

## A Study on the Measurement of Male Korean Hand - Focusing on Glove Size -

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### Abstract

*The purpose of this study was to develop the sizing system for men's glove. The combination of anthropometric and engineering aspects of glove pattern-making is difficult problem in engineering clothing. And the traditional measurements is not enough for glove. Therefore, to develop the hand measurement method and dimension for glove, a comprehensive list of candidate measurements was reviewed and the manufacturers (Their career was over the 15years) were interviewed on the method of glove pattern-making. This study was conducted traditional and creative 88 two-dimensional anthropometric measurements and 4 photometric measurements for glove pattern-making. In addition, 16 creative measurements were instrumented using a special hand measuring board for measuring of landmark locations on the hand. The subjects were 260 men's right hand in the age group of 18 to 35 years old in Korea.*

*Key words : sizing system, men's glove, measurement of male Korean hand*

### I. Introduction

The improvement in living standard nowadays was followed by an increase in leisure activities as well as improvement in science and technology. As a result, the traditional definition of gloves as "winter gear" and "protective gear" has been changing and the demand for gloves with specific functions in the leisure, science and technology market has been on the rise.

All this while, hand are to be measured as following <Fig. 1><sup>1)</sup> and <Fig. 2><sup>2)</sup>. There are hand breadth, wrist-center of grip length, hand circumference, wrist circumference, hand length,

wrist-index finger length, thumb breadth, wrist-thumbtip length and so many others.

However, no specific standard has been set on what parts of the hand are to be measured, and how these measurements are to be made to analyze glove patterns, especially for Koreans. Hence, this study will focus on setting a specific standard for measuring hand parts by obtaining detailed data of our subjects.

There are about 3 sizes system for gloves. In Europe, There are signed from 18 to 26(Table 1). America's commercial glove sizes range from 5 to 9 (from XS to XL) by gloves half-inch increments(Table 1). And in case of Japan, There<sup>3)</sup> are signed from SS to 3L(Table 2). But

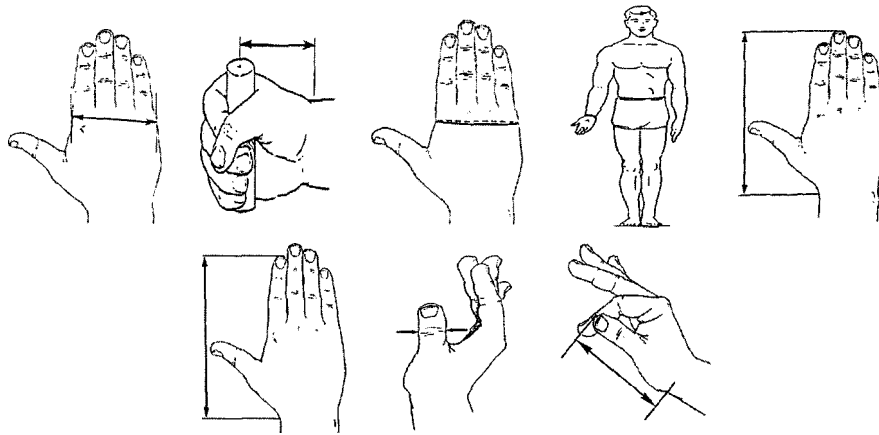
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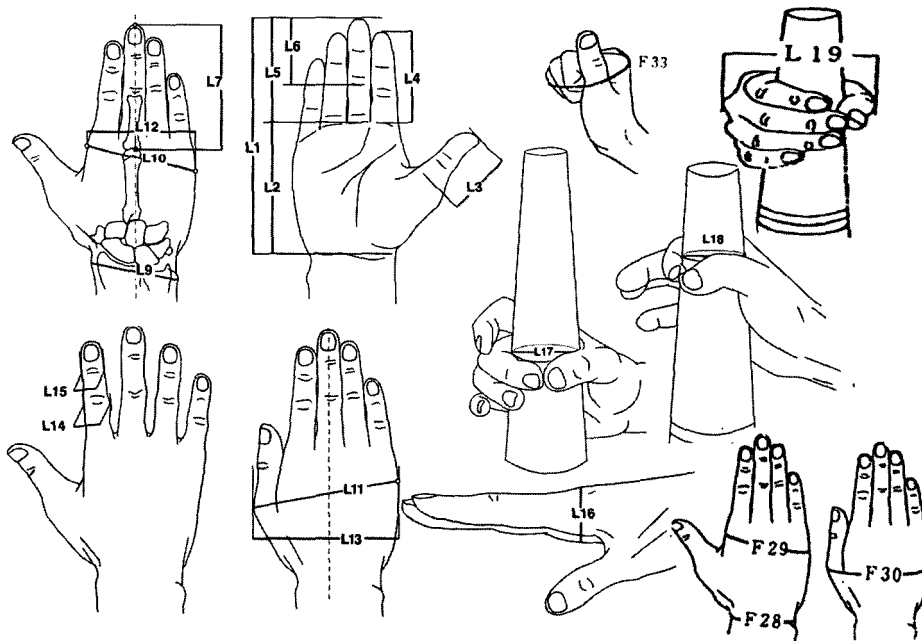
<sup>1</sup> Anthropology research project, INC. yellow spring, OH, *Anthropometric survey of U.S. army personnel: methods and statistics 1988*, U.S. Department of Commerce National Technical Service, Sep. 1989, pp. 19-332.

<sup>2</sup> National Institute of Bioscience and Human-Technology, *Human Body Dimensions Data for Ergonomic Design*, 1996, pp. 159-200.

<sup>3</sup> <http://www.fujitebukuro.co.jp/> (2002.11.17), <http://www.rescue-kitahara.co.jp/> (2002.11.17)



〈Fig. 1〉 Hand Dimensions OF U.S. ARMY (1989).



〈Fig. 2〉 Hand Dimension Data of National Institute of Bioscience and Human-Technology (Japan, 1996).

〈Table 1〉 Glove Size System in Europe & U.S.A

	Size								
Europe	18	19	20	21	22	23	24	25	26
U.S.A Men					7	7½	8	8½	9
					XS	S	M	L	XL
U.S.A Women	5	5½	6	6½	7				
	XS	S	M	L	XL				

〈Table 2〉 Glove Size System in Japan

Size	27	25.5	24.5	23.5	22	21						
Men	3L	2L	L	M	S	SS						
Women					WL	WM						
Children						JO	JL	JM	JS	CL	CM	CS
Age						13	11	9	7	5	3	

There are used all kind of glove size system in Korea. And mostly there are made one size, free size, in Korea.

For the purpose of achieving such goal, this study includes following detailed research subject: 1. Establishment of new measurement parts among hand measure parts for gloves patterns. 2. Development of the measuring device for measurement of hand dimensions. 3. Grasping the size and type of the hands of male Korean adults. 4. Establishment of a size system for gloves on the basis of such size and shape.

## II. Method

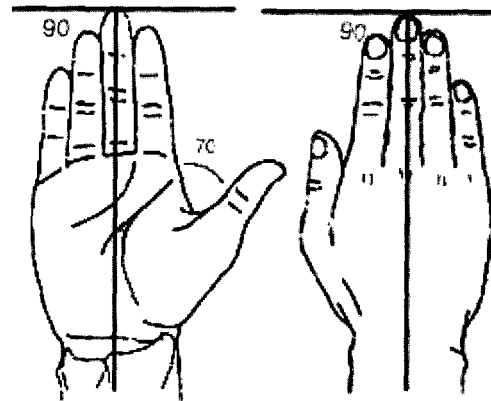
The study was carried out with below procedures.

First, we created a new measurement part besides the existing hand measurement parts, for the establishment of hand measurement parts for the development of gloves.

Second, we developed a device to stabilize the posture of the hands and to measure the newly established hand measurement parts. 〈Fig. 3〉 shows the posture in which the thumb was separated from the four fingers by an angle of 70 degrees while the midpoint between the stylions and the dactylion form a straight line.

〈Fig. 4〉 shows the posture in which the thumb is not separated from the four fingers. Hereinafter I will refer to these referential axes in the Figure as the horizontal axis and the vertical axis.

Our measurement setup consisted of three newly developed instruments(Fig. 5). The first was used to stabilize the hand for measurement on the table. The second was a device used to separate the thumb from the rest of the fingers

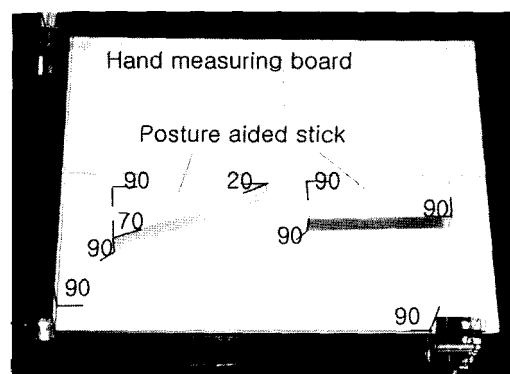


〈Fig. 3〉

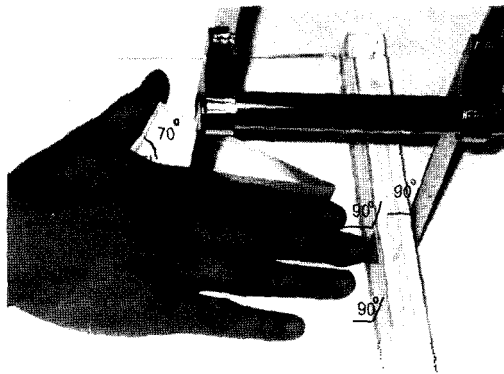
〈Fig. 4〉

at an angle of 70 degrees. The third was the device used to record the rectangular breadth of the subjects' hands. This piece of equipment formed a 90 degree angle on all its surfaces. The following 〈Fig. 6〉 shows how the experiment was set up.

Third, we took measurements on the male Korean's hands. The subjects were 260 men right hands in the age group of 18 to 35 years



〈Fig. 5〉 Developed Instruments.



〈Fig. 6〉 The Length from the Middle Finger to Digital Cleft Point.

old in Korea. The measurement is enforced in 2002. As a result, we had factor analysis, correlation analysis for male Korean's hands.

When taking measurements of the human body, certain terms are defined for clarifying the direction and division of parts. One of the difficulties we've encountered while taking hand measurements is that the parts are relatively small and it's difficult to maintain a specific posture. In the past, finger length have been measured from the phalanigion of each fingers. However, this measurement system was highly inaccurate for it was based on an unstandardized reference scale. It has come to our attention that it is necessary to set a standard on how the measurements are to be made. So far, no measurement on the digital cleft point has been made, which defines how well the glove fits the hand.

### III. Result

#### 1. Created Hand Measurement Parts

We set a new measurement definition for measuring hand parts that was completely different from the previously existing set of definitions. We established a total of seventeen parts for measurement which includes the distance from an imaginary line that is perpendicular to the tip of the middle finger to each fingers, the

distance to each digital cleft points from the same line, the distance between dorsal and palmar at finger crotch depth, palmar digital cleft point breadth between thumb and index finger, and hand thickness at hollow point, etc (Fig. 7).

#### 2. Developed Hand Measuring Board & Stick

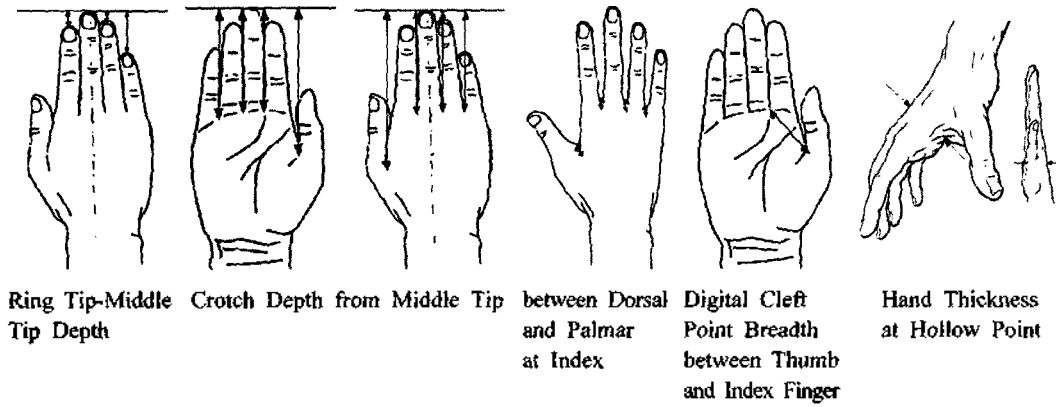
Our measurement setup consisted of three newly developed instruments. The first was used to stabilize the hand for measurement on the table. The second was a device used to separate the thumb from the rest of the fingers at an angle of 70 degrees. The third was the device used to record the rectangular breadth of the subjects' hands. This piece of equipment formed a 90 degree angle on all its surfaces. The following figures show how the experiment was set up.

Wilcoxon two sample test has been performed on the deviation that we gathered by repetitively using our devices. As a result, it has been proven that our devices yield stable and accurate measurements.

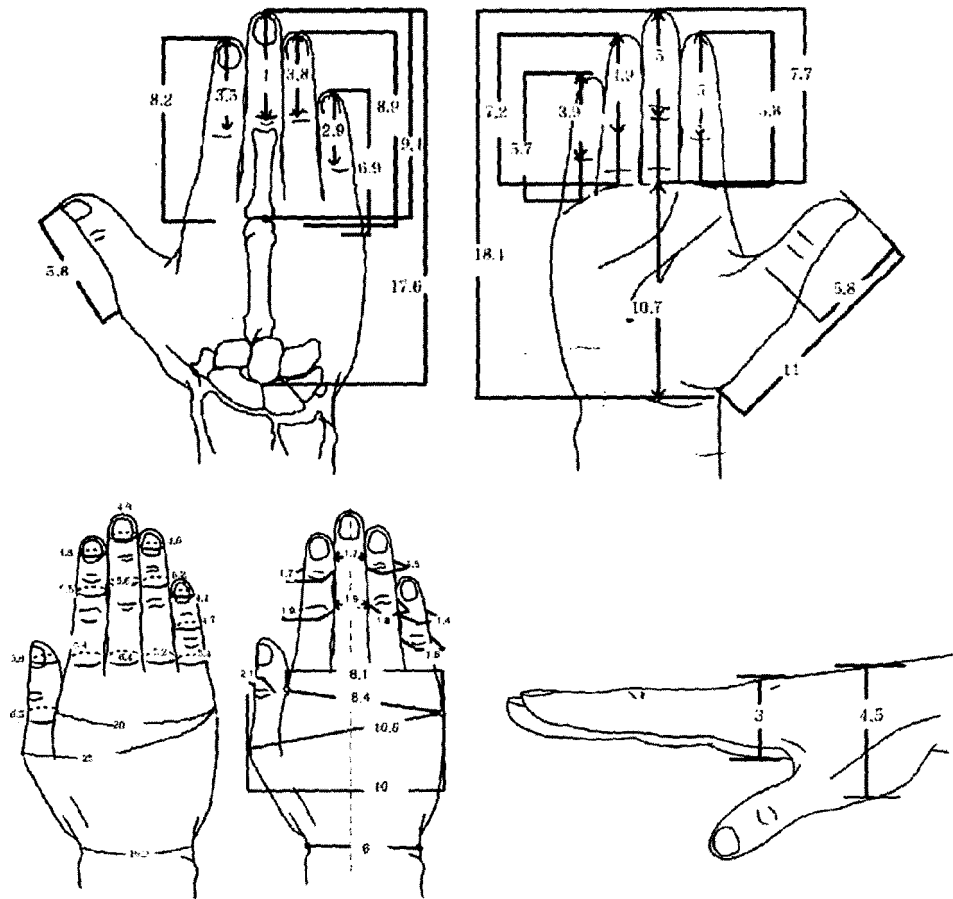
#### 3. Results of Hand' Size for Male Korean Adults

The following 〈Fig. 8〉 shows the results of hand size for male Korean adult.

Our experiment yielded an average hand length of 18.4cm and a circumference of 20.14 cm for male Korean adults. The average length of the middle fingers of the back of the hand was 7.7cm. Our new measurement scale consisted of measuring the average distance to the tip of the index finger, the middle finger, the ring finger and the little finger from the horizontal axis based on the tip of the middle finger and they were 1.18cm, 0.0cm, 0.86cm, 3.61cm, respectively. If you compare these measurements with currently accepted values of 1.4cm, 0.0cm, 0.7cm and 2.8cm, you will find out that the finger length of the existing gloves is not suitable for male Korean adults. That is, it was observed that the length of the index finger of an adult Korean male was longer than that of



<Fig. 7> Created Measurement Parts for Glove.



<Fig. 8> Results of Hand Size for Male Korean Adults Glove

the fingers used in gloves-manufacturing industries, and the length of the little finger was shorter. Also, in case of existing gloves, the distance to the digital creft point between the ring finger and the little finger and that between the index finger and the middle finger are respectively 0.9cm and 0.3cm longer than the digital creft point between the middle finger and the ring finger. This study shows that the distance to digital creft point between the ring finger and the little finger and that between the index finger and the middle finger is respectively about 1cm longer than and similar to that between the middle finger and the ring finger.

After a factor analysis of hand measurement parts, the proportion and the Eigen value of factor 1, which is the circumference and the breadth, was 62% and 27.76, while it was 30% and 13.43 for factor 2, the length(Table 3). The

factor having the greatest descriptive variance for factor 1 group was the circumference at 1st phalanx of the index finger, and that of factor 2 group was the length of the middle finger. These two are important factors and could be applied to the measurement system of gloves since their degree of representing other parts is great, and this was an unexpected result considering the fact that the system of the existing gloves is based on the circumference of the hand.

Therefore, we divided the hand measurement the middle finger and the circumference of the groups into 9 groups depending on the length of index finger. The horizontal part of the table indicates the size titles and the vertical part the detailed measurement scope. The size is marked in the order of the length of the middle finger-circumference of the index finger, and the deviation in the measurements was set up as 3-4

<Table 3> Factor Analysis

No		Eigenvalue	Factor 1		
		Number			
X4	Length	Middle finger length	0.85	0.16	-0.05
X35		Dorsal hand length	0.84	0.09	-0.02
X37		2~3 digital cleft point	0.83	0.06	-0.20
X38		Dorsal 3~4 digital cleft point	0.83	0.13	-0.24
X27		Dorsal middle finger length	0.82	0.23	-0.12
X28		Dorsal ring finger length	0.82	0.15	-0.01
X3		Index finger length	0.82	0.14	0.15
		<<omit>>			
X71	Circumference /breadth	Index finger circumference	0.01		0.37
X79		Little finger ring size	0.21		0.13
X55		Ring second phalanx breadth	0.26		-0.21
X73		Index first phalanx circumference	0.05		0.29
X51		Index finger terminal phalanx breadth	0.18		-0.11
		<<omit>>			
X61	Circumference	Thumb terminal phalanx circumference	-0.03	0.44	
		<<omit>>			
		Eigenvalue	27.76	13.43	3.59
		Proportion	0.62	0.30	0.08
		Cumulative	0.62	0.92	1.00

mm on the length and 3~5mm on the circumference. The deviation in the sizes of the existing gloves was even, and this measurement system is considered to be more satisfactory.

The (Table 4) shows the average value of the hand measurements by groups.

The table shows that the average value of the circumference of the index finger has a deviation of 3~4mm by size, and that of the length of the middle finger has a deviation of 4~5mm. 65~78 were the most frequently observed sized.

Their average hand length of 183.8mm, middle finger length of 76.4mm, hand circumference of 200.2mm, and middle finger circumference of 62.8mm indicate that they are bigger than that of an average Korean male. The measurement of the little finger varied the most by groups, indicating the largest variations by individuals.

#### IV. Conclusion

While there have been no previous research

(Table 4) Developed Glove Size System

(unit : mm)

No	Part	Size								
		60~74	65~74	75~74	60~78	65~78	75~78	60~94	65~94	75~94
Frequency		24	28	31	27	38	24	16	35	37
X1	Hand length	173.2	178.6	177.7	182.0	183.8	184.4	189.0	190.3	192.1
X2	Thumb length	53.7	54.7	56.4	57.9	57.8	58.1	59.6	60.5	61.1
X3	Index finger length	63.7	64.1	64.8	67.1	68.0	68.5	70.9	72.9	72.3
X4	Middle finger length	71.2	71.5	72.1	76.1	76.4	76.5	81.6	81.9	81.4
X5	Ring finger length	66.0	68.5	68.1	70.9	71.3	72.0	75.6	75.7	76.0
X6	Little finger length	52.7	53.2	54.3	56.3	57.6	56.2	59.6	60.9	59.4
<<omit>>										
X58	Hand circumference	191.7	196.6	204.9	195.0	200.2	205.1	195.7	204.1	211.8
<<omit>>										
X70	Thumb circumference	61.1	64.5	69.1	60.6	64.3	68.7	61.0	64.2	68.9
X71	Index finger circumference	59.5	63.5	68.8	59.8	63.6	68.0	59.1	63.6	68.9
X72	Middle finger circumference	59.6	62.2	67.3	59.9	62.8	66.6	59.3	63.0	68.1
X73	Ring finger circumference	56.0	59.6	63.7	56.1	59.7	63.3	56.1	59.5	64.6
X74	Little finger circumference	51.0	53.3	57.5	50.2	54.0	56.4	50.7	53.7	57.8
<<omit>>										
X85	Maximum hand thickness	42.8	45.0	46.6	42.2	47.1	46.5	43.2	45.3	47.4

or fundamental information on hands, this study provides detailed measurement information of hands by presenting hand measurements of each detailed parts. The significance of this research could be great as it could be used as a fundamental information in various hand-related fields. Also, the size system presented on the basis of measurement data will be helpful in the manufacturing of reasonable gloves, and such glove patterns could be developed into various glove patterns by applying extra amount, design, and physical properties of the materials.

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