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# Tactile Perception in the Sensory Comfort of Fabric Samples

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**Abstract**. This investigation aims to present the process of development of the attributes that will form the textile lexicon of the northeast region of Brazil for the assessment of textile tactile comfort. For this purpose, the following were adapted: ISO 11035:1994 Sensory analysis – Identification and selection of descriptors for establishing a sensory profile by a multidimensional approach; and ISO 8586:2012 Sensory analysis – General guidelines for the selection, training and monitoring of selected assessors and expert sensory assessor's standards concerning the areas of food and cosmetics. Three panels of naive assessors from three different cities in northeastern Brazil were invited to touch 8 samples of fabrics with different textures and compositions. Initially, they generated 322 terms. Afterwards, in a second phase, they qualitatively eliminated terms with the same meaning. In the third phase, they grouped the terms through similarity analysis, which resulted in 23 terms. Then, the terms that were most cited by the assessors were analyzed and, as a result, 4 terms were eliminated. Finally, similarities were evidenced in the haptic perceptions that were perceived by the different panels, due to their cultural proximity and the fact that they come from the same region of a country with continental dimensions, as well as the transformation of human subjectivity into objective parameters provided by the textile lexicon.

## Introduction

Despite the economic and social importance of Brazilian textile products, few studies have been carried out on their sensory quality. Among the several quality attributes, one of the properties that motivate consumer acceptance of textiles, and make consumers repeat their purchase, is comfort. Textile comfort has been studied using instrumental and sensory methods.

Sensory analysis is a science used to measure, assess and interpret sensory attributes of a product through the five human senses (sight, taste, smell, hearing and touch) [1]. Sensory assessment is the result of the psychological and physiological responses of each individual. It emerged as a technical standard initially developed by the food industry, with the aim of distinguishing and describing (qualitatively and quantitatively) sensory stimuli, [2] and [3]. Its main purpose is to understand the decision making process carried out by consumers when choosing products, and to find sets of characteristics that are a determinant of the perception of the product, using the human senses as assessment tools.

Some researchers have been adapting international standards developed for food evaluation in order to be employed in other areas, such as the textile and clothing sector, as studied by [4], [5], [6], [7], [8] [9], [10], [11], [12] and [13]. The investigation of these researchers took place mainly through the tactile perception of textile samples. When running the hand over a textile surface, a complex multisensory, emotional and cognitive process occurs, which causes a reaction based on the sensations obtained, and which is imprinted in the person's mind [11].

According to Philippe et al. [14], investigations concerning sensory analysis emerged in the 1950s with the development of descriptive methods used by the food industry. From the 1970s onwards, the

complete methodology of descriptive sensory analysis was proposed, becoming a standard in the USA in the 1980s, and currently being the international standard ISO:8586:2012 Sensory analysis – General guidelines for the selection, training and monitoring of selected assessors and expert sensory assessors. These sensory methods generally use the human senses as a measurement tool. In textile products, sensory studies were carried out from the 1980s onwards, with trained or untrained assessors, to perform the tactile assessment. Tactile sensory comfort in textiles is essentially the result of the tensions generated by touching the fabric and the way these sensations are transmitted to the skin [15].

The sensory analysis uses a set of standardized attributes for sensory evaluation: the lexicons. Therefore, the development of a global lexicon for tactile sensory analysis is an important tool for tactile evaluation of products. Therefore, this study adapted the sensory analysis methodologies developed for the food and cosmetic industries, [16], [17], [18] and [19], in order to develop a textile lexicon for tactile sensory evaluation.

Researchers in France (2004) [5], Portugal (2007) [20] and in the southern region of Brazil (2017) [23] developed textile lexicons using the same methodology adapted from the ISO 11035:1994 Sensory analysis – Identification and selection of descriptors for establishing a sensory profile by a multidimensional approach [18], and ISO 8586:2012 Sensory analysis – General guidelines for the selection, training and monitoring of selected assessors and expert sensory assessors [16]. Afterwards, the lexicons were compared and the similarities between them analyzed, firstly through Nogueira et al., who compared the French and Portuguese lexicons [20], and then through Nagamatsu et al. [21], who compared the French, Portuguese and Brazilian lexicons.

The French and Portuguese lexicons are formed by 14 attributes and the lexicon of the southern region of Brazil is formed by 11 attributes. As a result of this comparison, 7 attributes were found in common between the 3 countries. The 7 common attributes are the most mentioned among the panelists and offer greater subsidies for improvement in the development of innovative clothing, resulting in greater comfort for the consumer.

However, Brazil is a large country, with great cultural and climatic diversity. Therefore, the question arose about whether there would be differences between the textile lexicon developed in the southern region and one developed in the northeastern region of Brazil. To answer this question, this study aims to present the process of development of the attributes that will form the textile lexicon of the Northeast region of Brazil for the assessment of textile tactile comfort.

## Materials and Methods

The method for the development of the lexicon for the northeast region of Brazil regarding textile tactile sensory evaluation was adapted from the ISO 11035 [18] and ISO 8586 [16] standards, as well as the Quantitative Descriptive Analysis [22]. These standards indicate both the protocols needed to generate the sensory attributes and the four phases for the reduction of terms until the formation of the final lexicon: three qualitative reductions that eliminated hedonic terms and rejected descriptors with the same meaning, combining singular terms, and a quantitative reduction using statistical methods, such as geometrical analysis and Principal Components Analysis – PCA (Figure 1).

In this article, the results of the qualitative reduction of the terms that will compose the textile lexicon for the northeast region of Brazil are presented, in which all the different perceptions of the textile samples were evaluated until the words run out.

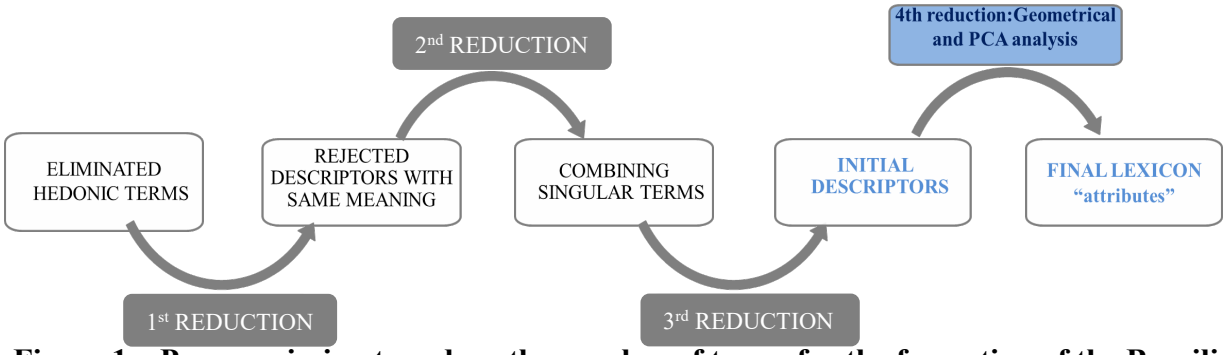


**Figure 1 – Process aiming to reduce the number of terms for the formation of the Brazilian lexicon [23].**

During the month of April 2019, three panels consisting of 47 naive volunteers were invited to participate in this study. They were of different genders, personal tastes and levels of education and expertise, residing in three different cities in the northeast region of Brazil: Recife (19 volunteers), Fortaleza (14 volunteers) and Teresina (14 volunteers). The three cities are classified as having a tropical climate and, during the month of April, their annual average temperatures do not differ from each other, with 25º C and relative humidity of 83%.

The panels of naive assessors were invited to touch and describe the sensations arising from the touch in 8 samples with different textile structures and fiber compositions, which were cut into 20X20 centimeters pieces (Figure 2). The samples were from a set of 54 samples used by researchers from the southern region of Brazil [24].

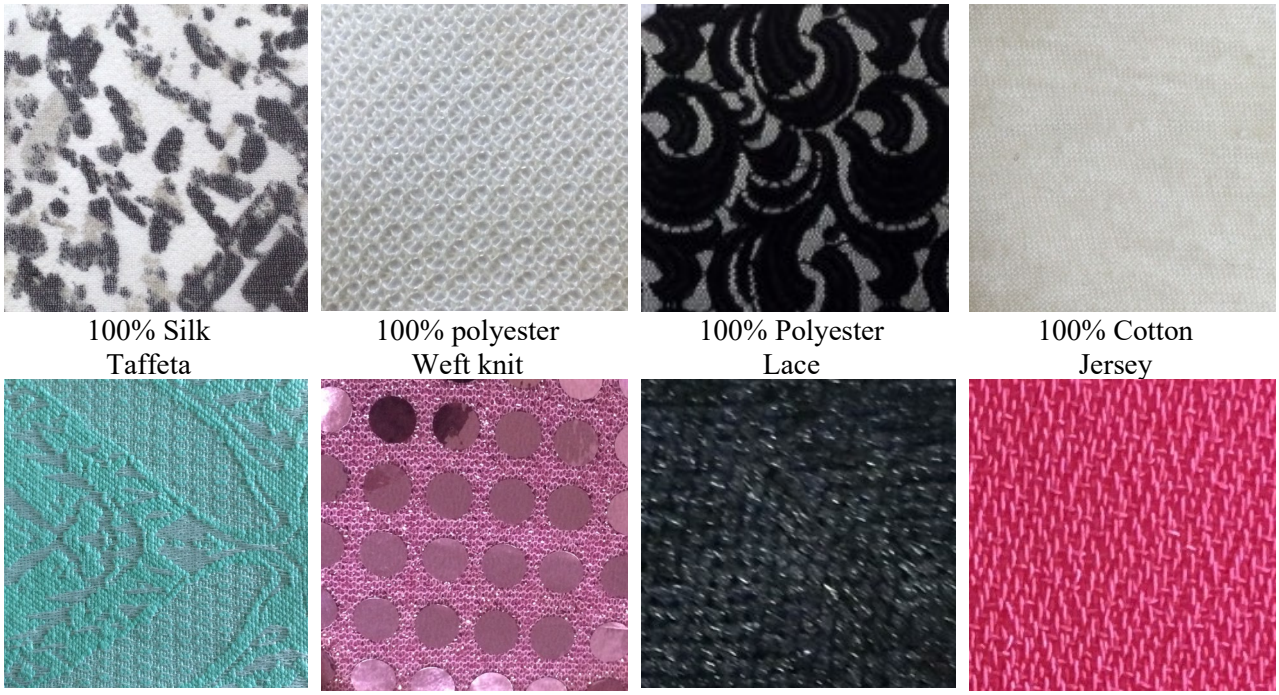


**Figure 2 – Textile samples.**

The three panels of sensory assessors touched the fabric samples, and they were behind a cardboard wall in Fortaleza and Teresina, whereas in Recife the assessors were blindfolded (Figure 3). The assessor's evaluation described the feelings when touching the samples without seeing them and using free vocabulary.

(a) (b) (c)

**Figure 3 – The panels of sensory assessors in: (a) Fortaleza (b) Recife, (c) Teresina.**

## Results and Discussion

Naive sensory assessors[1] generated 322 terms over a period of one hour. Afterwards, in a first reduction, 241 terms were eliminated, specifically terms that: characterized other senses (sight, taste, smell and hearing), were not quantifiable, referred to end use of the material, were antagonistic, characterized the textile property and those not relevant.

Then, the remaining 81 terms were subjected to the second reduction, in which terms with the same meaning were eliminated.

In a third reduction, the singular terms were grouped, resulting in 23 representative terms.

The 23 representative terms were first grouped into: hedonic (comfortable, uncomfortable), structural (open, thin, dense, elastic, heavy, light, ribbed, rigid), composition (natural, synthetic), surface (textured, smooth), thermal sensation (cold, warm) and fabric's property (fragile, durable, malleable, rustic, resistant, impermeable, adherent), as shown in table 1.

**Table 1 – Selected and grouped attributes.**

| Hedonic | Structure | Composition | Surface | Thermal sensation | Property |
|---|---|---|---|---|---|
| Comfortable | Open | Natural | Textured | Cold | Fragile |
| Uncomfortable | Thin | Synthetic | Smooth | Warm | Durable |
| | Dense | | | | Malleable |
| | Elastic | | | | Rustic |
| | Heavy | | | | Resistant |
| | Light | | | | Impermeable |
| | Ribbed | | | | Adherent |
| | Rigid | | | | |

Afterwards, the attributes that were most cited by the naive evaluators regarding the sensations perceived when touching the textile samples were qualitatively analyzed (table 2).

[1] Naive assessor: someone who doesn't need to meet any precise criterion in the sensory test [16].

**Table 2 – The attributes that were most cited by the volunteers**

| Sample | Hedonic | Structure | Composition | Surface | Thermal sensation | Property |
|---|---|---|---|---|---|---|
| A | - | Thin and light | - | Textured | Cold | Malleable |
| B | Comfortable | Dense and rigid | | Textured | Warm | Malleable |
| C | | Light and elastic | | Textured | Cold | Malleable |
| D | Uncomfortable | Dense, rigid and heavy | Synthetic | Textured and the reverse is smooth | Warm | Adherent |
| E | | Open, light, elastic and thin | | Textured | Cold | Malleable |
| F | Comfortable | Light and elastic | Synthetic | Smooth | Warm | Malleable |
| G | Comfortable | Dense and rigid | | Smooth | Warm | Malleable |
| H | | Rigid and light | Synthetic | Smooth | Warm and Cold | Malleable |

The property attribute that was most cited was “Malleable”. The attributes of the groups “surface” and “thermal sensation” can be classified as bipolar: Textured/Smooth and Warm/Cold.

The attributes of “structure” presented a wide diversity of terms, as in the previous study in the south of Brazil [21].

The naive volunteers did not mention the hedonic terms “comfort” or “discomfort” when touching the samples: A, C, E and H, and could not feel the composition when touching the samples: A, B, C, E and G. This indicates that the terms of the groups hedonic and composition are not quantifiable to the human touch and can be eliminated, resulting in 19 representative descriptors that form the initial lexicon for the northeast region of Brazil.

## Conclusions

In this study, it was observed that tactile comfort is not necessarily associated with the physical characteristics of the fabric, but rather with the way the individual perceives it.

It was also possible to observe similarities in the attributes perceived by the three panels of volunteers, due to their cultural proximity and because they live in regions with the same climatic conditions, in the northeast of Brazil.

The construction of the textile lexicon favors and simplifies the analysis of fabric samples, by synthesizing their characteristics, as a result, it is possible to easily describe a fabric and its performance with regard to the perception of different individuals. The adaptation of food and cosmetic standards facilitated the understanding of a complex system for the development of a textile lexicon aimed at tactile sensory evaluation. Furthermore, in the future, the lexicon from the experts from Apucarana/South of Brazil will be compared with the lexicon obtained in this study, regarding the northeast of Brazil, in order to observe if there are any differences between the lexicons from these regions of Brazil, since, although they are part of the same country, they form distinct regions, which can influence the perception arising from the touch.

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