7th International Textile Conference

November 10th-11th, 2016, Tirana, ALBANIA

BOOK OF PROCEEDINGS

Organized by
Polytechnic University of Tirana
Faculty of Mechanical Engineering
Department of Textile and Fashion

Department of Textile and Fashion

Head of Department: Prof. Dr. Genti GUXHO

Scientific Board of the Conference:

Academic Jorgaq KAÇANI	*Dean of Mechanical Engeneering Faculty*
Prof. Dr. Genti GUXHO	*Vice Dean of Mechanical Engeneering Faculty*
Prof. Dr. Spiro DRUSHKU	*Dean of Faculty of Natural Science*
Prof. Asoc. Ermira SHEHI	*Textile and Fashion Department, Polytechnic University of Tirana*
Prof. Asoc. Ilda KAZANI	*Textile and Fashion Department, Polytechnic University of Tirana*

The Scientific Board bears no responsibility for the content from the authors of articles included and published in this proceeding

ISBN:

PREFACE

The Textile and Fashion Department at the Mechanical Engineering Faculty, Polytechnic University of Tirana (PUT) since 2004 every two years organizes the textile conference with the participation of the professors/lectors of the Department of Textile and Fashion, other departments at PUT, University of Tirana and foreign universities with similar research areas in textile technology and textile materials.
The Department of Textile and Fashion in PUT is full member of AUTEX since 2008.
The mission of AUTEX (Association of Universities for Textiles) is to facilitate cooperation among members in research and teaching in textile field at the top level. Full members and associates members are consolidated reputable universities in higher education and research in the field of textile. AUTEX was established in 1994. Currently there are 34 members from 28 countries. PUT, Department of Textile and Fashion is accepted as full member in June 2008. The current president is Professor Vladan Koncar, ENSAIT, Roubaix, France.

The First Conference of Textile Tirana *was organized in July 2004. At the first conference that coinciding with the 20th anniversary of the Textile Department at the Faculty of Mechanical Engineering there were presented 12 papers. (Proceedings book, Scientific Library FIM)*

The Second Textile Conference in Tirana *was organized in July 2006. At this conference there were presented 12 papers. (Proceedings book, Scientific Library FIM).*

The Third International Conference of Textile in Tirana *was organized on November 20, 2008 in the framework of FP6 "RETEXRESALB", in which the Department of Textile and Fashion was the coordinator. The primary objective of conference was technology transfer. There were presented 14 papers. (Proceedings Book ISBN* 978-99956-16-27-4*).*

The Fourth International Conference of Textile in Tirana *was organized on November 19, 2010. At this conference there were presented 26 papers. (Proceedings book, Scientific Library FIM).*

The Fifth International Conference of Textile in Tirana *was organized on December 7, 2012 at this conference there were presented 20 papers. (Proceedings book, Scientific Library FIM).*

The Sixth International Conference of Textile in Tirana *was organized on November 20, 2014 at this conference there were presented 37 papers. (Proceedings book, Scientific Library FIM).*

In ***the Seventh International Conference of Textile in Tirana,*** *November 10-11, 2016 organized by the Department of Textile and Fashion in PUT, the participants will be from:*

ALBANIA
Polytechnic University of Tirana
Faculty of Mechanical Engineering,
Department of Textile and Fashion
Department of Production and Management
Department of Energy
Faculty of Mathematical Engineering and Physical Engineering
Department of Engineering Physics
Faculty of electric Engeneering
Department of Electrotechnics
Department of Automation Industry
Faculty of Information Technology
Telecommunication and Electronic Department
Faculty of Geology and Mining
Department of Earth Sciences

University of Tirana
Faculty of Natural Sciences
Department of Industrial Chemistry
Faculty of Economy

Agricultural University of Tirana
Department of Mathematics and Informatics

EPOKA University
Faculty of Architecture and Engineering

POLIS University
Department of Architecture and Design

Albanian Institute for the Research and Education in Information Technology (ISSETI)

Ministry of Education and Sports, National Agency for Examinations

Institute of Cultural Anthropology and Art Studies

Institute for Educational Development

General Directory of Metrology

BELGIUM
Ghent University
Department of Textile

BOSNIA AND HERZEGOVINA
University of Bihać

CROATIA
University of Zagreb, Zagreb
Faculty of textile technology
Department of Clothing technology

CZECH REPUBLIC
Technical University of Liberec
Department of Clothing

FRANCE
University of Haute Alsace
Laboratory of Mechanical and Physical Textiles

GERMANY
Bielefeld University of Applied Sciences,
Faculty of Engineering and Mathematics, Germany

GREECE
Piraeus University of Applied Sciences
Department of Electronic Engineering

ITALY
Politecnico di Bari, Italy
Dipartimento di Meccanica, Matematica e Management

MACEDONIA
University of Saint Cyril and Methodius
Faculty of Technology and Metallurgy
University Goce Delčev
Faculty of Technology, Štip

NORTH CYPRUS
Cyprus International University

ROMANIA
"Gheorghe Asachi" Technical University of Iasi
Faculty of Textiles, Leather and Industrial Management

TURKEY
Ege University
Department of Textile Engineering, Izmir
Erciyes University
Department of Textile Engineering
Namık Kemal University
Department of Textile Engineering Corlu
METU BIOMATEN Center of Excellence in Biomaterials and Tissue Engineering, Ankara,

TOPICS OF THE CONFERENCE

Garment Manufacturing

Textile Testing and quality control

Textile Processing

Biopolymers and Biotechnology

Comfort and Wellbeing

Developments in Textile Machinery

E-activities and E-commerce

Ecology and Environment in Textile Production

Fibre Physics and Textile Mechanics

Finishing, Dyeing and Treatment

Medical Textiles

Modelling and Simulation

Nanotextiles

Smart and Interactive Textiles

Supply Chain Management and Logistics

Technical and Protective Textiles

Textile Design and Fashion

Textile Education

INFORMATION ON THE DEPARTMENT OF TEXTILE AND FASHION, PUT

The Textile and Fashion Department (TFD) is unit of the Faculty of Mechanical Engineering at the Polytechnic University of Tirana. The Textile Engineering was established in 1968 in Berat as The Branch of Textile in the Faculty of Engineering at the University of Tirana.

The curricula was based on a 3 years part-time system. In 1984 the department was renamed The Chair of Textile at the Mechanical and Electrical Engineering Faculty, University of Tirana when it changed its curricula into a four and half year's program in textile engineering. In 1994 it was renamed to The Department of Textile. The academic program covered all the required subjects for the Textile Engineering Diploma.

The '90s were a challenge for the economy, politics and society and also for university education in Albania. In 1991 the group of the engineering oriented faculties created the Polytechnic University of Tirana. During the 90s, the Department of Textile and Fashion started the transformation process of the curricula, syllabuses, and the organization structure and strategy for transforming this department not only into a university teaching units but also into a research and development centre in the field of textile industry. During these years many improvements and modifications have been occurred such as: the introduction of new subjects in the 5-year study cycle e focusing in the garment manufacturing, garment design and marketing of the Textile Laboratory (1996), participation in several Tempus projects etc.

The period 2000 – 2012 was for the Department of Textile and Fashion the transformation decade of curricula and organization in the education system of textile and fashion branch in accordance with the Bologna Declaration signed by the government of the Republic of Albania.

The curriculum in textile and fashion engineering is organized in three study systems:

- *Bachelor degree (3 years study) in "Textile Engineering and Fashion" with three orientations*
- *Master degree (2 years study) in "Textile Engineering and Fashion"*
- *Doctorate (PhD) school in "Materials Science" orientation "Textile materials" (at least 3 years study and PhD thesis)*

It was a great effort and exceptional work of the relatively medium size department for seeking the harmonization of some specific requirements for this study:

- *Provision of similar studies with those of western universities*
- *Adaptation of the academic curricula to the needs of the Albanian labour market.*
- *Qualification of the staff.*

During 2000 - in the curriculum, the focus of our work has been in the staff qualification and research. Thus, only during the last fourteen years have been developed and approved nine micro theses, six doctorates in the textile area. Two achieved in Western universities, one in our

Department other five PhD studies are in process, and 12 post-graduate students, compared to only one PhD thesis during 90s.

The Textile laboratory was accredited under the new standard for accreditation of testing laboratories ISO/IEC 17025 and expanded its activities with the pilot testing of the chemical nature of textiles and leather materials. But during these years the Department of Textile and Fashion has participated and ran five national research projects funded by the Albanian government,, two projects " Quality and Equity in Higher Education" funded by the World Bank, an EU FP6 Project. The Department has also participated in a number of Tempus projects, FP7, CARDS and technical expertise in special fields.

The history of the Textile and Fashion Department is closely linked to the enormous work done by its dedicated academic staff. This dedication has resulted in the development of the academic programs, the teaching process, the effort put in scientific research and the publishing of scientific papers.

Since the establishment of the Textile and Fashion Department hundreds of specialists have been graduated in the fields of spinning, weaving, knitting and garment industry. The first group of lecturers were graduates of the Polytechnic University of Lodz, Poland. Among the most celebrated were such figures as Prof. Dr. Taxhedin Baholli, M.Sc Eng. Kozma Xhero, M.Sc. Eng. Eva Budina, M.Sc Eng. Shega Shapllo, M.Sc. Eng. Magdalena Ktona, etc.

The staff has since expanded to accommodate new lecturers. Most of them are graduates of the Polytechnic University of Tirana but there are also graduates of international universities.

TFD has also participated in many national and international cooperative projects, conferences and workshops.

INFORMATION ON TIRANA

Tirana is the capital of Republic of Albania since 1920. Polytechnic University of Tirana (1951), University of Tirana (1957), Agricultural University (1951), Academy of Science (1972), National Library (1922), as well as many museums, among which Museum of National Culture, Museum of Natural Sciences (1948), Museum of Archeology (1948) and Museum of National History (1981) are in Tirana.

Tirana has the only international airport "Nene Tereza". Tirana is only 40 km away from the most important harbor of Albania (Durres). In 2000 the center of Tirana, from the Polytechnic University's Main Building to Skanderbeg Square, was declared Cultural Heritage.

Geography. Tirana is located 110 meters above the sea level. The average height of the Tirana region is 521 m, while two high mountains near Tirana are Dajti and Mali me Gropa, respectively 1612 m and 1828 m high. The area of the city of Tirana is around 31 km². In Tirana prevails subtropical-Mediterranean climate.

For more information:

Department of Textile and Fashion: www.upt-tekstilmoda.org

AUTEX: www.autex.org

Faculty of Mechanical Engineering www.fim.edu.al

Polytechnic University of Tirana www.upt.al

CONTENTS

CONTRIBUTION OF TEXTURE TO AESTHETIC PROPERTIES

E. Tomovska[1], S. Jordeva[2] and K. Zafirova[1]

[1] Faculty of Technology and Metallurgy, University "Ss. Cyril and Methodius"- Skopje, Macedonia
[2] Faculty of Technology, University "Goce Delcev"- Stip, Macedonia
elena.tomovska@gmail.com

Keywords: texture, aesthetic properties, pantyhose

Abstract

The subjective perception of beauty plays a key role in the purchasing decision. This paper investigates the texture properties of knitted single jersey pantyhose fabrics, by defining the degree to which difference in texture can be subjectively accessed, as well as the contribution of texture to the aesthetic properties. Subjective evaluation was conducted by a panel of forty untrained evaluators on a sample of nine fabrics with different yarn count and composition. Objective measurement of the fabric texture was carried out by image analysis. The comparison of the objectively and subjectively measured texture showed that the differences in texture due to yarn count variation are visually perceptible, as coarser yarns were found to contribute to smoother texture in both cases. A smooth texture was found to be more appealing to the evaluators.

Introduction

Fabrics are never ideally smooth. Their texture varies between fine and coarse, quantified through the surface's vertical deviation. Fabric roughness, or its opposite smoothness, is employed as measure of the surface texture of fabrics. In general, texture depends upon fibre properties, yarn count, yarn twist, and fabric structure and fabric design).

Together with style and colour, texture is often a characteristic examined when purchasing clothes. Visual perception is sufficient for examining style and colour, whereas texture requires an additional tactile examination. Colour is precisely defined by colour systems enabling accurate simulation in diverse media (e.g. fabric, prints, on-screen). Texture on the other hand is a complex of two senses, thus it can be examined mechanically, through friction forces, or through optical methods. Examples of both methods of fabric texture examination can be seen in literature.

Optical properties of fabrics have been examined since 1917 [1]. Optical methods were traditionally used to characterize colour. Kobsa, Rubin et al. created a model for predicting the fabrics' optical properties by treating each filament separately [2], followed by multifilament tests [3]. Their results indicate that the quantity of dyestuff to obtain a certain tone depth depends

inversely from the square root of the filament count. Bae [4] studied the change and evenness of colour in relation to the fabric surface when printing. More recently, optical methods were dedicated to 3D modelling and visualisation of textiles [5-6].

Investigations into the combination of tactile and visual roughness assessment gave interesting results. Several separate researches (Guest and Spence [7], Tomovska and Zafirova [8], Xue et al. [9]) confirmed that the visual and tactile cues act as independent sources of information. Rather than improving the assessment of roughness, the combination of touch and sight divides the attention of evaluators. Accordingly, sight and touch bring the same information in the perception complex. These results can be explained through the development of tactile memory. With the development of experience the sense of touch and sight grow closer together, making the need to touch a familiar object to know its tactile properties superfluous.

Image analysis is an objective method used to define the surface properties of fabrics. The key application of image analysis is in quality control, for identifying fabric failures [10]. Additionally, it can be used to identify woven structure, along with finding application in different research, e.g. unevenness [11]. Similarly, image analysis is appropriate for researching roughness as a fabric surface parameter.

This paper aims to explore the texture properties of knitted single jersey pantyhose fabrics, by defining the degree to which difference in texture can be subjectively accessed, as well as the contribution of texture to the aesthetic properties.

Materials and Methods

Fabric Samples. The research used nine fabric samples knitted for the purpose. The knitting process was conducted with a carefully controlled machine setting, using the same machine in order to avoid parameter variation due to setting as much as possible. All samples are single jersey, whereas yarn count and composition were varied in the nine samples. The yarn count used in the samples are given in Table 1.

Table 1. Sample composition and yarn count

Sample	Composition	Yarn count [dtex]	
		PA	Additional fibre
1	84 PA6.6/16 Lycra	5.5/3	5.5
2	100 PA6.6	17/3	
3	84 PA6.6/16 Lycra	17/3 F	17
4	100 PA6.6	22/7	17/3 F (trilobal nylon)
5	100 PA6	22/7	
6	89 PA6.6/21 Lycra	22/7	22
7	100 PA6.6	33/10	44/34 (microfiber)
8	85PA6.6/15 Lycra	44/13	44
9	80PA6.6/20 Lycra	78/24	78

Objective Measurement of Fabric Texture. Image analysis was used to objectively measure fabric texture. In order to conduct the analysis an instrument for obtaining an image with standard lighting and a PC with software for processing and analysing the image are required. The examined samples were digitized by scanning them with an Epson Stylus SX115, with a resolution of 1200x1200 dpi. The samples are shown on Figure 1. Image analysis was conducted using Adobe Photoshop software. To avoid the influence of colour the pictures were converted to achromatic (grayscale).

One of the parameters generated by Photoshop is the percentage of black (K%), a numerical value representing the grayscale sample images in general. This parameter allows the comparison of the percentage of black in sample images, i.e. defining lighter and darker samples. As K values in Photoshop were measured in pixels, to obtain uniformity the pixels number of each image was kept constant. To determine the grayscale on the whole sample surface, i.e. the average K value for all pixels, the filter Blur average is used. Using this option shades in the image are mixed till one shade is obtained, obtaining the image average colour.

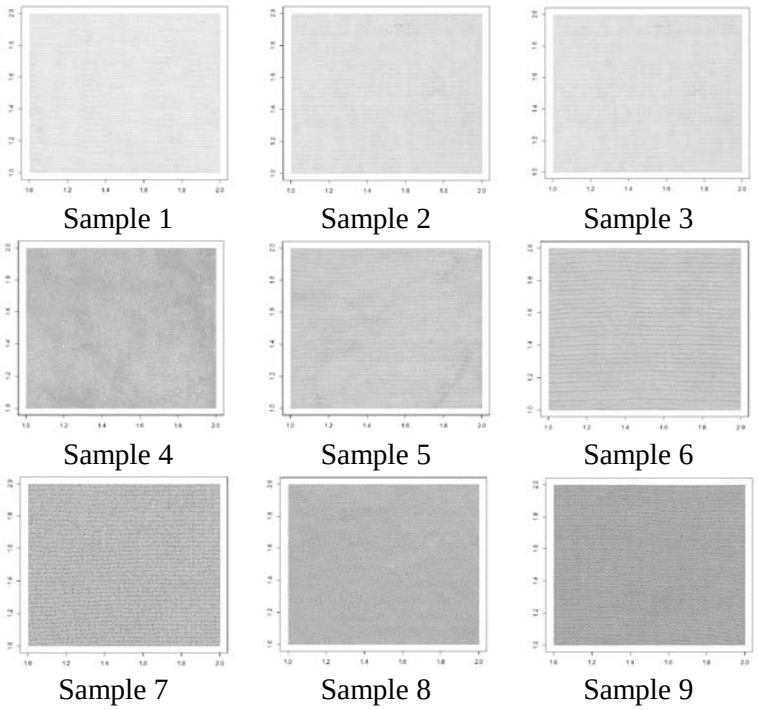


Fig. 1. Scanned samples

Subjective Measurement of Fabric Texture. Figure 2 shows a schematic illustration of experimental conditions for subjective evaluation. A knee-height leg model composed of vinyl chloride was used as the sample subject, with color values of $L^* = 59.5$, $a^* = 22.4$ and $b^* = 23.9$. Although the degree of pantyhose fabric extension is different on each leg part, because the circumference decreases from thigh to ankle, a realistic leg model was chosen in order to provide a visual simulation closest to actual wearing conditions. To standardize the evaluation, evaluators were asked to describe the shin part of the leg. The model was placed in a black viewing cabinet (length 60cm, height 50m, depth 45cm), with a D-65 light source, illuminating the leg surface under a 15^o angle.

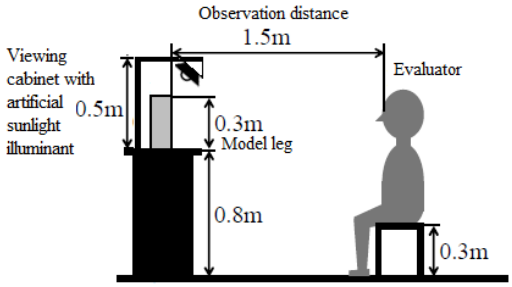


Fig.2 Conditions for subjective evaluation

During visual evaluation the evaluator determines firstly colour, followed by shape and finally texture, with observer distances ranging from 1m to 3m. As texture was being evaluated, shorter viewing distance was chosen. The evaluators were 40 women aged 20 to 60, with normal visual acuity. A semantic differential method in a five-scoring system was used to assess the texture parameters. Three parameters were examined: roughness, evenness and personal preference of the texture. Explanations of the terms of roughness, smoothness, eveness and unevenness were given to the evaluators prior to the experiment. The general aesthetic properties were evaluated using various abstract words such as “beautiful”, “natural”, “elegant”, and “expensive”.

Results and Discussion

Objective Evaluation of Fabric Texture. Grayscale histograms were drafted (Fig.3), showing the distribution of pixels in an image through grouping together pixels of each intensity of grey. Greyscale histograms give information on the different shades of grey in the image, as well as pixel distribution in light and dark grey shades.

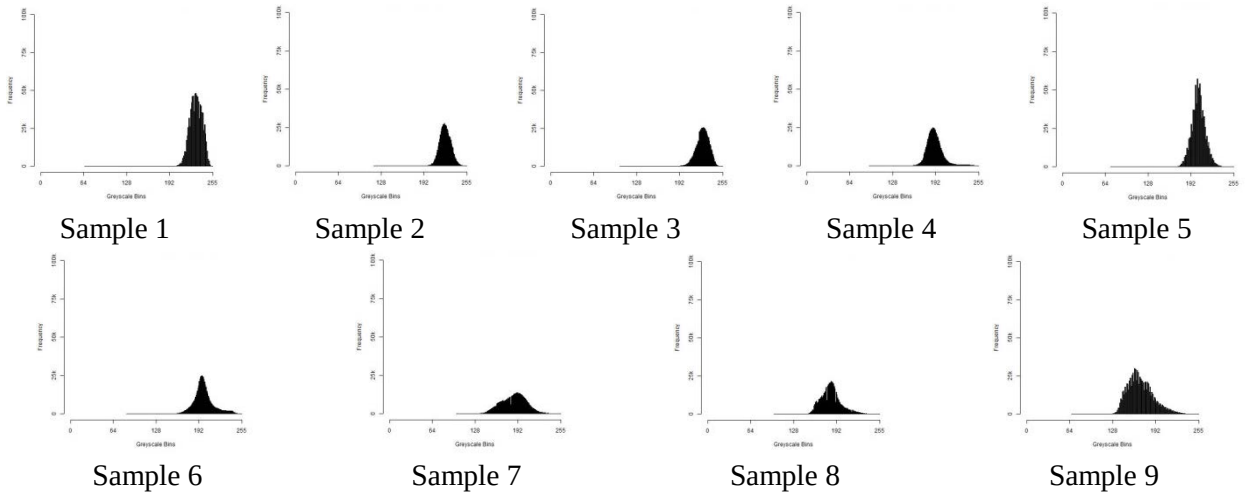


Fig.3 Image analysis histograms

The grayscale is placed on the histogram’s abscissa, starting from black (0) to white (255). The ordinate shows the number of pixels in each shade of grey. Data on the percentage of black (K),

mean, standard deviation, mode and median obtained from the image analysis are presented in Table 2.

Table 2. Image analysis data

Sample	1	2	3	4	5	6	7	8	9
K (%)	9.76	12.7	12.7	25.52	20.68	22.25	27.43	28.34	33.9
Mean	0.9	0.873	0.873	0.745	0.793	0.777	0.726	0.717	0.661
SD	0.04	0.032	0.032	0.049	0.039	0.058	0.072	0.058	0.074
Mode	0.9	0.867	0.867	0.736	0.792	0.762	0.763	0.73	0.646
Median	0.9	0.871	0.871	0.74	0.792	0.77	0.73	0.713	0.651

A Pearson's correlation coefficient of 0.84 shows strong relationship between K(%) and yarn count. The coarser the yarn used the smoother the fabric texture.

Subjective Evaluation of Fabric Texture. Texture parameters were subjectively measured on a five point semantic differential scale with 1 denoting smooth and even, and 5 denoting rough and uneven. In addition the personal preference for the texture was measured on a scale of 1- not acceptable to 5- very acceptable. The results of the subjective evaluation are presented in Table 3. As with the objective evaluations fabrics made of rougher yarns were found to be smoother and more even. For instance sample 9, made of a 78dtex filament was perceived to be the smoothest and most even (rated 2.2 and 1.93, accordingly). When examining samples with the same composition (nylon and lycra), strong linear correlation is found between the yarn count and roughness/evenness (Figure 4). The addition of microfiber (sample 7) and especially of trilobal fibre (sample 4) increases the perception of roughness and unevenness. The property of evenness, described as similar size in the texture grains, showed better correlation with the objective measurement of texture (-0.66) compared to roughness (-0.30).

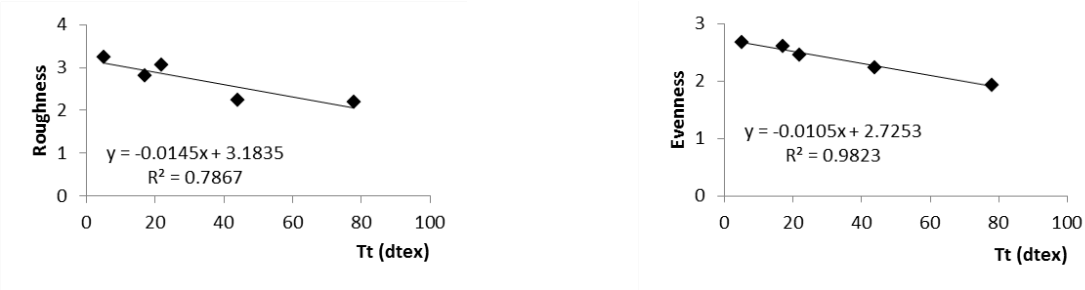
Table 3. Subjective evaluation of samples

Sample		**Roughness**		**Evenness**		**Acceptability**	
No.	Tt (dtex)	Mean	SD	Mean	SD	Mean	SD
1	5,5 (L)	3.23	1.17	2.68	1.23	3.03	1.1
2	17	2.83	1.08	2.95	1.22	3.63	1.23
3	17(L)	2.8	1.32	2.6	1.22	3.13	1.28
4	22 (T)	3.78	1.07	3	1.22	2.4	1.43
5	22	2.78	1.17	2.55	1.13	3.8	1.04
6	22 (L)	3.05	1.34	2.45	1.15	2.53	1.45
7	33 (M)	3.18	1.41	2.3	1.26	3.23	1.35
8	44 (L)	2.23	1.03	2.23	1.1	4.23	0.97
9	78 (L)	2.2	1.04	1.93	1.1	4.3	0.97

L – contains lycra; M – contains microfibre; T – contains trilobal fibre

Smoother and more even samples were evaluated as more acceptable. Thus, samples of 78dtex (graded 4.3) and 44dtex (graded 4.0), as well as samples without added lycra (sample 5 and 2) were best rated on the acceptability scale. The acceptability of pantyhose texture was correlated

to the evaluated roughness (0.89) and evenness (0.60), leading to the conclusion that pantyhose made of rougher yarn were more liked by the evaluators.



(a) (b)

Fig. 4 Relationship between yarn count and subjectively evaluated (a) roughness and (b) evenness of fabrics

Aesthetic Properties. The general aesthetic properties of the selected pantyhose were examined via abstract parameters such as looks "beautiful", "natural", "elegant", and "expensive". Each parameter was measured on a 5 point scale, with 1 having a negative, and 5 having a positive connotation. Figure 5 lists the average values of each property for the 9 samples. Samples 8 and 9 show an overall high score on aesthetic properties, followed by sample 5. The aesthetic properties showed good correlation with the subjective evaluation of roughness (correlation coefficients of -0.93, -0.80, -0.80, -0.80, accordingly). As seen in figure 6, the smoother fabrics are aesthetically more appealing.

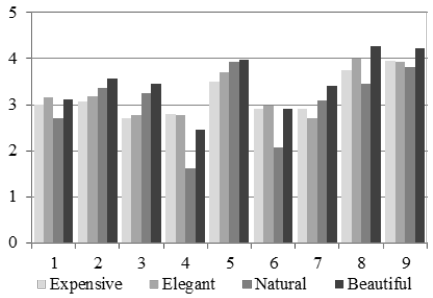


Fig. 5 Aesthetic properties of samples

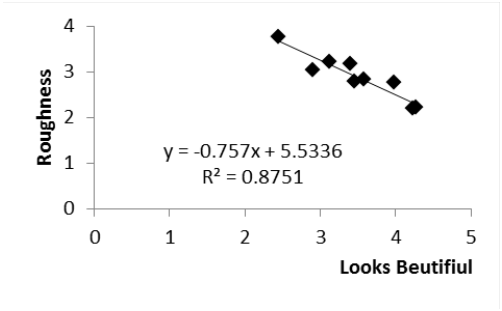


Fig. 6 Relationship between roughness and perception of beauty

Conclusion

The subjective perception of beauty plays a key role in the purchasing decision. The texture properties of knitted single jersey pantyhose fabrics are a factor which influences their aesthetic properties. A good correlation between the objectively measured surface smoothness and subjectively evaluated evenness shows that differences in texture can be judged by visual

inspection. Coarser yarns contribute to a smoother surface texture and increase the perceived beauty of pantyhose.

References

[1] Anon: Reflection of Light by Textiles, PosseltÇs Textile Journal, **20** (1917) 6, 111-113
[2] Kobsa et al.: Using Optical Ray Tracing to Explain the Reduced Dye Yield of Microdenier Yarns, Textile Res.J., **63** (1993) 8, 475-479
[3] Rubin B., Kobsa H. and Shearer S.: Modeling the Dependence of Fabric Reflectance on Denier per Filament, Textile Res. J., **64** (1994) 11, 685 -689
[4] Bae J.: Color in Ink-Jet Printing: Influence of Structural and Optical Characteristic of Textiles, (2007) PhD Thesis, North Carolina State University, USA
[5] Huang G. et al.: Feel the Fabric: An Audio-Haptic Interface, Proceedings Eurographics/SIGGRAPH Symposium on Computer Animation, (2003) 52-61
[6] Voloboy A. at all.: Simulation and Rendering Algorithms for Optically Complex Materials by the Example of Fabrics, Programming and Computer Software, **36** (2010) 4, 237-246
[7] Guest S., Spence C.: What role does multisensory integration play in visuotactile perception of texture?, International Journal of Psychophysiology, **50** (2003), 63-80
[8] Tomovska E., Zafirova K.: The Contribution of weave to visual perception of fabric texture, Tekstil, **59** (2010) 9, 379-387
[9] Xue, Z., Zeng, X Koehl, L. Chen, Y. (2014) Extracting fabric hand information from visual representations of flared skirts, Textile Research Journal 2014, Vol 84(3) 246–266
[10] Abouelela A. et al.: Automated vision system for localizing structural defects in textile fabrics, Pattern Recognition Letters **26** (2005), 1435-1443
[11] Milasius R., Milasius V.: Investigation of Unevenness of Some Fabric Cross-Section Parameters, Fibres&Textiles in Eastern Europe, July/September (2002), 47-49