

A Study of the Apparel Sizing of Children's Wear

- An Analysis of the Size Increments Utilized in Children's Wear Based on an Anthropometric Survey -

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Abstract : The purpose of this research is to analyze how appropriately the sizing of domestically produced children's wear compares to children's sizes; it is based on an anthropometric survey conducted in 1998. By discovering and understanding discrepancies between the sizing system of children's wear and the real size of children, this study aims to suggest solutions that will lead to increased comfort and more suitable fitting in children's clothes. This research analyzes and compares "the extent of growth between age groups" with "the difference in sizing system in use by manufacturers". The study focused on aged 4 to 12 children, who are usually divided in two groups; primary students and toddlers. In total, seven sizes were selected: bust, waist, and hip (which are girth sizes), and height, back neck to waist (top length), sleeve length, and waist to ankle (slacks length) as representing length.

The results of this research are analyzed by basing on the actual increments between the sizes of children's wear in certain basic items rather than sizes themselves because each size quite differed according to companies, items and designs. Significantly, the increase in the sizing was not as great as the average biennial growth rate of children. The consequences are poorer fit and unsuitable representative value for each age group because the actual sizes of children increasingly differ from the sample size.

Observing the increments in several sizes, we found that 81.8% of the companies used the certain and equal increases for grading sizes in sleeve length, waist, and bust. In addition, 72.7% of the companies adopted the same increments between sizes in height and hip girth, and 63.6% also chose equal increments in T-shirt length for making smaller or bigger sizes from the sample size. However, sleeve length and pant length were the components that displayed the most varied sizing. Interestingly, the few companies that used different increments between size groups, adopted the change only between one or two size groups, instead of all sizes.

In conclusion, this research reveals the unsuitability of the current sizing system and the necessity to increase consumer confidence in the size tags on children's wear by modifying the system to reflect the actual growth of children. The results can also contribute to future study on the development of a new and more accurate sizing system for children's wear.

Key Words : sizing system, children's wear, increments

I. INTRODUCTION

When a garment is properly styled and sized, it is reflecting the children's growth and also does not disturb body movements. Proper fit is particularly important in childhood because it is the period of greatest potential growth and body development. Children require the most flexible and comfortable attire possible.

The most important factor in making proper garments that accommodate children's growth is to develop sizing systems that fit each age group based on accurate data. This data should be acquired through the analysis of body sizes and shapes and modified by appropriate margin calculations to permit various actions and activities. However, according to prior studies on children's garment sizes, many manufacturers use their own different designations and body measurements for the same size products. This results in a lack of consistency in clothing sizes made by the garment industry (Jung Soon Park, 1994). The Agency for Technology and Standards (1997) has recommended that the age in months and the weight of infants and toddlers be used to representative size. However for children, these simple physical factors less accurately represent body size. In children's wear, there is a wide range of body sizes based on several lengths related to height (Chan Mi Park, 1999) and several girths indicating body shape. From ages 6 to 11, children show a remarkable increase in length related to height (Eun Gyung Chun, 1991; Jeong-Ah Jang, 1999), and a statistically significant difference of height between age groups was reported (Chan Mee Park, 1999). Therefore, length and some girths indicating body shape are more important factors than weight in the sizing of children's wear.

The Ministry of Education and Human Resources Development reported that the height of upper grade students in primary school was 2 ~ 4 cm. taller than 10 years ago, although the length from top to chair in the sitting position was less than 1 cm. greater (Results of the Student's Body Check in 2000). Moreover, according to a recent report, "The Buying Behavior of Infant and Children's Wear" in the Yonhap News, most consumers commonly buy bigger sized clothes than the actual size on the tag. This is a fact also realized by manufacturers. Consequently, the garment sizes on clothing tags do not match the actual body size of the children they should fit. This causes great confusion between consumers

and manufacturers.

One reason for this problem could be that the current garment sizing system for children's wear does not accurately reflect the body sizes or current growth rate of today's children. Therefore, the purpose of this research is to analyze and compare the general size specifications of children's wear in use by domestic manufacturers with the actual sizes reported in the 1998 anthropometric survey. This analysis will help determine and understand sizing discrepancies and offer solutions to establish a better system. This system will create less confusion on the part of consumers and help them select appropriate clothing for their children.

II. METHODS

The first step in enabling the consumer to understand and buy proper sizes for their children requires a statistical analysis of the measurements of body sizes and a comparison with the sizing systems in use in the apparel industry. This research used the National Anthropometric Survey of Korea 1997 to analyze actual body sizes and shapes; a summary of the analysis was compared with the size specifications of children's wear currently used by manufacturers.

1. Research Objectives

Generally, the market for children's wear is divided into 3 categories: infant, toddler, and children (Texjournal 1999,10) though older primary school students have recently been segmented into a subdivision called "Teen-generation". This research focuses on primary students ages 8 to 13 and includes between aged 4 and 7, the latter category included part of the toddler zone according to the apparel industry's manufacturing system.

This research analyzed and compared "the amount of growth between ages" with "the amount of increase between manufacturing sizes."

2. Research Sizes

For the mass customization of garments, several sizes such as height, bust, and waist are most commonly recommended by prior researchers for sizing children's wear though a great amount of other data exists to identify and analyze children's body sizes and shapes. At the first step, this research includes 4 basic sizes and some more sizes to be generally concerned for clothes; chest width, back width, nape-waist, shoulder width, crotch length and the angle of shoulders.

Next, to compare children's body sizes with their clothes sizes, a total of only 7 sizes selected for this research: height, bust, waist, and hip, which are basic sizes; back neck to waist (back neck to seam line); sleeve length and waist to ankle, which are related to height. For the top, height and bust(Chan Mee Park 1999, Hyoung Sook Lee 1982, Jae Eun Jung 1999, Yoon Ju Joe 1999), and for pants, height and waist (Hyoung Sook Lee, 1982) are suggested as the most important sizes.

3. Method

As the basic steps for analysis, several sizes were selected from the National Anthropometric Survey of Korea 1997. They were categorized by age, size, and survey year to identify the amount of partial growth and track the changes. Through statistical analysis, including means and standard deviations of 7 sizes, the variation of each size was carefully analyzed. In addition, the difference in each size between each age group or between age groups at 2-year intervals was compared with the size specification system of the apparel industry. The reason for utilizing 2-year interval groups was to make a proper comparison with the size system in use in the clothing industry. This size system is designed to cover age groups separated by 2 years, while the anthropometric survey reported the sizes of children by each calendar year

III. RESULTS

1. Several Sizes and Age Groups Indicating the Difference Between Genders (Table 1)

- a. Bust girth: The first signal of the difference in growth between boys and girls started to appear at 6 years old. By age 10, girls surpassed boys due to the influence of secondary sexual development.
- b. Waist girth: Girls' waist size, which makes the female silhouette, was smaller than boys' from age 5. Accordingly, from this age, a different pattern of sizing could be suggested for each sex rather than the unisex sizing commonly used in the children's clothes industry. The difference in waist girth became more dominant as age increased.
- c. Hip girth: This is the only part of the body on boys that were smaller than girls, and the difference increased clearly from age 10 onwards.
- d. Crotch length (CF-CB through legs): Girls' crotch length became longer than boys' from about age 7; it continued to dominate from then on.
- e. There were no big differences between the sexes for chest width, back width, nape-waist (Ann Hagger, 1990) or shoulder width. These measurements grew consistently by 0.5 - 1.5 cm. per year. Boys were usually bigger than girls by 0.5 - 1.5 cm. from ages 3 to 13 years. Sleeve length, which was highly relative ($r=80$) to height, continuously increased as children grew. There was no distinctive difference between sexes. However, girls stopped growing by age 14 while boys kept growing until age 18. This is the reason for the difference in sleeve length between sexes in adults (National Anthropometric Survey of Korea, 1997).
- f. The angle of the shoulder was an unusual measurement because girls' usually appeared steeper than boys'; specially, the right side showed much steeper angle than left for girls in all age groups.

As reported, most of the boys' sizes were bigger than the girls' except the bust and hip sizes: bust and hip became bigger as the female shape matured. The main size guidelines for children's wear such as bust, waist, and hip differed from ages 5 - 6 and became properly developed to each sex from ages 9 - 10.

Table 1. Means of Body Sizes by Ages

Sizes	Sex	Age										
		3	4	5	6	7	8	9	10	11	12	13
Height	Boys	99.6 (3.6)	105.0 (3.9)	108.9 (4.0)	120.4 (5.0)	124.8 (5.2)	128.4 (5.9)	134.8 (5.6)	139.7 (5.9)	145.4 (6.5)	151.9 (7.7)	158.8 (8.8)
	Girls	98.9 (4.4)	104.4 (4.4)	110.3 (4.9)	119.0 (5.4)	122.5 (5.1)	127.6 (6.0)	119.0 (6.4)	141.1 (7.3)	147.1 (6.5)	155.5 (5.5)	158.3 (5.6)
Bust	Boys	52.2 (2.1)	53.2 (2.2)	55.1 (2.5)	59.2 (3.2)	59.0 (2.9)	61.1 (4.2)	64.5 (5.1)	66.9 (5.5)	69.5 (5.7)	71.5 (6.5)	74.9 (7.2)
	Girls	51.3 (2.1)	52.4 (2.3)	54.1 (2.8)	57.5 (3.1)	59.0 (3.0)	59.2 (3.8)	62.2 (4.4)	67.0 (6.6)	70.3 (6.9)	73.7 (6.4)	77.2 (6.5)
Waist	Boys	48.0 (2.6)	49.1 (2.5)	50.7 (2.8)	53.4 (3.5)	53.4 (3.4)	55.1 (4.4)	58.9 (6.2)	61.3 (6.8)	63.0 (6.6)	63.7 (6.1)	66.2 (7.0)
	Girls	48.4 (2.7)	49.2 (2.9)	50.1 (3.3)	52.1 (3.4)	52.9 (4.2)	53.7 (4.5)	55.8 (5.0)	58.9 (6.1)	60.6 (6.2)	62.1 (6.0)	64.1 (5.9)
Front Neck	Boys	22.6 (1.6)	23.0 (1.7)	24.0 (1.8)	25.7 (1.9)	26.2 (1.8)	26.5 (2.1)	27.6 (2.0)	28.7 (2.1)	29.6 (2.2)	30.5 (2.5)	31.9 (2.9)
Point-Waist	Girls	21.6 (1.8)	22.5 (1.8)	23.2 (1.8)	24.6 (2.0)	24.5 (1.8)	25.2 (2.0)	26.2 (1.9)	27.2 (2.3)	28.2 (2.5)	29.3 (2.6)	30.6 (2.7)
Chest Width	Boys	20.2 (1.6)	20.6 (1.6)	21.8 (1.7)	24.1 (2.1)	23.8 (2.2)	24.5 (2.4)	25.6 (2.6)	27.1 (2.8)	27.9 (2.7)	29.1 (3.1)	30.7 (3.1)
	Girls	19.8 (1.6)	20.5 (1.6)	21.2 (1.7)	22.8 (2.0)	23.1 (2.0)	23.8 (2.1)	24.7 (2.0)	25.9 (2.3)	27.1 (2.7)	28.5 (2.7)	29.1 (3.2)
Back Width	Boys	23.1 (1.8)	24.2 (2.1)	25.4 (2.0)	26.6 (2.1)	28.2 (2.3)	28.7 (2.4)	30.0 (2.7)	31.5 (2.9)	32.8 (3.1)	34.2 (3.6)	35.6 (3.4)
	Girls	23.1 (1.8)	24.2 (1.7)	25.0 (1.8)	26.1 (2.2)	27.3 (2.2)	28.1 (2.4)	29.4 (2.5)	31.0 (3.2)	32.1 (3.2)	33.4 (2.9)	34.5 (2.9)
Nape - Waist	Boys	24.7 (2.0)	25.1 (1.9)	26.0 (2.1)	27.6 (1.8)	29.0 (2.2)	29.9 (2.6)	31.2 (2.4)	32.3 (2.7)	33.7 (2.6)	35.2 (3.0)	37.3 (3.3)
	Girls	24.0 (2.1)	25.0 (1.9)	25.6 (2.3)	27.0 (2.2)	29.8 (1.7)	28.8 (2.1)	30.2 (2.0)	31.7 (2.7)	32.9 (2.8)	34.7 (3.1)	36.3 (3.2)
Sleeve Length	Boys	31.1 (1.9)	32.5 (1.8)	34.8 (2.3)	36.9 (2.2)	39.3 (2.1)	40.6 (2.4)	43.0 (2.4)	44.7 (2.7)	46.5 (3.1)	48.5 (3.2)	50.9 (3.4)
	Girls	30.5 (1.8)	32.3 (1.9)	34.1 (1.9)	36.6 (2.2)	38.4 (2.0)	40.0 (2.5)	42.4 (2.6)	44.9 (3.0)	46.9 (3.2)	48.9 (2.4)	49.9 (2.3)

Table 1. Continued

Sizes	Sex	Age										
		3	4	5	6	7	8	9	10	11	12	13
Shoulder point - Shoulder point	Boys	25.7 (2.2)	26.5 (2.2)	27.9 (2.1)	29.5 (2.3)	31.5 (2.4)	32.2 (2.2)	33.2 (2.4)	34.9 (2.8)	36.5 (2.7)	38.2 (3.3)	40.0 (3.4)
	Girls	25.7 (1.9)	26.7 (2.0)	27.9 (2.1)	29.5 (2.2)	30.8 (2.4)	31.8 (2.2)	32.8 (2.2)	34.5 (2.6)	35.9 (2.7)	37.8 (2.4)	38.6 (2.3)
Hip	Boys	53.5 (2.6)	55.0 (2.9)	58.1 (3.9)	61.9 (4.1)	63.5 (4.4)	65.6 (5.0)	70.6 (7.1)	73.0 (6.3)	76.0 (6.8)	79.2 (7.5)	83.1 (7.9)
	Girls	53.8 (3.0)	55.7 (3.3)	58.2 (3.7)	62.0 (4.3)	63.3 (4.6)	65.1 (4.5)	69.7 (5.7)	73.4 (6.6)	77.3 (7.3)	81.8 (6.2)	85.4 (6.2)
Crotch Length	Boys	41.2 (3.1)	42.1 (3.4)	44.8 (3.7)	47.0 (4.0)	48.1 (4.1)	50.4 (4.7)	53.6 (5.1)	54.7 (4.6)	57.5 (5.1)	60.9 (6.0)	64.3 (6.4)
	Girls	40.6 (3.4)	42.1 (3.3)	44.3 (3.8)	46.7 (4.5)	49.1 (4.4)	51.6 (4.5)	54.0 (4.7)	57.4 (5.2)	60.5 (5.5)	64.1 (5.5)	64.9 (5.5)
Waist - Ankle	Boys	56.0 (3.3)	60.5 (3.0)	65.3 (3.8)	70.8 (3.9)	74.4 (3.7)	77.2 (4.1)	81.5 (4.3)	85.5 (4.5)	89.2 (4.8)	93.5 (5.6)	98.2 (5.8)
	Girls	56.1 (3.4)	60.8 (3.3)	65.1 (3.7)	70.9 (4.1)	74.0 (3.7)	77.7 (4.4)	82.6 (4.9)	87.0 (4.9)	92.1 (3.8)	94.7 (3.9)	95.7 (4.1)
Slope of shoulder (L)	Boys	22.2	22.6	22.6	22.2	21.6	22.2	22.0	21.5	22.2	22.2	22.4
	Girls	23.2	23.0	23.1	23.7	23.6	23.2	22.3	22.6	22.8	22.8	22.4
Slope of shoulder (R)	Boys	22.8	23.5	23.5	23.1	22.6	22.3	22.5	22.1	22.7	22.7	23.2
	Girls	24.0	23.9	24.0	24.1	24.6	24.0	23.2	23.3	23.5	23.5	22.7

* The numbers in parentheses are standard deviations

* Names of sizes followed Ann Hagggar (1990)

2. Comparison of Several Main Sizes Between Survey Years (Table 2)

Focusing on the differences and changes in 4 main body measurements between four survey years, 4 sizes showed an increase compared to past surveys. This difference of height, bust and waist appeared at about 6 years old and hip size showed a difference earlier at 5 years of age. In addition, the differences in sizes between survey years became more distinct in higher age groups.

The bust, waist, and hip sizes in 1997 were quite different from the sizes listed in 1979.

Table 2. Comparison of Sizes between Survey Years

Size	Sex	Year	Age										
			3	4	5	6	7	8	9	10	11	12	13
Height	Boys	1979	95.7	101.5	108.8	113.9	119.1	124.4	129.5	133.3	138.3	142.6	149.8
		1986	96.7	103.4	109.3	117	121.5	126.5	131.5	135.8	140.4	147	153.4
		1992	—	—	—	120.4	123.4	128.9	133.0	137.7	142.7	149.4	155.8
		1997	99.6	105.0	108.9	120.4	124.8	128.4	134.9	139.7	145.4	151.9	158.8
	Girls	1979	96.8	100.9	104.9	112.5	117.4	124.1	127.5	133.8	139.6	145.2	149.3
		1986	95.8	103	108.9	116.4	119.8	125.3	131.2	136.7	142.7	149.4	152.7
		1992	—	—	—	118.7	121.7	127.3	133.4	137.7	143.9	149.7	154.6
		1997	98.9	104.4	110.3	119.0	122.5	127.6	134.1	141.1	147.1	155.5	158.3
Bust	Boys	1979	53.3	54.6	55.2	57.0	58.4	60.4	61.9	65.0	67.4	69.4	73.1
		1986	51.6	53.4	54.7	57.1	58.1	60.3	62.3	64.7	66.6	69.8	72.5
		1992	—	—	§—	59.3	60	62.2	63.9	66.8	68.8	71.7	74.8
		1997	52.2	53.2	55.1	59.2	59.0	61.1	64.6	66.9	69.5	71.5	74.9
	Girls	1979	53.3	54.6	55.2	56.4	57.3	59.6	61.8	64.2	66.7	70.6	74.6
		1986	49.9	52.3	53.7	55.4	56.7	58	60.8	64	67.4	72.4	75.3
		1992	—	—	—	57.4	58.3	60.8	63.5	66.2	69.5	73.4	77.2
		1997	51.3	52.4	54.1	57.5	59.0	59.2	62.2	67.0	70.3	73.7	77.2
Waist	Boys	1979	50.8	51.1	51.7	52.5	52.6	53.9	55.3	57	58.6	59.7	62.8
		1986	48.8	50	51.3	51.7	52.9	54.5	55.7	57.5	58.7	61.6	65.7
		1992	—	—	—	53.4	54.2	55.8	57.3	59.6	61.1	63.1	64.7
		1997	48.0	49.1	50.7	53.4	53.4	55.1	59.1	61.3	63.0	63.7	66.2
	Girls	1979	50.6	51	51.3	51.2	51.1	52.4	53.3	55.3	56.9	58.6	61
		1986	48.4	49.7	51.2	50.3	51.5	52.5	54.9	56.2	58.1	60.1	61.6
		1992	—	—	—	51.7	52.2	54.0	56	57.3	59.5	61	63.1
		1997	48.4	49.2	50.1	52.1	52.9	53.7	55.9	58.9	60.6	62.1	64.1
Hip	Boys	1979	53.9	55.2	56.1	57.4	58.2	60.1	63.1	65.4	68.2	70.3	74.6
		1986	52.5	54.5	56.4	59.0	61.4	63.7	65.7	68.3	70.4	74.5	77.4
		1992	—	—	—	62.6	63.7	66.8	68.6	71.7	74.1	77.6	80.8
		1997	53.5	55.0	58.1	61.9	63.5	65.6	70.7	73.0	76.0	79.2	83.1
	Girls	1979	53.7	55.6	57.1	59.5	60.9	64.0	66.0	68.9	72.0	75.7	79.5
		1986	52.8	54.8	56.8	58.9	60.8	62.9	66.3	69.7	72.9	78.2	82.0
		1992	—	—	—	61.4	63.1	66.2	69.1	71.9	75.7	80.4	84.9
		1997	53.8	55.7	58.2	62.0	63.3	65.1	69.7	73.4	77.3	81.8	85.4

The size gaps between the two surveys started at about 6 years of age and became clearer as children grew older. Focusing on certain growth feature, the means of the bust and waist measurements in children 6 years of age and older in 1997 were similar to the measurements of the age group almost 1 year older in 1979.

In particular, height and hip measurements in 1997 showed the biggest gaps between other survey years. Specially, they were similar to the measurements of 1 or sometimes 2 years older groups in 1979. This fact could be interpreted as a problem between the old sizing system in the apparel industry and the expectation for suitable fit for children of today.

3. A Comparison Between the Increase in Body Size and the Difference Within Each Size as Used by the Apparel Industry (Tables 3, 4, 5, 6, 7, 8)

Among the top 15 companies (based on the annual sales reported by department stores in 2000), size specifications for the 7 aforementioned parts were surveyed at 11 companies (4 companies were unwilling to answer).

Of course, It is desirable to assess suitability by comparing the actual size of every pieces of clothing with the data of the target age; however, the number of sizes used by manufacturers varies infinitely according to item, design, and margin. For example, the length required by each design is quite different because each design aims at a different concept and a certain way of fitting. Accordingly, direct comparison of the garment sizes of each item with body size is not useful or significant unless designs are also taken into consideration. Therefore, this research analyzed and compared "the increments of garment size" with "the growth of body size", as the increment of size in an individual item is constant.

The sizes chosen for analysis were height, nape-waist, sleeve length and pant length for the length sizes and bust, waist, and hip for the girth sizes. The clothing items used for comparison were basic T-shirts and pants which were basic and classic style made of non-elastic material to exclude the possibility of stretching. Care was also taken to choose a style that was not designed for only girls. The clothing sizes determined for comparison in this

research were for 5, 7, 9, 11, and 13 year olds since these are common sizes in the surveyed apparel companies.

According to this research, the master pattern of most companies (63.6%) was size 7 for 7 years, and the next most common sample sizes were for 3 years or 9 years (18.2% each).

Looking at each size part, the representative value of the height used by each company was 10 cm. intervals within sizes for 5 year olds, 7 year olds and 9 year olds (90.1%) (i.e. 110, 120, 130, etc.). However, as the representative value for 11 year olds, 10cm. interval was less common than the previously mentioned years (70%) and the other companies used 15 cm. intervals (30%). This feature became dominant for 13 year olds; 62.5% of companies used 10 cm. intervals and 37.5% used 10 ~ 15 cm. intervals. In total, 72.7% of children's wear companies (8 companies) increased the size of clothes by 10 cm. even though the height increment between 2-year periods was more than 10 cm. during some periods (Table 3). This means that clothing sizes do not accurately reflect actual growth during a 2-year period, and the gap between the clothing sizes and height widens as the clothing size is graded further away from the sample size. It is possible that consumers become even more confused about buying the proper sizes for their children as unreliability of sizes in children's wear increases.

In the case of pants length, 63.7% of companies (7 companies) (Table 4) used the same interval of 6 ~ 7 cm. between all clothing sizes while only 27.4% of companies changed the

Table 3. Comparison of Increment Between Sizes of Clothes (height)

Size Height	The size of body				Increments of industry mean (height)
	Mean (boys)	Increment	Mean (girls)	Increment	
Size 3	99.6	0	98.9	0	
Size 5	108.9	+9.3	110.3	+11.4	+10(110)
Size 7	124.8	+15.9	122.5	+12.2	+10(120)
Size 9	134.8	+10.0	134.1	+11.6	+10(130)
Size 11	145.4	+10.6	147.1	+13.0	+10(140)
Size 13	158.8	+13.4	158.3	+11.2	+10(150)

* The "Size" number refers to age

* The number of "Increment of industry" is the mean of increment used by companies.

Table 4. Comparison of Increment Between Sizes of Clothes (pant length)

Size Pant length	The size of body				Increments of companies mean (range)
	Mean (boys)	Increment	Mean (girls)	Increment	
Size 3	51.9	0	52.1	0	
Size 5	60.8	+8.9	60.7	+8.6	+6.21(6.0 ~ 7.0)
Size 7	69.3	+8.5	69.0	+8.3	+6.06(6.0 ~ 7.0)
Size 9	76.0	+6.7	77.1	+8.1	+6.06(6.0 ~ 7.0)
Size 11	83.3	+7.3	86.2	+9.1	+6.07(6.0 ~ 7.1)
Size 13	91.8	+8.5	89.7	+3.5	+6.39(6.0 ~ 6.5)

* The "Size" number refers to age

increase between size classes. The affected age groups were between 11 to 13 and 5 to 7 years of age. The body increase for pants every 2 years was calculated using waist to ankle and waist to floor in the anthropometric survey. Through comparing these sizes, the result was the same as the height. Almost all increments between each 2-year interval exceeded the average of the increment between the sizes of pants length except in the case of 11-13 year old girls.

The length of the top was one of the parts that were mostly affected by design, so the most various sizes were collected in the research among the 7 sizes (Table 5). However, the result was similar to the other sizes. Of the companies surveyed, 63.6% (7 companies) used an equal amount within 3 ~ 5 cm. as the increment between all sizes while only 27.4% of them applied a changed increment for certain sizes. The classes applying unequal increments were between 5-7 year olds, and 9-11 year olds by 0.5 cm. and 11 - 13 year olds by 1 cm.

In the case of sleeve length (table 3-6), 81.8% of companies (9 companies) also chose an equal amount within 3.2 ~ 4 cm. as the increment between the all size classes while only 18.1% of them applied a different increment between certain sizes. The amount applied differently between the size classes was within 0.5 ~ 1 cm. and all changes appeared between 5-7 year olds. This is different from other sizes and quite meaningful because it could be interpreted as a reflection of the body increments between these age groups though the amount is small.

Table 5. Comparison of Increment between Sizes of Clothes (the length of top)

Size Length of top	The size of body				Increments of companies mean (Range)
	Mean (boys)	Increment	Mean (girls)	Increment	
Size 3	24.7	0	24	0	
Size 5	26.0	+1.3	25.6	+1.6	+3.66(3.0 ~ 5.0)
Size 7	29.0	+3.0	29.8	+4.2	+3.65(3.0 ~ 5.0)
Size 9	31.2	+2.2	30.2	+0.4	+3.69(3.0 ~ 5.0)
Size 11	33.7	+2.5	32.9	+2.7	+3.71(3.0 ~ 5.0)
Size 13	37.3	+3.6	36.3	+3.4	+3.87(3.0 ~ 5.0)

* The SIZE number refers to age

Table 6. Comparison Of Increment Between Sizes Of Clothes (sleeve length)

Size Sleeve length	The size of body				Increments of companies mean (range)
	Mean (boys)	Increment	Mean (girls)	Increment	
Size 3	31.1	0	30.5	0	
Size 5	34.8	+3.7	34.1	+3.6	+3.77(3.0 ~ 4.5)
Size 7	39.3	+4.5	38.4	+4.3	+3.79(3.0 ~ 4.5)
Size 9	43.0	+3.7	42.4	+4.0	+3.60(3.0 ~ 4.5)
Size 11	46.5	+3.5	46.9	+4.5	+3.63(3.0 ~ 4.5)
Size 13	50.9	+4.4	49.9	+3.0	+3.65(3.0 ~ 4.5)

* The "Size" number refers to age

Table 7. Comparison of Increment Between Sizes of Clothes (bust)

Size Bust	The size of body				Increments of companies mean (range)
	Mean (boys)	Increment	Mean (girls)	Increment	
Size 3	52.2	0	51.3	0	
Size 5	55.1	+2.9	54.1	+2.8	+4.15(3.5 ~ 5.0)
Size 7	59.0	+3.9	59.0	+4.9	+4.23(3.5 ~ 5.0)
Size 9	64.5	+5.5	62.2	+3.2	+4.36(3.5 ~ 5.0)
Size 11	69.5	+5.0	70.3	+8.1	+4.45(3.6 ~ 5.0)
Size 13	74.9	+5.4	77.2	+6.9	+4.72(3.6 ~ 6.0)

* The "Size" number refers to age

For bust (Table 7), one of the girth sizes, 81.8% of companies (9 companies) used an equal amount within 3.5 ~ 6 cm. as the increment between all sizes. The differently applied amount between certain sizes was more or less 1 cm. The classes where this difference applied were 5 to 7 or 11 to 13 year olds. Just as with the other sizes, the same difference to grade smaller or bigger sizes was used except by 12.2% of the companies, even this adoption was insufficient to cover the growth of children.

In hip girth (Table 8), an equal size increment within 4.5 ~ 5cm. was used by 72.7% of the companies (8 companies). The other companies (27.3%) adopted different increases between 5 - 7 or 9 - 11 year olds. Only one company used a different increment between 3 size classes,

Table 8. Comparison of Increments Between Sizes of Clothes (hip)

Size	The size of body				Increments of companies mean (range)
	Mean (boys)	Increment	Mean (girls)	Increment	
Hip					
Size 3	53.5	0	53.8	0	
Size 5	58.1	+4.6	58.1	+4.3	+4.18(2.8 ~ 5.0)
Size 7	63.5	+5.4	63.3	+5.2	+4.45(4.0 ~ 6.0)
Size 9	70.6	+7.1	69.7	+6.4	+4.45(4.0 ~ 6.0)
Size 11	76.0	+5.4	77.3	+7.6	+4.33(4.0 ~ 5.0)
Size 13	83.1	+7.1	85.4	+8.1	+4.25(4.0 ~ 5.0)

* The "Size" number refers to age

Table 9. Comparison of Increments between Sizes Of Clothes (Waist)

Size	The size of body				Increments of companies mean (range)
	Mean (boys)	Increment	Mean (girls)	Increment	
Waist					
Size 3	48	0	48.4	0	
Size 5	50.7	+2.7	50.1	+1.7	+3.42(2.5 ~ 4.0)
Size 7	53.4	+2.7	52.9	+2.8	+3.38(2.5 ~ 4.0)
Size 9	58.9	+5.5	55.8	+2.9	+3.33(2.5 ~ 4.0)
Size 11	63.0	+4.1	60.6	+4.8	+3.36(2.5 ~ 4.0)
Size 13	66.2	+3.2	64.1	+3.5	+3.46(2.5 ~ 4.0)

* The "Size" number refers to age

7 - 9 year olds, 9 - 11 year olds, and 11 - 13 year olds.

For the waist (Table 9), as a main reference size for pants, 81.8% of companies (9 companies) chose the size increment within 2.5 ~ 4 cm. and the others chose a different increment of 0.4 ~ 1 cm. more or less. The different increment was only adopted for 5 - 7 year olds.

IV. CONCLUSION AND SUGGESTIONS

Industrial children's wear is made using an individual sample pattern and grading system to express particular brand character. In addition, the increments between the sizes of children's wear are mainly decided by items at a company and remain through almost all sizes. However, each size differs according to the company, item, and design. The increments between the sizes of children's wear are less than the recorded growth per 2-year interval. Therefore, it is expected that children who wear the farthest sizes from the sample size will experience the most dissatisfaction with the fit. The results of this research indicate that the current sizing system for children's wear does not represent the standard size for each age group. The discrepancies create confusion for the consumer who searches for suitable sizes for children.

In total, over 70% of the companies applied exactly equal increments between the sizes of the clothes in this survey. However, according to the anthropometric survey results, the actual body increase in body size between age groups is irregular. In other words, clothing sizes do not reflect the actual increments in current body size between age groups. Therefore, the grading system currently used for each size of children's wear needs to be modified and developed to provide better fit.

The analysis of the increments in several sizes revealed that 81.8% of the companies used an equal amount of increases for grading sizes in sleeve length, waist, and bust. The same increments were adopted by 72.7% of the companies between the sizes in height and hip girth; 63.6% of the companies also used equal increments in the length of top and pants for making smaller or bigger sizes from the sample size. Even the few companies that used

different increments between sizes adopted the change for only 2 or 3 sizes, instead of all sizes. Sleeve length and pant length measurements were the most diverse in terms of increments and the adopted classes. This study's finding could reveal the most important reason for consumer complaints and frustration. The discrepancies between age and size could also be the reason why consumers buy clothing that is one or two sizes bigger than the age of their children.

In conclusion, this research revealed the unsuitability of the current sizing system used by the children's apparel industry. It would help increase consumer confidence in the accuracy of the sizes on clothing tags, if the size system were modified to reflect the actual growth of children. Our results can contribute to future study on the development of a new sizing system for children's wear.

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