Evaluation of three-dimensional virtual perception of garments

G Aydoğdu¹, S Yeşilpinar² and D Erdem²

¹GNT Textile, Tınaztepe Mevkii Adatepe Mahallesi 2/20 Sok No:29 Begos 3. Bölge, Buca/Izmir, Turkey
²Dokuz Eylül University, Engineering Faculty, Textile Engineering Department, Tınaztepe Campus, 35397, Buca/Izmir, Turkey

sevil.yesilpinar@deu.edu.tr

Abstract. In recent years, three-dimensional design, dressing and simulation programs came into prominence in the textile industry. These programs have some advantages both in terms of designers/factories and consumers. By these programs, the need to produce clothing samples for every design in design process has been eliminated. Clothing fit, design, pattern, fabric and accessory details and fabric drape features can be evaluated easily. Also, body size of virtual mannequin can be adjusted so more realistic simulations can be created. Moreover, three-dimensional virtual garment images created by these programs can be used while presenting the product to end-user instead of two-dimensional photograph images. In this study, a survey was carried out to investigate the visual perception of consumers. The survey was conducted for three different garment types, separately. Questions about gender, profession etc. was asked to the participants and expected them to compare real samples and artworks or three-dimensional virtual images of garments. When survey results were analyzed statistically, it is seen that demographic situation of participants does not affect visual perception and three-dimensional virtual garment images reflect the real sample characteristics better than artworks for each garment type. Also, it is reported that there is no perception difference depending on garment type between t-shirt, sweatshirt and tracksuit bottom.

1. Introduction

In recent years, three-dimensional design, dressing and simulation programs came into prominence in the textile industry. These programs have some advantages both in terms of designers/factories and consumers. By these programs, the need to produce clothing samples for every design in design process has been eliminated. Clothing fit, design, pattern, fabric and accessory details and fabric drape features can be evaluated easily. Also, body size of virtual mannequin can be adjusted so more realistic simulations can be created. All these features accelerate the design and decision-making process. Moreover, three-dimensional virtual garment images created by these programs can be used while presenting the product to end-user instead of two-dimensional photograph images [1, 2, 3].

In this study, a survey was carried out to investigate the visual perception of consumers. The survey was conducted for three different garment types separately. For the survey study, artworks, three-dimensional virtual garment images and real samples of the garments were created. It was expected from the participants to compare artworks, three-dimensional virtual garment images, and real
samples. The answers of the participants were analyzed to understand if there is a difference in visual perception of individuals for the garment designs prepared by three different methods.

2. Materials

Artworks, three-dimensional virtual garment images and real samples of the same design were used to investigate the visual perception of individuals. Three different garment samples (t-shirt, sweatshirt and tracksuit bottom) were provided from the selected apparel company (Figure 1).

In addition to real garment samples, two-dimensional patterns which are created using Assyst CAD, artworks and fabric samples of garments were provided from the company. Artworks of t-shirt, sweatshirt and tracksuit bottom samples are presented in Figure 2.

When three-dimensional virtual garments were preparing, physical properties of real garment samples’ fabrics were tested using Browzwear's fabric testing kit. Extension, shear and bend parameters can be investigated by this kit. Fabric specimens of three different garment types were prepared for tests. Each test was repeated three times. Each sample was conditioned under constant standard atmospheric conditions for 24 hours. The standard atmosphere for testing involves a temperature of 20±2 degree C, and 65±2% Rh. After the tests; average, standard deviation and coefficient of variation values of the samples were calculated and if coefficient of variation value was bigger than 10% tests were repeated. The values obtained from the tests were entered into V-Stitcher three dimensional garment design software.

2D pattern files of real samples were transferred to Browzwear V-Stitcher program in Dokuz Eylul University Textile Engineering Department to prepare 3D patterns of virtual garments. Patterns of three different garment types were dressed up on virtual mannequins, covered with garments and added model details to get a finished garment look in three dimensional garment design software. Physical properties of the garments of real samples were identified in the software before this process therefore when virtual garments were prepared any desired fabric was chosen. By this way, properties of the actual fabrics could be reflected on virtual garment during the simulation. Also, fabric properties as texture of fabrics, print details etc. were scanned with a high quality scanner and saved to software. Thus, three dimensional virtual garments were prepared closely similar to real samples. Figure 3 shows virtual woman and man mannequins dressed up in selected garments, respectively.
3. Method
In this study, a survey was conducted to evaluate the visual perception. In the first part of the survey, some questions about age, gender, the level of education, profession and online shopping tendencies were asked to participants to investigate their demographic situations and examine whether personality traits affect the visual perception or not. Then, in order to investigate the visual perception of consumers, five independent and twelve relevant questions were asked. Relevant questions were constituted to compare three-dimensional virtual garment images and artworks. Independent questions determined the situation if three-dimensional virtual garment image was preferred or not. To answer these questions, five-point Likert scale (1: Strongly disagree, 2: Disagree, 3: Partially agree, 4: Agree, 5: Strongly agree) was used. Relevant and independent questions were evaluated separately.

The survey was completed by 100 participants. Each participant answered the survey for each garment type separately. When the survey was applied to participants, real samples, three-dimensional virtual garment images and artworks of garments were shown and participants were expected to answer the questions. Entire survey was applied by face-to-face interviews. Survey results were evaluated using SPSS 15 statistical software. Significance level $\alpha$ was taken as 0.05 for these evaluations. Mann-Whitney U test and Wilcoxon W test were applied to survey findings.

4. Results and discussion
In the first part of the survey, some questions were asked to participants to investigate their demographic situations. These questions were about age, gender, level of education, online shopping tendencies and profession. The sample of the survey consisted of 100 participants. 76 % of participants took part between 21-27 age group. In the group of 24 % of participants, two participants took part within 17-20 age group, 22 participants took part in 28-55 age group. The half of participants were men and the other half of them were women. Men and women participants were considered equal with the aim to examine the visual perception changing or not changing according to gender. When educational status of 100 participants were examined, it was seen that three participants were students or graduates of high school, 45 participants were college student or bachelor and 52 participants were MSc/PhD or postgraduate. When online shopping tendencies of participants were evaluated, 74 % of them said that they shop on the internet but 24 % of them said that they do not use internet for shopping. Also, 53 participants study about textile or work in textile industry but 47 participants are not related to textile.

In the second part of the survey, 5 independent questions to examine the preference situation of three dimensional virtual garment images and 12 relevant questions for comparison of three dimensional virtual garment images and artworks for each garment were asked to participants. Wilcoxon test was carried out to perform a binary comparison of the three dimensional virtual garment images and artworks. The results indicated that three dimensional virtual garment images were preferred to artworks for each garment. Therefore, it can be said that three-dimensional virtual garments reflects the real samples better than artworks.
Another issue which was examined in the survey questions was to understand if three dimensional virtual garment images or artworks reflected the color, texture and drape of the fabric used in real samples in a realistic way or not. When the results were analyzed, it was seen that most of the participants stated that three dimensional virtual garment images reflected the fabric color, texture and drape of the fabric more successfully. However, some participants found three dimensional virtual garment images and artworks equal (Figure 4, Figure 5 and Figure 6). Only a small part of the participants reported that artworks reflected the fabric properties more realistic than three dimensional virtual garment images. With regard to these results, it can be said that three dimensional virtual garment images reflect the color, texture and drape of fabric in a more realistic way.

In another question, it was investigated if three dimensional virtual garment images or artworks reflected the model details (collar, arm, pocket, pleat, dart, hood etc.) of sewn sample in a realistic manner or not. When the responses were analyzed, it was understood that most of the participants found artworks more unsuccessful when compared to three-dimensional virtual images (Figure 7). However, a considerable number of participants found these two images equal. This situation is especially significant for the answers given to tracksuit bottom. For instance, t-shirt is a basic garment type and it is easier to simulate it more realistically in V-Stitcher software. Nevertheless, it becomes complicated to simulate more detailed models in three-dimensional software.
Another point examined in this survey is to investigate if three dimensional virtual garment images or artworks reflected the accessory details of sewn samples realistically or not (Figure 8). When Figure 8 was analyzed, it is seen that three dimensional virtual garment images reflected the accessory details better than artworks for each type of garment.

In the last part of the study, the effect of demographic structure (gender, online shopping tendencies and profession) on visual perception for each garment type was investigated using Wilcoxon W test. When p values were analyzed, it was seen that only a few questions remained under importance level. These results pointed out that demographic structure of participants made no difference on visual perception.

The average values of the scores given by the participants to relevant questions about three-dimensional virtual garment images and artworks for each garment type were given in Figure 9. When results were analyzed it was seen that three dimensional virtual garment images was chosen to artworks. Average values of three dimensional virtual garments were over 3.5 when this values were about 2.5 for artworks over 5 for each garment type.

The effect of online shopping tendencies on visual perception was also examined. The average values of the scores for three dimensional virtual garments and artworks according to online shopping situations of participants were compared. Both groups preferred the three-dimensional virtual images
to artworks. When average and p probability values were examined for each garment, it was seen that online shopping tendencies did not affect the visual perception of consumers. Therefore, consumers could try on a garment with original fabric on a virtual mannequin, which was created according to their own sizes; see the details and fitting of the garment. When consumers purchase a garment by this way, contentment will increase and return and complaint rates will decrease.

In another question, the effect of profession on visual perception was investigated. Answers of people that have a profession related to textiles and the other participants for each garment were examined. Both groups prefer three dimensional virtual images to artworks. Average and p probability values indicated that profession has no effect on visual perception.

When average values of the answers of questions about three dimensional virtual garment images for each garment was investigated, it was seen that the smallest value was 2.86 and the biggest value was 4.29 out of 5. When the same values for artworks were examined, it was seen that the smallest value was 1.88 and the biggest value was 3.24 out of 5. Also, the answers about three dimensional virtual garment images were found to be concentrated in the options “strongly agree” and “agree” when this concentration was in the options “partially agree” and “disagree” for artworks. Additionally, average values of the answers were found to be similar for t-shirt, sweatshirt and tracksuit bottom. For instance, the average values of the answers for the question “I prefer three dimensional virtual garment images to photographs when I buy clothes” were investigated, it was seen that these values were 4.21, 4.25 and 4.08 out of 5 for t-shirt, sweatshirt and tracksuit bottom, respectively. This situation was similar for other questions. These results showed that visual perception of consumers did not change according to different garment types.

When all independent and relevant questions were evaluated for each garment type, generally it was observed that three-dimensional images of garments were liked more than artworks. It was concluded that three dimensional virtual garment images represented real samples better than artworks. Also, relevant and independent questions were evaluated according to demographic status of participants. When probability value of p was determined, it was observed that participants’ demographic structure didn’t make difference on visual perception to answer survey questions.

5. Conclusion
In this study, a survey was carried out using garment samples, their three dimensional virtual garment images and artworks to investigate the visual perception of consumers. Survey was conducted for three different garment type separately. In survey study, some questions about gender, profession etc. were asked to the participants and expected them to compare real samples and artworks or three dimensional virtual images with a certain number of questions. When survey results were analyzed statistically, it was seen that demographic situation of participants did not affect visual perception and three dimensional virtual garment images reflected the real sample characteristics better than artworks for each garment type. Also, it was reported that there was no perception difference depending on garment type between t-shirt, sweatshirt and tracksuit bottom.

References
[1] Loker S, Ashdown S and Carnrite E (2008). Dress in Third Dimension: Online interactivity and its new Horizons. Clothing and Textile Research Journal, 26 (2), 164-176.
[2] Cordier F, Seo H and Magnenat-Thalmann N (2003). Made to measure technologies for an online clothing store. Computer Graphics and Applications, 23 (1), 38-48.
[3] Bye E and McKinney E (2010). Fit analysis using live and 3D scan models. International Journal of Clothing Science and Technology, 22 (2), 88-100.

Acknowledgments
We thank to Farbe Textile for assistance with clothing samples, patterns and artworks.