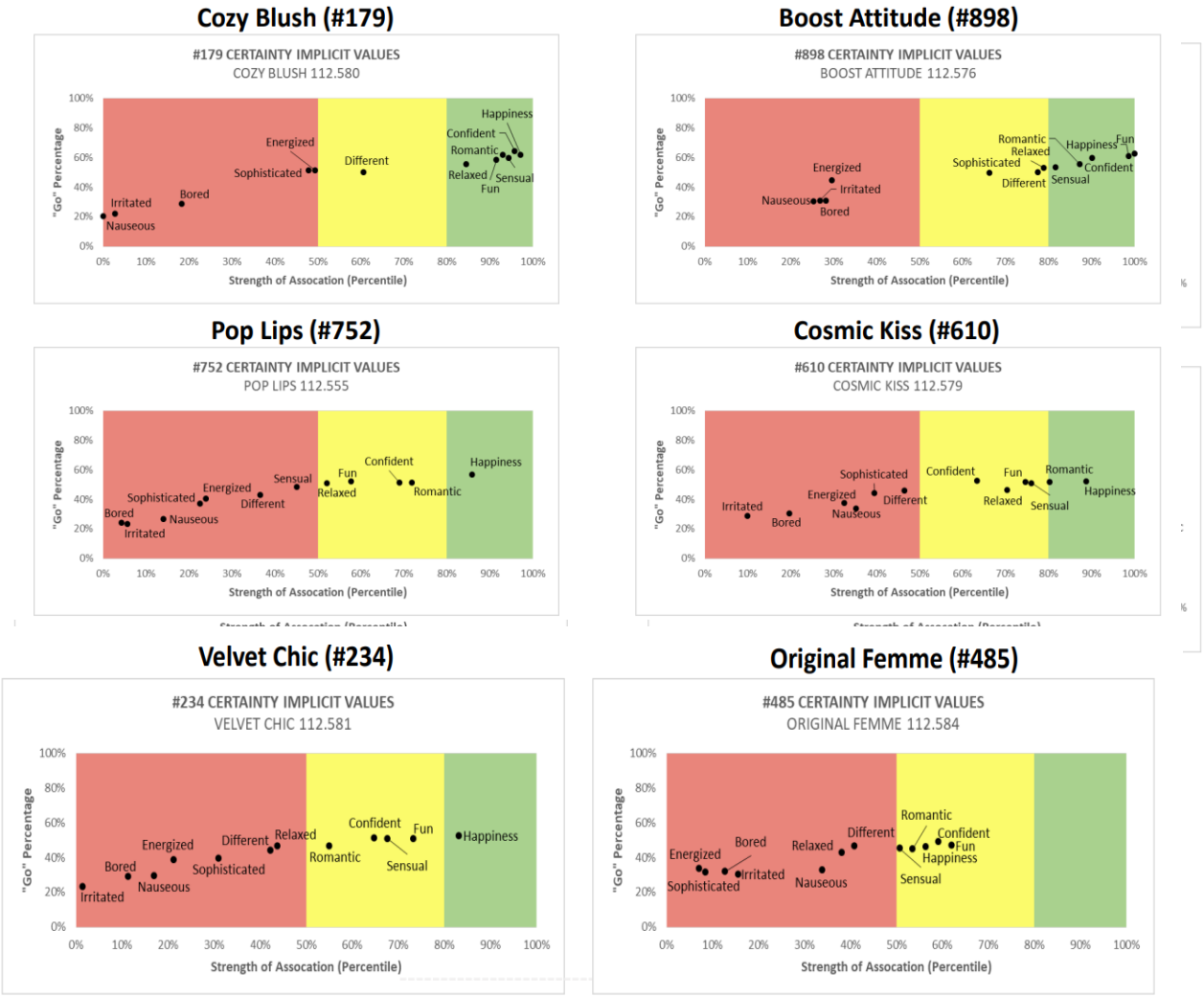

Figure 2: Moods and fragrances evaluated by IAT. Green stands for the high association, yellow stands for medium association, and red stands for the low association.

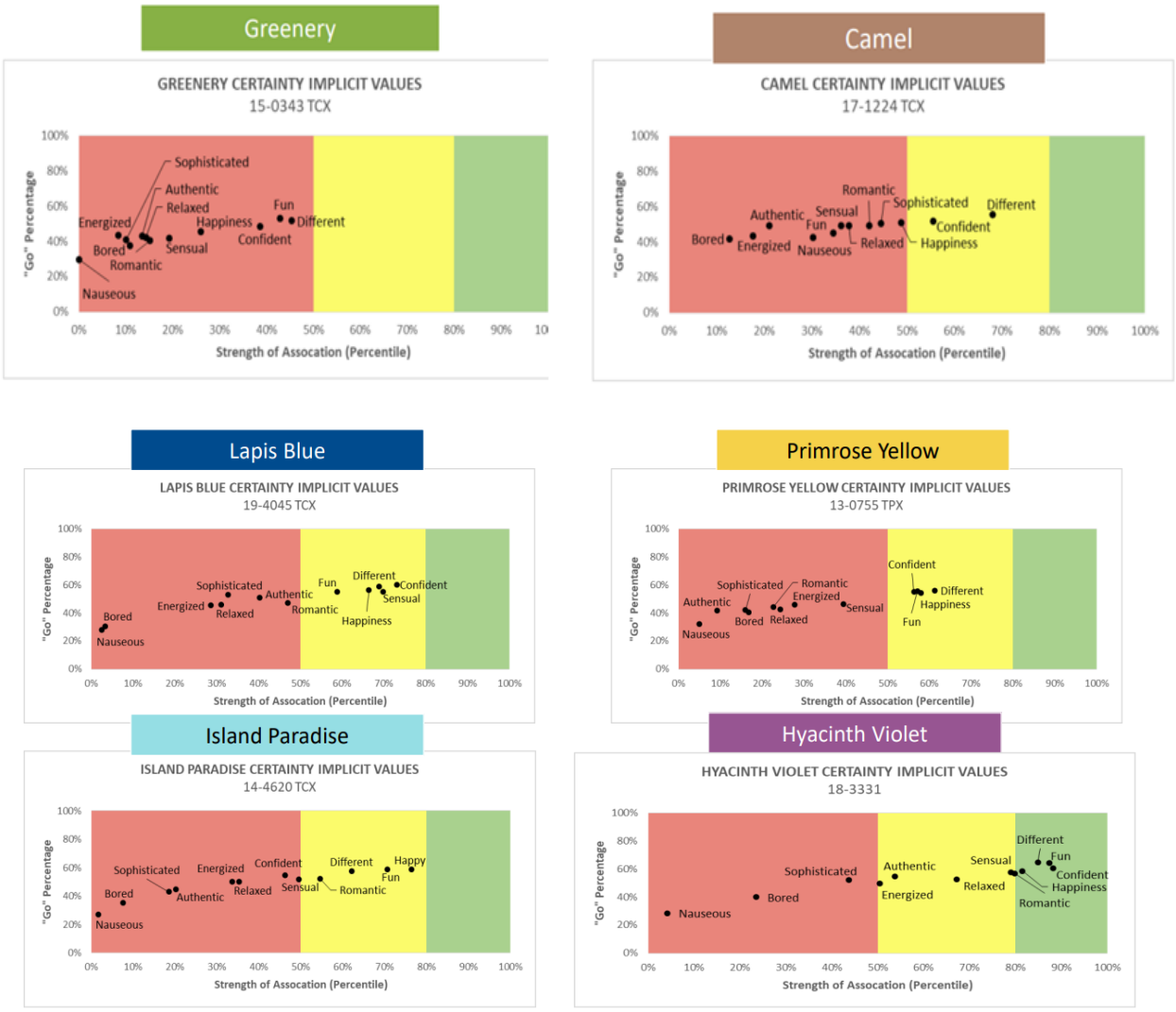

Figure 3: Moods and colors evaluated by IAT. Green stands for the high association, yellow stands for the medium association, and red stands for the low association.

The results demonstrated that most of the fragrances and colors were associated with several moods. For the mood of *Happiness*, the fragrances #179 Cozy Blush, #898 Boost Attitude, #752 Pop Lips, and #234 Velvet Chic and the colors Flame Scarlet and Pink Arrow were highly associated and therefore, the ones that best fit with the desired mood.

Psychometric Assessment

Oil Gel Infused Texture	Gel to Glass Texture	New Jelly Texture	Cloud Texture	Melting Wax Texture	Water Soft Texture	Creamy Texture
high pigmentation	high shine	with natural effect	with natural effect	melt your makeup	refreshing feeling	high pigmentation
comfortable feeling	comfortable texture	color that brings life to the skin	glow texture	Removes makeup and leaves skin feeling cared for	smooth as water	pigment on first application
elegant shine	with natural effect	Cheeks: No tightness / feeling hydrated	build coverage		high feeling of hydration	
striking lips	feeling of hydration	velvety touch	smooth touch	remove waterproof	smooth touch	practical 2 in 1 (face and lips)
harmonic shine	elegant shine	comfortable texture	delicate texture		not sticky	
feeling of hydration	luminosity to your lips	Jelly texture with a sparkling touch	Silky, non-sticky touch		feeling of care	build coverage
pigmentation with shine	does not flow	Flushed and vibrant skin	light coverage		take it like the breeze	fast drying
smooth touch	Does not accumulate in the creases and corner of the mouth	Fresh/refreshing feeling when applying	fast drying		matte texture	dry touch
comfortable texture			disguise imperfections		non oily	natural appearance
uniform color		does not accumulate	light texture		blur effect	
Non-sticky gloss effect		practical and comfortable	smooth skin			
not oily		blush and ready for everyday				
glossy lips						

Table 1: Result of evaluations with validated attributes

Discussion

For a product that deals with the benefits of important emotions and differentiated sensations, 3 main pillars: sensory evaluations for elaborate elaboration; use, and printing of the final product. Thus, each one of them can contribute and add different emotions. With the study, we were able to assess that the same texture with different ones can disperse a different emotion in the consumer. For this perception, it is necessary to study neuroscience methodologies associated with a sensory evaluation performed by experts. It is important to emphasize the need for a complementary method or another and not make a choice between them, so it is possible to bring strength to the result and greater certainty when declaring moods of happiness for example for the consumer of the cosmetic product.

It is necessary to develop new textures in the world.

The makeup is important to assess the colors attract or the consumer can use a particular product and not just the color of application the consumer but also the placement of packaging and product communication.

Conclusion

The research was carried out using advanced research methods, that made it possible to understand the consumer's perception regarding the connection between colors and fragrances related to moods and sensations. An understanding of texture associated with fragrance and color can be well accepted and arouse feelings and emotions for the consumer, what is important and makes difference in the choice and satisfaction during the application and permanence with the product. We conclude that for an evolution in the attributes communicated about a cosmetic product and especially makeup, it is necessary that we always have evolution in the methods of evaluation and complementation between them. As for texture, it is the scientist's role to be always evolving in the search for new textures, apply in makeup products, and suggest new options for the consumer. These textures can still have a better acceptance when fragrances that arouse sensations and emotions during the consumption journey are incorporated into the formulation.

Acknowledgments.

The authors would like to thank Grupo Boticário for the resources allocated to this research project.

Conflict of Interest Statement. NONE.

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