

# Research on the Classification of Body Type and Prototype of Middle-aged Women based on 3D Scanning

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## Abstract

The human body shape is the foundation of clothing structure design, it is important to analyze body shape accurately to satisfy people's demand for the fitness of clothing. With the improvement of people's requirements for the fit of clothing, the classification of body type is gradually refined. As a large group consumers of clothing products, middle-aged female body shapes are different from young and older women. This paper was based on the 3D human body measurement technology. 211 females' body data aged from 50 to 59 in central China were used as experiment samples. There are 26 body part sizes in total, including length, width and girth. Through the data analysis software SPSS, five types of body shape are obtained based on cluster analysis. Then the models of various types of middle-aged women were reconstructed, the specific characteristics of various types of body types were explained. Finally, the influence of body shape difference on the prototype version was studied by comparing the corresponding upper prototype of each body type. The research results of this paper can provide reference for the development of middle-aged women's upper prototype.

*Keywords:* Middle-aged Female; Three Dimensional Measurement; Cluster Analysis; Upper Prototype

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## 1 Introduction

The fitness of clothing not only affects beauty, it also affects comfort, and is closely related to the body shape [1]. With the development of 3D scanning technology, the analysis on the characteristics of body shape has gradually become a major focus of international ergonomics [2]. In recent years, the application of other 3D digital technologies has gradually become the focus of the breakthrough and innovation in clothing industry, such as 3D human modeling, 3D garment virtual fitting and other digital technologies [3]. At present, a lot of clothing pattern making has experienced the transformation from “body shape-pattern making-three-dimensional fitting-pattern modification” to “body shape-3d pattern making-two-dimensional pattern”. Zheng Yingying classified the body types of middle-aged and elderly women based on 3D scanning data, and established virtual models for various types of body shapes by CLO3d [4]; Zhang Heng

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analyzed the characteristics of 3d-lookstairX system, combined with the current situation of garment pattern design, the traditional method of two-dimensional pattern design was broken through [5]; Kaixuan Liu proposed an interactive garment pattern making approach to generate garment patterns without requiring prior pattern making knowledge from the user, which is not only applicable to measure-to-measure clothing, but also to mass production garments [6]. Jituo Li proposed a novel approach that decouples the high coupling between garment design and pattern making based on 3D new garment models are created on individual human models by compositing 3D parts from garment examples rather than 2D patterns [7]. In this paper, reverse modeling technology and digital cutting technology are combined to realize the transition from prototype making to digital three-dimensional cutting.

## 2 Experiment

### 2.1 Experimental Subjects

In this paper, 208 middle-aged females aged from 50 to 59 in central China were randomly selected as the research subjects. According to GB/T16160 standard, each subject was measured three times on the same sample at the specified measurement site, then the average value was taken as the valid data.

### 2.2 Experimental Instruments

The anthroscan 3-d body scanner and measurement system from Germany was used to scan the human body.

### 2.3 Experimental Conditions and Requirements

The experimental temperature was controlled in the range of  $(27\pm 3)^{\circ}\text{C}$ , and the experimental humidity was controlled in the range of  $(60+10)\%$ . The participants would wear white tight underwear with white hat to cover all the hair, standing on the footprints of the scanning platform, spreading their arms naturally to their sides and bending their elbows slightly, and the participants

Table 1: Measurement Items

Measurement Category	Detailed Measurement Items
Length (cm)	Height, Nape Height, Front Neck height, Shoulder Blade Height, High Waist, Abdominal High, Hip High
Curvature (cm)	Back Length, Front length, Length from BP Point to Lateral Neck Point, Length from Side Neck Point to Waist through BP Point, Length from Armpit to Waist
Width (cm)	Shoulder Width, Full Shoulder Width, Side Shoulder Width, Chest Width, BP Point Width, Back Width, Neck Width, Waist Width
Girth (cm)	Neck Circumference, Chest Circumference, Under Bust Girth, Waist Circumference, Abdominal Circumference, Hip Circumference