INTERNATIONAL JOURNAL OF APPLIED RESEARCH ON TEXTILE
URL: http://atctex.org/ijartex
Volume 2, Issue 1, pp 30-42, April 2014

EVALUATION OF SENSITIVITY AND DISCRIMINATIVE PERFORMANCE OF TACTILE SENSORY PANEL

HALLEB A. N.*, SAHNOUN M. AND CHEIKHROUHOU M.

TEXTILE ENGINEERING LABORATORY, UNIVERSITY OF MONASTIR, TUNISIA

Received 10 October 2013, Accepted 23 December 2013

ABSTRACT

In this work, a sensory assessment method was developed using a trained tactile panel, to help the company to foresee the sensory profile of its products, hence predict the degree of consumers' satisfaction of their products. This panel took part in a training program. During which, their performance on the level of repeatability was controlled to decrease the variability of the provided measurements. In This paper, the researchers underline the experience acquired by these panelists during the training program and assess their capability to differentiate between the denim fabrics treated with different finishing and softening processes. Analyse of variance and principal components analyses were carried out to define the most pertinent attributes, which allow to find out the difference between the treated samples, and to control the performance of the trained panel. These analyses permitted to set up a group of ten tactile experts able to discriminate and to quantify the difference between the assessed samples.

KEYWORDS

Sensory analysis, Handle, Finishing, Softening, Denim fabric.

1. INTRODUCTION

The term fabric "hand" or "handle" was defined as the quality of a fabric or yarn assessed by the reaction obtained from the sense of touch or the total sum of the sensations expressed when a textile fabric is handled by touching and flexing with the fingers (Bishop, 1996). It implies the ability of the fingers to make a sensitive and discriminating assessment, and the ability of the mind to assimilate and express the results in a single judgment (Ellis and Gransworthy, 1980).The hand indicates a subjective feeling; it can vary from one day to the next for the same person, from a person to another, from a culture to another. This term is treated in several manners in the literature;

Investigators like Binns (1926), Pierce (1930), Houghton and Yaglou (1923), Winslow et al (1937a, b), and others were the first to begin systematic analyses of subjective responses to textile and clothing. From those early efforts evolved the conceptual bases for the study of fabric "handle" and overall clothing comfort.

Howorth (1958, 1964) and Oliver (1958) studied the subjective assessment of fabric hand. They used a panel of 25 people with no special experience in handling fabrics to rank 27 samples of worsted suiting fabrics which were ranked according to hand by the method of comparison in pairs.

Brand (1994) is one of several researchers who made differences between experts and untrained judges of textile hand. He stated that; "aesthetic concepts are basically people's preferences and should be evaluated subjectively by people". Hui et al (2004) trained panelists to understand the definitions of the fourteen

*: Corresponding author. Email : Naimahalleb2005@yahoo.fr

significant bipolar pairs of sensory attributes of fabric hand. And in order to assess the reliability of these panelists, they conducted a test-retest reliability study.
Yick, et al (1995), studied the influence of the judge's experiences on the results of subjective handle assessment. They used a panel of 199 judges with different academic and industrial experiences in the textile and clothing industries. They concluded that the more experienced judges exhibited a higher percentage of significance and gave a higher level of overall agreement. Philipe et al (2003) developed a sensory panel, applied to textile goods, on the bases of studies already performed in the food industry.
In the work of Cardello and Winterhalter (2003) a standardized hand evaluation methodology (HSDA; Handfeel Spectrum Descriptive Analysis method) was checked for its sensitivity and reliability and was used to characterize military fabrics. They concluded that in conjunction with the panel training program, result in a sensory hand evaluation method is highly sensitive and reliable over an extended period of time.
The fabric handle depends on several parameters starting from the raw material to the finishing treatments. Colina et al (1999) used subjective and objective evaluation methods, to quantify the tactile and mechanical properties of 1*1 rib knitwear fabrics (acrylic, cotton, and wool) which were subjected to different techniques of laundering in a variety of washing and drying conditions. Philippe et al (2003) compared the effect of some type of softener on the sensory feeling of fabrics. In the work of Strazdiene et al (2006) the effect of two finishing products (the crease-resistant finishing Knittex "K" and the softener macro Silicone Ultratex "UI") upon 100 % cotton plain weave fabric was studied with two methods; objective evaluation and sensory analysis. Objective evaluation was done using Griff tester device where disc shaped specimen was extracted through a rounded hole of the stand. Sensory analysis was performed by a panel of 11 trained subjects. Jevsnik et al (2011) used the KES-FB Kawabata (1980) evaluation system to evaluate the effects of cellulose treatment on the weft knitted fabric related to mechanical and surface properties.

The purpose of this work is to control the performance of the trained panel and to assess the capability of the panelists to differentiate between the fabrics treated with different finishing and softening processes. Indeed a group of judges was selected and trained to identify and to quantify the perceptions obtained following the handling of the fabric samples of various aspects. This trained panel assessed 16 tactile attributes selected to find out the difference between assessed samples. The assessed samples were denim fabrics treated with a normal and fifties finishing processes and with softening treatments.

2. MATERIAL AND METHODS

2.1. Characteristics of the evaluated fabrics

The judges were trained to assess all kinds of textiles materials. But this work, only assessed one structure, the twill 3/1 (denim) 100 % cotton. This fabric is characterized by:

- Surface Mass: 451g / m2
- Warp tinted , ring yarn of Nm: 12.5
- Weft raw, Open End yarn of Nm: 13
- Warp Count: 27 yarns/ cm
- Weft Count : 17 yarns/ cm

The studied fabrics were subjected to two different processes of finishing. The first one was a normal finishing, the second a fifties finishing. For every process, we used two concentrations and two types of fabric softener.

Table 1: the assessed samples

Fabric Name	Finishing Process	Softener g/m²
53	Normal	0
54	Normal	30 g/m² ***acrylic resin***
55	Normal	60 g/m²***acrylic resin***
56	Normal	60 g/m² ***naturel acrylic***
57	Fifties	0
58	Fifties	30 g/m² ***acrylic resin***
59	Fifties	60 g/m²***acrylic resin***
60	Fifties	60 g/m² ***naturel acrylic***

The normal finishing:
It consists of a Denim Range treatment followed by a sanforizing:

- *Denim Range:* it is a treatment of fabric in a bath of finishing agent in the presence of a straightening mechanism, which permits to exercise a high tension to fix the angle of movement between the warp and the weft yarns. This treatment allows to increase the density of fabric and makes the handle of fabric more cardboard.
- *Sanforizing: (Pietro et al, 2001)* it is a treatment with a purpose of the dimensional stability of textile materials. The sanforizing allows making the cotton fabrics less fragile to the wash, in particular as regards to their shrinkage and the possible loss of colors. During this operation, fabrics are stretched as well in length as in width so that this is not made during the first wash by the customer.

The fifties finishing:
It is a process of finishing which begins with a treatment on Goller in the presence of NaOH (160g/l) and in a low temperature 10°C, followed by a succession of rinsing and neutralization. This treatment permits a partial desizing of fabric and makes it flatten, get denser, smoother and more brilliant, as it increases the fabric's dynamic resistance and the unification of dye. This finishing process ends-up in a Denim Range and a sanforizing treatment, as in the case of normal finishing.

The softening:
It is an organoleptic treatment. It has for objective to confer a pleasant handle to the fabric. There are several types of fabric softeners which can achieve this objective. The common point to all these fabric softeners is a grease aliphatic chain existing in their molecules. These long grease chains possess a hydrophobic character. During the softening process, these chains form a grease overcoat which sheathes the textile surface. This process makes the fabric saturated. These fabric softeners can be adheres by coating the textile surface or by chemical link with the textile material.

The surfaces of the studied fabrics are coated with softener foam. This treatment is made by means of an industrial machine.

In this work, we studied two types of fabric softeners:

- *Acrylic Resin:* it improves the fabric handle, but it gives a greyish aspect.
- *Natural Acrylic:* it makes the fabric softer and gives it a natural indigo color.

2.2. Condition of the sensory evaluation

The judges of the panel were recruited from volunteer employees at SITEX Company (weaving and finishing factory), chosen on the basis of interest, availability and tactile acuity/sensitivity. It is composed of administrator and laboratory technicians and engineers as well. They have experience of the procedures of fabric manufacture, but do not have any idea about the sensory analysis methods. Their age varies between 25 and 45. Panelists participated in a year and a half training program that consisted of training in the basic methodology and operational evaluation techniques employed in the handfeel. These panelists were trained on textile fabrics of different aspects and structures; furnishing fabrics, knitting and clothing fabrics. During the training program ten panelists (5 men and 5 women) were selected among fifteen trained judges according to their repeatability and their discriminative capacity. This trained panel assessed 16 attributes for 8 samples (2 raw, and 6 treated) using a structured scale (0 to 10) and in accordance with assessment methods predefined for each attribute.

The 16 fabric attributes were selected after qualitative and quantitative reductions of a list of 56 tactile attributes (Halleb, 2013), which were generated following a preliminary questionnaire. For each attribute the assessment methods were defined, through qualitative discussions with the panelists. The panelists were then trained in the quantification of each tactile attribute, in order to prove the consistency of the

panelists' evaluation and the variability between the panelists. The 16 fabric tactile sensory properties and their assessment methods are presented in table 3.

The fabrics were cut into 30cm ×25 cm swatches. Later samples were given to the panelists one after the other in a random order. Before testing, specimens were kept in standard atmosphere conditions (temperature 20 ±2°C, humidity 65 ±2%) not less than 24 hours (NF EN 20139, 1992). The tests were carried out in a room where the temperature and hygrometry were constant. The hands of the panelists were washed and dried before each evaluation sitting, in order to avoid the skews gotten by the cosmetic products and the contact with other products. The time of each evaluation session (4 sessions) was limited to 30 min, because hands become less sensitive if the test is too long. The number of samples to be evaluated by session was fixed to 4. One week was the time period in between two successive evaluation sessions. The evaluation was in specific cabinet and was predominantly tactile without sight.

3. RESULTS AND DISCUSSIONS

To reach the purposes of this work, analyses of variance (ANOVA) in two factors and principal components analyses (PCA) were carried out to define the most pertinent attributes. The ANOVA allowed us to calculate *F* fabric and *F* interaction (*F* was statistical of *Fisher Snedecor*).
The *F* fabric allows to know if the subjects will perceive the differences between fabrics. If *F* fabric is significant the fabrics can be considered different. The *F* fabric was defined as follows:

$$Ffabric = \frac{\dfrac{r\sum_{i=1}^{p}\left(\overline{Y_{ij}} - \overline{Y_{j}}\right)}{p-1}}{\dfrac{\sum_{i=1}^{p}\sum_{k=1}^{r}\left(Y_{ijk} - \overline{Y_{ij}}\right)^{2}}{p(r-1)}} \quad (1)$$

Where Y_{ijk} was the note given by *j*ème panelist to the *k*ème evaluation of the sample *i*. In our case, the number of samples *p* = 4, the number of panelists *q* = 10 and the number of evaluation for the same samples r = 2. $\overline{Y}_{ij}$ was the average of notice for the sample *i given by the* panelist *j*:

$$\overline{Y}_{ij} = \frac{\sum_{k=1}^{r} Y_{ijk}}{r} \quad (2)$$

The *F* interaction (equation 3) informs about the degree of association between the subjects; if *F* interaction is not significant the subjects can be considered as homogeneous in their notation for this attribute; therefore, they are considered in agreement. Otherwise, they are in total disagreement. In that case, it is necessary to find out the origin of the significance of this interaction. Indeed, a PCA is then carried out on the average notes for attributes in disagreements.

$$F\,\text{int}\,eraction = \frac{\dfrac{r\sum_{i=1}^{p}\sum_{j=1}^{q}\left(\overline{Y}_{ij} - \overline{Y}\right)^{2} - pr\sum_{j=1}^{q}\left(\overline{Y}_{j} - \overline{Y}\right)^{2} - qr\sum_{i=1}^{p}\left(\overline{Y}_{i} - \overline{Y}\right)^{2}}{(q-1)(p-1)}}{\dfrac{\sum_{i=1}^{p}\sum_{j=1}^{q}\sum_{k=1}^{r}\left(Y_{ijk} - \overline{Y}_{ij}\right)^{2}}{pq(r-1)}} \quad (3)$$

Where $\overline{Y}$ was the global average of the notice given by:

$$\overline{Y} = \frac{\sum_{i=1}^{p}\sum_{j=1}^{q}\sum_{k=1}^{r} Y_{ijk}}{pqr} \quad (4)$$

$\overline{Y}_j$ was the average of the notice for the panelist *j* :

$$\overline{Y}_j = \frac{\sum_{i=1}^{p}\sum_{k=1}^{r} Y_{ijk}}{pr} \quad (5)$$

And $\overline{Y}_i$ was the average of the notice for the sample *i* :

$$\overline{Y}_i = \frac{\sum_{j=1}^{q}\sum_{k=1}^{r} Y_{ijk}}{qr} \quad (6)$$

Table 2: Results of ANOVA to 2 factors

Attributes	**F Fabric**	**F Interaction**
Cold-heat	28.378 ●	22.769 ●
Moist-dry	6.197 ●	4.715 ●
Thin-thick	46.747 ●	0.964
Falling	14.006 ●	0.332
Tender	33.627 ●	1.79 ●●●
Silky	142.544 ●	8.991 ●
Light-heavy	43.222 ●	1.22
Sleek	22.996 ●	2.75 ●●
Slippery	9.833 ●	1.129
Smooth-grooved	1.629	0.925
Hairy	26.338 ●	12.489 ●
Compact	15.815 ●	0.769
Flexible	74.599 ●	2.775 ●●
Elastic	1.034	0.481
Supple-stiff	39.585 ●	1.304
Wrinkly	86.31 ●	4.422●

Table 2 shows that all the attributes have a significant *F* fabric except *elastic* and *smooth-grooved*. This implies that the assessed fabrics were different for the majority of these attributes according to the panel. The panel did differentiate between samples for the attributes *elastic* and *smooth-grooved*. This can be explained by the fact that the assessed fabrics have the same structure. These two attributes will not be taken into account there, for the later statistical study.

The *cold-warm, moist-dry, tender, silky, sleek, hairy, flexible and wrinkly* attributes presented a significant *F* interaction. We represented the circle of correlation (subjects were PCA variables and fabrics were the individuals) for each of these attributes, in order to determine the origin of disagreement between the panelists.

For the attribute *cold-warm* the panelists are scattered on the circle of correlation (figure1). It shows that, they are completely disagreeing on the notation of fabrics. This attribute cannot be interpreted. For that reason, it will not be taken into account in the statistical studies later. As for the *moist-dry* and *hairy* attributes (figure2 and figure 3), about which the panelists disagree less, they will not also be taken into account.

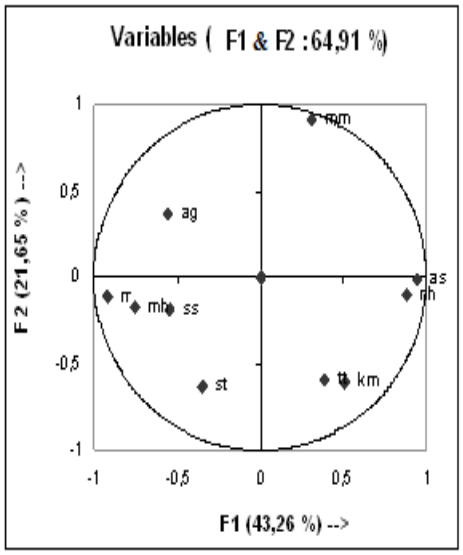

Figure 1: Cold-warm

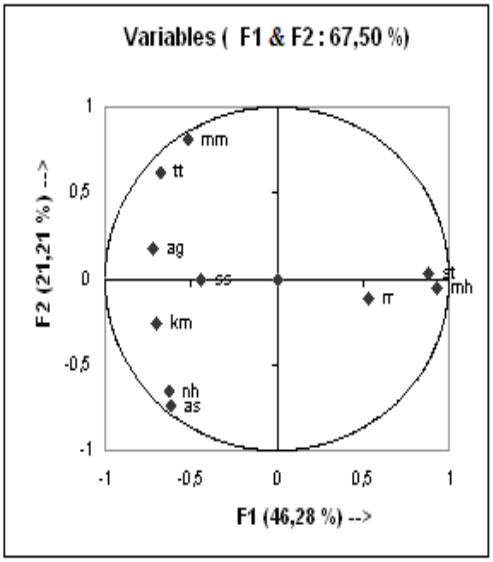

Figure 2: Moist-dry

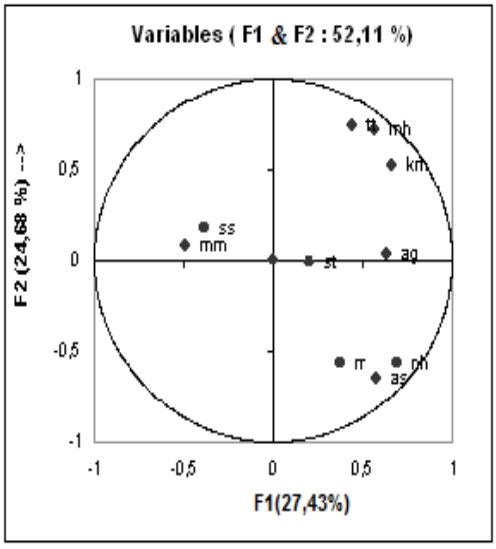

Figure 3: Hairy

However, the subjects are positively correlated on the axis F1 of the circle of the *silky* attribute (figure 4) except the subject **mm**. This subject did not noticed differences on two fabrics among eight, but the

agreement can be considered global; thus, this attribute will be taken into account during the later statistic studies.

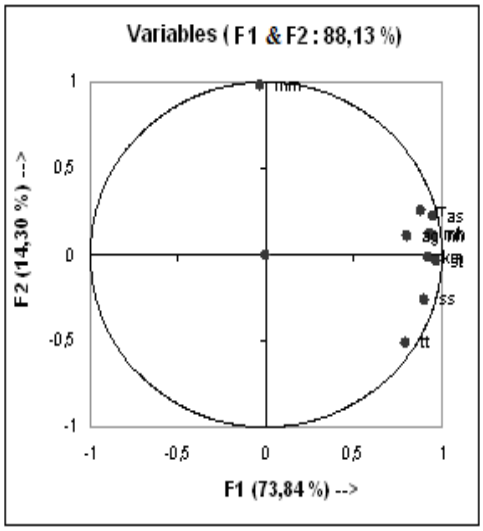

Figure 4: Silky

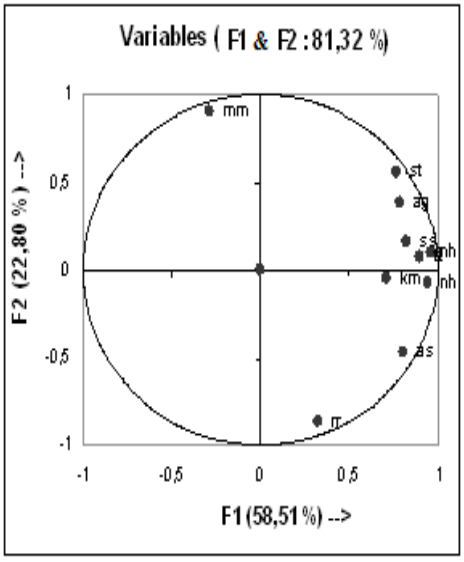

Figure 5: Sleek

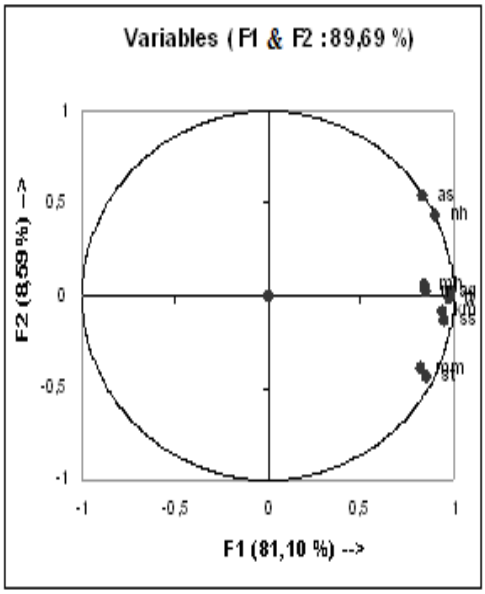

Figure 6: Flexible

For the *sleek* attribute (figure 5), the subjects **mm** and **rr** are a bit taken away from the others because they are not in agreement with the others on the ranking of some fabrics. All the same, we kept this attribute because the subjects can be considered globally in agreement on the evaluation of fabrics.

However, figure 6 shows that the agreement is global for the *flexible* attribute because the subjects are highly positively correlated with each other. This attribute will be considered in the following statistical studies.

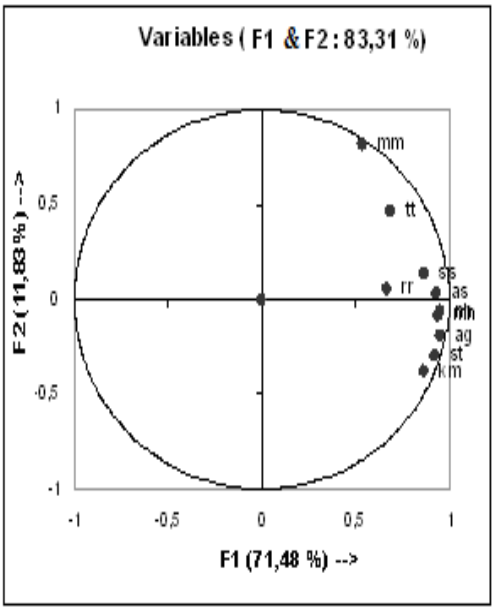

Figure 7: Wrinkly

The *wrinkly* attribute (figure 7) will also be taken into account. For this attribute the panellists present a slight disagreement due to the subjects' **mm** and **tt**, but the agreement is global for the majority of the subjects on the evaluation of fabrics.

According to the previous interpretations, the attributes to be taken into account are the ones which present a non-significant *F* interaction and a significant *F* fabric. The discriminating attributes are then *thin-thick*, *falling*, *tender*, *silky*, *sleek*, *light-heavy, slippery*, *compact*, flexible*, supple-stiff* and wrinkly.

We realized a global PCA on the average notes of the trained panel for these attributes in order to project a multi-dimensional data (11 size) onto the plane of two dimensions (F1 and F2) that account for the greatest percentage of the data variance. According to the curve of the appropriate values (figure8), the important percentage of information is accumulated on the axis F1 (95.51 %).

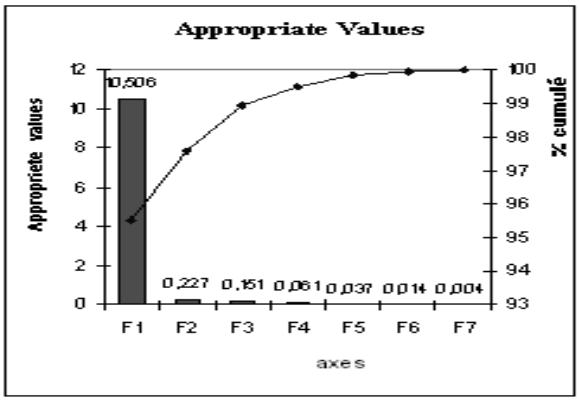

Figure 8: The appropriate values

Indeed, we represented the circle of correlation only on the two first axes, which we considered to be adequate for making broad comparisons between the treated fabrics and to give an overall view of all effects of finishing treatments on them.

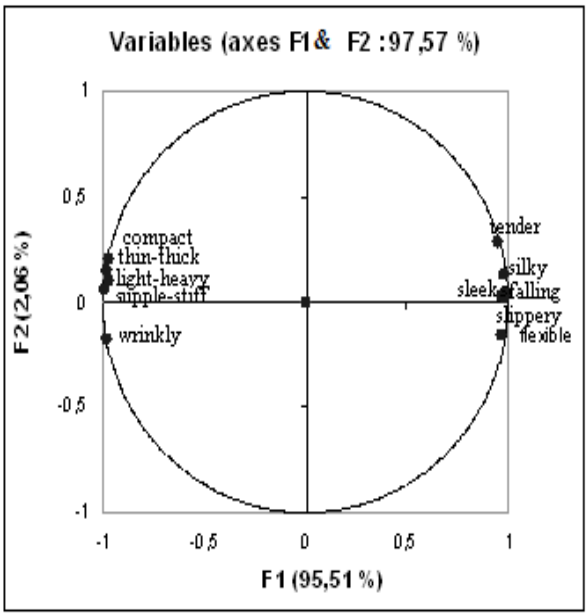

Figure 9: Circle of global correlation

Eleven attributes form two poles on the extremities of the first axis of the circle of correlation (figure9). The *falling, tender, silky, sleek, slippery and flexible* attributes are close together on the positive extremity and diametrically opposed to the other attributes which form the negative pole. This implies that the attributes of the positive pole evolve in the opposite direction of the attributes of the negative pole.

The PCA also allowed us to produce the vectors map of fabrics on these same axes. These maps illustrate the progress of fabric changes through the different finishing treatments and the correlation between the fabrics. On this map (figure10), the fabrics which are subjected to a fifties finishing process (57, 58, 59 and 60) oppose on the axis F1 those which are subjected to a normal process (53, 54, 55 and 56). This shows that the fifties finishing process improves the *falling*, *tender*, *silky*, *sleek*, *slippery* and *flexible* attributes.

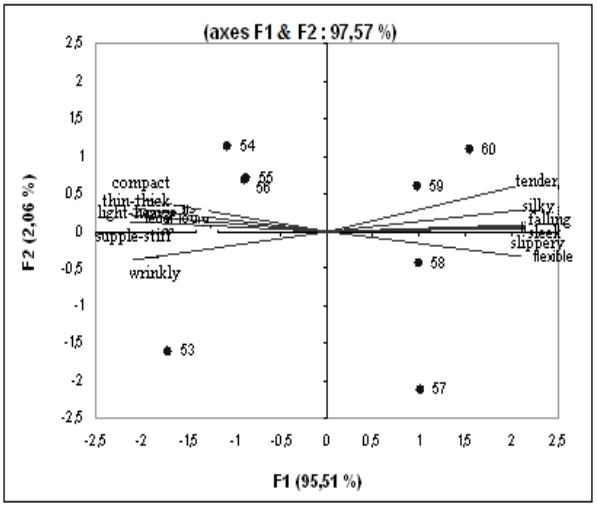

Figure 10: Map of fabrics

This map shows that the fabric not treated by softener 53 was felt the most *wrinkly*, the *stiffest*, the *thickest*, the *heaviest* and the most *compact*. Fabric 60, treated by the natural acrylic fabric softener, was judged to be the *tenderest*, the *silkiest* and the most *falling*. Fabrics 54, 55 and 56 were the most *compact*. This figure also shows that the handle of assessed fabric improves by increasing the concentration of fabric

softener in both cases of fifties and normal finishing processes. The panel did not notice any difference between the fabric treated by acrylic resin (55) and the fabric treated by natural acrylic (56), in the case of normal finishing. However, the panel could feel the difference between 59 and 60 which are respectively treated with the same softeners, in the case of fifties finishing. This can be explained by the fact that the influence of the natural acrylic softener is more readable in the case of fifties finishing. The natural acrylic softener made the fabric *silkier*, tenderer, more *falling*, *sleeker*, more *slippery* and *flexible*.

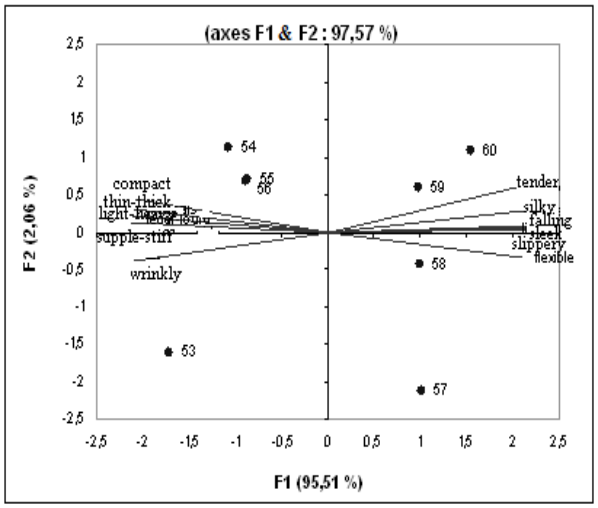

Figure 10: Map of fabrics

The previous results are confirmed by the profiles of fabrics represented in figure 11. This figure presents the evaluation of 11 attributes for eight fabrics tested by the panel of experts.

The analysis of these profiles shows that the influence of the process of finishing as well as the type and the concentration of fabric softener is significant in the handle of the studied fabric. According to these profiles, the *thin-thick*, *light-heavy* and *compact* attributes are more influenced by the finishing process.

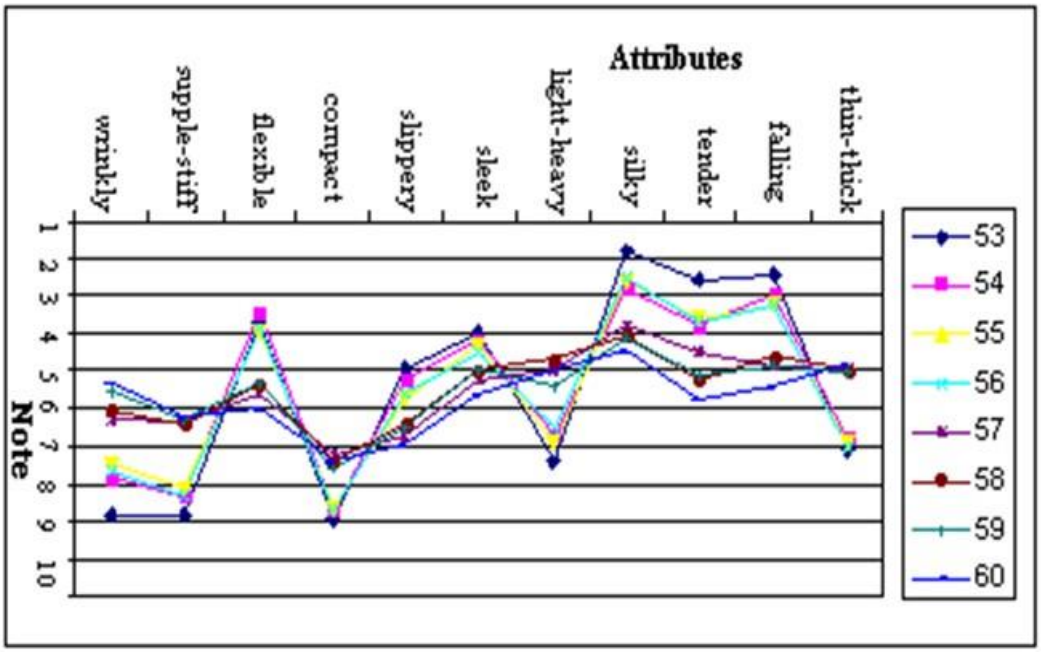

Figure 11: Profiles of fabrics

4. CONCLUSION

The previous results permitted to conclude that the panel perceived significant differences and made distinction between fabrics treated with a fifties finishing and fabrics treated with a normal finishing. This

difference could be due to the treatment with NaOH (in the case of fifties finishing), which allows to soften the fabric by removing an important percentage of size applied in the yarns during the denim fabric making. The panel did not perceive any difference between the fabric treated by acrylic resin and the fabric treated by natural acrylic, in the case of normal finishing. However, it noticed the difference between those which are respectively treated with the same fabric softeners, in the case of fifties finishing. This can be explained by the fact that the influence of the natural acrylic fabric softener is more legible in the case of fifties finishing.

ACKNOWLEDGMENTS

We would like to express our sincere thanks to the director and to all the group of development service of the SITEX Ksar Hellal company for their practically assistance.

REFERENCES

BS EN20139 (1992). Textiles. Standard atmospheres for conditioning and testing. *Britsh-Adopted European standard,* United Kingdom.

Brand, R. H. (1994). Measurement of fabric aesthetic: Analysis of aesthetic components. *Textile Research Journal,* 34, 791-804.

Binns, H. (1926). The discrimination of wool fabrics by the sense touch. *British Journal Psychiatry,* 16, 237-247.

Bishop, D. P. (1996). Fabrics: Sensory and mechanical properties. *Journal of Textile Institute* 26(3), 1-63.

Cardello, V. A., Winterhalter, C., Schutz, H. G. (2003). Predicting the handle and comfort of military clothing fabrics from sensory and instrumental data: development and application of new psychophysical methods. *Textile Research Journal,* 73(3), 221-237.

Colina, M., Subhashm C.A. David, P.B. (1999). Effects of laundering on the sensory and mechanical properties of 1×1 rib knitwear fabrics. Part II: changes in sensory and mechanical properties. *Textile Research Journal*, 69(4), 252–260.

Ellis, B. C. Gransworthy, R. K. (1980). A review of techniques for the assessment of hand. *Textile Research Journal*, 50(4), 231-238.

Halleb, A. N., Sahnoun, M. And Cheikhrouhou, M. (2013). Training and control of performance of tactile sensory panel. *Journal of Applied Sciences, 1*3(/3), 366-376.

Houghton, F. C. and Yaglou, C. P. (1923). Determining lines of equal comfort. *Journal of American Society for Heating and Ventilating Engineers Trans,* 29, 163-176, 361-384.

Howorth, W. S. Oliver, P. H. (1958). The application of multiple factor analysis to the assessment of fabric handl. *Journal of Textile Institute,* 49(11), T540–T553.

Howorth, W. S. (1964). The handle of suiting, lingerie and dress fabrics. *Journal of Textile Institute,* 55(4), T251–T256.

Hui, C. L., Lau, T. W., Ng, S. F. and Chan, K. C. C. (2004). Neural network prediction of human psychological perceptions of fabric hand. *Textile Research Journal,* 74(5), 375-383.

Jevsnik, S., Stjepanovic, Z., H eikinheimo, L., and Gothih, K. (2011). Effect of enzyme treatments on interlock knitted fabric. *International Journal of Clothing Science and Technology,* 23(1), 61-73.

Philippe, F., Laurence, S., Adolphe, D. C. and Dacremont, C. (2003). The sensory panel applied to textile goods – a new marketing tool. *Journal of Fashion Marketing and Management*, 7(3), 235-248.

Philippe, F., Schacher, L. And Adolphe, D. (2003). Characterisation of different finishing treatments using tactile sensory analysis. *The fiber society spring 2003symposium-Loughborough University, UK, 30juin-2juillet. Actesctes,* 11-12.

Pierce, F. T. (1930). Handle of cloth as a measurable quantity. *Journal of Textile Institute,* 21, T377–T416.

Pietro, B., Ferrucio, B., Ester, F., Rosace, G. and Sergio, V. (2001). *Reference book of textile finishing* . 1 edition.

Strazdiene, E., Ben Said, S., Gutauskas, M., Laurene, S. and Adolphe, D. C. (2006). The evaluation of fabric treatment by Griff tester and sensory analysis. *International Journal of Clothing Science and Technology*, 18(5), 326-334.

Yich, K. L., Cheng, K. P. S., and How, Y. L. (1995). Subjective and objective evaluation of men's shirting fabrics. *International Journal of Clothing Science and Technology,* 7(4), 17-29.

Winslow, C-E. A., Herrington. L. P. and Gagge, A. P. (1937). Physiological reactions of human body to varying environmental temperature. *American Journal Physiological,* 120, 1–20.

Winslow, C-E. A., Herrington. L. P. and Gagge, A. P. (1937). Relations between atmospheric conditions, physiological reactions and sensation of pleasantness. Am. J. Hyg., 26, 103–115.

Table 3: The list of attributes

	Categories			***Attributes***	***Reference***		***Assessment technique***
	surface	***physic***	***dynamic***		***negative***	***positive***	
Bipolar	*			Cold-heat	Glass or leather	Wool	To take the sample suspended with full hand
	*			Moist-dry		Wool	To take the sample suspended with full hand
		*		Thin-thick	Veil	Velvet of furnishing	To estimate the thickness with the thumb and index finger
		*		Light-heavy	Veil	Fabric furnishing	To weigh with the hand the mass of the sample.
	*			Smooth-grooved	Paper	Fabric furnishing	To estimate the relief and the grooves with the end of the thumb.
			*	Supple-stiff	viscose and lycra Jersey	Raw Twill	To handle and to compress the fabric with the two hands.
Simple		*		Falling	Raw Twill	Viscose and lycra Jersey	To take the closed hand, if it open while passing on the suspended fabric, therefore not falling.
			*	Flexible	Raw Twill	Viscose and lycra Jersey	The sample is held between two fingers in one hand and swept from top to bottom with the palm of the other hand.
	*			Tender	Raw Twill	Cashmere	To graze with the fingers and the palm of hand
	*			Silky	Raw Twill	Silk satin	To rub gently with the fingers and thumb
	*			Sleek		Satin	To make flat pass the fingers on the fabric, it is smooth when there is not roughness.
	*			Slippery		Paper	To move the palm of the hand across the surface of the sample.
	*			Hairy	Paper	Angora	To estimate the density and the length of fibers at the surface of the fabric with the ends of the fingers
			*	Elastic	Paper	Viscose and lycra Jersey	The edges of the sample are held with both hands then stretched for three times in the same direction.
	*			Compact		Paper	To check the density of the fabric with the ends of fingers.
			*	Wrinkly		Paper	To get the sample into one hand and to compress, open the fabric and check if the folds persist.