

# Application of CLO3D Software in the Teaching of Garment Structure Drawing

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**Abstract.** In the traditional teaching of clothing structure drawing, the examination of the pattern can only go through the tedious and time-consuming process of "sample-sample clothes-pattern correction-sample clothes". However, the sample plate adjustment function of CLO3D software realizes the coordinate conversion from plane to stereo, which saves manpower and man-hours. The human body creation function, perspective function, clothing pressure value function, clothing contact point function and other functions of clo3d software can deeply analyze many factors affecting clothing version to make the version more suitable. CLO3D software in the teaching of garment structure drawing can make students learn more intuitively and efficiently, and bring new changes and great impetus to the traditional teaching of garment structure drawing.

**Keywords:** clothing structure drawing, teaching research, CLO3D software, functional analysis.

## 1. Introduction of CLO3D software

CLO3D fitting software is a fashion design software produced by Korea CLO virtual fashion co., ltd. It has four functions: human body creation, pattern design, sample debugging and fitting display. This software can set up mannequins with accurate data, convert two-dimensional models into three-dimensional garments on the mannequins, and replace the types of fabrics to simulate the softness, thickness and drapability of fabrics. CLO3D fitting software has static and dynamic display functions, which can display the wearing effect of clothes from multiple angles and simulate the dynamic T-stage show.

CLO3D fitting software integrates garment style design, structural design, and three-dimensional fitting, and realizes the simultaneous modification and conversion of garments from two-dimensional to three-dimensional, allowing designers to intuitively see the finished dressing effect of the garment, without the need for intermediate samples. The sewing step saves manpower and man-hours. CLO3D fitting software is undoubtedly an intelligent, accurate and convenient garment design software, which has brought new changes and great impetus to the traditional garment structure drawing. As shown in Figure 1.

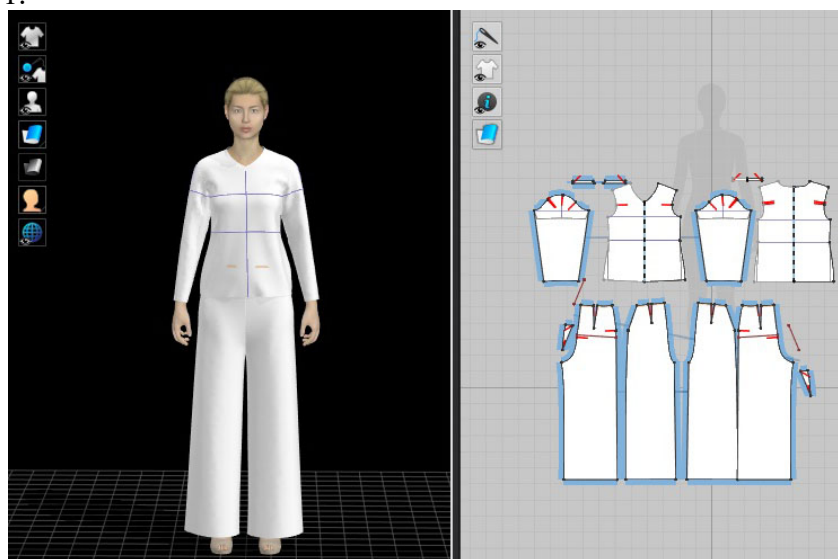


Fig.1 CLO3D fitting software

## **2. CLO3D software realizes the same position conversion from plane to stereo**

Garment structure drawing is only an intermediate link from a design drawing to a finished garment. Whether the structure drawing truly restores the designer's design ideas and achieves the expected wearing effect of the garment. It is necessary to cut fabrics, sew samples, and try on real models. Wear it to achieve. Traditional clothing structure drawing teaching basically adopts the form of drawing and explaining on the blackboard by the teacher while the students follow the teacher to draw, and then draw the structure drawing on paper, add seams, and cut out the model by hand. There are also garment colleges and universities that use garment CAD for computer drawing, computer link printer, print out the structural drawing, and automatically cut the template. No matter which form, it requires the cutting and sewing process of sample clothes, which is time-consuming.

CLO3D software's sample plate adjustment function can quickly show the state of model wearing sample clothes, realize the coordinate conversion from plane to stereo, and omit the tedious, time-consuming and repeated process of "sample plate-sample clothes-pattern correction-sample clothes". For example, in the past, when students designed the pattern of bubble sleeves, in order to achieve the ideal visual effect, the height of the sleeve mountain, the size and position of the fold added by the sleeve mountain need to cut the white cotton sample to verify whether the value is accurate and reasonable. With the help of CLO3D software to perform three-dimensional simulation fittings, you can quickly and accurately observe the three-dimensional forming effect of the puff sleeves, and thereby determine the problems in the structure of the puff sleeves. Adjust the size data of the two-dimensional structure diagram of the puff sleeve in the system, and can synchronously observe the shape of the sleeve of the three-dimensional puff sleeve, and whether the size of the fold is the expected effect.

## **3. 3D human body creation with clo3d software**

The clothing structure drawing is based on the human body. The human body displays the two-dimensional paper pattern of the clothing in three-dimensional form. The design of the clothing structure is ultimately designed for the human body. Therefore, the clothing structure drawing is centered on the human body. In the process of learning clothing structure drawing, students' body shape characteristics, structural characteristics of various parts, reference points of various parts in the clothing volume and horizontal part measurement (head circumference, neck circumference, bust circumference, etc.), clothing and human body static and Dynamic relationships are all knowledge that needs to be mastered in structural drawing. In CLO3D software, students can create a mannequin with accurate size and realistic shape according to the data of human body size. CLO3D software provides male and female models of yellow, white and black, as well as children models. Models of different races have their corresponding height and body shape characteristics. As shown in figure 2.

In order to create accurate body data, you can set the size of the model, such as chest circumference, waist circumference, hip circumference, height and so on. You can also set the size of each part of the model independently, including three dimensions of height, length and width. A total of 25 detail sizes can be adjusted. In the process of setting specific dimensions, students can have a more intuitive and in-depth understanding of the shape and proportions of the human body. When drawing clothing structure, they can associate three-dimensional wearing effects, and then simplify complex contours. , Leveling, and moderate modification, so that the clothing structure diagram can achieve the purpose of beautifying the human body and satisfy the function of human movement.



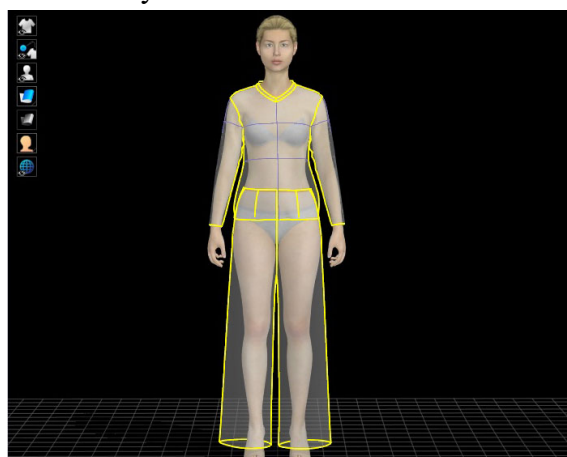
**Fig.2** male and female models of yellow, white and black, as well as children models provided by CLO3D software

#### **4. CLO3D software can more effectively control the amount of relaxation**

In the garment structure drawing, the amount of relaxation directly affects the appearance of the garment, the mobility and comfort of the human body, and how to accurately design the amount of relaxation is the key to the design specifications of the finished garment. How to "quantify" the amount of relaxation in clothing has always been a test of the designer's comprehensive level. In the previous teaching of clothing structure drawing, the net size of the human body + the amount of relaxation = clothing specifications, the amount of relaxation can only be judged and determined based on factors such as the thickness of the inner garment, the thickness of the fabric, the amount of human activity, and the visual effect of the appearance. , Mostly based on the teacher's experience, lack of accuracy. CLO3D software has the functions of clothing perspective, clothing pressure value and clothing contact point, which can intuitively show the relationship and pressure between clothing outline and human body, and thus judge the comfort and relaxation of clothing.

##### **4.1 Clothing perspective function**

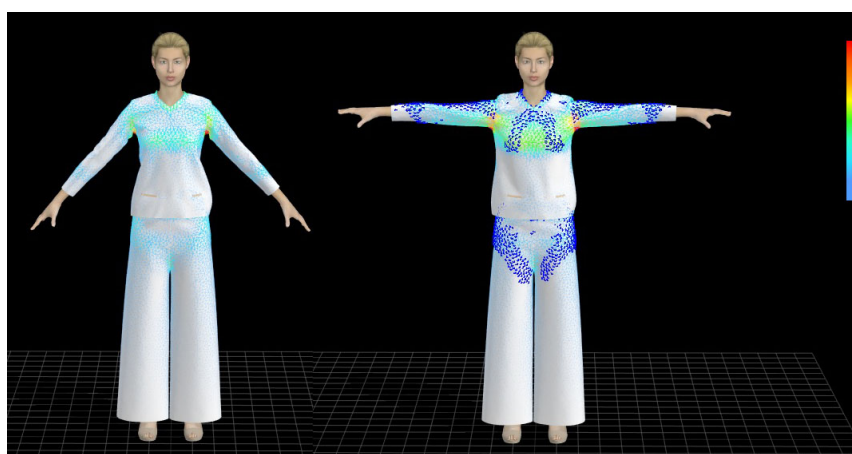
The CLO3D software can adjust the transparency of the garment pieces during the sample. After displaying the virtual dress of the human body, you can see the gap between the outer contour of the garment and the human body, so as to determine whether the amount of relaxation in the garment structure diagram is appropriate. Teachers can directly show students the relationship between the amount of relaxation and the outer contour of clothing through the synchronous simulation of paper pattern and clothing, so as to accurately calculate the amount of relaxation. As shown in Figure 3.



**Fig.3** CLO3D software can adjust the transparency of the garment pieces during the sample

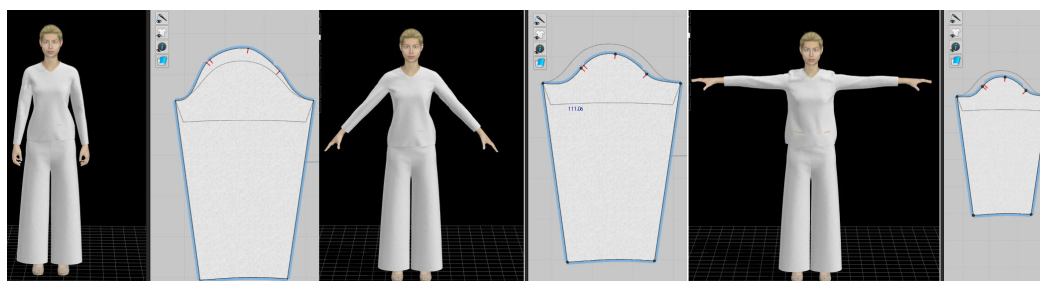
## 4.2 Function of clothing pressure value

The clothing pressure in clo3d software can be expressed by color and value. The relaxation amount of clothing can be determined by the different colors of clothing "pressure point" and "pressure surface" on the human body. When the stress map effect is selected, the clothing pressure surface can distinguish the pressure of clothing on the human body through the color displayed on the human body. The larger the red area is, the greater the pressure value in this area is, the green area indicates the state of small pressure value, and the yellow area indicates the state of intermediate pressure value. Using CLO3D software, students can judge the fitness of clothing according to the color of clothing pressure. For example, when checking whether the sleeve mountain height of sleeves is too high, they can simulate the lifting state of human arms. The higher the sleeve mountain height, the more limited the lifting height of arms, and the larger the red area of chest and armhole. Therefore, students can adjust the sleeve mountain height to find the best size of sleeve mountain height. As shown in fig. 4, there is a great difference in the pressure value of the sleeve mountain when the human arm is lifted up by 45 degrees and the human arm is lifted up by 90 degrees, so as to detect the height of the sleeve mountain.

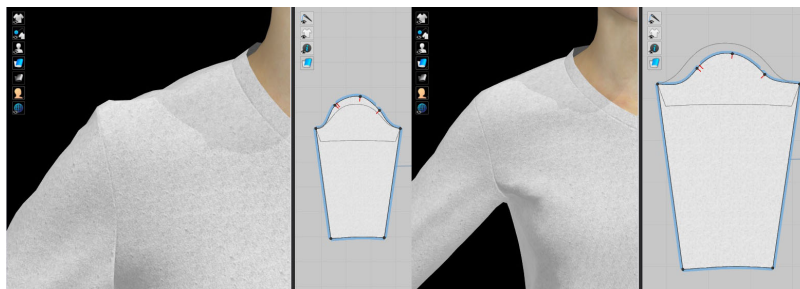


**Fig.4** CLO3D software can judge the fitness of clothing according to the color of clothing pressure

Set the motion angle of the human arm to be 0°-90°. When the angle of the arm is 0° at rest, the sleeve height is 16.5 cm at this time. When the arm is raised 1°, the sleeve height decreases by 0.183 cm. When the arm is raised 45°, the sleeve height is 8.25 cm, and when the arm is raised 90°, the sleeve height is theoretically 0 cm. As shown in Figure 5. Through clo3d software, students can see the change of sleeve mountain height during arm movement, find the disadvantages caused by too high sleeve mountain and correct it in time. As shown in Figure 6, when the sleeve mountain is properly reduced, the excess wrinkles on the shoulder disappear.



**Fig.5** Motion angle of the human arm



**Fig.6** Change of sleeve mountain height during arm movement based on clo3d software

### 4.3 Function of clothing contact point

The "pressure point" in CLO3D software is the contact point between virtual clothing and virtual human body, which can also be understood as the point where clothing binds human body. When any contact point between clothing and human body is selected, the human body surface will show the pressure value. The greater the number of pressure points, the greater the restraint force of the clothing on the human body in the area, and the clothing is in a state of being retracted or tight. Students can judge whether the amount of relaxation of the clothing is reasonable and the comfort after wearing the clothing according to the density and distribution of the contact points.

## 5. Fabric virtual of clo3d software

In the teaching of garment structure drawing, the selection of fabric is closely related to garment structure modeling. Fabric is the carrier of garment. Before structure drawing, the analysis and research of fabric is indispensable. The influence of fabric on garment structure is mainly: the appearance performance of fabric, the water absorption and expansion performance of fabric, and the process operation performance of fabric. Different fabrics have different properties, which requires corresponding adjustments to the garment pattern according to the properties of specific fabrics when the garment structure is drawn. The thickness of the fabric, the tightness of the fabric organization, the elasticity of the fabric, the seam shrinkage, and the ironing shrinkage rate are all important factors to be considered in the garment structure drawing.

However, in the past teaching of structural drawing, the changes that these fabric factors have on the pattern and the finished clothing effect are difficult to be precise. CLO3D software can effectively solve this dilemma. The fabric used can be detected and analyzed by a cloth tester, such as the density, square meter weight, breaking strength and color fastness of the fabric, and the detection results can be input into CLO3D software, and design parameters, such as fabric texture, thickness, elasticity and texture direction, can change the physical properties and surface texture of the fabric, and then the display effect of the fabric in virtual state can be displayed. Then, the pattern with modified fabric parameters is placed on the corresponding part of the human body and displayed by virtual stitching. For example, when thick fabrics are used for sewing, the thicker the fabrics, the smaller the space formed between human body and fabrics, and the greater the amount of relaxation needed. However, the relationship between the thickness of fabrics and the amount of relaxation can only be taught to students by empirical data in traditional structural drawing teaching. When using clo3d software, the appearance and fitness of clothes formed by thick fabrics are clear at a glance, which is very conducive to students' learning. As shown in Figure 7.



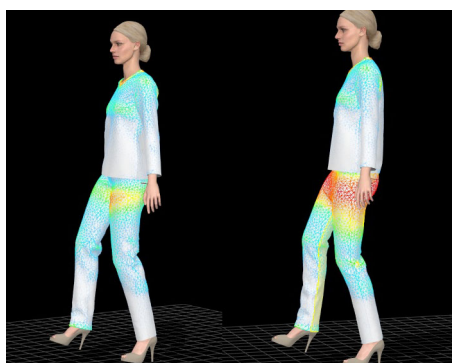


**Fig.7** Appearance and fitness of clothes formed by thick fabrics

## 6. CLO3D software has dynamic display function

The dynamic display function of clo3d software can effectively verify the rationality of clothing structure diagram. CLO3D software can simulate the wearing effect of clothing with human movement. The human body is complex and changeable during movement. All movements will cause changes in the surface length of the moving parts. If the elasticity of the fabric is poor and the length and relaxation of the clothing are not enough, the clothing will hinder the human body during movement. Through the CLO3D software, you can observe the specific changes in the clothing when the human body is walking, so as to infer whether there is a problem with the clothing version.

For example, the relationship between the position of crotch bottom and movement has always been a difficult point when students draw the structure of low crotch pants. As the lower the position of crotch bottom, the smaller the stride size when the human body walks. Through the dynamic display of CLO3D software, we can see the degree of restriction in walking, so as to adjust the structure diagram of low crotch pants and make the version show the best wearing effect. CLO3D software can record the model's dynamic walk show into video for repeated observation. In Figure 8, the crotch depth of the pants is 10 cm lower than the normal crotch position. It is obvious that when people walk, the pressure value of the crotch of the pants becomes larger and they are uncomfortable.



**Fig.8** Crotch depth of the pants is 10 cm lower than the normal crotch position

The clothing structure drawing teaching combined with the human body creation, pattern design, model debugging, and fitting display functions of the CLO3D software can enable students to learn clothing structure more intuitively and in-depth, which is also an inevitable development trend in the traditional clothing structure drawing teaching. The exploration and research on the application of CLO3D software in the teaching of clothing structure drawing is of great practical value in teaching, which requires teachers to find problems, foster strengths and circumvent weaknesses, sum up experience and cultivate more outstanding clothing talents.

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