HOW TO DESCRIBE THE HANDLE OF FABRICS?

A FOCUS ON GRAINY, HARSH, ROUGH AND RASPY PERCEPTION

L. Pelletier 1, I. Soufflet 2 & C. Dacremont 1,3

1 ENSBANA, Université de Bourgogne, France
2 Institut Français du Textile et de l’Habillement, France
3 CESG, UMR CNRS(5170)-Université de Bourgogne-INRA, France

E-mail: catherine.dacremont@u-bourgogne.fr, Phone0033 3 80 39 66 67, Fax: 0033 3 80 39 66 11

Abstract

Sensory techniques originally developed for food products, are nowadays applied to other fields such as cosmetics, car industry or fabrics. The French Institute of Textile and Clothing (Institut Français du Textile et de l’Habillement) works on the sensory characterisation of the handle of textiles i.e., the perceptive experience related to touch and handling of fabrics. A study run in 2003 (Soufflet, Calonier and Dacremont) underlined that the attributes harsh, rough, raspy and grainy were close to each others and opposite to soft. Do those four words refer to the same sensory concept? Classification studies run on fabric samples with non-trained assessors showed that grainy was a perception in its integrity. Harsh and rough/ raspy samples were differentiated as well. Moreover, the studies underlined that the discrimination between the samples is finer when the untrained assessors handled the fabric with their full hands (three-dimensional handling) rather than in a surface context, only with the five fingers of one hand (two-dimensional touch). When the samples were assessed with the surface context, harsh, rough and raspy seemed to constitute a sensory continuum. To check this hypothesis, untrained assessors assessed fabric samples on a non-structured linear scale labelled from ‘not soft at all’ to ‘very soft’ (randomised and monadic evaluation). After the evaluation, they were asked to put on the scale the labels harsh, rough and raspy. Raspy was the farthest from soft, then harsh and finally rough but there is no significant difference between the last two. These results were compared with those obtained with a trained jury. The conclusion is that grainy, which is easily differentiated by the untrained assessors, is not used by the trained jury but they used relief instead. Harsh and rough are not exactly used in the same way by untrained and trained assessors and the difference of use is even more important for rough.

Keywords: sensory evaluation, fabrics, rough, harsh, raspy, novices

INTRODUCTION

Haptic perceptions, including both cutaneous and kinesthetic perceptions, guide consumers’ choice for clothes as well as textile manufacturers (weavers, finishers, fabricators, etc.) for technical decisions. The perceptive experience resulting from the manipulation of fabrics is called the “handle”. Its accurate description is essential for efficient communication of sensory specifications among manufacturers and also between manufacturers and consumers.

The pioneer approach to describe the handle of fabrics was based on instrumental measurements. The KES-F (Kawabata Evaluation System for Fabrics) was developed in Japan to measure various mechanical (compressional, tensile, shearing and bending) and surface properties of fabrics using small deformations (Kawabata, 1980). These physical
parameters are combined to predict “primary hands” i.e., main attributes of the fabrics handle as defined by a panel of Japanese industrial experts. Although useful information is obtained, this approach shows some limitations. Recently, sensory approaches, stemming from methods widely used in the food-processing industry, were adopted to describe haptic properties of textile products. More particularly, the sensory profile has been adapted to the textile field (Civille & Dus, 1990; Robinson et al. 1997; MacKay et al., 1999; Giboreau et al., 2001; Griffiths & Kulke, 2002. Cardello et al., 2003; Philippe et al., 2003, 2004; Pense-Lheritier et al., 2006; Yenket et al., 2007).

In descriptive analysis, a lot of efforts during training are devoted to reach an agreement among panelists on the meaning of each attribute. This concept alignment (O’Mahony et al., 1990) leads sometimes panelists to elaborate a very specific meaning for the attribute. An example is given by Roudaut et al. (2002) who reported several definitions for “crispness” used by different panels. Obviously the same term “crispness” referred to different perceptions according to panels. From that, results the issue of communicative value of attributes. To be efficient, profiles must be communicable, outside the panel, and understood by professionals who make technical decisions based on such results. The importance of the communicative value was stressed as one of the requirements for attributes selection by Civille & Lawless (1986). Practically how attributes would be understood outside the panel, if the panel changed the meaning from the everyday language meaning to a specific and somehow different meaning? One way to solve this problem is to provide attributes’ definitions elaborated by the panel (Giboreau et al., 2007).

A complementary approach is to choose highly consensual terms, spontaneously used by both novices and experts. Soufflet et al. (2004) found some “core attributes” for description of fabrics handfeel. Those terms are related to the most salient dimensions of the tactile perceptive space (Holins et al., 1993; Picard et al. 2003). The most salient dimension is probably the “soft” dimension. Doux (Soft) is the most often and spontaneously mentioned term when French people are prompted to describe touch perception (Picard et al., 2003; Giboreau et al., 2005). By contrast several terms are mentioned to refer to non-soft touch: Granuleux (Grainy), Rêche (Harsh), Rugueux (Rough), Râpeux (Raspy). The objective of the present work is to investigate the meaning and use of these four descriptive terms. The studies were carried out in France with French native speakers and the results are therefore related to French words. However, for readers’ convenience, English words are used in this text.

This work is organised in four experiments. In the first experiment, we checked whether the terms “Grainy”, “Harsh”, “Rough”, and “Raspy” referred to different perceptions. Experiments 2 and 3 focused on the relationship between those terms and their potential organisation along a perceptive continuum. Finally, we compared two methods of evaluation (surface or handling) and its impact on the use of the four terms.
EXPERIMENT 1: DO GRAINY, HARSH, ROUGH AND RASPY REFER TO THE SAME PERCEPTION?

The objective of the experiment was to determine whether the terms “Grainy”, “Harsh”, “Rough”, and “Raspy” referred to distinctive characteristics when spontaneously used by novices to describe the touch of fabrics.

Materials and methods

Subjects: 40 subjects (20 men and 20 women) were recruited on the Campus of The Université de Bourgogne. All of them were volunteers and novices (without any particular knowledge in either sensory science or textile field).

Samples: 29 samples of fabrics used for clothing were chosen to represent a wide range of both textile materials and technologies (weaving, knitting, non-woven processes, etc.). 24 samples were previously characterized as being grainy, harsh, rough or raspy and five as being soft (Soufflet et al., 2004). Two of these samples were duplicated in order to check the consistency of the results. Therefore subjects assessed 31 samples. Each sample measured approximately 21x30 cm.

Procedure: Subjects took part individually in the experiment in a single session. The experiment took place in a quiet and dimly lit room. Fabrics were coded with a three-digit number and put in a box to remove the influence of color on haptic judgment. Each subject assessed the samples randomly in a monadic way. The samples were evaluated in a two-dimensional context, called ‘surface’ context: the subjects were asked to put their hand palm on the fabric doing backward and forward motion with their fingers. Subjects had to evaluate each fabric and then to choose the most appropriate term among the following propositions: “Grainy”, “Harsh”, “Raspy”, “Rough” and “None”, according to what they perceived. Only one answer was allowed.

Results

Data obtained from the forced choice description task were summarized in a contingency matrix where the number of occurrence of the proposed terms was reported for each sample. Then, a correspondence analysis (CA) was performed.

When all data were included in the analysis, the CA space was essentially structured by the proposition “None” faced to the other descriptive terms. In order to eliminate this effect and to better interpret the differences between Harsh, Grainy, Rough and Raspy, fabrics mainly described as “None” were removed from the final analysis. This final analysis (Figure 1) was consequently performed with only 19 fabrics.

Grainy seems to be a distinctive perception, as this term was used by a majority of subjects to describe four samples (031, 856, 952, 901) and much less often for the other samples. The distinction between Harsh, Rough and Raspy seems less clear because for a large number of samples, two terms (Raspy/Rough or Rough/Harsh) were almost used an equivalent number of times.
Figure 1. Do Grainy, Harsh, Rough and Raspy refer to the same perception? CA "surface" context, 19 samples assessed

The U-shaped repartition of fabrics on the CA space (dimensions 1 and 2) could indicate that this space might account for only one dimension, with Harsh, Rough, and Raspy, and even Grainy, referring to different levels of a same perceptual continuum. This means that Harsh, Rough, and Raspy would be fuzzy and overlapping categories. Thus, subjects considered that both terms were appropriate to describe tactile properties of some products.

EXPERIMENT 2: FOCUS ON HARSH, ROUGH AND RASPY

The objective of the second experiment was to further investigate how Harsh, Rough and Raspy were used when subjects were free to use more than one adjective to describe each product. As ‘Grainy’ was used in a distinctive way in experiment 1, it was not considered in this experiment.

Materials and methods

Subjects: 45 subjects (35 men and 10 women) participated and were recruited according to the same specifications detailed in the first experiment.

Samples: the same samples of fabrics as the ones used in the first experiment were evaluated.

Procedure: the conditions of the experiment were the same as those described in the first experiment except that subjects had to evaluate each of the terms “Harsh”, “Raspy” and “Rough” according to “not adapted at all”, “relatively adapted” or “quite adapted”, for every fabrics. The fabric/term couples to be assessed were randomly presented.
Figure 2. Focus on Harsh, Rough and Raspy. PCA, "surface" context, 23 samples assessed

Results
Assessments were transformed into scores as following: 1 for “not adapted at all”, 2 for “relatively adapted” and 3 for “quite adapted”. A Principal Component Analysis (PCA) was performed on mean scores. (Figure 2).

The first dimension (73.13 %) opposed the samples perceived as being very Harsh, Rough, and Raspy to the ones perceived as being less Harsh, Rough, Raspy.

The Pearson correlation coefficients between the three attributes (Tab. 1) showed a significant correlation between Rough and Raspy whereas Harsh was not significantly correlated with the two others. Thus, this experiment confirmed that Harsh was used somehow in a different way than the two others, Rough and Raspy being used overall in a similar way.
Table 1. Focus on Harsh, Rough and Raspy. Pearson correlation coefficient, "surface" context, 23 samples assessed, * significant at 5%.

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<th>Harsh</th>
<th>Rough</th>
<th>Raspy</th>
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<tr>
<td>Harsh</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rough</td>
<td>0.39</td>
<td>1</td>
<td></td>
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<tr>
<td>Raspy</td>
<td>0.60</td>
<td>0.79*</td>
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EXPERIMENT 3: ARE HARSH, ROUGH AND RASPY PART OF THE SAME SENSORY CONTINUUM?

If Harsh, Rough and Raspy referred to several levels of a same continuum, as suggested by experiment 1, how would they be sorted? The objective of the third experiment was to study how these three terms would be ranked on a “Soft” scale.

Materials and methods

Subjects: 45 subjects participated and were recruited according to the same specifications detailed in the first experiment.

Samples: A subset of 14 samples, perceived as being Harsh, Rough or Raspy in the previous studies, were selected.

Procedure: As in the previous study, subjects took part individually in the experiment in a single session. Fabrics were coded with a three-digit number and fixed on a rigid paper in an opaque envelope to remove the influence of color on haptic judgment. Before starting the evaluation, subjects were asked to handle all the samples to get familiar with them. Then, they had to evaluate the softness of each fabric on a 10cm non-structured linear scale, anchored from “not soft at all” to “very soft”, in a monadic way. The objective was to promote a proper context of use of the scale for the last part of the experiment. Subjects were finally asked to put the labels “Harsh”, “Raspy” and “Rough” on the “Soft” scale.

Results

The data obtained for the three labels were transformed into scores from 0 (not soft at all) to 10 (very soft). An analysis of variance (Score = Subjects + Attributes + Errors) showed a significant “attributes” effect.

Figure 3. Are Harsh, Rough and Raspy part of the same sensory continuum? Comparison of the means.
As expected, the scores were low (Figure 3). However, “Raspy” and “Rough” were significantly different. “Hash” was not significantly different from the two others. Thus, when subjects are forced to put the terms on a soft scale, differences in intensity are observed: “Rough” seems to be the softest and “Raspy” the less soft, “Harsh” is in between.

EXPERIMENT 4: HARSH, ROUGH AND RASPY: COMPARISON SURFACE / HANDLING

In the first three experiments, subjects were instructed to touch the surface of the fabrics laid out on a rigid surface. However, in everyday life, we would rather evaluate fabrics’ tactile properties by handling, i.e. with three-dimensional solicitations. The objective of this last experiment was to evaluate if the context of evaluation (surface vs. handling) has got an impact on touch description.

Materials and methods

Subjects: 45 subjects (35 men and 10 women) participated and were recruited according to the same specifications detailed in the first experiment.

Samples: the same samples of fabrics as the ones used in the first experiment were evaluated.

Procedure: the conditions of the experiment were the same as those described in experiment 2. However the samples were evaluated in a three-dimensional context, called ‘handling’ context: the subjects were free to handle the fabrics with their two hands.

Results

The data were analysed in the same way as they were for the second experiment. The results are presented in Figure 4. Figure 4 shows that the first dimension (62,1%) opposed the samples Raspy and Rough to the ones perceived as being no Raspy and no Rough. Dimension 2 (33%) opposes the samples perceived as being Harsh to the ones perceived as no Harsh. Pearson correlation coefficients obtained are summarised in table 2:

Table 2. Harsh, Rough and Raspy. Comparison Surface/Handling. Pearson correlation coefficient, "handling" context, 19 samples assessed, * significant at 5%.

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<tr>
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<th>Harsh</th>
<th>Rough</th>
<th>Raspy</th>
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<tbody>
<tr>
<td>Harsh</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rough</td>
<td>0.20</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Raspy</td>
<td>0.02</td>
<td>0.83*</td>
<td>1</td>
</tr>
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</table>
The pattern of correlation was similar to the one obtained in experiment 1: Rough and Raspy were significantly correlated. But Harsh was more differentiated from Rough/Raspy when handled. This might mean that “Harsh” perception includes a kinaesthetic component.

**GENERAL DISCUSSION**

Overall the results indicates that the four terms *Granuleux* (Grainy), *Rèche* (Harsh), *Rugueux* (Rough), *Râpeux* (Raspy) refer to different tactile perceptions (for French native speakers) and are not used in an interchangeable way to describe handfeel of fabrics. Subjects used “Grainy” in a distinctive way: a very large majority of subjects described some fabrics as Grainy, when it was used only marginally for most of the other samples (Experiment 1). The distinction is less clear for the three other terms. In the surface context (two-dimensional exploration), these terms seem to refer to overlapping fuzzy-bounded categories arranged on a same perceptive continuum: from Raspy (closer to Grainy) to Harsh, with Rough in between. When subjects are instructed to rank the three labels on a “Soft” scale (Experiment 3), the picture is slightly different: Raspy is still the most distant
from the Soft end of the scale, but the position of Rough and Harsh are reversed. An explanation might be that Rough and Harsh are equivalent, as the difference in mean scores is not significant at the 5% level in Experiment 3. A second explanation might be related to the context of evaluation. In Experiment 3, the Soft context is explicitly mentioned, whereas any reference to Soft is made in Experiment 1. Words in everyday language are polysemic i.e., their meaning is context-dependant. For instance, in the three following sentences the meaning of “sweet” is quite different: “This fountain delivers sweet water”, “She prefers salty to sweet food”, and “James is a sweet boy”. We may face a shift of meaning of Rough and Harsh when used in the specific context of “Soft” scale in experiment 3. The impact of context may also explain the discrepancy observed between Experiments 1 and 2. In experiment 2, Rough and Raspy were used in a much more similar way than in Experiment 1. In Experiment 2 subjects assessed only one attribute at a time when they had to choose among several attributes in Experiment 1. The latter experimental design leads to narrow the meaning of each attribute because asking to choose among alternatives implicitly defines boundaries for each attribute. For instance, when subjects were instructed to pick up one term among Grainy, Harsh, Rough, Raspy, it implicitly define Rough as something that is not Grainy, Harsh or Raspy. However, when they had to assess whether a fabric was Rough, there is no indication of the boundaries of “Rough” and its meaning might be broader and encompass the meaning of Raspy. A similar phenomenon was observed in texture description with the attributes crispy, crackle, crunchy assessed all at once or one at time (Dacremont, 2006).

A third and last explanation is that Harsh might not be completely accurate to describe handfeel in the surface context. Actually, Experiment 4 would suggest that Harsh encompass a stiff component, requiring a three-dimensional exploration to be perceived. This may explain why the assessment of Harshness was less stable when assess in the surface context.

CONCLUSION

In the context of descriptive analysis, the results of the present study may help in the process of attributes selection. First, it seems useful to assess the samples in both 2- and 3-dimentional explorations depending on the attributes (Harsh being assessed by handling, for instance). In surface evaluation, Rough and Raspy seem close and may represent two levels on the same continuum. Thus, only one of them is needed for intensity assessment. Grainy may also belong to this same continuum. It is worth mentioning again, that this was obtained for the French attributes used by French native speakers. Any transfer to another language should be done carefully. From these results, the question of using a uni or a bipolar scale is also underlined. Bipolar scales are usually avoided in sensory profile. However, anchoring the scale at both extremities may help to narrow the meaning of the attribute and thus speed up the reach of consensus. Providing such a scale defines a genuine perceptual continuum.
REFERENCES


