Advances in Social Science, Education and Humanities Research, volume 286

3rd International Seminar on Education Innovation and Economic Management (SEIEM 2018)

Online Fashion Design Education Supported by Digital Three Dimensions Technologies

Liwen Gu
Fashion & Art Design Institute
Donghua University
Shanghai, China

Xiaogang Liu*
Fashion & Art Design Institute
Donghua University
Shanghai, China
*Corresponding author

***Abstract*—Online fashion design education is new but booming these years. A general landscape of the conventional online fashion design education without using the digital 3D fashion design techniques was presented. The drawback was analyzed and listed. Based on that, corresponding solutions of digital 3D fashion design techniques were presented by classifying into core techniques and assistive techniques.**

Keywords—online education; fashion design; computer aided design；three dimensions

I. INTRODUCTION

Distance education can be defined as the education process carried out among teacher and students are located in different physical location based on the support of information technologies to bridge the instructional gap [1]. Today, with the widespread use of Internet technology, distance education is more widely carried out in the form of online education. Online education can be referred to the education programs which utilize the internet to distribute instructional materials and realize interactions between teachers and students, or among students [2]. As a branch of the online education, online fashion education is gradually emerging. Fashion design curriculum is usually composed by two categories of courses: fashion design and garment construction [3]. These course can be divided into three kinds:

- fashion design courses, such as fashion illustration, style design etc., take place by using two dimensional (2D) technique including hand drawing, 2D computer graphic (CG) software and 2D computer aided design (CAD) software.
- Some of the garment construction courses, such as pattern making, utilized 2D computer aided design (CAD) software.
- The other garment construction courses, such as draping, sewing, knitting etc. require operating in physical 3D environment.

The first two kinds can be classified as operating-in-2D-courses while the third kind can be classified as operating-in-3D-course. In online education, operating-in-3D-courses usually show difficulties when taken place in online education. A solution to solve these drawbacks by involving digital 3D technologies based on the analysis on the current online fashion education landscape was discussed in this paper.

II. DRAWBACKS OF ONLINE FASHION EDUCATION WITHOUT DIGITAL 3D TECHNOLOGIES

A. Barrier between 2D and 3D Operating

In conventional online fashion education curriculum, digital technologies are widely utilized by the operating-in-2D-courses. These digital technologies can generally be classified into two groups: CG software and CAD software. There are many mature commercial software can be used, such as Adobe Photoshop, Adobe Illustrator, CoreDRAW etc. for CG software while GERBER-ACCUMARK, Lectra, Optitex etc. for CAD software. Almost all these software are used in industry as well, which makes it reasonable and necessary to involve them into the education program. On the contrary, when it comes to the operating-in-3D-courses, most of the course have to be taken place in physical environment, such as cutting, sewing or draping etc. Though there were some digital solution can be used, these solutions still have not been widely intergraded in the industry, which reduce the incentive to use this technology in education. Consequently, an invisible barrier between digital and physical world appears in the middle of the operating-in-2D-courses and the operating-in-3D-courses, which lead to some disadvantage as follows.

The barrier mentioned above (2D-3D-barrier) cut the curriculum into isolated pieces, which bring difficulties for students to have a comprehensive understanding content of different courses. Take pattern making course for example. In this course, students can learn pattern making skills by using the 2D CAD software instead of doing it with pencil and paper in physical environment. But without digital 3D technologies, students cannot has an accuracy visual of the final garment prototype until the prototype is finished in the physical environment by cutting and sewing. Two major problem occurred. First, generally, pattern making and sewing technique are two independent courses in conventional fashion design curriculum, which cause difficulties for students to finish a garment prototype no matter which course they learn first. Second, Because of the lack of professional experience, the first prototype usually has variety of defects. The refining work usually took long time when switching between the 2D and 3D operating steps, which lead to low iteration rate. The result is,

students usually cannot have a clear understanding what they are learning within the pattern making course.

In fashion industry, compared with physical fashion design techniques, digital ones have many advantages in editing design. The first one is high efficiency: the digital files can be re-edited much more easily than the physical ones, which means that they can be improved rapidly or even be re-used. The second is high standardization: digital files can be created and modified parametrically, which makes it possible to create standard works with higher accuracy while reducing the workload. In conventional fashion design curriculum, these advantages are fully exploited in operating-in-2D-courses by using the digital 2D technology, but cannot be extended to the operating-in-3D-courses without the digital 3D techniques, which limits the improvement of students' abilities.

B. Difficulty in Interactive Education

In online fashion education, internet is the only way for teacher and students to communicate with each other. By using the digital fashion design techniques, the interactive education can be realized. Instead of sending text, image or video material from teacher to students, interactive education allows teacher and students to work on the same documents in distance and in real-time, so that the teacher can give advice by editing the student' works directly, just like teaching face to face. Without the digital 3D fashion design techniques, the interactive education cannot take place in the operating-in-3D-courses, which is not conducive to students' understanding and absorption of teacher's guidance. It leads to the reduction of the teaching efficiency and negative affect on the studying progress.

Team-work is an important teaching means in conventional fashion design education. When it comes to online courses, team-work can also be realized by using the digital fashion design techniques. Students can finish one task together by sharing their digital works through internet. It is hard to achieve for the operating-in-3D-courses without the support of digital 3D fashion design techniques.

C. Requirement on Hardware and Consumables

In conventional fashion education curriculum, operating-in-3D-course usually have high requirement on teaching props and facilities, such as avatars and sewing machine etc. Most of them are with large volume and high price. Nondistance education can easily solve this problem by bringing together the required hardware and reusing it, but not for online education without using the digital 3D fashion design techniques.

Meanwhile, in the conventional fashion design curriculum, the operating-in-3D-courses usually consume a lot of consumables. In fashion industry, about 15 percent of the total fabric was wasted [4]. The same problem also happens in fashion education field. Students usually need to try plenty of times before they become professional in garment making. Tons of fabric was wasted during this process, which not only increase the financial burden of students, but also causes eco-problem. Without taking digital 3D fashion design techniques, this problem won't be solve either in online education or in offline education.

III. SOLUTION BY DIGITAL 3D FASHION DESIGN TECHNIQUES

The solution which can support the operating-in-3D-course for online fashion design education can be divided into two categories: core techniques and assistive techniques. The core techniques were composed of digital human model (DHM) modeling techniques and digital garment model (DGM) modeling techniques. The assistive techniques includes 5G net technology and virtual reality (VR)/augmented reality (AR) technology.

A. DHM modeling techniques

The DHM modeling techniques can be used to achieve ideal, customized or standardized avatar for fashion design. It can be mainly classified into three groups: capturing methods, modeling methods and parametric methods.

The capturing methods obtain 3D DHM by using 3D capture devices, such as 3D scanner [5], depth camera [6] or common monocular camera [7]. The methods which uses 3D scanner or depth camera are advantaged to obtain exactly accurate customized DHM of the target body because they record the target body's 3D geometry shape passively. However, they still have disadvantages such as high cost of the equipment [8] and inconvenient access for most people [9], incomplete surface information [9], poor animation and parametric editing property of the obtained DHM, etc. The representative commercial solution of 3D body scanner are TC2, 3dMD, Human Solutions etc. The typical device of depth camera is Kinect from Microsoft. In comparison, the methods utilizing the common camera are much more accessible. These methods work to extract features or 3D spatial information of the target human body from 2D photos, based on which to generate the 3D model. There are two major categories for these methods: template morphing methods and photogrammetry methods. The template morphing methods work to deform the 3D shape of the template model of human body to match the body features which are extracted from the 2D photos of the target body [8]. There are two major advantages. First, this method only require a small number of the 2D photos to rebuild the DHM. From the academic perspective, some researchers achieved to reconstruct the target human body based on the body silhouette on four 2D full body photos [7], some other researchers succeeded to rebuild the DHM based on the skeleton and silhouette extracted from one 2D full body photo [10]. From the perspective of practical usage, some cellphone applications which utilize these methods, such as Nettelo, 3DLOOK etc., only require 2 photos of the target body. The second advantage is that, by obtaining the reconstructed 3D DHM based on the morphing of the body template, the 3D DHM can inherit the properties which the body template possess originally such as high resolution surface or animation. The disadvantage is that the template and the morphing rules are usually not able to cover all kinds of body types, which leads to inaccuracy of the rebuilt DHM. The photogrammetry methods works to obtain the information of the target body's surfaces from 2D photos or video of the target body and build the customized 3D DHM by measuring and interpreting this information [11]. The representative cellphone application are Meshroom, TechMed3D, Qlone etc. The advantage is that these methods build the 3D DHM based on

the complete objective geometric data of the target body instead of relying on the predefined template, which is a more reliable modeling method. The disadvantage is that they usually requires a huge amount of photos or 360°video of the target body, which is tend to cause inaccurate rebuilt result because the pose-changing of the target body.

The modeling methods create 3D DHM by manual modeling through 3D modeling software [12]. These methods are suitable to create DHM with ideal or special body shape which is hard to find in the real world. The widely used software are including 3DsMax, Maya, Rhino, Blender etc. The advantage is that these methods are almost unlimited in 3D modeling. The disadvantage is that they usually require professional modeling skills.

The parametric methods create 3D DHM by adjust the data which reflects the body size [13]. These methods are capable to create 3D DHM with desired body size and shape requiring little 3D modeling skills. Many CAD software for clothing industry support this approach for avatar size adjusting, such Lectra, GERBER, CLO3D etc. There is some specialized parametric human modeling software like MakeHuman, DAZ, Poser etc. The advantage is that they require no extra device and quite easy to use. The disadvantage is that the size adjusting rules usually cannot cover all figure types, which lead to ill-posed problem [14].

B. DGM Modeling Techniques

The DGM modeling techniques can generally be classified into two major categories: 2D pattern based technique and direct modeling technique. The 2D pattern based technique create a 3D DGM by sewing the digital 2D pattern together to form a complete garment model in virtual environment [15]. The advantage is that the virtual work flow is almost the same as the one in real world which was commonly taken in the apparel industry. The disadvantage is that it requires professional pattern making and sewing skill, which is usually not possessed by fashion designers or common leaners. The representative commercial CAD software includes GERBER, Optiex, Lectra, CLO 3D, DC Suite etc.

The direct modeling technique creates and edits the 3D DGM directly in the 3D virtual environment. The direct modeling technique is not as mature as the 2D pattern based technique, but it is more intuitive to use. The representative software is LookStailorX.

C. Assistive Techniques

The VR/AR techniques is booming in these years. Though there is few VR/AR application in fashion industry, it is still potential to be used in the online 3D fashion design courses because its advantages on immersive-learning and wireless multiplayer function [16]. In order to realize the huge data transferring through the internet for digital 3D online courses, 5G network will be necessary in the future.

IV. CONCLUSION

The current statement of online fashion design education was discussed in the paper. The drawback which was caused by lack of digital 3D fashion design techniques was analyzed. Based on that, the solution which can do help on realizing the digital 3D online fashion design education was presented. The DHM and DGM modeling techniques can be used to solve the problem of the barrier between 2D and 3D operating and the requirement on hardware and consumables, while the VR/AR and 5G network techniques as the assistive techniques can be used to solve the difficulty in interactive education.

REFERENCES

[1] W. Barry. "Distance education: A practical guide," Educational Technology, 1993, pp. 4

[2] M. Bakia, L. Shear, Y. Toyama, and A. Lasseter, "Understanding the Implications of Online Learning for Educational Productivity," Office of Educational Technology US Department of Education. pp. 76, 2012.

[3] S. Faerm, "Towards a future pedagogy: The evolution of fashion design education." Int. J. Humanit Soc. pp. 210-219, 2012.

[4] R. Timo, H. Mcquillan, and R. R. Range, "Zero Waste Fashion Design." Epress.lib.uts.edu.au, vol. 4, 2015.

[5] C. L. Istook, "Three-dimensional body scanning to improve fit. Advances in Apparel Production," Cambridge, England: Woodhead Publishing, pp. 94-116, 2008.

[6] H. Xu, Y. Yu, Y. Zhou, Y. Li & S. Du. "Measuring accurate body parameters of dressed humans with large-scale motion using a Kinect sensor," Sensors, vol. 13, pp. 11362-11384, 2013.

[7] A. Hilton, D. Beresford, T. Gentils, R. Smith, W. Sun, & J. Illingworth, "Whole-body modeling of people from multiview images to populate virtual worlds," The Visual Computer, vol. 16, pp. 411-436, 2000.

[8] F. Bogo, M. J. Black, M. Loper & J. Romero, "Detailed full-body reconstructions of moving people from monocular RGB-D sequences," Proceedings of the IEEE International Conference on Computer Vision, pp. 2300-2308, 2015.

[9] S. Zhu, P. Y. Mok & Y. L. Kwok, "An efficient human model customization method based on orthogonal-view monocular photos," Computer-Aided Design, vol. 45, pp. 1314-1332, 2013.

[10] P. Guan, A. Weiss, A. O. Balan, & M. J. Black, "Estimating human shape and pose from a single image," Computer Vision, pp. 1381-1388. IEEE, 2009.

[11] T. Schenk, "Introduction to photogrammetry," The Ohio State University, Columbus 106 pp. 3, 2005.

[12] Z. Xin-juan, and X. Xiao-ya, "Human body shapes modeling and feature points location based on ASM for virtual fitting," ICIST, pp. 476-481, May 2016.

[13] M. Kasap, and N. Magnenat-Thalmann, "Skeletonaware size variations in digital mannequins," The Visual Computer, vol. 27, pp. 263-274, April 2011.

[14] Y. Zhang, J. Zheng, & N. Magnenat-Thalmann, "Example-guided anthropometric human body modeling," The Visual Computer, vol. 31, pp. 1615-1631, 2015.

[15] N. Mangnenat-Thalmann, "Modeling and simulating bodies and garments". London: Springer, pp.139-144, 2010.

[16] S. Dieter, A. Fuhrmann, and G. Hesina. "Bridging multiple user interface dimensions with augmented reality," IEEE & Acm. Int. Sym. Aug. Rea., 2000.