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Descriptive Geometry Education at the Department of Clothing and Textiles, Otsuma Women's University

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Abstract. The department of clothing and textiles, Otsuma women's university, conducted an educational program as an initial step in getting students to recognize the importance of accurate description in the proper analysis of 3-dimensional objects. The program, which consisted of an application of descriptive geometry in the teaching of clothing pattern planning, met with success. This paper summarizes the results of the program and its unsolved questions which it raises:
One of the goals of the course was to give students a theoretical line of thinking about clothing pattern planning. With a clear concept of modeling, the student is able to visualize and understand the relationship between the 3-dimensional shape of the human body and a clothing pattern. And the student is able to recognize that clothing pattern construction is closely related to the morphological aspect of the human body. On the other hand, there still remain some unsolved problems concerning the contents of the curriculum and policy.

Key Words: Clothing pattern planning

1 Introduction

The educational program recently conducted by the department of clothing and textiles, Otsuma women's university ([1]), consisted of an application of descriptive geometry in the teaching of clothing pattern planning, and met with success as an initial step in getting students to recognize the importance of accurate description in the proper analysis of 3-dimensional objects.

Previous clothing pattern planning courses have tended to teach that a basic pattern is constructed from measurements such as segmental lengths or circumferences of the body. This kind of traditional anthropometric measurement-oriented clothing pattern planning is impractical in many ways for the designing of general clothing patterns, as those measurements alone are not sufficient to cover the wide variety of shapes and proportions of the various body

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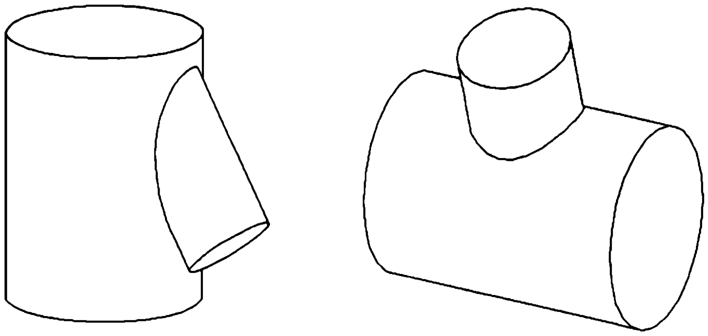


(a) trunk and upper arm (b) trunk and neck

Figure 1: Orthogonal projection

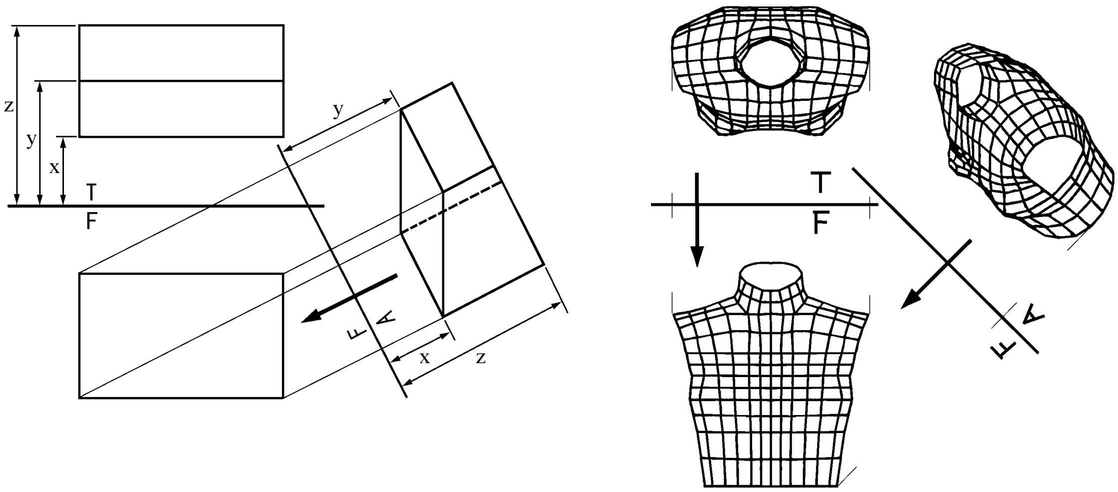


Figure 2: Intersection: a) Trunk and upper arm b) Trunk and neck

types. Analyses of both measurements and figure of the human body are required in the study of the clothing pattern planning.

In this paper we discuss the major role of descriptive geometry embedded in clothing pattern planning and its unsolved points.

2 Course Contents and Teaching Method

2.1 Contents

Descriptive geometry for clothing pattern planning is a semiannual elective subject for students in their third year and consists of lecture and practical training. The main goal of the course is to enhance the visualization abilities of the students and to have them recognize the importance of accurate description in the proper analysis of the 3-dimensional objects, i.e., human body and the clothes having on the body. The contents of the course are as follows:

1. Detailed observations and accurate descriptions of 3-dimensional objects through orthogonal projection.

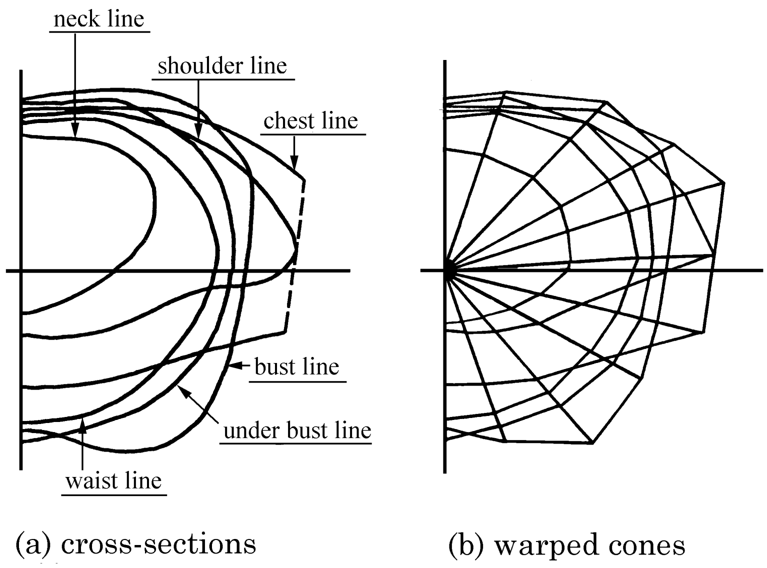


Figure 3: Cross-sections of a human body

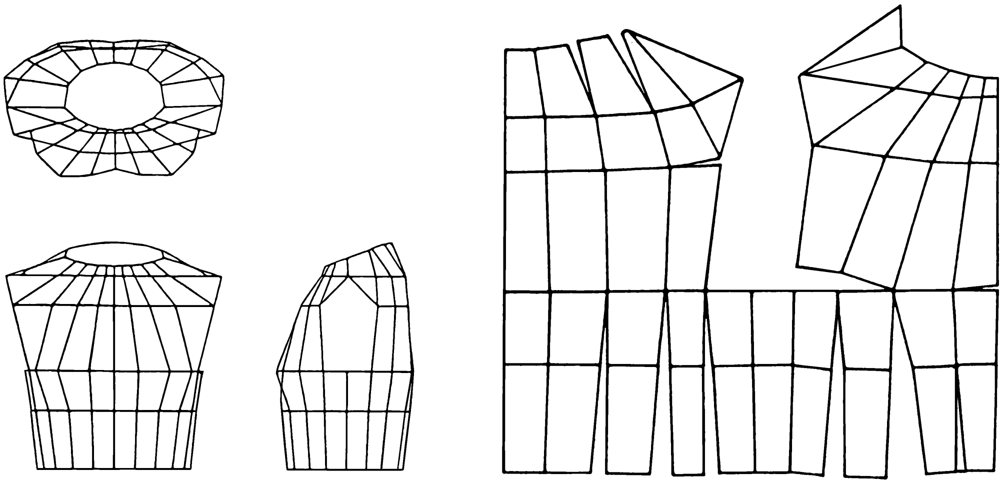
2. Drawings of intersections and their development using two regular solids such as prisms or pyramids either of which have been modeled after human figures.
3. Data handling and analysis of the characteristics and approximate surface development of a human body figure both of which are taken from 3-dimensional measurements of actual human bodies.

2.2 Teaching Methods

The first section of the content consists of having students acquire some projection methods, especially orthogonal projection and including auxiliary projection (Fig. 1). Every participating student is provided with a paper model of a gable-roofed house and is required to make drawings of the principal views of this and also to imagine and sketch several projected figures of the paper model, i.e., auxiliary projections. After having made drawings of real auxiliary projections, the student is required to ascertain the sketches. It is here that the student learns to recognize the relationship between 3-dimensional shapes and their accurate projected figures.

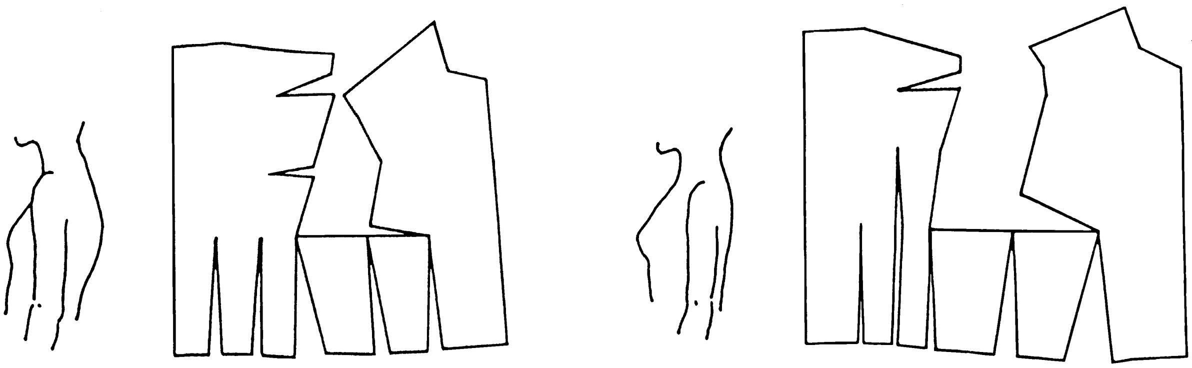
The second section of the contents is directed at the handling of the intersection of two geometrical shapes which have been modeled from two adjacent human body segments, such as a trunk and upper arm or a neck and trunk (Fig. 2). This modeling makes it possible for the student to define and handle a relation between the paired segments clearly and easily. If, in place of the model, there is a human body wearing tight clothes, the surface developments are considered to be the basic patterns of the clothes, i.e., the body and a sleeve or the body and the collar. In this way, students gain the ability to handle clothing patterns using a geometrical model.

In the third section of the contents, students are given layered cross-sections of an existing human body (Fig. 3a). The purpose of the exercise is to learn how the human figure should be modeled and developed. Although it is impossible to expand a complex curved surface such as that of a human body onto a plane surface, it is possible to develop it approximately, if each segmental body surface enclosed by two adjacent cross sections is considered to be a warped



(a) warped cones (b) surface development

Figure 4: Surface development of right half of upper trunk



(a) Woman with protruding shoulders (b) Woman with straight back

Figure 5: Approximated surface development of different body figure

cone (Figures 3b and 4a). The carefully approximated surface development is regarded as the fundamental figure of the basic clothing pattern of the body (Fig. 4b). Thus the students are required to analyze relationships between various shape characteristics of a human body model such as posture, body build, motion, etc., and its surface development (Fig. 5). In the final exercise, the students construct and make observations of a paper-model of a human trunk using the surface development and the cross-sections.

3 Results

3.1 Results of the Teaching in the Course

In the first section of the contents, the students experienced some difficulty in recognizing parallel projection. Some students were unable to perceive the edge view as a straight line (Fig. 6). They drew the edge view as if they have been observing an oblique plain. Some of them sketched the paper-model house using perspective projection. Whatever these results actually mean, it is certain that the exercise gave students the opportunity to observe the characteristics of parallel projection after having taken a paper-model in their own hands and having made a thorough investigation from all angles, from near and from far.

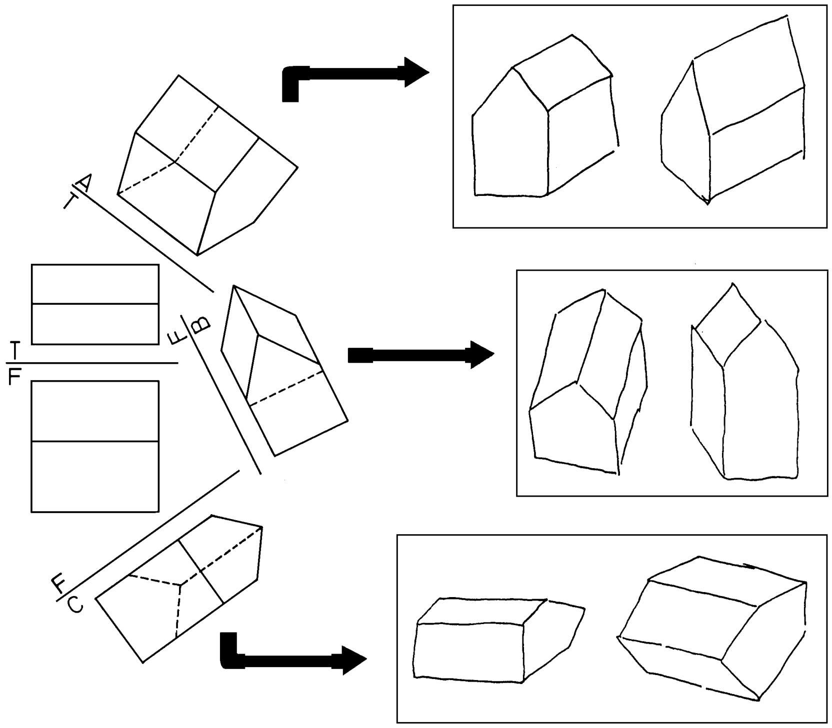


Figure 6: Sketch of projections of the paper model of the gable-roofed house

One of the exercises requires to draw the intersection and the surface development of two cylinders. It is supposed that the large cylinder is a human trunk and the other smaller one an upper arm. In this exercise, students change the arrangement of the smaller cylinder in order to represent the motion of the upper arm (Fig. 7). The differences which appear on the surface development of the cylinder as it goes through the various positions called for in the exercise, gets the students to notice that the motion of a segment of the human body brings about a new phase in the development, i.e., the clothing pattern (Fig. 7b). In this way, students recognize that separate clothing patterns exist according to various functions, as it is shown in Fig. 7:

c) A woman wearing a formal dress, being modestly, is apt to keep her upper arm in static position.

d) A woman wearing working clothes is the most ready to raise and lower her arm during working.

Here variety may be induced into the clothing pattern not only by the motion of the body but also by the size and proportional variation of the segments.

Concerning the third section of the contents, the drawings of the warped cone and its surface development were rather complicated for the students, for the reason that it was difficult for them to arrange elements lines taking care to keep in shape (Fig. 3b). However, the process of approximation was a useful one for them in that it enabled them to grasp the concept of the unevenness of the body surface. In this way, the students came to realize that

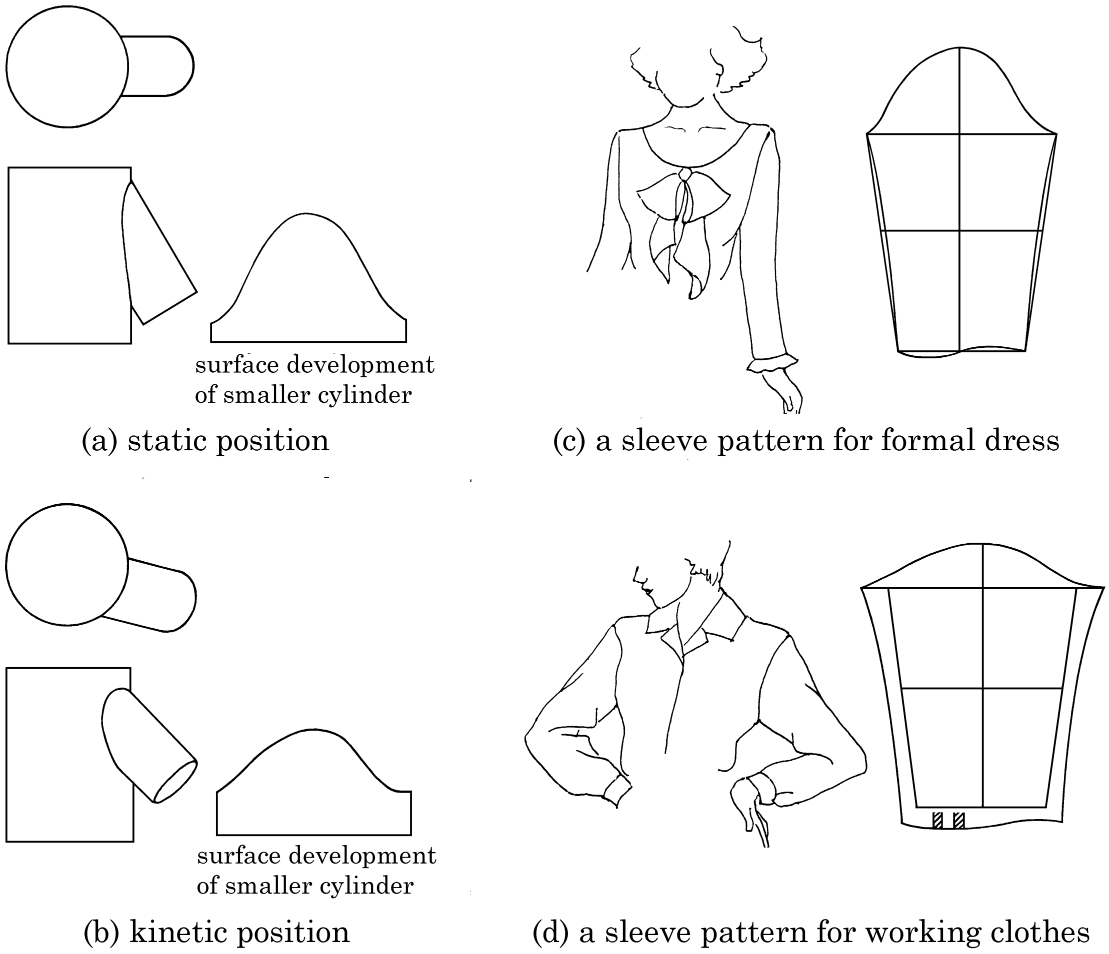


Figure 7: Intersection and development of Arm Model

an investigation of the relationship between various kinds of simply approximated models of human figures and their surface developments gave them better grasp of the kind of process required for a well-planned basic clothing pattern.

3.2 The Role of Descriptive Geometry in the Course

The overall purpose of the course was to enhance the visualization abilities of the students and to have them recognize the importance of proper analysis of 3-dimensional objects through accurate descriptions. The results, on the whole, showed that descriptive geometry plays an important part in getting students to understand clothing pattern planning from the viewpoint of human engineering and also in getting them to realize that clothing pattern construction is closely related to the morphological aspect of the human body. Proper analyses of the relationship between human figures and their clothing patterns were accomplished merely by using simple approximated segmental models to furnish a description of the human body. And from the construction and subsequent observation of a paper-model of the human trunk using the approximated surface development and cross sectional information, the students gained the ability to recognize spatial information as an actual entity.

4 The Unsolved Points of the Course

After having pointed out several merits of the course, it must also be said that there were some difficulties in the course arrangement. First it is expected for the students in the course to study multifarious leanings, because there is almost no other subject in the curriculum which is so relevant to the description and analysis of body shape and clothing patterns except for practical training for draping, i.e., pattern making using lay figures and cloth. Even in draping training, recognition of the body as a 3-dimensional structure is an important matter. What should be emphasized within a descriptive geometry curriculum for students who are majoring in clothing and textiles has yet to be established. And the question remains how we can train or improve the student's concept of spatial abilities.

Although the goal of the course is to teach the students the fundamentals of clothing pattern planning through an application of descriptive geometry to the 3-dimensional shape of the human body, it is also important to know how pattern making is carried out in industry. Factory visits or lectures by speakers from the industry are recommended as they would undoubtedly rouse students' interest in clothing pattern planning. From this point of view also, pattern making training using a computer aided design system along with computer graphics might be indicated.

5 Summary and Conclusion

The educational program conducted by the department of clothing and textiles, Otsuma women's university, met with success as an initial step in getting students to recognize the importance of accurate description in the proper analysis of the 3-dimensional object. With a clear concept of modeling, the students were able to visualize and understand the relationship between the 3-dimensional shape of the human body and clothing patterns, and were able to recognize that clothing pattern construction is closely related to the morphological aspect of the human body. The course was considered to give students a theoretical line of thinking about clothing pattern planning. On the negative side, however, some questions still remain. What content should be carried over from descriptive geometry curriculum which is basically engineering in order to provide a more in-depth study of clothing pattern planning? How is it possible to broaden students' outlook for general clothing pattern planning? Here the intention is to construct an educational program that will build a closer connection with industry while at the same time giving a good grounding in clothing pattern planning.

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References

[1] E. Tsutsumi: *Teaching Descriptive Geometry in Clothing Pattern Planning.* Proceedings of the 1st China-Japan Joint International Conference on Graphics Education, Wuxi 1993, p. 139-144.

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