

Francisco Rebelo  
Marcelo M. Soares *Editors*

# Advances in Ergonomics in Design

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# **Advances in Intelligent Systems and Computing**

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# Garment Sizing in Portuguese Children's Fashion Brands

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**Abstract.** This paper describes a study of the children's clothing sizing used by Portuguese companies. A survey of children's fashion brands was conducted in Portugal, accessing official public data, followed by a field research. A semi structured interview technique was used to interview designers and pattern-makers, using two distinct scripts. The purpose was to better understand the reality of the Portuguese children's fashion industry, mapping the profile of these brands, understanding how they deal with garment sizing, as well as to know how their body measurements tables were obtained. The study was carried out in the northern region of Portugal, where there is a greater concentration of apparel companies in the country. The selection criteria of the companies considered in the study was based in those whose target audience is between the ages of interest of this research, i.e. 3 to 9 years old.

**Keywords:** Anthropometrics · Pattern design · Children's fashion · Size tables

## 1 Introduction

Garment sizing is the first step to be considered in the construction of a garment, based on anthropometric measurements of each target audience. The development of an anatomical measurement table is the key to the development of the basic patterns (slopers), which, according to the style, type and desired shape, will be assigned with different amounts of ease. Ease values are assigned to assure the needed ergonomic comfort and meet the needs of the users.

This paper describes the study of children's clothing sizing within Portuguese brands. A survey of the main children's fashion brands was conducted accessing official Portuguese data. The methodology used in this study involved a field research with a semi-structured interview technique, developed with two different interview scripts, one intended to reach product designers and the other to obtain the patternmakers perception.

This study is part of an ongoing PhD in Fashion Design at University of Minho and University of Beira Interior, and its purpose was to better understand the reality of the Portuguese children's fashion industry, understanding how these companies develop

their own garment sizing, which measurement tables they use, how those measurements were obtained and how they set up their sizes. The study was conducted in the northern region of Portugal where there is a greater concentration of clothing manufacturing industries in the country.

The selection process of the target companies to visit was based in the available data from the sector institutions *ANIVEC/APIV*'s, about existing businesses. Their studies identify four different contributions for the available data: The *ANIVEC/APIV* chairs, the *Technical Committee of Standardization of Portuguese Textiles*, contributing to the respective work within the *European Committee for Standardization (CEN)* and the *International Organization of Standardization (ISO)*.

From these studies we could identify thirty-four brands working in the children's fashion segment, although some of these are not specifically dedicated to this segment, as they also target the adult audience. Therefore, we selected only the companies that target the age of interest of our study, from three to nine years old, so we have identified only twenty-eight companies.

We found that the preparation of the tables of measurements was mostly carried out from other brands, as well as from local pattern design training in different institutions and fashion schools, adapting those tables over time to the needs of their target audience. The perceived uncertainty exposes the reality that there is a lack of anthropometric studies of the Portuguese children, which makes relevant this research, intending to develop an anthropometric data collection in this age range, to be able to more accurately define new tables of measurements for the main age groups, based on real measurements of the Portuguese children's population. Only this way, fashion companies will be able to provide garments that truly fit them, considering their ergonomic needs in their clothing offer.

There are several factors that interfere in the sizing of children's clothes, among them are: ethnicity, age, food habits and others, as their requirements and characteristics are different from the adult population. In a later phase of this research, the measurements used by these companies will be compared with the proposed size tables, based on anthropometric data of the children from three to nine years old, obtained through the use of a 3D body scanner technology.

## 2 Garment Sizing

The sizing of clothing began to be a concern for researchers, since clothes are no longer made-to-measure, but as part of a mass production. This old manufacturing process allowed tailors to manually obtain the main measurements of their clients, which were unique to each production. According to Zakaria "*that outfit was custom made for one size and for one shape of body*" [1]. With industrialization, the process of garment sizing was required, and these sizes should fit different body types, requiring anthropometric studies to define the average measurements for the construction of the size tables. The goal was to achieve a standard of measurements that could be used in a greater number of people, even with different body shapes. "However, from the mid-18th century, there was a demand for clothing to be mass produced [2]. The demand started with military

uniforms, as they needed to be available in large quantities. These mass-produced clothes were based on pre-assigned sizes according to the classified groups, and were known as ready-to-wear (RTW), sold in retail stores [3]. As there was a great variety of bodies, garments began to be returned to the store by consumers, as they did not fit well. It was important to keep constant the study of size standards for each target population, considering that each country should establish their own size system for garment's production.

Within the children's fashion segment, the common sizing system is done according to their age. This typical procedure by the majority of the brands in the market does not provide satisfactory information for users, once a garment suitable for a certain age may not match the actual size of the child. It is very common to hear parents affirming that their two years old babies already wear garments labeled as four years old, referring they are above the average. This becomes more complicated when a child of eight or nine wears a fourteen or sixteen garment. This situation will not often fit their motor, psychological and social development, as it may not be a suitable outfit for their age.

According to the same author, studies performed around the world to improve the quality of RTW garments "*are conducted primarily to have a better understanding of the human body, so that the variety of shape and body sizes can be laid down in each particular country*".

Gupta and Zakaria [3] mention that since the emergence of the RTW garments, the fashion industry depends on the accuracy of body sizes, referring the need for all countries, and even all the regions within the same country, to establish their own sizing system.

## 2.1 Anthropometry for Garment Construction

Anthropometry is a very ancient science, with multiple ways of application, health, engineering, architecture, industrial design, and is embedded of fundamental importance in garment's construction (Norton 2005, p. v). It also is important that researchers, when collecting anthropometric data, must know how to apply it. Anthropometry "*is the study of human body measurements*", as the word has its origin from the Greek word "*anthropos*", meaning human, and "*metron*", meaning measurement [4].

According to Otieno and Fairhurst [5], the first children anthropometric survey registered was held between 1937 and 1939 by the *Textile and Apparel Division* of the *U.S. Department of Agriculture* [5]. The aim of this study was to create uniformity among manufacturers of children's clothes and also to establish a sizing system based on height and hip girths.

The garment industry lacks reliable and accurate anthropometric measurements, obtained by methods and techniques that can guarantee the needs of fashion design in terms of fit and ergonomic comfort. The values used are often based on measurements obtained from other countries, adapted individually to the specific measurements of their consumers, by highly subjective and questionable reasons. It is assumed that each region has differentiated anthropometric characteristics, according to ethnicity, age, culture, climate, among other aspects.

According to *Proteste* magazine [6], anthropometric studies in Portugal do not contemplate the child population. Current studies in the country cover only a part of the



population, including only people from eighteen to eighty-six years old. The existing table of measurements used by the Portuguese fashion industry vary largely between brands. Additionally, there is no standardization of these table of measurements, with stakeholders in this industry recognizing the need for such studies. It has been found, through a preliminary measurement of similar garments from four Portuguese brands dedicated to this apparel child segment, a difference of up to five centimeters between the highest and the smallest value for the same body measurement. *“Modern industry needs anthropometric measurements increasingly detailed and reliable. On the other hand, it is required by the needs of mass production of products such as garments and footwear”* [7, p. 97].

According to Iida [7] three steps are needed for anthropometric measurements respond to the consumers' needs through the standardization of products: *“a) set the nature of the anthropometric dimensions required in each situation; b) perform the needed steps to generate reliable data, and c) apply properly such data”*.

Anthropometric data should be used as a principle in the development of ergonomic consumer products, especially children's clothing. For Cooklin (1991, quoted by [8]) *“children who wear clothes that fit their body, will have contribution to the growth and development of a healthy body”*. In the garment industry there is a critical issue to minimize the number of sizes, maximizing the number of users [8]. In this context, consumers are in a disadvantage position, as they have more difficulty to find garments that fit their bodies.

Although boys are born, and grow, larger and heavier, than girls, another relevant characteristic is that: *“Until the end of childhood, around nine years old, both genders have similar growth. (...) Growth starts accelerating around ten, with girls growing faster around thirteen and boys, two years later, from twelve and half to fifteen and half”* [7]. Measurement tables published by some authors make no distinction of gender until nine years of age, being in accordance with these observations.

With the anthropometric data obtained, we can see that the graduation of sizes for children's clothing in this age group, used by manufacturers, uses the same table of measurements for both gender and the same basic patterns for the pattern design process”. Age is a factor that changes the shape and measurements of the body” [8].

Children's fashion designers and pattern designers, should be alert with children's body proportions, on the heights of the joints and perimeter of the head. According to Iida *“the newborn has, proportionally, big head and short limbs. The stature of a newborn is 3.8 times the size of the head and the torso is equivalent to an arm size. With growth, these proportions will change”. (...) Meanwhile, the brain develops earlier, and, at the age of five, already reaches 80% of its final size”* [7].

Exporting apparel companies, responsible for the complete product development of garments, have been suffering with the problem of anthropometric measurements. In these cases it is not enough to increase or decrease measurements, it is necessary to identify the characteristics and body differences of the ethnic groups and check the proportions of measurements in different parts of the body. As an example, he mentions that *“Arabs have their arms and legs relatively longer than Europeans, while Asians have them shorter”* [7].

Fashion designers and pattern designers may find alternatives using innovative techniques for pattern design, developing accessories and devices as regulators of sizes, so that garments may follow, in part, the development and the constant movement of the child's body, providing comfort and safety, as well as fitting a larger number of consumers. "*Children's clothing designers should be aware and sensitive to the rapid development of a child*" [8].

Through anthropometric data, we may obtain anatomical measurements that should be used to build the basic patterns (slopers). However, it is also necessary to define the industrial measurements including the needed ease for garment production.

According to Roebuck [4] anthropometry "*is a basic tool for designers during product development, since it covers considerations such as scopes, sizes, proportions, mobility, strength and other factors that define human beings physically*".

Like most of the countries, the Portuguese garment industry lacks an anthropometric study of their younger population, to serve the children's fashion industry. Only with reliable data, it is possible to efficiently perform the product development task, with the desirable ergonomic parameters, with focus on the ergonomic comfort and users' security.

Also, within children, several factors should be considered, according to the different age groups. "*In that sense, the design methodology must define the characteristics of those who will use the product, because it is crucial to the whole process, required for serial production and critical to usability. The standardization of excessive measurements, which puts all at the standard medium, not always is translated in comfort, safety and efficiency*" [4].

There are different methods to obtain anthropometric data, but the process of obtaining measurements of the human body in a three-dimensional scale, is being increasingly used around the world, making it possible to obtain a larger number of measurements, within a shorter time and with a lesser degree of subjectivity.

Braganca et al. [9] present an example of the use of these 3D body scanner technologies, using the *KBI system (Kinect Body Imaging)*, where four *Kinect* devices are used to capture the entire human body, generating automatically a 3D image of the body with the main body measurements, volumes and shape, reducing errors and increasing the speed of the process.

### 3 Methodology

The methodology used for this part of the research was base in a bibliographical research and field work, visiting children's clothing companies. The instrument used for the field research was a semi-structured interview, where two distinct scripts were developed to be applied, one with the fashion designers and the other with the pattern designers of the selected brands.

From these studies we could identify thirty-four brands working in the children's fashion segment, although some of these were not specifically dedicated to this segment, as they also target the adult audience. Therefore, we selected only the companies that

target the age of interest of our study, from 3 to 9 years old, having identified twenty-eight companies.

The study was conducted in the northern region of Portugal, where the companies were established.

The first instrument used to establish contact with each company was a formal letter, explaining the study, its relevance for the industry and for the users, requesting their participation in the research, allowing a visit to their facilities, interview their design team, including designers of the garment collections and pattern designers. Additionally, research has been carried out online, getting in touch with some companies through their website, sending emails and messages through social media applications, like *Facebook*. In total, twenty-eight letters were sent, requesting collaboration. From these contacts, two companies replied negatively (7.2%), five companies agreed to participate in the study (17.9%) and the others didn't respond (75%). The random sample obtained was considered significant, despite the low number of replies. Due to the specificities of each brand, we have reached brands that work with the traditional party segment clothing, brands that work with a variety of uniforms, and brands more focused in producing a contemporary fashion style with differentiated design.

Interviews with design teams had an average duration of two hours, starting with general information about the company and followed by more specific questions. Permission to audio record the interview was also requested and pre-printed scripts were used to write down the information for each question. The interviews were after scanned in the form of a report, compiling the results.

## 4 Results

All visited companies were genuinely Portuguese, with differentiated target public, and with a market not restricted to Europe, as their products also reach United States of America and several Asian countries. The range of products varies from party clothes, school uniforms, and fashion collections. This diversity enriched the research, because we had the opportunity to observe in loco their product development process, including traditional, stylish, conceptual, and fashionable brands, with differentiated design, with excellent quality and affordable prices, from timeless pieces to contemporary ones, considering comfort and ease care.

Regarding the educational knowledge of designers, we found professionals with master degrees, as well as some without specific training in the area, but with relevant experience in the market.

On the other hand, all pattern designers had technical training in standard styles: female, male and children. They preferably use CAD systems to support their pattern design process, although the use of paper and pencil still remains.

Basic patterns (slopers) were built using their tables of measurements, which they designate as anatomical measurement table (measurements taken directly from the body without any ease value). Ease and settings are assigned according to the desired shape for each particular style. According to some pattern designers, the size grading of patterns (increase and reduction of measurements according to age) does not follow a

constant value, as it is the most common case with the adult's measurement tables. Ease is assigned according to the product. An example of a winter coat, showed that ease values could go up to sixteen centimeters in circumferences, due to the lining, filling, type of filler, and also the fact that the coat is used over other pieces of clothing.

Another reality found in the research field was the fact that two companies were using the anatomical tables from ZARA brand and others using tables from Portuguese fashion schools, adjusting them according to the needs of their target population.

The company specialized in school uniforms, values comfort and the importance of meeting the demand of ergonomic comfort, using measurement tables with specific dimensions requested by their customers.

All companies have their own measurement tables but when the client sends a specific table they use it.

None of the companies had a precise answer about the source data of the measurements in the tables they use. No one run a study or knew a study to achieve the standard size of their clothing collections. In addition, they also do not know how ZARA and those fashion schools built their body measurements.

Some of the comments made by the company that works with the Asian countries, refer that Asian children have a greater head perimeter than Western children, and some other measurements are also different due to cultural aspects, such as religion: for example, the extent of Jewish girls' skirts above twelve years old should be longer to cover knees. So, there are several factors that will interfere with the sizing of children's garments, because their requirements and characteristics are different from the adult audience.

With respect to the body on which prototypes are tested, it was noticed that draping dummies is a common procedure, generally equivalent at the age of six. Only one company validates prototypes in real children, combined with dummies. Prototypes are adjusted until they are approved by the client and there is a control to guarantee that those changes are registered.

In all companies, pattern designers have demonstrated a high level of experience and security in what they do at work, and all were concerned with the children's safety.

We have identified that Portuguese companies export more their products, than they sell in their internal market.

## 5 Conclusions

It is a fact that garment sizing is critical to the construction of ready-to-wear garments. Research to improve the scaling systems date back more than a century ago, with the attempt to find the sizes that are closer to the real human body. This procedure cannot be static, as the world evolves, miscegenation, climate, nutrition, sports and lifestyles changes occurs and the development of the industry has to keep up with continuous adjustments.

In this context, the standardization and normalization of children's clothing for each specific population assumes important relevance to respond to basic requirements of fit, ergonomic comfort and safety of the products.

The Portuguese brands surveyed in this study, have their own measurement tables based on other brands and data from fashion schools, changing them along the way according to their needs, sometimes as a result of a complaint or perception that it should be different, adjusting it for a specific population, type of material (depending on its composition and mechanical proprieties, in particularly its elasticity), according to the segment of the brand and the style of the garment. As the majority of the companies studied export their production, they have the same need, the need for a more universal table of measurements, a table that meets the shapes and differentiated measurements of their clients.

The companies involved were collaborative enough in passing information, explaining their internal processes, showing how they run their computerized process of pattern design, as well as how designers are carrying out their creative process, the technical control and monitoring specifications. It was very important to have the opportunity to visit on-the-spot Portuguese companies, and be able to get in touch and examine their products, understanding how they were created and manufactured.

As a next stage of this research, the measurements used by these companies will be compared with the measurement tables based on our anthropometric study of the Portuguese children population, from three to nine years old, obtained through the use of a 3D body scanner technology.

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