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The Use of Factor Analysis in the Development of Hand Sizes for Glove Design

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THE USE OF FACTOR ANALYSIS IN THE DEVELOPMENT OF HAND SIZES FOR GLOVE DESIGN

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Factor analysis was used to develop a more detailed description of the human hand to be used in the creation of glove sizes; currently gloves sizes are small, medium, and large. The created glove sizes provide glove designers with the ability to create a glove design that can provide fit to the majority of hand variations in both the male and female populations.

The research used the American National Survey (ANSUR) data that was collected in 1988. This data contains eighty-six length, width, height, and circumference measurements of the human hand for one thousand male subjects and thirteen hundred female subjects. Eliminating redundant measurements reduced the data to forty-six essential measurements. Factor analysis grouped the variables to form three factors. The factors were used to generate hand sizes by using percentiles along each factor axis. Two different sizing systems were created. The first system contains 125 sizes for male and female. The second system contains 7 sizes for males and 14 sizes for females. The sizing systems were compared to another hand sizing system that was created using the ANSUR database indicating that the systems created using factor analysis provide better fit.

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CHAPTER 1

Introduction

The world is comprised of approximately seven billion people and each individual is unique in various ways. Adjusting the workplace, tools, and personal protective equipment to accommodate humans is a key component of ergonomics. One aspect of ergonomics is anthropometry.

Anthropometry can be used to accurately describe the human body's shape, size, and capability (i.e. reach, strength, and work envelope). Specifically, sizing and size structure can be generated from anthropometric databases. The human hand has a large amount of variation in size, shape, and strength between and within individuals and populations. Characterizing hands into sizes to accurately account for the variations within a specific population would be a valuable contribution to glove manufacturers. Currently hand sizes used in the manufacturing industry use static measurements of hand length, breadth, and circumference.

This method of sizing does not accommodate for the many variations in the human hand and a more modern statistically based approach using multivariate analysis on a database can more completely describes the United States population. Multivariate analysis can be used to group numerous dimensions of the human hand into a few critical factors that explain most of the variability of the data and then used to describe the data and generate sizes.

The database created in 1988 of the American population called the American National Survey (ANSUR) conducted by the United States Army was used to develop sizes for the human hand. The database contained 86 measurements of the human hand for 1,003 male subjects and 1,304 female subjects.

The overall goal of this thesis is to develop different glove sizes using the ANSUR database. To meet this goal, four specific objectives were developed. The first objective was to reduce the number of variables in the ANSUR database by classifying them into groups. The second objective was to develop a sizing system using the factor scores. The third objective of this research was to identify specific sizes using percentiles and cluster analysis. The last objective was to compare the developed sizing system with the research done by Kwon et al, (2009).

Chapter 2 gives a description and review of anthropometric literature. Chapter 3 develops the rationale and methodology for this research. Chapter 4 presents the results obtained from the methodology. Chapter 5 is a discussion of the results and conclusion for future research.

CHAPTER 2
Background Literature

2.1 Anthropometry

Anthropometry is "the study and measurement of human body dimensions" (Wickens, 244). Anthropometry may be simple to define; however it is very difficult to illustrate what the study entails and how it affects every day circumstances for humans. A brief historical description of anthropometry is given to show the history of anthropometry and the direction that it is currently taking. Chapter 2 also provides a detailed explanation of anthropometry, plus a discussion of variability between and within populations, genders, and individuals.

The human body dimensions vary a significant amount from one individual to the next by differences in shapes and sizes of various body parts. It is the responsibility of ergonomic engineers to design products and materials to adequately fit and properly accommodate the large variations in the human population. Anthropometry can be used to examine the different ways that engineers and scientists can measure the human body (Pheasant, 2006).

2.1.1 History of Anthropometry

Anthropometry and the data analysis of human measurements dates back to 1654 when a German physician, by the name of Johann Sigismund Elsholtz, published a thesis entitled *Anthropometria*. The thesis described anthropometria as the study of human measure. It gave a synopsis of human measurements and the proportions of the body. The book was made for artists, astrologers, and for the study of medicine. A tool to be used in human measurement was even designed in the paper, it was called an

anthropometron. The device was similar to tools used by artists to make human sculptures (Ulijaszek et al., 1998). Although Esholtz's first paper described anthropometry in 1654 it would be many years later before a study would take place collecting data and organizing it into a database.

In 1861 an instructor at Amherst College in Boston Massachusetts began the first anthropometric data collection in the United States. Dr. Edward Hitchcock would record measurements of his students five separate times during their collegiate careers. The measurements included: age, weight, height, finger reach, chest girth, lung capacity, and strength (Jenkins, 2005). These measurements were the basis of advice on health and exercise techniques that would be important to the students (Seaver, 1905). The study continued for around twenty-five years, at which time new techniques that were being discovered by other researchers came to the forefront. During these times many scientists around the world began forming groups and publishing anthropometric journals. This newly found research pushed authors to write books on the subject and some interesting research formed during the latter half of the 18th century (Hrdlicka, 1919).

As the research in anthropometry grew so did the industrial revolution that was taking place around the world. The industrial revolution began in the late 1700's, but did not become a powerful worldwide entity until the 1880's at which time the United States, Canada, Australia, Europe, Russia, and Japan had joined the new age (Stearns, 2007). The revolution which began the mass production of goods required products that would accurately describe the customers. Before this time craftsman would design each product for its individual owner. As chairs, shoes, clothing, and many other products became

manufactured by large industries, anthropometry found a place in the design aspect of production (Karwowski, 2006). This aspect of anthropometry pushed the field again into a new phase of history and into the 20th century.

The industries around the world flourished in parallel with the research into anthropometry. A large impetus came in the 1940's and the dawning of World War II. The war pressed for more advances in soldier uniforms, equipment, and everyday items. A group of scientists and engineers who were working on this type of research into product development found that there were many practical applications to human factors engineering. In 1949 after the war, Dr. Hywell Murrell created a name for the research into "the study of human beings in their working environment" called ergonomics (Pheasant, 2006). The new discipline of ergonomics created a large need for anthropometric data. This *need* gave researchers the necessary fuel to begin large databases and the standardization of measurements.

A vast majority of the databases are constructed from military personnel. This is due in part to the cost and inadequate technologies that hinder private industries to make large and accurate civilian databases (Karwowski, 2006). The majority of research that is conducted in the U.S. is comprised of military studies, but as technologies grow better scientists are able to find new ways to acquire and analyze civilian databases. In recent years technology has allowed scientists to record electronic databases and begin recording digital measurements which are more accurate than traditional methods.

The military's database for anthropometric measurements is comprised of 40 surveys that were taken over 43 years beginning in 1945 and includes over 75,000 subjects (Adebisi, 2009). The data that is used in the research that was conducted for this paper comes from the American National Survey (ANSUR) which was recorded in 1988.

2.1.2 Anthropometric Tools

Anthropometry requires the use of many different measuring devices as well as techniques to acquire measurements of height, breadth, depth, distance, circumference, and curvature (Kroemer, 2001). The primary tools used by engineers are: athropometers with straight or curved branches, spreading calipers, and a sliding compass (Wickens, 2004). Measuring tapes can also be used to measure circumferences and curvatures. In recent years technology in the area of 3-D scanning has evolved to where entire bodies can be scanned and the dimensions and contours of the human body saved to a database (Pheasant, 2006).

The first successful 3-D scanning survey was the Civil American and European Surface Anthropometry Resource (CAESAR) survey, which collected samples from over 5000 subjects (Duffy, 2007). The use of 3-D scanning helps researchers examine the variability in different populations. Two researchers Zhang and Molenbroek, used 3-D scanning to develop new head wear. In the study they found that the 3-D images allowed them to generate better fit, but it will take more time before the technology can be fully utilized (Zhang & Molenbroek, 2009).

The CAESAR database was recently used by Daisy Veitch and Barbara Davis (2009) to design biofidelic apparel fit manikins. The manikins created were

representations of real persons whose dimensions were collected in the CAESAR database. The manikins were then used to produce 2D apparel patterns and blocks/slopers that can be used by clothing designers. The designers can use the patterns and blocks to improve fit and lower material costs in the apparel industry (Veitch & Davis, 2009).

A paper presented at the 17th World Congress on Ergonomics in 2009 explored the current research using 3D technology to reveal the internal structure of human variability (Meunier et al., 2009). The paper addressed 3D scanning systems and multivariate statistical techniques such as principal components analysis (PCA). The goal of the paper was to show the available options in 3D design and discuss a possible new tool that can be used in the design phase of anthropometry. The authors felt that PCA could be very helpful in defining the inner structure of anthropometric data.

Once the data has been collected, scientists and engineers can begin the task analyzing the variability within the data. Since humans have a high variability it may be easier to examine the variations between and within populations, genders, and individuals. When examining the variation, researchers are looking for ways to describe variability of data in such a way to aid with improvement and design of products.

2.1.3 Variability of Anthropometry

The following section describes the research that has been conducted on the diverse forms of variation. This includes within populations, between populations, between genders, within individuals, and between individuals.

2.1.3.1 Within Population

In every population around the world there are groups of elderly and disabled people. These groups rely heavily on equipment specifically a wheel chair to maneuver and function in day to day situations. A study by Molenbroek and Zhang (2000) used the Anthropometric Information System (AIS) to aid in the design of a wheel chair. The AIS allowed designers to choose a target group within the overall general population to receive feedback for the purpose of major design decisions (Molenbroek & Zhang, 2000). By separating the dimensions of a specific group within the population the wheel chair's overall function can be improved for the intended users.

Population continuously change over time, this can be seen in the U.S. were nutrition factors having an impact on human girth measurements (Karwowski, 2006). As the U.S. population changes overtime there is a wider variation in the measurements within the population compared to other countries. Similarly, research conducted by Daisy Veitch (2009) found that the Australian databases for measurements that would be used for clothing design were out of date and lacked critical measurements that provided a more appropriate fit to the customers. The data that was being used by the designers was acquired in 1926, since then the variation within the population had changed dramatically, thus new databases needed to be obtained (Veitch, 2009).

Another example of variance within a population can be seen in research that was conducted on U.S. truck drivers. The data found that the 95^{th} percentile for the U.S. population differed greatly to that of the truck drivers. The study suggested that the cab and seat design was inadequate because it used the 95^{th} percentile measurements for the

U.S. population instead of using a sample of the employees in the specific occupation (Guan et al., 2009). The inadequate seat design resulted in poor fit which had consequences of discomfort and fatigue. If an occupation has a high percentage of a specific segment of a population then the design of a product should take into consideration changes within the population.

Office workers within the Lebanese work force have also experienced pain and discomfort; specifically musculoskeletal pain. Since the addition of computers in the workplace office workers have been experiencing shorter breaks between tasks and change in posture. It was found that the Lebanese office workers had an increased chance of musculoskeletal pain over the rest of the population. The study requested that office workers be given more breaks and decreased high pressure time schedules to reduce the pain felt by the workers. Relief could also be achieved through chair and desk redesign (Akel et al., 2009).

2.1.3.2 Between Populations

A study on anthropometric dimensions of female Korean factory workers in the garment industry was conducted as part of a project to analyze work stations that used equipment from foreign countries. Twenty three dimensions were taken from 101 workers and were compared to dimensions of Western and Japanese females. The results found that body dimensions for the Korean female workers were different from both populations of the Western and Japanese females (Fernandez, 1989).

Imrhan et al. (1993) compared twenty-four hand dimensions of Vietnamese American females with available dimensions of Hong Kong, American, Japanese and

United Kingdom females. They identified that Vietnamese American hands were shorter, broader and less thick than Hong Kong and United Kingdom females (Imrhan et al., 1993). Imrhan also conducted similar research on Asian American female hand dimensions. This time he compared them to American and European females. The results of the experiment found that the Asian American women had smaller hands than American and European women (Imrhan & Younes, 1996).

In 2005 research on evaluating anthropometrics and hand performance of four ethnic populations was conducted by Vettrivel Gnaneswaran at the University of Nebraska-Lincoln. The research used anthropometric measurements of hand length, hand breadth, upper-arm length, forearm length, arm length, and hand volume in the evaluation of hand performance. Hand performance was evaluated using dexterity, tactility, manipulability, grip strength and two task performance capabilities. It was found that hand length, forearm length, and hand volume varied with ethnicity and gender. The upper arm length varied between the ethnic populations, and hand length varied between the genders. The glove evaluation found that ethnicity and glove type were significant (at $\alpha = 0.05$) for all hand performance measures (Gnaneswaran, 2005)

Three dimensional hand models were created by Kouchi et al. (2005) to be used in product design and creation. The hand models were created using data collected from the Japanese population. When the models were compared to western populations it was found that they were smaller and would not give an accurate description of the western population. The authors suggested with the amount of imported and exported goods

around the world that a hand model should be created representing the entire world wide variation.

A pilot study conducted on pork processing workers by Spahr et al. (2009) was aimed at glove and protective equipment design for Hispanic, African American/Sudanese, and Caucasian employees. The goal was to see if there were any significant differences in the anthropometric dimensions of the three ethnic groups. The equipment was originally designed using databases created from mostly Caucasian subjects, but in the pork packing industry there is a high percentage of Hispanic and African American/Sudanese employees.

The researchers wanted to focus on these two ethnic groups for glove redesign. It was found that there were significant differences between the ethnic groups (Spahr et al., 2009). The differences between ethnic group dimensions are an example of variation between populations. The ethnic populations vary greatly in hand dimension regarding mean and range so when designing equipment variations between the populations can have an effect on job performance and safety.

Poor fit and design of clothing and protective equipment can lead to injury, which was a result found by Australian helmet designers. The designers examined two different populations of users, motorcyclists and bicyclists. The designers compared the stability and fit of helmets between the two populations. The researchers found that fifty percent of both populations were wearing helmets that were not suitable for their specific head

size, and the mishandling of the helmets was very high among the bicyclists (Thai et al., 2009).

Cultural differences can have an impact on population variances. In western culture is customary to have the elderly live away and independently from the children. This is not the case in eastern culture, were the elderly live with their children. This must be taken into consideration when designing smart home technology. Researchers in Singapore found that the research done in western cultures would not be directly applicable to the eastern cultures. Thus, new research must be conducted to make the smart homes adhere to the different cultures and lifestyles of eastern occupants (Wong & Tay, 2009).

2.1.3.3 Between Genders

The differences between men and women physically can be very apparent. Males have a taller stature and are usually considered larger than females. Designing for both males and females becomes difficult when examining the multiple variations of the human body beyond height and mass. Both genders have similar hip and thigh measurements, but are considerably different when comparing chest and shoulder measurements (Wickens, 2004). Depending on the type of research being conducted it must be determined if the population should be divided into male and female.

Differences between male and female subjects can be seen when examining the effects of grip span, wrist position, hand and gender on grip strength. Ten male subjects and ten female subjects performed maximal exertions with both hands at different wrist

angles for three jamar hand dynamometer spans. The study found that all of the main effects were significant at the 0.01 level (Ramakrishnan et al. 1994).

A study on hand size and optimal grip span for both men and woman found significant differences between the genders. The study used a standard hand dynamometer to find the grip span that would yield the maximum grip strength. The size of each subject was taken into consideration. It was found that regardless of hand size the male optimal grip span was constant. For females a linear combination was found and a mathematical equation was computed from the data to find a woman's specific optimal grip span (Ruiz-Ruiz et al., 2002).

In research conducted by Meng-Jung Chung (2007) on designing school uniforms for elementary and high school students, the data was divided by gender because of the different growth rates of males and females. Females tend to reach maximum growth rate before males, so at varying times the resulting scenarios can be found: males and females can be the same size, females are larger than males, and males are larger than females (Chung, 2007). This forced Wang to separate the sizing systems by gender so the fit would be appropriate for the changing growth rates.

The tea industry in India employs a large amount of women leaf pluckers. The high percentage of women workers requires some adaptations to the protective technologies. A study by Kishtwaria and Rana (2009) developed gender specific tools that could be used by the workers to reduce heart rate and energy expenditure. It was found that special finger blades could be used in the aid of leaf removal and gum shoes

could used to reduce the distance that the females would have to reach for leaves on the upper branches (Kishtwaria & Rana, 2009).

Engineers in South Africa working on construction ergonomics concerning health and safety among male and female workers found interesting results when analyzing the tasks performed by the works. The physical activities that surround the workers created more ergonomic problems for females more so than males and females found much of the work associated with the tasks less suitable than males. The researchers saw that great gains could be made for the female workers if reengineering for the basic physical processes was conducted (Smallwood & Haupt, 2009).

2.1.3.4 Within Individuals

The planet Earth contains four seasons summer, fall, winter, and spring. These changes occur of a one year cycle at which time the human body adapts to the temperature fluctuations. A study by Nakamura and Okamura (1998) examined the seasonal variation of sweating responses in identical heat stress. The researchers found that an individual's body reacts differently to heat stress during the different season due to the mean outside temperature that is experienced by the subject.

From the time a humans are born until the time they die their bodies is constantly going through changes. Age variation is a common distinction that happens within each individual and must that be considered by researchers. The most rapid growth period for humans is from birth through adolescence (Bogin, 1999). During these phases the human body goes through many changes that can have a major impact on anthropometric measurements. Chung (2007) had made adaptations to his sizing systems for the growth

rates of the school children. During the years in which children have a higher or faster growth rate, larger ranges were needed for the uniform's key dimensions. At times, the children were at stages of slower growth rates, thus smaller ranges at the key dimensions were necessary (Chung, 2007).

Age variation can also affect assembly lines and manufacturing systems. In research conducted in Germany, manufacturers had to adjust assembly systems and planning scenarios due to the aging population. It was found that the average age of skilled works in Germany was increasing overtime. Process reengineering was necessary to account for the drop off in physical stamina and durability as the employees got older (Zulch et al, 2009). Age must be recognized and accounted for in the design phase of work places or problems will arise resulting in poor fit and inadequate design. The insufficient design in this case could result in injury or death.

2.1.3.5 Between Individuals

A study conducted on male and female shoulder flexion endurance by Mathiassen and Ahsberg (1999) explored the effects of gender, age, and maximum shoulder torque on overall endurance time. It was found that an individual's shoulder torque was strongly related to the endurance time, but the gender and age had little impact on the endurance time (Mathiassen & Ahsberg, 1999). Maximum shoulder torque overall shoulder flexion endurance vary greatly from individual to individual.

Between each individual there can be a large amount of variance. A research study was conducted by the British Association of Hand Therapists on variance between right-handed and left-handed individuals on grip strength and dexterity. The researchers

found that there was a statistically significant difference in right-hand dominant individual's right and left hand strength, while left-hand dominant individuals did not have a difference in hand strengths (Hodges & Adams, 2007). Each individual compared to another may have numerous disparities. These disparities or differences make each of us as individuals unique. The uniqueness that is present in each individual makes sizing for a population challenging for engineers.

2.2 Sizing

2.2.1 Overview

In ergonomics, sizes are generated for garments and protective equipment, so they can be adjusted for each individual's particular dimensions. This can be very difficult because the human population contains large amounts of variation. The sizes must be established from the critical dimensions as to account for much of the variation as possible. Often times there are a large number of critical dimensions, which can make the selection of critical variables difficult for designers. Another difficulty in sizing is using the critical dimensions to define and describe the population. The most common method for defining the sizes for garments and protective equipment would be the percentiles method.

2.2.2 Traditional Methods of Sizing for Gloves

The textile manufacturing industry currently uses three measurements in the design of gloves. The three measurements are hand breadth (HB), hand length (HL), and hand circumference (HC). Most designs utilize one of these measurements or a combination of two. The sizes are usually divided into small, medium and large although there are some manufacturers that include extra small and extra large sizes. There are no

standards in the manufacturing industry for glove sizes, so it can be challenging for designers to determine the critical dimensions for glove design.

Robinette and Annis (1986) created nine sizes for chemical defense gloves to be used by U.S. Air Force men and women for protection against hazardous chemicals that are by-products of chemical warfare. The sizes covered 95 percent of the population for HL and HC, using a bivariate model. From the critical dimensions of HL and HC, 22 values for hand dimensions at each size category were calculated. The hand dimensions were created using linear regression models and were to be used for design purposes.

Rosenblad-Wallin (1987) developed a similar sizing system to Robinette and Annis (1986) using the HL and HC dimensions. The system was to be used on anatomically designed military hand mittens to be used by men and women in extreme cold weather enviroments. A survey was constructed on the intended users and user populations were generated for key dimensions. The system was designed for thick thermal material and the fitting tolerance between the hand and mitten was adjusted accordingly. Only two sizes were created from the research, but tested well among the large trial groups.

Hidson (1991) produced a computer-aided glove design constructed from 50 hand dimensions gathered from a small sample of subjects. The design was created to show that CAD/CAM systems can be used to generate models of the human hand. The model created did not produce a sizing system, but developed a system to which computer

models can be created from information that has been collected from large databases of anthropometric data.

2.2.3 Contemporary Methods of Sizing

Science and technology are ever changing and it is important to refer to the most recent advances in the area of sizing when developing a new sizing system. The following section gives description of some recent literature that is relevant to the development of human hand sizes and using multivariate analysis to develop sizes.

An article published by Korean researchers in 2009 addressed the sizing issues in the manufacturing industry. The researchers used the ANSUR data from 1988 to devise a system using two of the three measurements that are most often used in manufacturing. Correlation analysis of the HB, HL, and HC measurements with the other measurements in the data found that the combinations of HL and HB, HL and HC provided high correlations and would be considered key dimension pairs.

Multiple regression analysis was conducted on the key dimension pairs with different hand dimension types such as hand breadth, hand length and hand circumference measurements that were selected from the data set. HL and HC were indicated in the regression analysis as the two key measurements that would allow for the best fit when regarding their high correlation with the other measurements within the ANSUR data. Sizes were created by dividing up the data ranges for HL and HC into intervals and examining the frequency for each combination of size intervals. This left the researchers with eight sizes for males and six sizes for females (Kwon et al., 2009).

Research conducted at the University of Nebraska-Lincoln by Mithra Chandrasekaran (2009) on the ANSUR data used Principal Component Analysis (PCA) to reduce multiple variables into categories based on their variation. This method can be used in anthropometry to reduce multiple measurements of the human body into three or four categories which can be useful in describing shape or defining size.

The research was aimed at developing manikins for the National Aeronautics and Space Association (NASA). The manikins generated from the research would be used in the creation of space suit sizes for astronauts. Currently each suit must be tailored for each specific astronaut. This practice can be very costly, thus a less expensive alternative was needed. Chandrasekaran (2009) used the ANSUR data which contains 226 variables for both male (499 subjects) and female (554 subjects). Of these 226 variables, 19 variables were selected as the essential measurements for the data analysis, thus a 554 by 19 matrix was formed for the female data and a 599 by 19 matrix for the male data. PCA was performed on the two matrices and the 19 variables were reduced to three Principal Components (PCs). The PC scores for each subject were found in a matrix of the subjects and the three PCs (Chandrasekaran et al., 2009). Once the PC scores have been calculated there are different techniques that can be used in developing and extracting the sizes.

Based on the rules of trivariate normal distributions the PC scores form an ellipsoid. Different techniques were devised on how to properly divide up the shape evenly into sizes. The authors decided that partitioning the PC axes by percentages would be effective. The following gives a description on how the sizes were developed.

> The boundaries that include 90% of population (5th and 95th percentiles) form the first two sizes. End points of the three axes and the midpoint of the ellipsoid form seven sizes. The balance of 8 sizes was obtained at the first and third quartiles of the first principal component. The coordinates of the 5th and 95th percentiles of second and third components were chosen (each) at the first and third quartile of the main principal components. In all, 17 size manikins were developed (Chandrasekaran et al., 2009, p. 2).

The 17 new size manikins resulted in a new sizing system that can be used in the generation of new NASA Extravehicular Activity (EVA) suit designs.

A similar use of multivariate analysis was conducted using factor analysis on human hand data to construct digital boundary manikins for the Japanese population. The researchers used 82 measurements of the human hand collected from 103 subjects. The 82 measurements were grouped into two factors of length measurements and thickness or width and circumference measurements. The 82 dimension were reduced to 39 measurements that would be critical to generating 3D digital representations of the human hand. The method of sizing used by the researchers created sizes at the boundaries and the center of the ellipse. In all nine, sizes were created for the Japanese population. The investigators found that the hand length and hand circumference measurement when compared to western variations was not adequate in terms of being under sized. It was previously stated that a similar approach should be used to develop sizes for European and American populations (Kouchi & Mochimaru, 2005).

A method of factor analysis and cluster analysis was used by Chung et al. (2007) to develop uniforms for school children. Factor analysis was used to identify key

dimensions that can be used in the description of body shape. The factor scores were then subject to cluster analysis to classify the figure types. The goal was to cover as much of the population with the fewest number of sizes. The analysis resulted in twelve sizing systems for upper and lower garments that covered roughly 90 percent of the population (Chung et al., 2007).

2.3 Summary of Literature

The literature on anthropometry and human variation shows that there are various techniques and approaches that can be used to acquire and analyze human measurements. The field of anthropometry has grown over many years and has had many influences from society. Researchers, engineers, and scientists have been on a constant never-ending journey to find a method of explaining the variance that occurs in nature.

2.3.1 Human Variability

The human body encompasses large amounts of variation. The overall challenge when describing and creating size for a population is accounting for all of the variation. Examining the variations between and within populations, genders, and individuals can be helpful when defining sizes. The variation between populations shows the importance of proper data collection with regards to the intended users. The data collected for a specific design should reflect the intended users of that design. The variation within a population suggests that each design should incorporate adjustability or sizing to account for deviation. Since male and female genders are significantly different, specifically in hand anthropology, dividing a sizing system by gender can have a positive impact on the fit and coverage of the glove.

2.3.2 Need for Different Approach

The human hand contains a vast amount of variation not only between populations but also within a population. It is necessary that gloves have sizes designed for the variation within a population. Previous research has tried to develop sizing systems for the human hand, but the systems seem to be limited to two or three measurements. The traditional anthropometric methods of creating human hand models for sizing utilize the measurements of HL, HB, and HC.

The sizing systems relied on these measurements to account for all of the variation in the human hand. It is can easily be seen that not all hands that have the same measurement for HL and HC would have the same thumb circumference or index finger height. Hands come in different shapes and sizes some have short and thick fingers with narrow palms while others have long skinny fingers with a thick wide palm. There are so many combinations that occur in nature that a hand sizing system needs be created using many variables to account for all the variation within the human hand population. A new approach using multivariate analysis is needed to account for as much variation within a population as possible.

An approach using multivariate analysis that is similar to Chandrasekaran (2009) and Kouchi et al (2005) must be used to develop hand sizes. Multivariate analysis can be used to group numerous dimensions of the human hand into a few critical factors that can then be used to describe the data and generate sizes. The factors that are created in factor analysis are combinations of all of the variables, and a few factors are selected to explain a large amount of the variation in the population.

Chandrasekaran (2009) used the PC scores to form an ellipsoid. The sizes were to be generated from the trivariate normal distribution using an ellipsoid, distance and percentile and quartiles methods. Although this method yielded sizes, it was commented that an easier approach could be used by dividing the PC axes into quartiles or possibly using a cluster of k-means approach that was used by Chung et al (2007).

The method of factor analysis used by Kouchi and Mochimaru (2005) was used with some success in the creation of hand models for the Japanese population. The method can be used on the ANSUR data base to create a sizing system for the U.S. population. Previous static sizing systems for the human hand relied heavily on only two to three sizes. It is felt that the small number of dimensions could not fully accommodate the total variation within the human hand.

2.3.3 Current Objective for NASA in Glove Design

In October of 2005 NASA launched the Centennial Challenges which were a group of innovation challenges that offered large cash prizes for pioneering and imaginative designs in the area of astronomical exploration. One such challenge was to develop a next generation astronaut glove to be used in extravehicular activity (EVA) (Groshong, 2006). Two designers, Peter Homer and Ted Southern, in 2009 answered NASA's challenge by creating glove designs that improved on the Phase VI glove design with stronger and more durable material that allowed for flexibility and reduced fatigue (Heiney, 2009).

The new design should incorporate a new sizing system while still in the prototype phase to reduce cost and improve the overall design. The current sizing system

for the Phase VI glove used by NASA crew members for EVA on the International Space Station utilizes hand casting and CAD programs to create gloves (Graziosi et. al., 2009). The customization process is improved in terms of cost over previous designs, but still requires large amounts of time and money to produce.

2.3.4 Objectives

The objectives of this thesis are:

1. Place the variables from the ANSUR database into groups,
2. Develop two sizing systems from the variable groups using factor scores,
3. The first sizing system will use percentile divisions and the second system use cluster analysis of observations to identify sizes, and
4. The systems will be compared to the system created by Kwon et al. (2009) to see if the new systems provide better fit.

CHAPTER 3
Methodology

3.1 Rationale

The new approach incorporates the methods of multivariate analysis that are similar to those performed by Chandrasekaran (2009) and Kouchi et al (2005). Factor analysis, which is similar to PCA was used to group the variables. Sizes was generated using the recommendations that were made by Chandrasekaran (2009) to use percentiles along the axis as opposed to boundary measurements which was the method used by Kouchi et al (2005).

3.2 Description of Analysis

Factor analysis was used for the analysis of the ANSUR data because of its ability to construct factors and generate factor scores that were used in the generation of hand sizes. The ANSUR data contains 86 variables for both male (1003 subjects) and female (1304 subjects). The 86 variables from the ANSUR data were to be reduced to a smaller more manageable number. The reduction process eliminated redundant measurements and dimensions that were deemed unbeneficial to the analysis such as weight, stature, and arm length.

The American National Survey began in 1987 under the direction of Dr. Claire Gordon of United States Army after it was realized that the anthropometric database at the time was outdated and new data was needed to account for the ever changing demographics of the U.S. military. The preceding survey for males was conducted in 1966 and for females was conducted in 1977. Since that time, large changes had taken

place in the numbers of female and minority soldiers. Also, during that time the average age of the soldiers had increased.

The survey took about one year to conduct and spanned eleven U.S. Army posts. The researchers used a complex sampling strategy to attain data from 9,000 subjects. The strategy used two sampling plans the first was a measured plan that measured 132 dimensions on all of the subjects. The second plan screened the first group of individuals and organized selected subjects into occupational subgroups. From the 9,000 subjects, 1,774 men and 2,208 women were chosen as the subjects that would comprise the working database. The database contains 240 measurements which include: face, torso, leg, arm, foot, and hand measurements (Gordon et al., 1989).

The U.S. Anthropometric data from 1988 contains 86 measurements for the human hand. There were 1,003 male subjects and 1,304 female subjects. Due to time constraints the observers used a hand photo box to aid in the data collection. The development of a hand-shadow-gram device allowed researchers to obtain any and all measurements that were necessary for glove design. Finger circumferences were measured directly on 620 males and 570 females. Regression analysis was then used to extrapolate the data onto the remaining subjects (Greiner et al., 1991).

Once the variables or dimensions were selected, factor analysis using varimax rotation was performed. Factor analysis is a data reduction technique that divides a data set into orthogonal or "independent" groups, which are algebraic combinations of the original variables. Different rotation techniques facilitate orthogonality and variance

dispersion. Varimax rotation is widely used and allows for easier interpretation by making the loadings much larger or much smaller so difference between variables can be seen. The first step of factor analysis was to find the number of factors to be extracted from the data. A scree plot was created to find were the loss of benefit would be located. The scree plot is a graph of eigenvalues versus number of factors. An eigenvalue is derived from the correlation matrix and can be associated with the magnitude of variance within each factor, in essence the higher the eigenvalue the higher the amount of total variance described by that factor.

Each factor has a loading for each variable and a variable has a high loading value (positive or negative) for a particular factor, then it can be said that that variable has a strong influence on the factor. A variable was associated with the factor that had the highest weighted value. Variables were divided into groups based on which factor the variable had the highest loading.

Factor analysis gave a factor score for each subject that was used in the analysis. The factor score for a subject is the value of the using the subject's value of the variables. By understanding the distribution of the subject's factor score, decisions were made on how the distributions were divided into sizes. The factor scores were acquired with the aid of statistical software such as Minitab (version 14.20) or SAS (version 9.0).

3.3 Development of Sizes

The factor scores were used to develop sizes. Based on the research and recommendations of Chandrasekaran (2009) an approach using percentiles and quartiles were used to divide the PC axes. Measured values were extracted from the 5^{th}, 25^{th}, 50^{th},

75th, and 95th percentiles on each factor and sizes were generated from the values. Another approach using cluster analysis was taken from the research done by Chung et al (2007) which used cluster of k-means to divide the scores in size categories.

The hand sizes were broken into three different areas of interest. These were based on the structure and intention of which the sizes were going to be used in glove design. The first system designed were for specialized industries that were heavily task oriented and require many different critical measurements as well as many variations in sizes. An example would be a glove that would be used for highly detailed and intricate work or work done in extreme environments such as the vacuum of space. The second system was a simplified version of the first and has only have the most frequently used factor scores. The combinations of factors were identified using cluster analysis. It was the intention that the cluster analysis results would be a more mass production friendly design.

The system using HL and HC that was developed by Kwon et al (2009) was the basis of comparison for the factor analysis system. The fit and coverage of gloves can be described as sizes that have minimal distance between the subject's hand and inner surface of the glove. If was a large distance between the individuals hand and the glove, the fingers or palm may slide and move freely within the glove. The goal was to reduce this distance, so the glove fits snugly on the subject's hand. The distance between each subject's dimensions and the nearest hand size was calculated. The dimensions for the factor score methods are taken from the subjects at the specific sizes. The mean distance for the sample population was computed and compared between the two systems through

a one tailed paired Student's t-test. After a comparison has been made it should be found that either the current system is adequate or the factor analysis driven method would be a more appropriate model for glove sizing.

CHAPTER 4
Results

Chapter Four presents in detail the results obtained from the analysis that was conducted using the methodologies explained in Chapter Three.

4.1 Description of Data

The following tables give statistical descriptions of the ANSUR hand data that was described in Section 3.2.

Table 4.1 ANSUR Male Data

Measurement	Mean (cm)	Std Dev (cm)	Minimum (cm)	Maximum (cm)
Digit 1 Length*	6.97	0.48	5.5	8.6
Digit 1 Height*	10.03	0.74	7.6	12.6
Digit 1 Tip to Wrist Crease	13.79	0.87	11.2	17
Digit 1 Interphalangeal Breadth*	2.4	0.13	2	2.8
Digit 1 Interphalangeal Circumference*	7.23	0.29	6.3	8.1
Digit 1 Link Length*	12.34	0.72	10.3	14.6
Digit 1 Metacarpal Link Length	8.23	0.71	6.1	11
Digit 1 Proximal Phalanx Link Length	2.11	0.3	1.2	3.1
Digit 1 Distal Phalanx Link Length	3.45	0.26	2.7	4.5
Digit 2 Length*	7.53	0.49	5.8	9.2
Digit 2 Height*	18	0.95	13.9	21
Digit 2 Tip to Wrist Crease	18.52	0.99	14.4	22.5
Digit 2 Proximal Interphalangeal Breadth*	2.3	0.16	1.9	2.8
Digit 2 Proximal Interphalangeal Circumference*	6.84	0.18	6.4	7.4
Digit 2 Distal Interphalangeal Breadth*	2.01	0.15	1.6	2.5
Digit 2 Distal Interphalangeal Circumference*	5.74	0.16	5.3	6.3
Digit 2 Link Length*	10.83	0.69	8.6	13.5
Digit 2 Metacarpal Link Length	7.68	0.48	5.5	9.5
Digit 2 Distal Phalanx Link Length	2.84	0.23	2.1	3.6
Digit 2 Medial Phalanx Link Length	2.26	0.24	1.6	3.2
Digit 2 Proximal Phalanx Link Length	6.08	0.59	4.6	10
Digit 3 Length*	8.38	0.54	6.4	10.5
Digit 3 Height*	19.41	1.03	14.4	23.1
Digit 3 Tip to Wrist Crease Length	19.45	1.03	14.4	23.2

Table 4.1 Continued

Digit 3 Proximal Interphalangeal Breadth*	2.25	0.16	1.8	2.9
Digit 3 Proximal Interphalangeal Circumference*	6.96	0.2	6.4	7.7
Digit 3 Distal Interphalangeal Breadth*	1.98	0.14	1.6	2.4
Digit 3 Distal Interphalangeal Circumference*	5.78	0.16	5.3	6.3
Digit 3 Link Length*	10.99	0.7	8.2	13.2
Digit 3 Metacarpal Link Length	8.46	0.6	6.2	10.4
Digit 3 Distal Phalanx Link Length	2.84	0.23	2.2	4.1
Digit 3 Medial Phalanx Link Length	2.64	0.28	1.9	3.7
Digit 3 Proximal Phalanx Link Length	5.48	0.5	4	7.9
Digit 4 Length*	7.92	0.52	6.2	10.3
Digit 4 Height*	18.02	1.01	13.2	22.3
Digit 4 Tip to Wrist Crease	18.5	1.02	14.3	22.7
Digit 4 Proximal Interphalangeal Breadth*	2.14	0.15	1.7	2.6
Digit 4 Proximal Interphalangeal Circumference*	6.49	0.19	5.9	7.2
Digit 4 Distal Interphalangeal Breadth*	1.85	0.14	1.3	2.4
Digit 4 Distal Interphalangeal Circumference*	5.38	0.13	4.9	5.9
Digit 4 Link Length*	10.69	0.65	8.3	13.5
Digit 4 Metacarpal Link Length	7.81	0.56	5.9	9.7
Digit 4 Distal Phalanx Link Length	2.96	0.24	1.9	3.8
Digit 4 Medial Phalanx Link Length	2.43	0.26	1.6	3.5
Digit 4 Proximal Phalanx Link Length	5.29	0.4	4	6.8
Digit 5 Length*	6.47	0.49	5.1	8.3
Digit 5 Height*	14.54	0.94	10.5	18.4
Digit 5 Tip to Wrist Crease	15.99	0.98	13	20.1
Digit 5 Proximal Interphalangeal Breadth*	1.92	0.13	1.5	2.4
Digit 5 Proximal Interphalangeal Circumference*	5.78	0.18	5.2	6.5
Digit 5 Distal Interphalangeal Breadth*	1.74	0.13	1.3	2.1
Digit 5 Distal Interphalangeal Circumference*	4.92	0.16	4.4	5.5
Digit 5 Link Length*	8.6	0.59	6.9	11.2
Digit 5 Metacarpal Length	7.39	0.6	5.7	9.4
Digit 5 Distal Phalanx Length	2.73	0.23	1.8	3.5
Digit 5 Medial Phalanx Length	1.75	0.22	1.1	2.5
Digit 5 Proximal Phalanx Length	4.15	0.36	3	5.7
Hand Length from Digitizer	19.41	1.03	14.4	23.1
Hand Length Measured*	19.41	0.99	16.9	22.9
Hand Circumference*	21.39	0.98	18.2	24.7
Palm Length*	11.05	0.6	8	13.6
Hand Breadth from Digitizer	9.53	0.58	7.9	11.7
Hand Breadth Measured*	9.04	0.42	7.9	10.6

Table 4.1 Continued

Wrist Breadth*	6.58	0.45	5.3	8.2
Wrist Circumference*	17.43	0.82	14.3	20.4
Wrist To Center of Grip Length*	6.98	0.48	5.8	8.7
Wrist Index Finger Length*	18.1	0.91	15.8	21.6
Wrist Thumb Tip Length*	12.45	0.68	10.6	14.8
Crotch 1 Height*	6.91	0.47	5.4	8.8
Crotch 2 Height*	11.04	0.61	8.2	13.3
Crotch 3 Height*	10.99	0.64	7.9	13.4
Crotch 4 Height*	9.66	0.62	6.8	12.1
Forearm Hand Length	48.4	2.33	41.5	57.8
Elbow Wrist Length	29	1.53	24.4	35
Elbow Center of Grip Length	35.98	1.77	30.7	43.6
Rediale Stylion Length	26.92	1.58	22.2	32.5
Forearm Circumference Flexed	30.39	1.89	23.3	36.3
Biceps Circumference Flexed	33.87	2.72	25.9	42.6
Arm Length	79.03	3.85	69.3	95.9
Shoulder Elbow Length	36.96	1.83	31.9	44.6
Acromion Radiale Length	34.14	1.75	28.7	41.5
Thumb Tip Reach	80.15	3.94	69.7	98
Wrist Wall Length	68.11	3.48	58.2	83.5
Wrist Wall Length Extended	74.76	3.75	64.4	90.3
Stature	175.7	6.71	157	204
Weight	78.62 (Kg)	11.04 (Kg)	49.8 (Kg)	124.3 (Kg)

The asterisk (*) notes all variables that are used in the factor analysis and are explained in Section 4.2.1.1.

The male data shown in Table 4.1 gives the name for each measurement in column one, the mean value in column two, standard deviation value in column three, and minimum and maximum values in columns four and five. The measurement values are in centimeters except for the weight measurement which is in kilograms. The weight measurement has the largest amount of variation at 11.04 kilograms, while digit 5 distal interphalangeal breadth, digit 5 proximal interphalangeal breadth, digit 4 distal

interphalangeal circumference, and digit 1 interphalangeal breadth have the smallest amount of variation with 0.13 centimeters. There are a total of 86 variables in the table.

Table 4.2 ANSUR Female Data

FEMALE	Mean (cm)	Std Dev (cm)	Minimum (cm)	Maximum (cm)
Digit 1 Length*	6.35	0.48	4.9	8
Digit 1 Height*	9.26	0.73	7.2	11.5
Digit 1 Tip to Wrist Crease	12.57	0.87	10.3	15.4
Digit 1 Interphalangeal Breadth*	2.06	0.13	1.7	2.5
Digit 1 Interphalangeal Circumference*	6.3	0.25	5.6	7.2
Digit 1 Link Length*	11.05	0.69	9.1	13.2
Digit 1 Metacarpal Link Length	7.57	0.7	5.7	9.9
Digit 1 Proximal Phalanx Link Length	1.92	0.29	1	2.9
Digit 1 Distal Phalanx Link Length	3.08	0.24	2.2	4.1
Digit 2 Length*	6.96	0.46	5.6	8.4
Digit 2 Height*	16.51	0.9	13.5	19.6
Digit 2 Tip to Wrist Crease	16.99	0.93	14	20.3
Digit 2 Proximal Interphalangeal Breadth*	1.99	0.13	1.6	2.4
Digit 2 Proximal Interphalangeal Circumference*	6.12	0.2	5.6	6.8
Digit 2 Distal Interphalangeal Breadth*	1.73	0.12	1.4	2.3
Digit 2 Distal Interphalangeal Circumference*	5.08	0.19	4.5	5.8
Digit 2 Link Length*	10.02	0.64	8.1	12.4
Digit 2 Metacarpal Link Length	6.96	0.49	5.4	9
Digit 2 Distal Phalanx Link Length	2.55	0.21	1.9	3.2
Digit 2 Medial Phalanx Link Length	2.11	0.22	1.4	2.8
Digit 2 Proximal Phalanx Link Length	5.65	0.53	4.1	8
Digit 3 Length*	7.72	0.51	6.2	9.6
Digit 3 Height*	17.79	0.98	14.5	21.3
Digit 3 Tip to Wrist Crease Length	17.84	0.98	14.6	21.3
Digit 3 Proximal Interphalangeal Breadth*	1.93	0.13	1.6	2.4
Digit 3 Proximal Interphalangeal Circumference*	6.13	0.19	5.6	6.8
Digit 3 Distal Interphalangeal Breadth*	1.71	0.11	1.4	2.1
Digit 3 Distal Interphalangeal Circumference*	5.09	0.17	4.6	5.7
Digit 3 Link Length*	10.03	0.64	8	12.3
Digit 3 Metacarpal Link Length	7.81	0.56	5.8	9.8
Digit 3 Distal Phalanx Link Length	2.55	0.21	2.1	3.4

Table 4.2 Continued

Digit 3 Medial Phalanx Link Length	2.51	0.27	1.7	3.6
Digit 3 Proximal Phalanx Link Length	4.97	0.44	3.7	7
Digit 4 Length*	7.22	0.5	5.5	9
Digit 4 Height*	16.46	0.96	13	19.7
Digit 4 Tip to Wrist Crease	16.89	0.98	13.8	20.3
Digit 4 Proximal Interphalangeal Breadth*	1.84	0.12	1.5	2.3
Digit 4 Proximal Interphalangeal Circumference*	5.74	0.19	5.2	6.5
Digit 4 Distal Interphalangeal Breadth*	1.58	0.11	1.3	2.1
Digit 4 Distal Interphalangeal Circumference*	4.68	0.16	4.2	5.3
Digit 4 Link Length*	9.73	0.59	7.9	11.9
Digit 4 Metacarpal Link Length	7.16	0.53	5.2	9
Digit 4 Distal Phalanx Link Length	2.61	0.22	1.9	3.3
Digit 4 Medial Phalanx Link Length	2.28	0.26	1.6	3.5
Digit 4 Proximal Phalanx Link Length	4.84	0.34	3.7	6
Digit 5 Length*	5.83	0.46	4.1	7.3
Digit 5 Height*	13.21	0.88	9.8	16.2
Digit 5 Tip to Wrist Crease	14.55	0.94	11.4	18
Digit 5 Proximal Interphalangeal Breadth*	1.65	0.11	1.3	2
Digit 5 Proximal Interphalangeal Circumference*	5.06	0.17	4.5	5.7
Digit 5 Distal Interphalangeal Breadth*	1.47	0.11	1.2	1.9
Digit 5 Distal Interphalangeal Circumference*	4.25	0.15	3.8	4.9
Digit 5 Link Length*	7.76	0.54	6	9.7
Digit 5 Metacarpal Length	6.79	0.59	4.8	9
Digit 5 Distal Phalanx Length	2.37	0.2	1.6	3
Digit 5 Medial Phalanx Length	1.63	0.22	1	2.4
Digit 5 Proximal Phalanx Length	3.78	0.3	2.8	4.9
Hand Length from Digitizer	17.79	0.98	14.5	21.3
Hand Length Measured*	18.07	0.98	14.9	21.5
Hand Circumference*	18.65	0.86	15.8	23
Palm Length*	10.09	0.57	7.9	12.4
Hand Breadth from Digitizer	8.31	0.44	6.9	9.9
Hand Breadth Measured*	7.95	0.38	6.6	9.8
Wrist Breadth*	5.7	0.34	4.6	7
Wrist Circumference*	15.14	0.69	13	17.4
Wrist To Center of Grip Length*	6.62	0.49	5.2	8.3
Wrist Index Finger Length*	16.95	0.9	14.1	20.2
Wrist Thumb Tip Length*	11.77	0.68	9.6	14.2
Crotch 1 Height*	6.28	0.46	4.9	8
Crotch 2 Height*	10.5	0.57	8	12.6

Table 4.2 Continued

Crotch 3 Height*	10.03	0.6	8	12.5
Crotch 4 Height*	8.79	0.58	6.7	11.3
Forearm Hand Length	44.35	2.36	32.4	53.3
Elbow Wrist Length	26.28	1.56	17	31.8
Elbow Center of Grip Length	32.9	1.78	23.7	38.7
Rediale Stylion Length	24.36	1.56	15.7	30.6
Forearm Circumference Flexed	25.41	1.5	21.2	32.5
Biceps Circumference Flexed	28.16	2.26	21.5	37.1
Arm Length	72.39	3.9	57.9	87.1
Shoulder Elbow Length	33.59	1.77	28.9	40.1
Acromion Radiale Length	31.2	1.7	26.5	37
Thumb Tip Reach	73.54	3.7	60.5	89.8
Wrist Wall Length	62.05	3.24	50.8	76.3
Wrist Wall Length Extended	68.01	3.43	56	80.8
Stature	163.02	6.39	144.7	183.6
Weight	62.2	8.37	41.3	94.6

The asterisk (*) notes all variables that are used in the factor analysis and are explained in section 4.2.1.1.

The data from female subjects shown in Table 4.2 gives the name for each measurement in column one, the mean value in column two, standard deviation value in column three, and minimum and maximum values in columns four and five. The measurement values are in centimeters except for the weight measurement which is in kilograms. The weight measurement has the largest amount of variation at 8.37 kilograms, while digit 5 distal interphalangeal breadth, digit 5 proximal interphalangeal breadth, digit 4 distal interphalangeal circumference, and digit 3 distal interphalangeal breadth have the smallest amount of variation with 0.11 centimeters. There are a total of 86 variables in the table.

4.2 Sizing

There were two different approaches that were used when designing the sizes systems. These were based on the structure and intention to which the sizes were going to be used in glove design. The first system using percentile division of factor scores was designed for specialized industries that were heavily task oriented and required many different critical measurements as well as many variations in sizes. The second system using cluster analysis on factor scores was designed as a reduced version of the first. It is the intention that the second version would be a more mass production friendly design.

4.2.1 Factor Analysis

Multivariate factor analysis was performed on the male and female datasets as described in section 3.2.

4.2.1.1 Data Selection and Reduction

As described in Section 3.2, redundant measurements and dimensions that were deemed unbeneficial to the analysis (i.e. weight, stature, arm length, forearm hand length, elbow wrist length, rediale stylion length) were eliminated and the 86 variables were reduced to 46 essential human hand measurements. For example, the distal phalanx link length, medial phalanx link length, and proximal phalanx link length can be eliminated for each finger because the summation of these measurements is the finger's link length. All metacarpal lengths were removed because of the combination of the palm lengths and link lengths include these measurements. The measurements that were used have been highlighted with an asterisk and can be seen in Table 4.1 for males and Table 4.2 for females. After reducing the number of variables down; the measurements were ready for

the analysis which was conducted using Minitab (version 14.20) statistical software for Microsoft Windows © operating systems.

4.2.1.2 Selecting the Number of Factors

The selected measurements underwent factor analysis. During factor analysis the number of factors to be extracted from the variables must be chosen. Section 3.2 described how a scree plot can be formed.

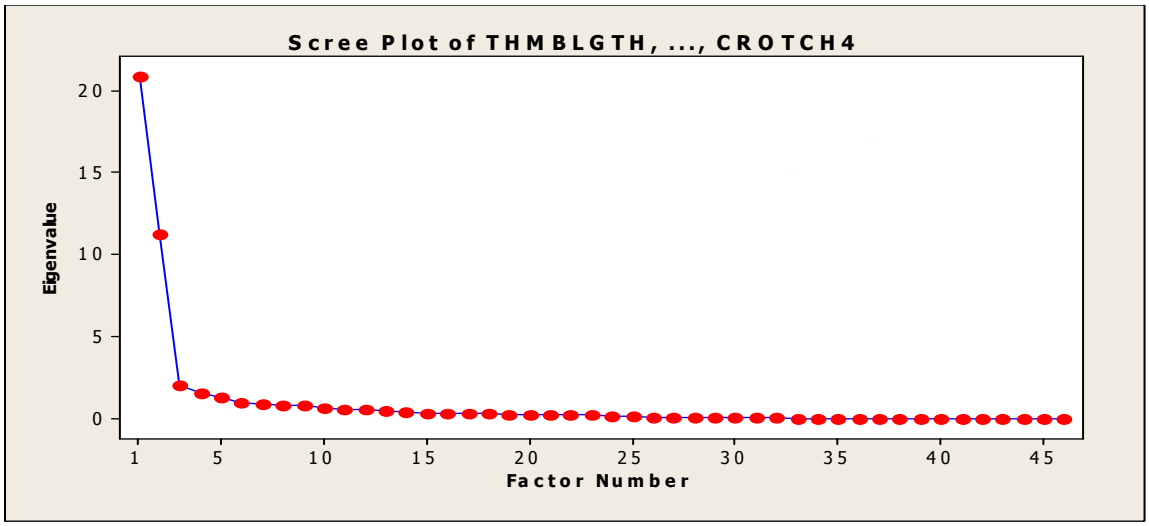

Figure 4.1 Scree Plot for Male Hand Data

The graph in Figure 4.1 shows the scree plot for males. There is a plateau in eigenvalues after the third factor, which means that there would be a very small benefit in adding more factors. The three factors together for males explain 74.1 percent of the total variance.

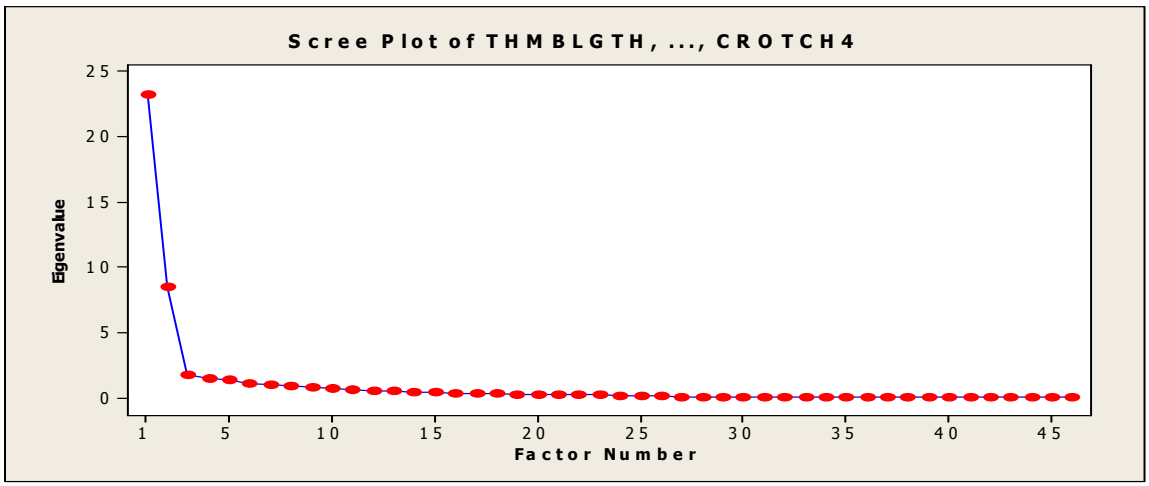

Figure 4.2 Scree Plot for Female Hand Data

The graph Figure 4.2 shows the scree plot for females. Similar to the male scree plot a plateau begins after the third factor, so three factors are chosen to be extracted from the data. The three factors explain 72.6 percent of the total variance for the female data. The three factors were then used to form a factor loading matrix that was described in section 3.2.

4.2.1.3 Factor Loadings and Descriptions

As described in Section 3.2, the factor loading matrix is a varimax rotated matrix of variables and factors that shows the amount of influence a variable has on each factor. Minitab software offered an option for sorting the matrix which helps with the interpretation. Table 4.1 below shows the factor loading matrix that was created for males and Table 4.2 shows the matrix for females.

Table 4.3 Sorted Male Factor Loadings

Variable	Factor1	Factor2	Factor3
D3HGHT	0.960	-0.057	0.160
D4HGHT	0.950	-0.027	0.113
D2HGHT	0.919	-0.076	0.206
D3LGTH	0.895	-0.064	0.046
D5HGHT	0.893	0.014	0.055
D4LINK	0.884	-0.145	0.033
D4LGTH	0.882	-0.100	0.020
D2LGTH	0.880	-0.101	0.023
CROTCH3	0.860	-0.005	0.174
D2LINK	0.858	-0.114	0.033
HANDLGTH	0.857	-0.168	0.258
WRINFNGL	0.856	-0.155	0.248
CROTCH2	0.853	-0.050	0.239
D3LINK	0.851	-0.069	0.039
PALMLGTH	0.842	-0.041	0.232
D5LINK	0.835	-0.218	-0.036
CROTCH4	0.822	0.043	0.139
D5LGTH	0.796	-0.169	-0.056
WRTHLGTH	0.783	-0.114	0.308
THMBLGTH	0.754	-0.235	-0.054
D1HGHT	0.706	-0.063	0.262
D1FUNCLT	0.670	-0.372	-0.010
CROTCH1	0.663	-0.059	0.345
WRCTRGRL	0.446	-0.039	0.383
D3DCIRC	0.069	-0.919	0.110
D3PCIRC	0.095	-0.917	0.142
D4DCIRC	0.091	-0.911	0.040
D2PCIRC	0.050	-0.901	0.128
D4PCIRC	0.125	-0.900	0.056
D2DCIRC	0.041	-0.896	0.120
D3DIP	0.053	-0.883	0.090
D3PIP	0.107	-0.864	0.154
D4DIP	0.058	-0.854	0.026
D5DCIRC	0.112	-0.850	0.143
D2DIP	0.030	-0.843	0.107
D2PIP	0.058	-0.838	0.127
D4PIP	0.142	-0.827	0.063
D5PCIRC	0.130	-0.811	0.149
D5DIP	0.058	-0.790	0.108
D5PIP	0.138	-0.764	0.149
WRISBRTH	0.139	-0.695	0.128
THUMBBR	0.165	-0.365	0.795
THMBCIRC	0.165	-0.365	0.795
HANDCIRC	0.419	-0.435	0.594
HANDBRTH	0.419	-0.407	0.578
WRISCIRC	0.372	-0.448	0.573
Variance	17.179	13.609	3.320
% Var	0.373	0.296	0.072

Table 4.4 Sorted Female Factor Loadings

Variable	Factor1	Factor2	Factor3
D3HGHT	0.944	-0.196	0.158
D4HGHT	0.933	-0.178	0.119
D2HGHT	0.906	-0.190	0.190
D4LINK	0.886	-0.218	0.044
D3LGTH	0.884	-0.166	0.037
HANDLGTH	0.879	-0.208	0.248
WRINFNGL	0.878	-0.171	0.258
D5HGHT	0.875	-0.135	0.054
D4LGTH	0.866	-0.177	0.021
D3LINK	0.861	-0.161	0.067
D2LGTH	0.856	-0.168	0.020
CROTCH3	0.837	-0.162	0.197
CROTCH2	0.837	-0.171	0.246
PALMLGTH	0.831	-0.190	0.241
D5LINK	0.830	-0.232	-0.043
D2LINK	0.819	-0.139	0.064
WRTHLGTH	0.816	-0.140	0.308
CROTCH4	0.806	-0.138	0.155
D5LGTH	0.789	-0.190	-0.065
THMBLGTH	0.788	-0.184	-0.039
D1FUNCLT	0.775	-0.246	0.090
D1HGHT	0.692	-0.060	0.269
CROTCH1	0.636	-0.142	0.362
D3DCIRC	0.167	-0.897	0.126
D3PCIRC	0.196	-0.880	0.127
D4DCIRC	0.190	-0.876	0.031
D4PCIRC	0.226	-0.874	0.036
D5DCIRC	0.132	-0.847	0.089
D2PCIRC	0.135	-0.847	0.151
D2DCIRC	0.128	-0.843	0.143
D3DIP	0.112	-0.835	0.112
D5PCIRC	0.154	-0.834	0.104
D3PIP	0.213	-0.815	0.120
D4PIP	0.255	-0.791	0.039
D4DIP	0.118	-0.790	0.020
D5PIP	0.167	-0.766	0.112
D2DIP	0.100	-0.762	0.114
D5DIP	0.081	-0.759	0.055
D2PIP	0.140	-0.746	0.153
WRISBRTH	0.224	-0.561	0.179
HANDCIRC	0.467	-0.519	0.462
HANDBRTH	0.470	-0.480	0.471
WRISCIRC	0.399	-0.479	0.457
THMBCIRC	0.179	-0.412	0.769
THUMBBR	0.179	-0.412	0.769
WRCTRGRL	0.390	-0.028	0.442
Variance	17.471	12.963	2.945
% Var	0.380	0.282	0.064

The highlighted areas show the shift in the amount of influence for each factor. The factors were then organized by these shifts and the following factors were formulated.

Factors for male are given below.

1. Factor one of the matrix accounted for 37.3 percent of the total variance. There are 24 variables in factor one: finger lengths for digits one through 5, link lengths for digits one through five, crotch lengths for digits one through five, finger heights for digits one through five, hand length, wrist to index finger length, palm length, wrist to thumb tip length, and wrist to center of grip length. The common theme among the measurements is finger and palm lengths, hence factor one was called the length factor.
2. Factor two consisted of 17 variables: finger circumferences for digits one through five, interphalangeal lengths both distal and proximal for digits one through five, and wrist breadth. It accounts for 29.6 percent of the total variance. The measurements in this factor are all thickness measurements, so factor two was called the thickness factor.
3. Factor three has the smallest number of variables with 5 measurements, accounting for 7 percent of the total variance. It includes the measurements: thumb breadth, thumb circumference, hand circumference, hand breadth, and wrist circumference. The measurements are centered on the thumb and inner surface of the hand, so factor three was called the palm and thumb factor.

Factors for females are given below.

1. Factor one of the matrix accounted for 38.0 percent of the total variance. It contains 23 variables: finger lengths for digits one through 5, link lengths for digits one through five, crotch lengths for digits one through five, finger heights for digits one through five, hand length, wrist to index finger length, palm length, and wrist to thumb tip length. Similar to the male factor the female factor one was called the length factor.
2. Factor two, created from 20 variables, describes 28.2 percent of the total variance. The variables within this factor are finger circumferences for digits one through five, interphalangeal lengths both distal and proximal for digits one through five, wrist breadth , hand circumference, hand breadth, and wrist circumference. Factor two for females like factor two for males was called the thickness factor.
3. Factor three consists of thumb circumference, thumb breadth, and wrist to center of grip length. There is 6.4 percent of the total variance in this factor. For females factor three was called the thumb factor.

After the factors had been categorized, the task of designing and developing glove sizes began.

4.2.1.4 Factor Scores

Factor scores were obtained using SAS (version 9.0) statistical software as described in Section 3.2. Full factor score matrices for males and females can be found in Appendix A.

4.2.2 Sizing Method I

Sizing Method I is for specialized industries that may require many different size variations. Factor score sizes can be generated by dividing the factors along their axes. The factor axis was the Eigenvector on which the variances were located. For the three factors, measurements were extracted from the 5^{th}, 25^{th}, 50^{th}, 75^{th}, and 95^{th} percentiles of factor scores. The percentiles were positions located along the factor axis. The sizing structure for each individual was a combination of each of the three factors. Figure 4.3 shows an example of a subject with factor one at the 5^{th} percentile, factor two at the 50^{th} percentile, and factor three at the 25^{th} percentile. Thus for factor one the individual's measurements for that factor were closest to the 5^{th} percentile of factor one. Similarly for the factor two, measurements were closest to the 50^{th} percentile values, and factor three was closest to the 25^{th} percentile values. This method can essentially be called a mix and match method of sizing. A sizing chart was created by taking the measurements from the subjects at each percentile value for the three factors for both genders. The charts are in Appendix B.

Factor 1	Factor 2	Factor 3
5th	5th	5th
25th	25th	25th
50th	50th	50th
75th	75th	75th
95th	95th	95th

Figure 4.3 Sizing Combination Example

Specialized industries, specifically NASA, required a glove that was deeply rooted about the task that was being performed with the glove. For example gloves that are required during high precision tasks must have minimal loose material or space between the inner glove wall and subjects fingers. The gap is a measure fit, and the smaller the gap the better the fit. Glove designs that require a high degree of fit require many key dimensions as well numerous sizes. A glove to be used in the defusing of bombs for example requires maximum protection for the user as well as supreme fit. The level of detail and sophisticated tasks that must be carried out are vital to the glove design. The user must have an extensive amount of control to deal with delicate parts as well as many layers of protection in case of accidental detonation. This requires many size options to be available to the designers so optimal fit can be achieved.

There were three factors with five combinations of sizes at each factor. A total of 125 sizes are generated from the data for each gender. There are a total of 46

measurements that can be used in the design of a glove. The measurements and their corresponding sizes are located in Appendix B.

Specification or natural tolerance limits can be calculated for the 46 measurements to be used in the creation and design of gloves. The tolerance limits are used in the production and manufacturing of the gloves and refer to the limits of variability that the subjects have required. Tolerance limits were created using the value of the measurement plus or minus three times the inherent variation within the human hand. Three standard deviations around the mean is a common practice in quality engineering and is well supported by the quality leader Walter A. Shewart (Krishnamoorthi, 2006). Table 4.5 gives the tolerance limits for factor one of the male data.

Table 4.5 Tolerance Limits for Male Factor One

Factor 1	Male			
Variable	Percentile	Measurement (cm)	Lower Tolerance Limit (cm)	Upper Tolerance Limit (cm)
Digit 1 Length	5th	66	64.56	67.44
Digit 1 Length	25th	62	60.56	63.44
Digit 1 Length	50th	68	66.56	69.44
Digit 1 Length	75th	70	68.56	71.44
Digit 1 Length	95th	81	79.56	82.44
Digit 1 Height	5th	97	94.78	99.22
Digit 1 Height	25th	99	96.78	101.22
Digit 1 Height	50th	104	101.78	106.22
Digit 1 Height	75th	96	93.78	98.22
Digit 1 Height	95th	111	108.78	113.22
Digit 1 Link Length	5th	121	118.84	123.16

Digit 1 Link Length	25th	121	118.84	123.16
Digit 1 Link Length	50th	125	122.84	127.16

Table 4.5 Continued

Digit 1 Link Length	75th	132	129.84	134.16
Digit 1 Link Length	95th	133	130.84	135.16
Digit 2 Length	5th	69	67.53	70.47
Digit 2 Length	25th	72	70.53	73.47
Digit 2 Length	50th	76	74.53	77.47
Digit 2 Length	75th	78	76.53	79.47
Digit 2 Length	95th	82	80.53	83.47
Digit 2 Height	5th	171	168.15	173.85
Digit 2 Height	25th	172	169.15	174.85
Digit 2 Height	50th	180	177.15	182.85
Digit 2 Height	75th	186	183.15	188.85
Digit 2 Height	95th	194	191.15	196.85
Digit 2 Link Length	5th	99	96.93	101.07
Digit 2 Link Length	25th	103	100.93	105.07
Digit 2 Link Length	50th	109	106.93	111.07
Digit 2 Link Length	75th	114	111.93	116.07
Digit 2 Link Length	95th	123	120.93	125.07
Digit 3 Length	5th	76	74.38	77.62
Digit 3 Length	25th	83	81.38	84.62
Digit 3 Length	50th	85	83.38	86.62
Digit 3 Length	75th	87	85.38	88.62
Digit 3 Length	95th	92	90.38	93.62
Digit 3 Link Length	5th	101	98.9	103.1
Digit 3 Link Length	25th	107	104.9	109.1
Digit 3 Link Length	50th	111	108.9	113.1
Digit 3 Link Length	75th	118	115.9	120.1
Digit 3 Link Length	95th	119	116.9	121.1
Digit 4 Length	5th	71	69.44	72.56
Digit 4 Length	25th	76	74.44	77.56
Digit 4 Length	50th	78	76.44	79.56
Digit 4 Length	75th	83	81.44	84.56
Digit 4 Length	95th	82	80.44	83.56
Digit 4 Height	5th	164	160.97	167.03

Digit 4 Height	25th	173	169.97	176.03
Digit 4 Height	50th	177	173.97	180.03

Table 4.5 Continued

Digit 4 Height	75th	190	186.97	193.03
Digit 4 Height	95th	192	188.97	195.03
Digit 4 Link Length	5th	98	96.05	99.95
Digit 4 Link Length	25th	103	101.05	104.95
Digit 4 Link Length	50th	111	109.05	112.95
Digit 4 Link Length	75th	112	110.05	113.95
Digit 4 Link Length	95th	111	109.05	112.95
Digit 5 Length	5th	52	50.53	53.47
Digit 5 Length	25th	64	62.53	65.47
Digit 5 Length	50th	67	65.53	68.47
Digit 5 Length	75th	69	67.53	70.47
Digit 5 Length	95th	73	71.53	74.47
Digit 5 Height	5th	125	122.18	127.82
Digit 5 Height	25th	138	135.18	140.82
Digit 5 Height	50th	140	137.18	142.82
Digit 5 Height	75th	154	151.18	156.82
Digit 5 Height	95th	161	158.18	163.82
Digit 5 Link Length	5th	72	70.23	73.77
Digit 5 Link Length	25th	85	83.23	86.77
Digit 5 Link Length	50th	91	89.23	92.77
Digit 5 Link Length	75th	88	86.23	89.77
Digit 5 Link Length	95th	95	93.23	96.77
Palm Length	5th	104	102.2	105.8
Palm Length	25th	105	103.2	106.8
Palm Length	50th	108	106.2	109.8
Palm Length	75th	115	113.2	116.8
Palm Length	95th	119	117.2	120.8
Wrist To Center of Grip Length	5th	63	61.56	64.44
Wrist To Center of Grip Length	25th	70	68.56	71.44
Wrist To Center of Grip Length	50th	72	70.56	73.44
Wrist To Center of Grip Length	75th	73	71.56	74.44
Wrist To Center of Grip Length	95th	71	69.56	72.44

Wrist Index Finger Length	5th	174	171.27	176.73

Table 4.5 Continued

Wrist Index Finger Length	25th	171	168.27	173.73
Wrist Index Finger Length	50th	182	179.27	184.73
Wrist Index Finger Length	75th	186	183.27	188.73
Wrist Index Finger Length	95th	195	192.27	197.73
Crotch 1 Height	5th	69	67.59	70.41
Crotch 1 Height	25th	69	67.59	70.41
Crotch 1 Height	50th	69	67.59	70.41
Crotch 1 Height	75th	70	68.59	71.41
Crotch 1 Height	95th	76	74.59	77.41
Crotch 2 Height	5th	105	103.17	106.83
Crotch 2 Height	25th	104	102.17	105.83
Crotch 2 Height	50th	108	106.17	109.83
Crotch 2 Height	75th	112	110.17	113.83
Crotch 2 Height	95th	119	117.17	120.83
Crotch 3 Height	5th	102	100.08	103.92
Crotch 3 Height	25th	104	102.08	105.92
Crotch 3 Height	50th	106	104.08	107.92
Crotch 3 Height	75th	112	110.08	113.92
Crotch 3 Height	95th	115	113.08	116.92
Crotch 4 Height	5th	87	85.14	88.86
Crotch 4 Height	25th	90	88.14	91.86
Crotch 4 Height	50th	93	91.14	94.86
Crotch 4 Height	75th	100	98.14	101.86
Crotch 4 Height	95th	105	103.14	106.86
Digit 3 Height	5th	180	176.91	183.09
Digit 3 Height	25th	188	184.91	191.09
Digit 3 Height	50th	193	189.91	196.09
Digit 3 Height	75th	201	197.91	204.09
Digit 3 Height	95th	210	206.91	213.09
Hand Length Measured	5th	184	181.03	186.97
Hand Length Measured	25th	189	186.03	191.97

Hand Length Measured	50th	196	193.03	198.97

Table 4.5 Continued

Hand Length Measured	75th	197	194.03	199.97
Hand Length Measured	95th	208	205.03	210.97

Table 4.5 presents the full listing of tolerance limits for factor one on the male hand data. The first column gives the variable name and the second column gives the percentile or location for the variable. The third column presents the size value for the percentiles measurement. The final two columns provide the lower tolerance limit and the upper tolerance limit. The remaining lists of tolerance limits for the other factors for males and all of the factors for females can be found in Appendix C.

4.2.2.1 Method I Procedure (Percentile Division)

A step by step procedure of how to use the Method I sizing chart is presented in this section. The procedure shows designers how to use the sizing chart and tolerance limits in the creation and manufacturing of gloves. The sizing for Method I works on a coordinates system in which the three factors were axes and the five sizes were divided along each axis. This can be seen in Figure 4.4 where the axes represent the percentile values of the factors.

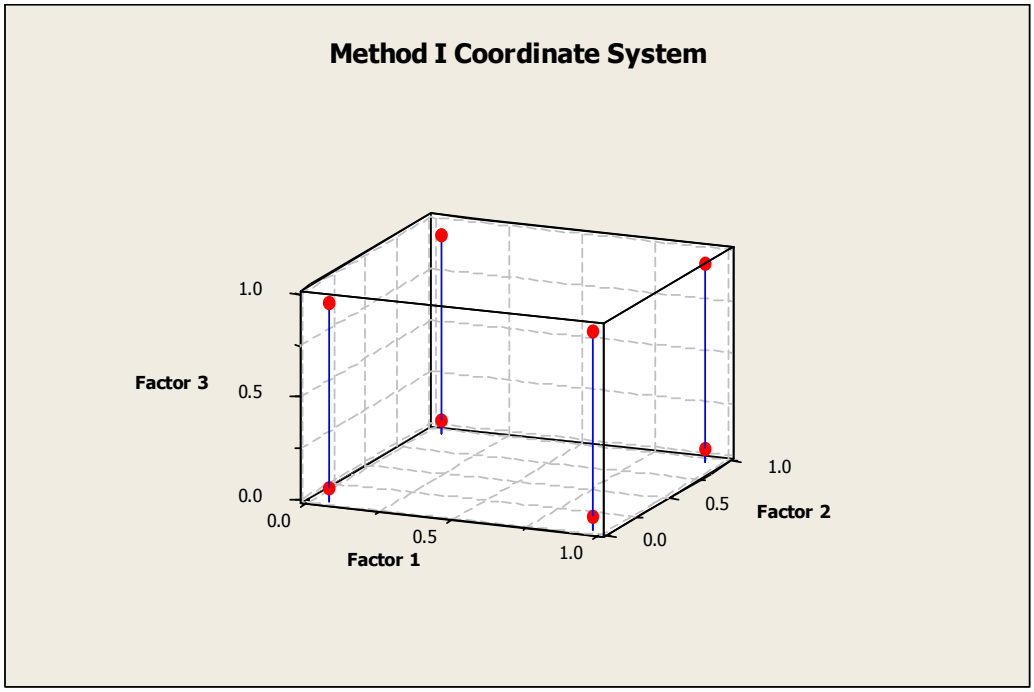

Figure 4.4 Method I Coordinate System

1. The first step requires the designer to identify the coordinates that the individual's hand size is located. A simple engineering solution can used to find the individuals location. The 46 dimensions could be measured and entered into an Excel macro that gives the coordinates for the individual. The tolerance limits, which are located in Appendix C, can be used to identify which sizes the designer could use for the glove. Another method could be created by developing manikins from the dimensions. In this example the designer wants to make a glove for a male that has the 5^{th} percentile for the length factor or factor one, the 5^{th} percentile for the thickness factor or factor two, and the 5^{th} percentile for the palm and thumb factor or factor three.
2. Once the sizes for each factor have been chosen the designer can extract the measurements for the glove from Appendix B. In this example a designer

needs the measurements for the 5th percentile of the male factor one. The designer finds the table for male factor one and selects all of the dimensions that are located at the rows labeled 5th percentile. For males there are 23 measurements that are in factor one. Similarly the measurements can be extracted for the other two factor sizes. In all, there are 46 dimensions.

3. The designer now has 46 dimensions that are representative of a male that is at the 5th percentile for all three factors. A glove can be manufactured around these dimensions. The glove design could be modular, so the designer would have to assemble the three corresponding modules. Otherwise a manikin could be developed from the sizes.

4.2.3 Sizing Method II (Cluster Analysis)

In the mass production of gloves it may be necessary to have a simplified and easier to use version of the sizing system that was created because mass producing 125 size combinations can be assumed infeasible. This requires the number of sizes to be reduced. Cluster analysis can group observations together into subsets. In this case it was used to identify sizes and the combinations of the factor scores that occur most frequently in the sample population. A partitional clustering was performed on the factor scores for both male and female subjects using Minitab (version 14.20). The cluster analysis used the average linkage method, which the distance between clusters is the average distance between an observation in one cluster and an observation in the other cluster. The distance between the observations was measured using the Euclidean distance measure. Table 4.6 shows results for the cluster analysis for males and Table 4.8 shows the results from the cluster analysis for females.

Table 4.6 Cluster Analysis for Males

	Number of observations	Within cluster sum of squares	Average distance from centroid	Maximum distance from centroid
Cluster1	1	0.00	0.00000	0.0000
Cluster2	2	13.47	2.59544	2.5954
Cluster3	114	2643.71	4.34109	9.6859
Cluster4	5	36.80	2.45353	4.0659
Cluster5	1	0.00	0.00000	0.0000
Cluster6	10	123.52	3.06583	6.6408
Cluster7	21	394.16	4.06897	7.8129
Cluster8	384	8524.97	4.34516	9.7585
Cluster9	2	3.44	1.31231	1.3123
Cluster10	64	1029.36	3.77268	8.3146
Cluster11	2	7.45	1.93054	1.9305
Cluster12	11	117.45	3.05328	4.7476
Cluster13	237	5467.03	4.40360	10.9227
Cluster14	23	276.08	3.26052	5.9163
Cluster15	105	2088.83	4.15557	8.6478
Cluster16	1	0.00	0.00000	0.0000
Cluster17	3	13.53	1.86681	2.7745
Cluster18	5	50.28	3.05990	4.2531
Cluster19	9	118.02	3.53718	4.6893
Cluster20	3	49.61	3.98779	5.1080

The information in Table 4.6 shows the cluster number in column one. The cluster number is associated with a factor score combination that can be considered a size. The second column gives the total number of observations in the data that are within that cluster. The remaining columns explain the sum of squares for the cluster, the average distance a subject's factor scores were from the centroid, and the maximum distance that a single subject was from the centroid. The aim was to acquire around 90 percent of the sample observations with the minimum number of clusters.

Table 4.7 Cluster Analysis Centroids

Variable	Cluster1	Cluster2	Cluster3	Cluster4	Cluster5	Cluster6	Cluster7
Factor1	96.6767	100.379	115.369	109.255	107.951	114.383	120.127
Factor2	98.3091	90.459	88.169	88.623	95.472	88.806	93.377
Factor3	56.3892	46.683	45.425	47.978	41.247	35.952	43.396

Variable	Cluster8	Cluster9	Cluster10	Cluster11	Cluster12	Cluster13
Factor1	122.402	117.482	123.056	121.628	127.568	130.013
Factor2	87.440	87.073	88.353	94.904	85.967	87.854
Factor3	42.957	56.170	51.366	33.542	34.255	42.916

Variable	Cluster14	Cluster15	Cluster16	Cluster17	Cluster18	Cluster19
Factor1	130.376	136.043	134.368	138.782	142.414	143.963
Factor2	88.575	87.402	91.112	81.407	82.833	86.995
Factor3	53.567	47.134	62.070	40.569	52.143	42.131

Variable	Cluster20	Grand centroid
Factor1	152.640	125.267
Factor2	86.702	87.824
Factor3	43.990	44.394

The maximum number of sizes that were to be extracted was chosen at twenty, because it was felt that more than twenty would be difficult to manufacture. Seven sizes based on the frequency of observations were selected from the twenty clusters that were created from the analysis. The sizes were clusters 3, 7, 8, 10, 13, 14, and 15, which can be seen in Table 4.7. There were a total of 948 subjects that were within these sizes, thus accounting for 94.5 percent of the sample population. The measurements for the sizes were created by finding an individual in the data that was closest to the three factor scores and using their dimensions. A full list of dimensions for the sizes is in Appendix D. The Tolerance limits to be used in manufacturing are in Appendix F.

Table 4.8 Female Cluster Analysis

	Number of observations	Within cluster sum of squares	Average distance from centroid	Maximum distance from centroid
Cluster1	64	782673	86.025	255.331
Cluster2	17	29442	30.216	89.954
Cluster3	10	2853	14.795	29.446
Cluster4	56	503201	69.890	204.499
Cluster5	76	1672434	133.810	255.837
Cluster6	92	2424270	133.861	350.955
Cluster7	25	109876	57.980	130.544
Cluster8	53	1100280	130.628	269.282
Cluster9	54	298448	66.971	149.588
Cluster10	21	30413	19.833	163.138
Cluster11	74	1716916	135.897	256.046
Cluster12	77	685568	87.349	179.014
Cluster13	42	369169	89.239	142.770
Cluster14	102	1544251	102.776	211.638
Cluster15	54	637878	99.461	196.873
Cluster16	25	25990	26.629	80.477
Cluster17	50	271372	66.189	110.164
Cluster18	292	2014801	70.188	182.737
Cluster19	104	83557	25.118	50.396
Cluster20	16	124170	81.148	132.649

The information in Table 4.8 shows the cluster number in column one. The cluster number is associated with a factor score combination that can be considered a size. The second column gives the total number of observations in the data that are within that cluster. The remaining columns explain the sum of squares for the cluster, the average distance a subject's factor scores were from the centroid, and the maximum distance that a single subject was from the centroid. Again like the males, the aim was to acquire around 90 percent of the sample observations with the minimum number of clusters.

Table 4.9 Cluster Analysis Centroids

Variable	Cluster1	Cluster2	Cluster3	Cluster4	Cluster5	Cluster6	Cluster7
Factor1	130.938	181.378	213.41	246.49	301.35	361.20	445.97
Factor2	93.188	193.491	250.90	311.52	415.52	526.86	684.98
Factor3	-162.079	-720.834	-1052.71	-1401.14	-1983.80	-2616.43	-3509.62

Variable	Cluster8	Cluster9	Cluster10	Cluster11	Cluster12	Cluster13
Factor1	496.09	536.73	572.55	617.94	680.98	740.60
Factor2	787.84	864.47	928.38	1019.54	1135.19	1248.68
Factor3	-4089.48	-4526.42	-4890.88	-5405.48	-6061.53	-6701.86

Variable	Cluster14	Cluster15	Cluster16	Cluster17	Cluster18	Cluster19
Factor1	780.01	816.81	851.64	884.22	913.37	950.39
Factor2	1326.16	1395.72	1462.10	1522.03	1580.20	1648.41
Factor3	-7138.00	-7533.28	-7910.29	-8248.53	-8577.10	-8961.52

Variable	Cluster20	Grand centroid
Factor1	413.97	653.83
Factor2	629.10	1085.75
Factor3	-3200.62	-5778.92

The maximum number of sizes that were to be extracted, like males was chosen at twenty, because it was felt that more than twenty would be difficult to manufacture. Fourteen sizes were selected from the cluster analysis based on the frequency of observations. The sizes were clusters 1, 4, 5, 6, 8, 9, 11, 12, 13, 14, 15, 17, 18, and 19 which can be seen in Table 4.9. There were a total of 1,190 subjects that were within these sizes, thus accounting for 91.3 percent of the sample population. The measurements for the sizes were created by finding an individual in the data that was closest to the three factor scores and using their dimensions. A full list of dimensions for the sizes can be found in Appendix E. The tolerance limits to be used in manufacturing can be found in Appendix G.

The reduced sizes have all 46 measurements, so designers can choose measurements that are critical to their design. For example designers of bicycle riding gloves do not necessarily need finger lengths because the majority of bicycle gloves have the finger tips removed. Instead the designers would be more interested in the finger circumferences and palm measurements that can be obtained from the sizing chart in Appendix D for males and Appendix E for females.

4.2.3.1 Method II Procedure

A step by step procedure of how to use the Method II sizing charts for males and females is presented in this section. The procedure shows designers how to use the sizing charts and tolerance limits in the creation and manufacturing of gloves. This procedure differs from the Method I procedure because Method I uses combinations of three factors, where the sizes in Method II the factor combinations are predetermined and are intended to be used in the creation of hand manikins.

1. The first step requires the designer to choose the hand size to be manufactured. In this case the designer wants to make a manikin for size one.
2. Once the size has been chosen the designer can extract the measurements for the manikin from Appendix B. In this example a designer needs the measurements for size one. The designer finds chart for females and the row for size one and selects all of the dimensions that are located on the row for size one. There are 46 measurements that are in the row labeled size one.
3. The designer now has 46 dimensions that can be used to create a hand manikin. A glove can be manufactured around the manikin.

4. To make sure the glove will provide the required fit, the designer will check the final glove dimensions and specifications with the tolerance limits which are located in Appendix F for males and Appendix G for females. If an individual's dimensions fall within the tolerance limits for a particular size, then that size should be considered for that individual.

4.2.4 Comparison of the Sizing Methods

As discussed in Section 3.3 the system using HL and HC that was developed by Kwon et al. (2009) was the basis of comparison for the two sizing systems that were developed using factor analysis. This was accomplished by comparing the quality of fit between the systems. Fit was described as the minimal play or space between the inner glove wall and subjects fingers for only HL and HC. It was assumed that the smaller the distance between the individual's hand and the glove, provide the best fit. To calculate the fit, the distance for each individual in the ANSUR data to the nearest size value was measured. The average of all the distances was calculated. This gave the average distance between the subjects measured values and the size that was created.

The smaller the mean distance between subjects and the nearest size was associated with a better fit for the population. Microsoft Excel © was used to calculate the means. Each subject's measurement was placed in a table and the distance for each subject's measurement to the nearest size was calculated. The average for both systems was found and a Student's paired t-test can be used to compare the means since all of the systems being compare were created from the ANSUR database. A sample calculation can be seen in Appendix I. Method I and Method II were compared individually with

Kwon's system. Since the system developed by Kwon used two measurements, HL and HC, only these two measurement sizes can be compared.

For example in the top comparison box in Table 4.9, male hand length for Method I is being compared to male hand length for Kwon's system. The mean distance for Method I is smaller, but the paired t-test was used determine if the comparison is statistically significantly different. The null hypothesis is $\mu_{Method} - \mu_{Kwon} \geq 0$ versus the alternative hypothesis of $\mu_{Method} - \mu_{Kwon} < 0$. If the null hypothesis is rejected than it can be assumed that the factor analysis method provides a statistically significant better fit.

Table 4.9 Male Hand t-test Comparisons

Dimension	**System**	**Mean (cm)**	$\mathbf{t_{calc}}$	$\mathbf{t_{0.05,1002}}$
HL	Method I	2.55		
HL	Kwon	3.19	-6.33*	-1.65
Dimension	**System**	**Mean (cm)**	$\mathbf{t_{calc}}$	$\mathbf{t_{0.05,1002}}$
HC	Method I	2.81		
HC	Kwon	3.28	-9.05*	-1.65
Dimension	**System**	**Mean (cm)**	$\mathbf{t_{calc}}$	$\mathbf{t_{0.05,1002}}$
HL	Method II	2.18		
HL	Kwon	3.19	-13.45*	-1.65
Dimension	**System**	**Mean (cm)**	$\mathbf{t_{calc}}$	$\mathbf{t_{0.05,1002}}$
HC	Method II	3.73		
HC	Kwon	3.28	3.275	-1.65

*- Reject Ho

The comparison Table 4.9 shows the dimension that were compared in column one which either contains an HL for Hand Length or HC for Hand Circumference. The

two systems of comparison are in column two which is labeled System. The third column gives the mean distance for each subject to the nearest size measured in millimeters. The fifth column displays the computed t-calculated value for the comparison. The sixth column gives the t-critical value which is set for a one tailed test at alpha equal to 0.05 and 2,004 degrees of freedom.

An asterisk next to each t-calculated indicates all significant differences in means. It was found that all of the comparisons for males were significant at the alpha equal to 0.05 level except for HC for Method II. The sizes for both HL and HC for Method I had significantly smaller mean values. The sizes for HL for Method II were also significantly smaller than the mean distances for Kwon's system. The HC for Method II compared to the system developed by Kwon et al (2009) was found to be not significant.

Table 4.10 Female Hand t-test Comparisons

Dimension	**System**	**Mean (cm)**	t_{calc}	$t_{0.05,1303}$
HL	Method I	3.40		
HL	Kwon	3.16	2.56	-1.65
Dimension	**System**	**Mean (cm)**	t_{calc}	$t_{0.05,1303}$
HC	Method I	3.20		
HC	Kwon	3.69	-6.34*	-1.65
Dimension	**System**	**Mean (cm)**	t_{calc}	$t_{0.05,1303}$
HL	Method II	2.22		
HL	Kwon	3.16	-8.52*	-1.65
Dimension	**System**	**Mean (cm)**	t_{calc}	$t_{0.05,1303}$
HC	Method II	1.33		
HC	Kwon	3.69	-44.52*	-1.65

*-Reject Ho

The information in Table 4.9 is similar to Table 4.10 but only for females. HL and HC were compared using the student's paired t-distribution. The t-calculated values for all of the comparisons were significant except for HL for Method I. The mean distance values for HC for both Method I and Method II and HL for Method II were significantly smaller than the mean values for the female sizing structure of Kwon et al (2009).

CHAPTER 5
Discussion

5.1 General Discussion

The first objective of the thesis was to place the variables from the ANSUR database into groups using factor analysis. Factor analysis was very helpful in the organization of variables and arranging them together through correlation. This increased the simplicity of interpretation and allowed for a sizing system to be developed from the factor scores which was the second objective. The factor analysis approach yielded results similar to those of Kouchi et al. (2005). Kouchi's (2005) method developed two factors that were related to hand length and hand circumference. The first two factors from the factor analysis using the ANSUR data were also hand length and hand circumference related measurements. The addition of a third factor found that the palm and thumb measurements increased the amount of variability that was explained.

The third objective to develop two sizing systems from the variable groups using factor scores was successful. The first sizing system used percentile divisions and the second system used cluster analysis of observations to identify sizes. Both of these methods and the fourth objective of comparing the systems to the system created by Kwon et al. (2009) are discussed in detail in Section 5.2.

5.2 Sizing

Two methods were developed using the factor scores obtained from the multivariate factor analysis. The methods were compared to the Kwon et al (2009) sizing system and showed indications that the new systems provide better fit. The results of the

comparisons and future work using a computer sizing method will be discussed in this section.

5.2.1 Method I

Method I is a hand sizing system that is designed for specialized glove manufacturing industries that require many sizes and measurements. The method when compared to Kwon's sizing system provided better fit regards to hand length and hand circumference measurements. The results for males showed that both measurements of hand length and hand circumference provided closer fit for the 1,003 subjects. The female results found that hand circumference was improved, but the hand length sizes there was no improvement. Although there are indications that this system provides a better fit, Kwon's (2009) sizing system utilizes only two measurements where the sizing system for Method I provides sizes that present information and values for 46 measurements.

5.2.2 Method II

Method II is a hand sizing system that is designed for mass production of gloves for textile manufacturing industries. The method of cluster analysis to identify key sizes when compared to Kwon's (2009) had results that indicated better fit for the subjects. The HL and HC sizes for females provided an improved fit for the sample population. As mentioned before Kwon's (2009) method only used two measurements, so it is difficult to compare the other 44 sizing dimensions. The male sizes provided a closer fit for HL, but HC did not provide a statistically significant decrease in gaps between the subjects and the nearest sizes.

Since it may not be feasible for a designer to measure all 46 measurements on a subject, a system using only nine measurements could be created. The nine measurements were created by taking three measurements from each factor. The factor score can still be generated by extrapolating a few measurements from each factor on the sizing chart in Appendices D and E to acquire the remaining measurements in each factor, because the variables within each factor have minimal variance between them. More data analysis and research would be required to make this a feasible option.

5.2.3 Future Work

The data and measurements that were created from the sizing system can be used to develop 3D hand models and software similar to those created by Kouchi et al (2005). The system would be able to determine a specific factor score for an individual calculated from a few key measurements of a subject. The key variables would be evaluated using further statistical analysis on the factor variables to decide which dimensions can be used to predict the factor scores. Regression analysis could be used to develop predictors for the factor scores, so only five or six measurements could be taken and a size could be generated at each factor.

The software would also construct specification limits for the sizes from the factor scores. The factor sizes could then give the designer a three dimensional model to develop the glove around. The model would be specific for the individual and could be saved for future glove designs. The computer generated size should be able to provide an exact fit for the subject's hand. This would eliminate the use of hand molds and plaster

castings, which are currently used by NASA to produce gloves for its astronauts. Further analysis and research would be required to make this possible.

References

Adebisi, S.S. (2008). Medical impacts of anthropometric records. *Annuals of African Medicine*, *7*(1), 42-47.

Akel, R., Ataya, A., Daoud, J., Kanaan, C., Radwan, G., Shmeis, A., & Habib, R.R. (2009). Musculoskeletal disorders among lebanese office workers. *17th World Congress on Ergonomics: International Ergonomics Association*.

Bogin, Barry. (1999). *Patterns of human growth*. New York, NY: Cambridge Univ Pr.

Chandarsekaran, M., Gnaneswaram, V., Rajulu, S., & Bishu, R. (2009). Principle component analysis of anthropometric data: a revisit of a different approach. *17th World Congress on Ergonomics: International Ergonomics Association*.

Chung, M.J., Lin, H.F., & Wang, M.J. (2007). The Development of sizing systems for taiwanese elementary and high school students. *International Journal of Industrial Ergonomics*, *37*, 707-716.

Duffy, Vincent. (2007). *Digital human modeling*. Springer-Verlag New York Inc.

Fernandez, J., Malzahn, D., Eyada, O. & Kim, C. (1989). Anthropometry of Korean female industrial workers. *Ergonomics*, *32*(5), 491-495.

Gnaneswara, Vettrivel. (2005). An Evaluation of anthropometrics and hand performance of four ethnic population. *Unpublished Thesis Presented at The University of Nebraska-Lincoln*.

Gordon, C.G., Churchill, T., Clauser, C.E., Bradtmiller, B., Tebbets, I., Walker, R., & McConville, J.T. (1989). 1988 anthropometric survey of u.s. army personnel: Methods and Summary Statistics. *Technical Report NATICK*.

Graziosi, D., Stein, J., Ross, A., & Kosmo, J. (2001). Phase vi advanced eva glove development and certification for the international space station. *Society of Automotive Engineers*.

Greiner, Thomas M. (1991). hand anthropometry of u.s. army personnel. *Technical Report NATICK*.

Groshong, K. (2006, February 09). *NASA unveils its toughest challenges yet*. Retrieved from http://www.newscientist.com/article/dn8701-nasa-unveils-its-toughest-challenges-yet.html

Guan, Jinhua, Bradtmiller, Bruce, Hsiao, Hongwei, & Spahr, James. (2009). Anthropometric changes among u.s. truck drivers. *17th World Congress on Ergonomics: International Ergonomics Association*.

Heiney, A.C. (2009, November 03). *Inventors answer call of nasa*. Retrieved from http://www.nasa.gov/topics/technology/features/glove_2009.html

Hidson, D. (1991). Development of a standard anthropometric dimension set for use in computer-aided glove design. *Defense Research Establishment of Ottawa. DREO Technical Note 91-22*.

Hodges, L., & Adams, J. (2007). Grip strength and dexterity: a study of variance between right- and left-handed healthy individuals. *Hand Therapy*, *12*(1), 15-21.

Hrdlicka, Ales. (1919). *Physical anthropology: its scope and aims; its history and present status in the united states*. Philadelphia, PA: The Wistar Institute of Anatomy and Biology.

Imrhan, S.N., Nguyen, M.T., & Nguyen, N.N. (1993). Hand anthropometry of americans of vietnamese origin. *International Journal of Industrial Ergonomics*, *12*, 281-287.

Imrhan, S. N. & Younes, S. (1996). Comparison of Anthropometric Ratios across Populations. *Advances in Occupational Ergonomics and Safety I, Edited by A. Mital, H. Krueger, S. Kumar, M. Menozzi and J. Fernandez. International Society for Occupational Ergonomics and Safety, Cincinnati, Ohio, USA, Volume 1*, 66-70.

Jenkins, Simon. (2005). *Sports science handbook: the essential guide to kinesiology, sport, and exercise science, volume 1, a-h*. Multi-Science Publishing Co.

Karwowski, Waldemar. (2006). *International encyclopedia of ergonomics and human factors*. CRC Press.

Kishtwaria, J., & Rana, A. (2009). Gender sensitive protective technologies for tea pluckers. *17th World Congress on Ergonomics: International Ergonomics Association*.

Kouchi, M., Miyata, N., & Mochimaru, M. (2005). An Analysis of hand measurements for obtaining representative japanese hand models. *SAE International Conference*.

Krishnamoorthi, K.S. (2006). *A First course in quality engineering*. Upper Saddle River, NJ: Prentice Hall.

Kroemer, K., Kroemer, H., & Kroemer-Elbert, Katrin. (2001). *Ergonomics: how to design for ease and efficiency*. Upper Saddle River, NJ: Prentice Hall.

Kwon, O., Jung, K., You, H., & Kim, H.E. (2009). Determination of key dimensions for a glove sizing system by analyzing the relationships between hand dimensions. *Applied Ergonomics*, *40*, 762-766.

Mathiassen, S.E., & Ahsberg, E. (1999). Prediciton of shoulder flexion endurance from personal factors. *International Journal of Industrial Ergonomics*, *24*(3), 315-329.

Meunier, P., Shu, C., & Xi, P. (2009). Revealing the internal structure of human variability for design purposes. *17th World Congress on Ergonomics: International Ergonomics Association*.

Minitab (Version 14.20) [Computer Software]. (2005). Minitab Inc.

Molenbroek, J.F.M., & Zhang, B. (2000). Anthropometry of elderly and disabled with special attention to (wheel) chair design. *Ergonomics for the New Millennium. Proceedings of the XIVth Triennial Congress of the International Ergonomics Association and 44th Annual Meeting of the Human Factors and Ergonomics Society, San Diego, California, USA, July 29-August 4, 2000.*, 704-707.

Nakamura, Y., & Okamura, K. (1998). Seasonal variation of sweating responses under identical heat stress. *Applied Human Science*, *17*(5), 167-172.

Pheasant, Stephen, & Haslegrave, C. (2006). *Bodyspace*. CRC Press.

Ramakrishnan, B., Bronkema, L.A., & Hallbeck, M.S. (1994). Effects of grip span, wrist position, hand and gender on grip strength. *Human Factors and Ergonomics Society Annual Meeting Proceedings, Industrial Ergonomics*, 554-558.

Robinette, K.M., & Annis, J.F. (1986). A Nine size system for chemical defense gloves. technical. *Anthropology Research Project, Inc., Yellow Springs, OH (USA)*.

Rosenbald-Wallin, E. (1987). An anthropometric study as the basis for sizing anatomically designed mittens. *Applied Ergonomics*, *18*(4), 329-333.

Ruiz-Ruiz, J., Mesa, J.L.M., Gutierrez, A., & Castillo, M.J. (2002). Hand size influences optimal grip span in women but not men. *American Society for Surgery of the Hand*, *27*, 897-901.

Seaver, Jay W., A.M., M.D. (1905). *Anthropometry and physical examination*. New Haven, CT: Press of the Dorman Lithographing Co.

Smallwood, J.J., & Haupt, T.C. (2009). Construction ergonomics: perspectives of female and male production workers. *17th World Congress on Ergonomics: International Ergonomics Association*.

Spahr, J., Bradtmiller, B., & Guan, J. (2009). Hand dimensions of hispanic and other ethnic group meat processing works. *17th World Congress on Ergonomics: International Ergonomics Association*.

Stearns, Peter. (2007). *The Industrial revolution in world history*. Westview Pr.

Thai, K.T., Pang, T.Y., McIntosh, A.S., & Schilter, E. (2009). Helmet stability and fit in australian pedal and motor cyclist. *17th World Congress on Ergonomics: International Ergonomics Association*.

Ulijaszek, S.J., Johnston, F.E., & Preece, M.A. (1998). *The Cambridge encyclopedia of human growth and development*. Cambridge University Press.

University of Wisconsin-Madison. (1998, August 26). *Factor Analysis versus PCA*. Retrieved February 12, 2010, from http://psych.wisc.edu/henriques/pca.html

Veitch, Daisy. (2009). Sizing up Australia: What use have designers made of anthropometric data. *17th World Congress on Ergonomics: International Ergonomics Association*.

Veitch, D., & Davis, B. (2009). Practical application of 3d data for apparel industry use. *17th World Congress on Ergonomics: International Ergonomics Association*.

Wickens, Christopher. (2004). *An Introduction to human factors engineering*. Upper Saddle River, NJ: Prentice Hall.

Wong, A., & Tay, Z. (2009). Desing smart homes for families in singapore- integrateing smart home technologies into daily living of elderly. *17th World Congress on Ergonomics: International Ergonomics Association*.

Zhang, B., & Molenbroek, J.F.M. (2009). Application of 3d anthropometry data in headwear product design. *17th World Congress on Ergonomics: International Ergonomics Association*.

Zulch, G., Becker, M., & Linsenmaier, W. (2009). Modeling and simulation of human performance changes in assembly systems due to aging. *17th World Congress on Ergonomics: International Ergonomics Association*.

Appendix

Appendix A Factor Scores
Male Factor Scores

SUBJNO	Factor1	Factor2	Factor3
2287.00	96.68	98.31	56.39
320.00	98.05	91.53	47.09
7199.00	102.71	89.39	46.27
5325.00	107.09	87.60	40.43
19180.00	107.33	87.80	46.42
13570.00	107.73	86.42	41.78
21822.00	107.95	95.47	41.25
20197.00	108.38	87.92	39.45
14192.00	108.89	88.17	52.00
23567.00	108.94	89.64	42.05
6219.00	109.24	88.65	47.42
16966.00	109.75	85.46	40.51
23617.00	110.12	91.16	46.63
7714.00	110.15	88.21	43.45
6218.00	110.17	88.01	40.83
22691.00	110.58	87.32	38.03
20423.00	110.71	87.33	47.43
5300.00	111.32	87.16	40.69
20070.00	111.54	85.07	37.65
24180.00	111.96	87.53	49.64
3041.00	112.17	90.90	43.14
123.00	112.43	86.66	41.87

SUBJNO	Factor1	Factor2	Factor3
19399.00	112.54	87.86	39.83
4891.00	112.59	89.82	41.38
5106.00	112.64	88.42	43.80
20674.00	112.65	87.01	42.01
6531.00	112.66	86.86	48.16
5221.00	112.75	86.87	44.08
17684.00	112.77	91.53	41.04
7328.00	112.82	86.24	50.90
9944.00	112.83	87.49	45.51
5031.00	112.89	94.37	44.33
16853.00	112.92	87.76	36.66
15799.00	112.95	87.32	36.02
5153.00	113.03	89.05	52.32
224.00	113.26	88.08	43.74
17262.00	113.28	92.50	43.66
16271.00	113.38	88.87	45.01
20453.00	113.39	83.14	32.63
23835.00	113.41	87.18	38.97
1474.00	113.53	86.73	44.36
24187.00	113.53	90.73	45.24
12964.00	113.59	88.69	43.96
19732.00	113.62	89.78	41.08

SUBJNO	Factor1	Factor2	Factor3
24229.00	113.98	94.16	35.10
6030.00	114.13	93.53	45.66
10757.00	114.16	93.53	50.56
13498.00	114.19	87.96	47.89
20586.00	114.20	87.47	45.37
14198.00	114.29	87.02	46.78
5014.00	114.31	88.44	39.75
3253.00	114.40	89.56	46.42
5826.00	114.40	92.32	43.37
682.00	114.42	90.44	36.99
4253.00	114.48	86.50	47.71
19985.00	114.48	87.86	37.42
15546.00	114.49	91.90	46.04
21384.00	114.61	88.22	41.02
22323.00	114.63	87.95	40.96
5069.00	114.65	88.03	44.29
14182.00	114.69	88.93	41.27
12642.00	114.81	86.11	37.73
23492.00	114.84	87.83	42.98
20705.00	114.85	88.74	48.02
19484.00	114.86	89.91	43.61
222.00	114.89	86.69	45.53
15694.00	115.02	91.41	50.10
19091.00	115.08	92.86	40.52
22282.00	115.08	89.64	44.53

SUBJNO	Factor1	Factor2	Factor3
7739.00	115.20	85.44	45.12
18882.00	115.22	93.07	35.68
15174.00	115.23	88.93	44.52
16717.00	115.28	88.68	40.25
3627.00	115.30	87.03	38.87
3319.00	115.35	84.17	49.60
22277.00	115.40	88.65	44.35
481.00	115.49	88.01	52.67
6252.00	115.56	91.21	43.13
2627.00	115.59	89.93	42.32
21915.00	115.63	87.02	39.75
12003.00	115.71	87.97	41.59
18937.00	115.75	88.40	35.66
23363.00	115.90	89.79	35.63
20159.00	115.90	87.34	43.09
24175.00	115.91	95.03	40.83
2481.00	115.93	89.02	45.47
17662.00	115.96	89.15	50.58
7590.00	116.06	84.44	48.94
23714.00	116.10	88.93	45.01
21717.00	116.12	87.64	44.65
386.00	116.26	84.04	48.10
21738.00	116.27	87.46	48.64
18944.00	116.28	90.08	47.94
16820.00	116.30	88.12	41.46

SUBJNO	Factor1	Factor2	Factor3
2988.00	116.32	90.76	47.38
7274.00	116.35	86.93	43.73
8530.00	116.37	87.57	55.67
5433.00	116.45	96.44	40.91
20880.00	116.49	89.26	44.70
15680.00	116.50	88.33	52.08
24371.00	116.61	88.17	46.48
18240.00	116.63	90.74	39.46
6233.00	116.66	89.11	49.15
9101.00	116.67	87.29	46.46
23701.00	116.68	88.04	38.86
19181.00	116.69	85.11	41.15
12095.00	116.70	88.31	44.18
2257.00	116.71	86.54	43.93
11816.00	116.73	88.19	46.07
23597.00	116.76	85.23	38.94
6245.00	116.80	92.42	43.15
19046.00	116.86	86.38	38.89
5553.00	116.87	84.52	46.41
21778.00	116.89	87.40	47.60
23260.00	116.99	91.26	39.81
11148.00	117.03	89.98	38.06
11959.00	117.05	86.20	43.32
4236.00	117.06	88.27	42.65
5322.00	117.10	87.37	44.90

SUBJNO	Factor1	Factor2	Factor3
16870.00	117.11	86.21	40.72
20439.00	117.17	89.58	46.63
302.00	117.23	87.11	43.17
18502.00	117.24	87.57	44.89
23590.00	117.27	86.68	46.32
24414.00	117.28	89.95	39.34
15754.00	117.31	87.75	40.52
13787.00	117.37	86.39	38.42
17164.00	117.38	87.98	40.99
475.00	117.42	86.88	41.94
20667.00	117.45	85.79	35.85
7583.00	117.48	88.52	48.79
14277.00	117.53	86.74	40.75
25972.00	117.56	94.65	45.64
704.00	117.67	87.89	40.13
321.00	117.68	85.44	45.73
861.00	117.75	89.98	50.41
14975.00	117.86	88.51	44.39
23619.00	117.93	85.91	41.16
11916.00	117.93	89.42	46.76
23868.00	117.96	86.95	38.38
24186.00	118.01	91.59	35.30
16565.00	118.03	88.22	45.95
855.00	118.07	85.26	49.45
24205.00	118.08	90.19	49.11

SUBJNO	Factor1	Factor2	Factor3
21880.00	118.08	87.99	46.52
384.00	118.14	84.62	40.39
11406.00	118.19	87.23	42.68
12013.00	118.24	86.30	41.24
5649.00	118.24	82.88	46.05
16850.00	118.25	88.30	40.02
4996.00	118.26	88.01	46.24
13292.00	118.28	90.27	51.39
14246.00	118.29	88.52	42.34
1720.00	118.29	89.66	38.93
16930.00	118.29	85.79	40.33
4277.00	118.40	90.48	39.10
7260.00	118.47	85.19	40.98
425.00	118.50	85.44	49.50
8897.00	118.57	87.15	42.25
14382.00	118.59	87.63	42.28
6572.00	118.59	86.58	56.67
21900.00	118.61	89.58	45.58
492.00	118.66	93.94	45.36
18516.00	118.67	88.52	51.26
6867.00	118.72	94.06	45.39
322.00	118.73	87.86	49.47
7981.00	118.76	87.22	48.36
19477.00	118.78	87.44	42.92
11330.00	118.79	85.94	42.77

SUBJNO	Factor1	Factor2	Factor3
19242.00	118.87	88.30	51.30
14861.00	118.89	89.71	43.23
22672.00	118.91	87.35	37.35
5326.00	118.95	83.40	45.04
23717.00	118.97	88.37	44.63
8032.00	118.98	86.88	40.94
13569.00	119.00	88.29	38.40
23668.00	119.01	89.18	47.26
18335.00	119.05	88.48	40.02
297.00	119.05	83.93	46.32
12296.00	119.07	88.22	39.59
17604.00	119.08	87.91	41.13
5241.00	119.12	91.72	47.55
17595.00	119.15	88.61	36.28
4863.00	119.17	85.14	42.45
15131.00	119.21	85.82	36.69
21343.00	119.30	87.12	48.82
21881.00	119.31	89.05	45.79
19513.00	119.34	87.19	41.72
20703.00	119.40	85.96	40.72
4954.00	119.43	92.54	45.94
4824.00	119.44	89.06	45.08
19636.00	119.45	93.18	49.82
6372.00	119.48	87.15	47.96
7053.00	119.49	85.81	46.06

SUBJNO	Factor1	Factor2	Factor3
4272.00	119.50	86.80	48.12
22614.00	119.51	88.23	46.68
22327.00	119.52	88.52	44.34
13825.00	119.53	87.71	42.04
18401.00	119.55	93.05	46.24
22232.00	119.55	90.45	44.68
5357.00	119.56	86.27	37.31
5270.00	119.56	95.01	46.74
17285.00	119.60	87.96	41.58
14487.00	119.62	90.41	45.15
23458.00	119.63	90.03	51.35
14415.00	119.63	87.16	43.30
20387.00	119.69	90.35	39.81
23615.00	119.71	88.98	42.77
21902.00	119.73	87.24	40.76
6211.00	119.73	85.43	44.19
6250.00	119.74	86.56	42.96
8782.00	119.75	86.21	43.39
2340.00	119.80	87.51	42.16
426.00	119.84	85.75	48.96
20503.00	119.85	87.31	34.15
20583.00	119.86	89.07	43.21
1794.00	119.87	92.62	51.03
24423.00	119.88	89.90	53.30
22314.00	119.89	86.93	43.10

SUBJNO	Factor1	Factor2	Factor3
5333.00	119.95	90.88	50.77
2357.00	120.00	91.38	45.80
14201.00	120.00	87.37	42.96
25969.00	120.03	92.94	38.69
24177.00	120.03	91.15	42.81
5494.00	120.04	83.40	46.72
25965.00	120.10	86.79	42.62
23305.00	120.16	88.40	50.47
23864.00	120.19	94.68	47.25
12056.00	120.20	87.34	45.26
25971.00	120.25	90.76	45.20
12307.00	120.29	89.94	51.81
20071.00	120.31	86.50	39.68
18939.00	120.31	91.56	37.01
14958.00	120.32	87.56	43.62
15782.00	120.34	88.44	41.21
22611.00	120.36	87.23	45.45
24209.00	120.37	89.93	41.06
24182.00	120.37	86.66	37.05
12228.00	120.39	85.38	34.44
5100.00	120.40	84.42	36.77
13638.00	120.40	88.28	44.14
6050.00	120.41	86.40	44.94
11189.00	120.41	88.55	49.31
15082.00	120.42	85.87	38.26

SUBJNO	Factor1	Factor2	Factor3
12149.00	120.42	85.27	35.23
16964.00	120.43	88.30	41.49
18391.00	120.44	91.62	47.13
8980.00	120.45	89.16	44.47
3303.00	120.46	86.27	40.04
20575.00	120.47	87.40	42.24
19497.00	120.49	85.87	40.69
16903.00	120.49	85.78	38.60
2250.00	120.49	85.57	45.16
20366.00	120.50	83.94	39.14
12616.00	120.52	86.74	39.42
3631.00	120.53	85.51	45.67
25983.00	120.55	90.25	35.75
18176.00	120.56	89.09	40.62
5827.00	120.57	82.24	44.40
4329.00	120.58	84.94	42.89
18477.00	120.61	87.14	41.62
11881.00	120.62	86.17	43.18
3883.00	120.64	86.19	49.13
23722.00	120.66	90.73	43.73
18588.00	120.67	87.17	41.78
7774.00	120.73	90.15	52.50
6057.00	120.73	85.38	51.17
3043.00	120.74	88.73	45.88
7579.00	120.77	87.72	49.25

SUBJNO	Factor1	Factor2	Factor3
11506.00	120.78	88.33	40.88
1189.00	120.81	82.60	46.60
762.00	120.82	88.91	49.79
315.00	120.82	85.70	42.71
20968.00	120.83	85.90	41.31
310.00	120.86	87.04	47.20
8706.00	120.86	87.61	41.93
22355.00	120.88	89.45	45.78
21918.00	120.89	86.82	42.18
18847.00	120.90	86.96	48.98
14500.00	120.92	88.97	50.26
13824.00	120.93	85.77	44.66
16330.00	120.93	89.60	38.08
18214.00	120.97	89.62	47.22
21541.00	120.97	89.09	41.81
13810.00	121.00	86.51	40.56
12580.00	121.01	83.83	37.50
5323.00	121.02	84.33	52.53
3884.00	121.02	87.50	47.38
23648.00	121.05	93.17	44.39
5312.00	121.05	87.88	51.69
4268.00	121.10	86.76	41.74
19178.00	121.11	86.95	45.07
11535.00	121.11	88.39	48.90
10113.00	121.12	83.37	41.99

SUBJNO	Factor1	Factor2	Factor3
1648.00	121.15	87.21	41.76
17027.00	121.17	87.34	44.39
20963.00	121.17	88.80	44.81
16351.00	121.21	90.13	48.04
419.00	121.25	86.63	47.57
311.00	121.25	83.31	47.21
21347.00	121.26	86.33	45.82
15125.00	121.26	85.14	34.00
7337.00	121.29	88.44	53.73
5205.00	121.30	88.49	40.02
228.00	121.31	86.26	47.07
6371.00	121.36	85.43	34.26
24400.00	121.39	89.33	47.09
21807.00	121.43	89.86	48.09
16612.00	121.44	90.18	43.34
6647.00	121.48	81.91	43.98
18425.00	121.50	88.93	46.86
14208.00	121.50	86.64	45.62
16673.00	121.53	88.86	37.49
4274.00	121.54	86.11	46.66
2226.00	121.59	83.04	44.88
18591.00	121.60	89.77	47.56
16892.00	121.61	88.65	43.57
15130.00	121.61	93.30	32.47
3813.00	121.63	89.51	43.60

SUBJNO	Factor1	Factor2	Factor3
18137.00	121.65	96.51	34.62
9867.00	121.67	89.81	42.90
22329.00	121.70	87.89	43.09
24450.00	121.75	93.06	41.78
406.00	121.76	85.64	48.61
2300.00	121.77	84.89	48.61
6653.00	121.78	83.78	40.48
21794.00	121.84	88.48	52.47
15781.00	121.84	90.94	39.71
15727.00	121.86	91.84	44.39
11255.00	121.88	88.59	48.35
21917.00	121.88	88.15	45.89
6311.00	121.88	85.08	54.33
6118.00	121.89	91.13	50.14
12591.00	121.93	86.47	45.94
17056.00	121.94	83.96	43.02
15438.00	121.95	86.65	42.50
16885.00	121.96	86.01	40.16
11962.00	121.96	88.76	46.49
18532.00	121.96	89.42	43.26
20770.00	121.97	90.11	43.85
23841.00	121.98	90.59	51.89
16961.00	122.00	85.55	41.21
21598.00	122.01	87.47	52.03
18565.00	122.07	86.19	43.59

SUBJNO	Factor1	Factor2	Factor3
13811.00	122.07	87.14	43.90
11224.00	122.12	85.99	43.83
11541.00	122.13	86.65	44.09
18203.00	122.18	92.46	41.90
16895.00	122.18	86.55	40.38
16283.00	122.20	87.58	44.10
16827.00	122.20	85.25	42.26
15561.00	122.20	88.23	38.99
5013.00	122.23	85.74	46.20
19125.00	122.24	89.47	49.01
21861.00	122.25	89.20	50.32
16256.00	122.29	89.36	43.42
15705.00	122.37	87.04	41.41
6137.00	122.39	88.76	44.96
17309.00	122.41	87.65	42.06
7842.00	122.42	83.90	52.00
18139.00	122.44	91.37	47.85
7219.00	122.45	85.59	47.99
20520.00	122.46	89.01	45.14
11346.00	122.50	87.28	46.99
13180.00	122.50	86.61	36.35
6179.00	122.51	86.16	43.81
11964.00	122.52	88.17	44.46
20714.00	122.53	89.51	41.31
22559.00	122.56	87.72	41.74

SUBJNO	Factor1	Factor2	Factor3
23592.00	122.58	88.49	43.41
13763.00	122.59	87.01	41.55
22758.00	122.60	88.97	44.21
5290.00	122.61	91.29	48.29
13632.00	122.63	87.82	41.95
12937.00	122.64	83.50	42.69
24132.00	122.65	87.86	43.57
4460.00	122.65	82.67	49.72
9779.00	122.67	87.62	45.48
1343.00	122.70	87.82	48.43
24140.00	122.70	87.75	41.77
24276.00	122.70	88.88	41.68
20442.00	122.71	85.91	39.44
20696.00	122.72	86.86	36.64
11432.00	122.73	86.85	52.58
15865.00	122.73	88.28	47.39
15702.00	122.75	91.12	45.49
13170.00	122.75	88.57	37.89
14966.00	122.76	92.14	45.46
23318.00	122.83	91.95	46.92
706.00	122.84	85.42	54.64
3638.00	122.86	85.07	47.10
8132.00	122.88	85.86	36.98
18823.00	122.88	90.12	52.05
20984.00	122.90	86.25	43.48

SUBJNO	Factor1	Factor2	Factor3
13398.00	122.90	87.33	39.68
11469.00	122.91	85.35	34.91
4783.00	122.96	90.65	51.35
24192.00	123.00	87.80	34.43
18437.00	123.01	87.84	36.93
2244.00	123.02	86.09	45.51
407.00	123.03	85.81	51.90
3585.00	123.03	85.70	50.22
20505.00	123.03	87.55	41.71
16859.00	123.04	87.23	47.22
23510.00	123.05	90.37	44.69
17737.00	123.06	86.52	40.06
7272.00	123.08	84.70	45.83
17383.00	123.09	86.63	42.27
852.00	123.10	89.80	50.13
13300.00	123.10	88.59	47.18
19214.00	123.10	90.24	48.53
21862.00	123.14	88.09	46.17
8058.00	123.18	86.26	49.50
11808.00	123.21	89.79	49.65
6214.00	123.26	84.07	48.12
15006.00	123.28	88.22	38.77
21942.00	123.29	87.82	41.02
11974.00	123.29	85.79	37.37
15138.00	123.30	92.77	40.15

SUBJNO	Factor1	Factor2	Factor3
18885.00	123.31	86.52	38.24
20529.00	123.33	88.92	47.98
18412.00	123.34	88.11	42.06
2232.00	123.35	85.81	45.23
16849.00	123.35	91.64	53.17
13283.00	123.36	87.10	39.26
23809.00	123.37	91.45	38.80
6208.00	123.43	87.01	43.23
20635.00	123.43	87.70	41.60
19244.00	123.44	90.12	46.59
17382.00	123.45	88.30	38.88
17116.00	123.46	88.60	43.80
13296.00	123.47	87.47	41.82
15678.00	123.50	85.02	40.41
22348.00	123.53	88.88	48.12
20980.00	123.53	90.26	46.31
4273.00	123.53	89.30	38.25
4452.00	123.55	90.76	48.16
8858.00	123.58	84.99	52.62
18125.00	123.61	90.75	43.95
23189.00	123.61	87.57	43.39
19092.00	123.64	88.51	39.37
6593.00	123.66	89.26	48.86
14962.00	123.67	87.51	43.93
1685.00	123.70	88.00	45.59

SUBJNO	Factor1	Factor2	Factor3
16665.00	123.71	86.87	41.21
19209.00	123.75	85.91	42.26
20205.00	123.78	89.46	43.83
6841.00	123.79	84.65	49.27
12927.00	123.79	86.18	37.16
18942.00	123.81	88.32	42.96
22332.00	123.88	87.91	37.28
10100.00	123.89	88.89	42.79
21117.00	123.93	88.80	46.87
220.00	123.96	88.09	48.57
5209.00	123.96	83.72	44.47
14900.00	123.98	88.42	42.11
14356.00	124.01	89.33	35.33
22352.00	124.02	85.63	40.52
15692.00	124.03	86.24	43.01
19144.00	124.03	90.57	44.82
22287.00	124.06	87.71	45.02
490.00	124.07	92.00	54.56
15679.00	124.08	87.54	41.15
15016.00	124.09	87.49	43.02
20923.00	124.12	86.57	44.40
19009.00	124.13	85.11	43.12
23472.00	124.14	89.36	42.07
16843.00	124.15	88.44	45.17
25968.00	124.16	89.96	41.97

SUBJNO	Factor1	Factor2	Factor3
18478.00	124.16	88.48	39.40
23624.00	124.17	88.16	49.70
20081.00	124.18	88.83	37.46
21736.00	124.19	88.47	44.07
18393.00	124.20	89.13	51.63
8976.00	124.20	86.04	52.69
21385.00	124.21	87.65	40.52
485.00	124.21	82.03	42.10
16995.00	124.21	86.96	49.33
11622.00	124.24	85.78	46.43
12657.00	124.25	88.55	41.17
5744.00	124.26	83.89	46.70
5959.00	124.26	85.28	49.27
16689.00	124.28	86.80	39.43
23476.00	124.28	87.15	41.03
316.00	124.32	84.52	49.60
23496.00	124.32	92.43	52.54
20655.00	124.33	89.57	41.83
22896.00	124.33	87.18	46.18
16558.00	124.34	85.64	40.84
23485.00	124.34	86.31	43.81
20651.00	124.37	85.09	46.56
15800.00	124.39	88.92	42.74
4514.00	124.40	86.22	51.96
15026.00	124.41	90.73	42.69

SUBJNO	Factor1	Factor2	Factor3
20899.00	124.42	89.05	39.30
118.00	124.43	85.41	40.42
12929.00	124.45	90.20	47.80
2630.00	124.48	92.42	46.60
22627.00	124.49	88.84	41.76
22779.00	124.53	88.51	49.82
17371.00	124.57	90.56	45.41
16841.00	124.58	88.55	50.07
17697.00	124.59	89.71	41.02
14917.00	124.61	89.27	47.90
11762.00	124.63	87.19	42.78
19983.00	124.69	88.87	46.96
20896.00	124.70	87.07	49.48
17561.00	124.71	88.51	42.25
17613.00	124.72	88.92	42.02
16522.00	124.73	91.32	50.11
5027.00	124.76	87.81	44.19
22706.00	124.77	86.11	34.31
17692.00	124.77	87.91	42.44
299.00	124.79	84.23	49.10
2960.00	124.79	85.72	51.48
411.00	124.80	85.27	51.17
13634.00	124.83	85.94	44.77
17626.00	124.84	90.69	42.06
5911.00	124.84	87.81	46.27

SUBJNO	Factor1	Factor2	Factor3
409.00	124.84	88.54	48.77
14238.00	124.85	86.68	45.08
295.00	124.92	82.25	47.12
23603.00	124.95	93.02	41.66
12289.00	124.99	88.71	43.23
6098.00	125.02	93.52	49.76
11933.00	125.05	86.58	40.89
20436.00	125.06	85.09	40.63
23606.00	125.06	84.88	44.24
17370.00	125.09	89.01	46.79
14399.00	125.15	87.41	43.12
21134.00	125.18	88.61	46.90
22641.00	125.20	84.69	44.36
15014.00	125.21	85.65	40.29
16720.00	125.24	84.84	40.47
21832.00	125.25	88.43	46.62
20969.00	125.29	89.23	50.58
15830.00	125.30	86.49	32.93
6334.00	125.32	89.34	54.84
22748.00	125.34	89.01	42.56
12534.00	125.35	82.67	36.85
12348.00	125.35	87.44	48.20
14386.00	125.36	85.17	39.19
14363.00	125.39	85.14	46.62
16791.00	125.47	87.99	39.93

SUBJNO	Factor1	Factor2	Factor3
15169.00	125.49	91.68	46.47
225.00	125.49	85.50	46.78
13386.00	125.54	88.05	46.62
17118.00	125.56	89.05	45.50
23602.00	125.56	87.87	40.84
21845.00	125.61	87.05	46.33
126.00	125.63	80.28	42.92
14362.00	125.67	85.75	44.79
14377.00	125.67	88.23	43.64
11192.00	125.68	87.45	47.45
23650.00	125.68	86.16	34.62
21229.00	125.68	89.38	43.75
7692.00	125.77	91.58	47.19
19986.00	125.77	87.62	41.15
13173.00	125.78	86.17	41.64
114.00	125.80	85.44	48.30
21461.00	125.81	91.75	46.46
18841.00	125.81	87.24	48.02
11291.00	125.81	82.58	40.75
20100.00	125.84	90.04	50.76
11515.00	125.86	88.36	47.84
14357.00	125.88	88.27	42.66
15760.00	125.90	88.25	44.78
6382.00	125.90	85.80	51.22
23224.00	125.90	85.89	44.56

SUBJNO	Factor1	Factor2	Factor3
15724.00	125.94	87.98	51.23
5206.00	125.95	87.65	54.34
19067.00	125.95	87.36	46.70
21913.00	125.99	88.28	44.09
7705.00	125.99	89.53	53.92
12888.00	125.99	88.73	45.74
19601.00	126.00	88.14	47.88
9792.00	126.06	90.27	51.16
8739.00	126.06	85.98	37.70
18106.00	126.06	83.16	39.45
13165.00	126.12	86.10	40.45
11239.00	126.12	87.07	42.06
6840.00	126.15	85.90	45.18
18696.00	126.18	89.15	41.68
7589.00	126.18	85.44	45.87
15756.00	126.20	88.02	44.61
9858.00	126.21	91.19	43.31
23591.00	126.22	87.14	40.98
11900.00	126.23	89.61	52.70
12928.00	126.30	87.70	47.67
5409.00	126.31	86.47	41.20
23460.00	126.32	87.99	42.56
15045.00	126.36	87.93	44.81
25963.00	126.36	92.59	39.91
18416.00	126.38	89.16	44.57

SUBJNO	Factor1	Factor2	Factor3
13642.00	126.39	89.55	45.72
16684.00	126.43	87.81	38.59
12629.00	126.47	85.96	42.11
11090.00	126.49	86.90	48.64
22269.00	126.58	85.83	43.89
20609.00	126.59	88.64	41.00
12678.00	126.61	90.31	47.28
7376.00	126.61	87.30	49.37
3609.00	126.69	87.49	40.27
5709.00	126.69	84.79	46.91
2241.00	126.73	86.47	42.07
20411.00	126.75	87.73	45.65
25979.00	126.77	96.06	40.27
16977.00	126.79	89.12	46.67
18215.00	126.82	90.83	46.72
14954.00	126.82	91.47	39.32
16864.00	126.86	89.82	49.64
15722.00	126.89	85.27	35.13
16799.00	126.90	88.66	42.45
16633.00	126.93	89.47	48.11
21885.00	126.93	85.92	44.52
7452.00	126.95	87.06	50.79
24532.00	126.96	87.14	48.77
7193.00	126.98	94.13	54.70
397.00	126.99	84.60	46.74

SUBJNO	Factor1	Factor2	Factor3
21149.00	127.03	86.92	42.89
24171.00	127.04	88.65	35.87
22738.00	127.05	90.12	44.19
19195.00	127.07	85.30	44.43
12923.00	127.12	87.01	39.18
7625.00	127.13	87.33	43.77
12329.00	127.19	85.28	47.47
22349.00	127.21	88.35	44.06
15050.00	127.22	86.69	43.05
10734.00	127.24	89.35	48.16
9974.00	127.31	85.93	41.20
550.00	127.31	87.81	50.06
4256.00	127.31	90.11	48.74
20585.00	127.34	82.72	37.58
7576.00	127.36	85.47	42.23
21596.00	127.40	88.31	37.01
14513.00	127.44	92.17	43.01
15404.00	127.48	85.96	41.64
23469.00	127.50	87.22	45.58
9247.00	127.52	88.77	47.43
7187.00	127.53	81.15	51.18
22273.00	127.59	89.42	43.99
21167.00	127.61	91.62	42.46
290.00	127.64	94.87	49.01
21193.00	127.68	86.26	43.96

SUBJNO	Factor1	Factor2	Factor3
16681.00	127.70	89.70	41.17
24216.00	127.72	91.40	52.27
12066.00	127.73	84.86	39.20
18459.00	127.75	89.23	44.37
21093.00	127.76	88.37	43.15
16723.00	127.76	86.24	42.94
1972.00	127.77	85.90	46.18
11473.00	127.80	87.08	41.84
18204.00	127.81	92.00	38.53
17294.00	127.95	89.54	47.86
22305.00	127.97	87.83	43.79
13482.00	128.05	84.23	47.47
15133.00	128.05	90.57	37.64
19418.00	128.06	87.87	43.15
21877.00	128.07	89.39	44.11
14291.00	128.09	87.80	39.95
16894.00	128.10	88.63	43.22
18305.00	128.15	87.88	58.13
21175.00	128.17	89.60	50.46
17655.00	128.18	90.51	39.67
18491.00	128.22	87.64	44.01
23625.00	128.26	88.22	46.62
15711.00	128.34	88.44	45.04
20060.00	128.38	91.45	39.40
2252.00	128.40	83.20	51.47

SUBJNO	Factor1	Factor2	Factor3
21131.00	128.40	89.46	43.31
13785.00	128.42	85.66	42.09
15669.00	128.44	87.29	39.67
23600.00	128.44	92.20	41.75
18081.00	128.47	90.15	47.57
15765.00	128.53	87.82	41.29
14278.00	128.53	88.24	40.37
19489.00	128.55	88.70	53.62
1683.00	128.58	86.48	55.19
16706.00	128.61	89.24	42.04
21340.00	128.65	87.82	41.91
16813.00	128.66	86.07	38.53
12968.00	128.69	87.67	43.89
12323.00	128.72	86.38	45.93
18802.00	128.73	86.73	46.80
8036.00	128.75	87.01	38.68
6364.00	128.76	90.41	47.89
7598.00	128.78	86.18	40.31
20495.00	128.79	89.82	45.21
11818.00	128.80	87.02	38.54
11764.00	128.81	83.39	46.72
22929.00	128.81	93.06	41.25
15753.00	128.86	88.74	38.29
18375.00	128.86	87.68	45.26
18150.00	128.86	89.38	32.07

SUBJNO	Factor1	Factor2	Factor3
18415.00	128.89	87.49	43.88
22664.00	128.90	87.09	33.60
4217.00	128.94	88.67	45.03
6194.00	128.94	85.02	41.18
20437.00	128.95	89.11	40.30
575.00	128.95	83.41	44.92
21183.00	128.97	89.68	48.94
978.00	128.97	85.41	52.65
18104.00	128.98	86.29	41.94
11635.00	128.98	87.64	46.95
22281.00	128.99	87.76	47.22
20932.00	129.00	89.94	52.00
5724.00	129.00	88.57	53.11
6756.00	129.01	87.79	38.27
7954.00	129.01	83.73	47.83
12906.00	129.04	86.87	39.36
11421.00	129.06	85.92	41.97
17288.00	129.07	88.09	40.14
5937.00	129.10	90.73	42.41
14216.00	129.11	85.96	38.84
18105.00	129.11	88.44	47.42
4945.00	129.15	90.56	38.47
13287.00	129.17	85.86	41.33
14371.00	129.18	88.18	46.67
21823.00	129.20	88.05	49.51

SUBJNO	Factor1	Factor2	Factor3
24152.00	129.20	90.58	39.82
24509.00	129.22	93.61	42.31
23626.00	129.25	89.55	47.89
12059.00	129.25	87.70	43.89
3885.00	129.30	86.81	39.29
23439.00	129.32	90.01	49.49
15353.00	129.32	87.18	44.76
16989.00	129.33	85.47	38.30
23848.00	129.35	87.50	46.16
15755.00	129.36	86.85	44.03
5481.00	129.37	90.35	51.52
491.00	129.37	84.99	46.01
17147.00	129.41	87.54	46.87
21195.00	129.42	86.75	43.46
18385.00	129.43	86.77	42.25
22648.00	129.44	86.62	52.40
3686.00	129.45	83.66	50.76
5796.00	129.48	86.16	43.78
20003.00	129.53	87.83	42.46
18436.00	129.56	87.17	41.93
9841.00	129.58	87.04	44.81
12105.00	129.58	89.94	41.85
15683.00	129.61	87.80	40.35
21141.00	129.61	89.74	48.98
20424.00	129.62	86.00	42.52

SUBJNO	Factor1	Factor2	Factor3
15067.00	129.64	88.52	43.41
5273.00	129.73	87.92	44.50
122.00	129.74	85.66	42.71
5595.00	129.75	87.03	48.35
1652.00	129.76	87.59	49.20
18356.00	129.80	89.36	39.89
11897.00	129.85	88.25	47.82
6555.00	129.90	86.62	51.16
15770.00	129.91	90.44	47.86
20865.00	129.96	86.71	42.67
4885.00	129.98	86.35	44.25
14174.00	130.00	86.30	41.31
15797.00	130.01	86.29	34.57
13022.00	130.01	86.77	34.24
14411.00	130.03	88.13	40.76
20073.00	130.04	86.28	46.50
19579.00	130.07	88.01	43.78
16817.00	130.10	89.84	42.64
18852.00	130.10	86.42	45.44
12305.00	130.10	88.23	44.59
15441.00	130.14	86.70	30.90
16690.00	130.21	85.09	47.16
16980.00	130.23	87.09	49.81
3895.00	130.25	82.31	38.67
7851.00	130.26	84.95	47.70

SUBJNO	Factor1	Factor2	Factor3
6156.00	130.29	91.12	42.76
21772.00	130.31	86.77	46.88
1576.00	130.36	84.29	43.88
7243.00	130.42	84.71	45.07
18463.00	130.42	86.81	47.56
21414.00	130.46	87.23	37.29
20843.00	130.47	89.06	49.31
21412.00	130.48	87.76	36.78
13182.00	130.50	86.69	42.36
4952.00	130.50	86.34	48.55
9118.00	130.51	86.97	43.74
18999.00	130.52	85.66	37.70
11297.00	130.52	86.73	42.10
20874.00	130.56	86.43	43.16
11972.00	130.57	84.75	40.84
15676.00	130.61	87.58	49.13
16259.00	130.64	88.35	47.33
21699.00	130.71	86.60	45.43
520.00	130.72	87.13	52.26
17455.00	130.74	84.42	36.61
14158.00	130.86	88.76	57.45
8479.00	130.89	87.45	44.82
7355.00	130.90	87.77	46.90
903.00	130.92	86.43	44.62
18694.00	130.92	90.83	50.69

SUBJNO	Factor1	Factor2	Factor3
928.00	130.94	89.82	45.33
12587.00	130.96	84.34	40.69
12594.00	131.03	86.32	44.68
18547.00	131.06	89.15	47.47
19139.00	131.10	88.08	49.01
11555.00	131.15	87.08	49.45
5410.00	131.25	92.55	42.94
18681.00	131.26	92.00	35.77
23593.00	131.29	88.55	43.02
21925.00	131.34	87.48	38.59
6342.00	131.41	87.06	55.02
19177.00	131.43	90.27	45.98
16935.00	131.50	89.72	41.45
23444.00	131.51	92.92	39.02
12655.00	131.52	85.81	44.02
15776.00	131.59	85.88	39.98
21749.00	131.68	91.07	51.01
19870.00	131.69	86.36	40.93
14364.00	131.71	89.47	39.94
11628.00	131.72	87.41	46.34
19448.00	131.73	89.88	52.32
19100.00	131.81	87.78	49.11
16514.00	131.81	89.05	40.40
19030.00	131.87	86.54	36.14
14156.00	131.87	89.69	52.49

SUBJNO	Factor1	Factor2	Factor3
13454.00	131.92	85.82	43.63
21895.00	131.97	89.14	39.81
8063.00	131.99	85.96	38.86
12036.00	132.00	87.63	41.60
23594.00	132.01	90.59	52.99
19400.00	132.05	87.61	39.69
14398.00	132.10	88.15	44.45
23741.00	132.10	89.85	45.89
21770.00	132.11	87.89	50.03
14842.00	132.12	85.97	44.56
6532.00	132.25	86.15	58.63
3012.00	132.26	81.40	39.24
22212.00	132.29	85.70	40.74
13817.00	132.29	87.14	41.22
13660.00	132.30	84.48	37.69
18596.00	132.33	87.04	45.07
226.00	132.33	84.93	49.13
17290.00	132.34	87.71	47.34
3001.00	132.37	90.25	35.67
9294.00	132.41	88.22	46.78
5973.00	132.44	86.72	38.32
9624.00	132.47	89.08	45.18
18164.00	132.47	92.31	40.76
1484.00	132.54	87.75	55.65
12877.00	132.56	88.77	40.94

SUBJNO	Factor1	Factor2	Factor3
289.00	132.58	82.57	47.40
25967.00	132.59	89.60	39.16
2294.00	132.59	86.23	51.63
25978.00	132.59	91.30	34.09
17117.00	132.62	84.18	39.02
10831.00	132.67	90.79	40.25
9304.00	132.72	87.45	48.43
6737.00	132.73	89.19	43.38
414.00	132.76	87.71	58.91
13198.00	132.76	85.51	42.91
16953.00	132.80	86.29	51.98
20657.00	132.84	89.58	38.59
14486.00	132.87	91.08	39.13
15731.00	132.89	85.81	38.92
18695.00	132.89	86.91	41.11
3575.00	132.91	87.44	46.32
16834.00	132.93	86.58	46.97
6027.00	133.01	88.52	48.18
1618.00	133.01	85.44	45.48
11588.00	133.04	89.03	52.15
9778.00	133.07	86.89	39.82
16701.00	133.11	87.89	39.90
20525.00	133.16	87.63	52.08
8029.00	133.16	85.55	41.00
11104.00	133.16	93.11	46.44

SUBJNO	Factor1	Factor2	Factor3
13443.00	133.22	87.42	43.94
23306.00	133.30	92.23	46.50
8741.00	133.32	85.20	40.69
4255.00	133.35	88.19	38.05
2256.00	133.43	84.18	45.13
20441.00	133.44	88.57	48.93
23563.00	133.45	89.16	39.40
18465.00	133.54	88.07	42.64
16214.00	133.58	83.38	39.64
432.00	133.60	83.76	48.43
12931.00	133.68	87.00	51.24
14227.00	133.73	89.81	49.30
17720.00	133.75	88.62	46.95
24463.00	133.78	86.40	38.42
18381.00	133.79	87.54	41.21
6126.00	133.80	83.25	46.76
10865.00	133.82	86.21	43.48
20735.00	133.83	86.87	48.37
24214.00	133.85	89.11	41.78
16943.00	134.00	87.67	47.10
21904.00	134.03	89.72	47.74
16826.00	134.11	86.35	44.51
16704.00	134.15	87.28	48.58
8599.00	134.17	87.03	51.67
377.00	134.23	84.63	50.48

SUBJNO	Factor1	Factor2	Factor3
19999.00	134.24	90.35	50.38
4301.00	134.28	86.70	50.25
13775.00	134.36	87.72	41.40
6286.00	134.37	91.11	62.07
16932.00	134.37	86.31	48.78
15007.00	134.45	92.45	37.13
15896.00	134.45	88.14	53.47
16836.00	134.54	89.59	51.81
19731.00	134.55	87.47	40.62
20965.00	134.60	85.38	42.23
21188.00	134.61	88.05	47.64
21469.00	134.65	86.37	48.83
12578.00	134.72	87.26	48.06
20704.00	134.79	86.25	44.29
23423.00	134.80	88.22	51.16
15476.00	134.88	89.89	43.67
19656.00	134.91	87.49	40.59
478.00	134.95	84.40	48.20
20118.00	134.98	93.19	40.07
3029.00	135.11	85.22	52.86
23243.00	135.19	87.51	47.93
18521.00	135.27	89.79	44.58
11231.00	135.27	87.02	44.38
385.00	135.30	85.46	46.12
20069.00	135.32	88.00	38.76

SUBJNO	Factor1	Factor2	Factor3
17087.00	135.32	86.41	45.96
18488.00	135.38	86.77	35.69
7720.00	135.42	86.54	51.25
18637.00	135.43	88.07	44.50
7599.00	135.47	90.33	47.33
20983.00	135.48	89.59	48.06
20188.00	135.50	87.52	42.43
17623.00	135.56	92.10	37.00
11377.00	135.61	89.14	47.99
16182.00	135.61	88.84	38.59
18072.00	135.61	87.35	45.08
19344.00	135.79	88.52	46.30
22986.00	135.80	88.10	46.00
21723.00	135.93	86.80	44.70
14959.00	135.97	84.94	41.23
17673.00	136.02	88.38	44.05
13814.00	136.10	87.90	45.66
21899.00	136.19	87.39	54.65
20549.00	136.28	90.39	49.68
8213.00	136.30	85.31	46.09
18043.00	136.41	87.31	50.73
6291.00	136.58	88.39	43.60
389.00	136.58	89.79	49.49
21905.00	136.58	86.85	41.86
18600.00	136.62	85.85	42.04

SUBJNO	Factor1	Factor2	Factor3
8066.00	136.64	85.72	43.53
17565.00	136.70	87.99	40.51
13641.00	136.73	86.05	41.10
17710.00	136.88	87.94	42.84
518.00	136.90	80.02	40.18
24415.00	136.94	87.85	46.20
20516.00	137.08	86.73	37.51
20097.00	137.17	88.71	52.68
6466.00	137.21	86.38	44.05
12851.00	137.33	84.94	43.23
19469.00	137.46	86.30	43.10
12252.00	137.53	87.01	44.45
12192.00	137.79	86.35	46.98
298.00	137.84	85.64	44.47
23480.00	137.88	87.82	51.48
21510.00	137.94	87.94	46.25
19995.00	138.10	89.07	53.62
21101.00	138.14	87.36	48.99
14224.00	138.33	87.97	41.71
6851.00	138.34	81.33	40.60
2932.00	138.37	81.69	46.79
3011.00	138.40	90.60	48.16
3246.00	138.48	87.27	42.59
6383.00	138.49	86.67	47.89
12344.00	138.60	85.20	47.22

SUBJNO	Factor1	Factor2	Factor3
23595.00	138.65	88.31	43.71
14359.00	138.81	91.31	50.03
8731.00	139.08	85.20	47.03
11788.00	139.19	87.11	52.99
16693.00	139.27	87.83	43.77
20849.00	139.35	87.60	47.70
15686.00	139.47	86.02	44.73
23262.00	139.69	91.10	50.75
5015.00	139.76	89.99	46.98
20580.00	139.93	86.50	43.22
12016.00	139.97	88.77	41.81
383.00	140.03	82.18	53.60
3437.00	140.15	81.92	54.43
12253.00	140.15	86.44	42.06
19479.00	140.39	84.73	45.22
13511.00	141.11	82.87	40.93
21378.00	141.73	86.69	39.52
20435.00	141.74	87.29	41.06
2785.00	141.94	89.60	49.16
5940.00	142.30	84.46	52.55
16699.00	142.63	86.89	39.26
18345.00	143.11	88.22	38.98
514.00	143.45	86.92	49.95
12969.00	143.67	85.84	44.11
23614.00	143.88	89.44	50.17

SUBJNO	Factor1	Factor2	Factor3
2713.00	144.03	82.97	48.21
2299.00	144.41	90.84	42.61
22704.00	145.56	82.63	51.93
14190.00	145.63	87.41	46.41
20450.00	146.17	85.33	45.92
17028.00	146.57	84.44	41.30
14240.00	151.14	88.96	48.32
13809.00	153.28	87.64	40.85
17689.00	153.50	83.51	42.80

Female Factor Scores

SUBJNO	Factor1	Factor2	Factor3
352.00	124.99	81.84	-95.26
526.00	108.11	97.13	-156.19
527.00	134.51	91.82	-153.80
1129.00	154.26	131.81	-360.97
2072.00	181.22	183.87	-688.65
2093.00	163.19	193.18	-689.16
3199.00	211.51	256.17	-1074.37
3821.00	238.29	292.84	-1288.84
3934.00	230.92	296.45	-1327.28
3970.00	228.99	303.06	-1337.24
4725.00	261.38	347.21	-1601.24
5244.00	278.92	381.91	-1776.71
6248.00	310.38	439.77	-2124.67
6347.00	318.78	445.03	-2154.48
6352.00	315.51	445.23	-2154.32
7155.00	332.03	495.44	-2437.51
7804.00	365.26	535.52	-2658.52
7874.00	363.31	544.29	-2677.39
7914.00	366.19	542.75	-2694.48
8017.00	367.29	547.31	-2732.75
10156.00	443.11	677.72	-3468.66
10164.00	448.22	677.90	-3469.27
10309.00	444.11	684.24	-3520.72
11214.00	463.07	744.64	-3833.58
11693.00	485.37	771.40	-3997.77
11716.00	476.03	773.07	-4008.52
11718.00	484.83	770.95	-4005.60
11775.00	487.11	775.17	-4025.24
12414.00	513.39	816.95	-4243.10
13050.00	529.54	856.49	-4463.00
13115.00	520.14	857.02	-4483.53
13302.00	529.75	867.29	-4550.28
13518.00	543.24	880.17	-4624.57
13585.00	549.72	884.30	-4647.63
13627.00	545.42	887.35	-4662.60
14270.00	563.73	926.39	-4885.51
14293.00	567.13	931.33	-4890.14
14305.00	574.70	928.85	-4895.49
14311.00	577.37	930.19	-4896.42
14314.00	576.21	931.38	-4897.11
14322.00	572.17	930.14	-4904.57
14325.00	557.48	928.79	-4906.80
15296.00	597.01	990.23	-5236.06
15307.00	607.15	989.73	-5242.11
15607.00	606.03	1010.62	-5342.69
15609.00	618.19	1004.54	-5350.75
15642.00	617.10	1013.03	-5356.95
15655.00	617.90	1008.50	-5362.49
15656.00	608.54	1012.36	-5363.96
15657.00	617.04	1010.83	-5362.44
15662.00	614.45	1012.66	-5363.24
15663.00	613.33	1011.15	-5363.54
16059.00	621.83	1037.25	-5501.85
16076.00	607.74	1035.57	-5510.82
16148.00	619.99	1042.64	-5531.87
16379.00	624.15	1057.26	-5607.81
16401.00	647.88	1055.01	-5615.65
16402.00	626.81	1059.16	-5620.46

SUBJNO	Factor1	Factor2	Factor3
16418.00	642.87	1058.89	-5622.50
16453.00	636.88	1064.13	-5639.92
17240.00	669.04	1108.45	-5907.00
17508.00	676.44	1121.28	-6001.55
17520.00	667.17	1125.26	-6001.20
17757.00	684.96	1140.23	-6083.66
17807.00	676.49	1143.13	-6102.93
17916.00	673.56	1151.72	-6141.84
17918.00	687.24	1154.63	-6136.98
17941.00	699.69	1147.55	-6146.07
17976.00	682.59	1153.54	-6160.68
18051.00	687.90	1156.75	-6186.94
19279.00	725.29	1232.03	-6613.12
19381.00	733.79	1239.59	-6637.30
19394.00	733.48	1238.89	-6645.64
19701.00	742.08	1259.35	-6749.62
20220.00	761.19	1288.01	-6930.88
20224.00	762.94	1288.42	-6930.45
20247.00	754.56	1291.42	-6940.63
20489.00	760.81	1309.79	-7023.03
21014.00	793.32	1338.81	-7199.51
21047.00	779.02	1341.88	-7214.57
21260.00	800.95	1349.89	-7288.02
21262.00	800.82	1351.72	-7287.85
21296.00	798.15	1352.40	-7303.99
21305.00	790.14	1354.60	-7306.05
21715.00	799.53	1382.32	-7443.55
22138.00	816.74	1406.58	-7591.56
22444.00	832.27	1425.55	-7695.08
22969.00	835.73	1459.87	-7877.42
22998.00	851.73	1458.59	-7889.35
23000.00	847.86	1456.78	-7889.60
23108.00	845.26	1464.83	-7926.30
24013.00	883.11	1518.63	-8238.94
24027.00	886.62	1520.23	-8238.87
24298.00	877.62	1538.57	-8334.24
24719.00	898.08	1563.97	-8476.73
24730.00	901.62	1562.73	-8487.30
24737.00	901.85	1563.16	-8484.47
24745.00	898.95	1564.86	-8491.29

SUBJNO	Factor1	Factor2	Factor3
24776.00	899.18	1566.01	-8502.31
24934.00	908.44	1575.59	-8552.44
24942.00	904.41	1577.27	-8554.51
25013.00	910.71	1580.14	-8577.54
25031.00	910.57	1583.01	-8588.13
25036.00	913.41	1577.84	-8593.52
25041.00	919.05	1582.49	-8589.35
25134.00	913.58	1587.38	-8623.83
25138.00	920.15	1586.81	-8621.45
25145.00	906.11	1589.10	-8628.60
25161.00	911.85	1590.10	-8632.07
25205.00	922.83	1594.37	-8642.32
25206.00	915.94	1590.31	-8650.27
25214.00	925.10	1592.05	-8649.86
25316.00	917.65	1602.68	-8687.45
25334.00	924.37	1600.31	-8690.66
25489.00	921.19	1611.13	-8745.39
25992.00	938.85	1643.73	-8915.93
25995.00	943.84	1636.82	-8922.30
25997.00	941.48	1642.08	-8915.42
25999.00	938.32	1639.40	-8922.73
26019.00	941.74	1644.04	-8929.03
26020.00	947.05	1642.24	-8924.60
26022.00	943.48	1643.20	-8927.50
26174.00	943.52	1651.29	-8978.75
325.00	123.99	79.19	-82.57
337.00	116.65	85.83	-85.96
1111.00	141.94	126.12	-358.68
2106.00	194.86	183.85	-699.01
3123.00	215.92	248.41	-1052.64
3146.00	205.76	251.96	-1056.44
3167.00	214.01	250.34	-1065.29
3183.00	219.07	252.23	-1071.50
3848.00	229.49	290.48	-1300.46
4054.00	238.50	305.01	-1368.47
4074.00	250.51	309.46	-1374.88
4094.00	241.51	309.35	-1383.94
4158.00	253.51	309.29	-1399.79
4659.00	263.75	343.69	-1575.92
4664.00	259.58	341.79	-1582.25

SUBJNO	Factor1	Factor2	Factor3
4685.00	252.84	346.30	-1582.63
4723.00	266.00	344.85	-1599.87
5247.00	275.94	377.83	-1779.83
5280.00	271.49	381.84	-1786.39
5597.00	287.62	396.93	-1903.55
5919.00	299.11	422.57	-2004.31
5996.00	303.69	422.35	-2039.27
6002.00	309.00	424.70	-2039.53
6060.00	299.94	432.79	-2059.49
6109.00	299.17	430.88	-2077.14
6116.00	318.21	432.33	-2082.04
6158.00	311.16	434.02	-2091.72
6162.00	307.92	435.50	-2092.15
6251.00	312.08	437.39	-2123.58
6255.00	323.41	440.09	-2121.85
6357.00	307.57	446.78	-2158.61
6360.00	319.30	445.05	-2161.16
6465.00	319.45	453.54	-2196.50
6477.00	315.79	450.98	-2200.36
7251.00	341.89	501.70	-2470.22
7286.00	352.66	502.02	-2477.12
7395.00	354.41	506.02	-2516.35
7752.00	356.70	530.68	-2641.61
7790.00	358.38	535.22	-2654.37
7794.00	363.93	534.30	-2655.57
7800.00	359.09	535.15	-2654.20
7913.00	366.84	541.05	-2698.70
8042.00	368.14	548.27	-2739.35
8045.00	376.17	550.00	-2742.83
8078.00	375.60	550.70	-2755.77
8107.00	375.49	555.18	-2760.48
8128.00	374.56	552.21	-2775.97
8373.00	381.10	567.61	-2857.53
8394.00	372.78	568.65	-2863.70
8448.00	381.41	571.72	-2882.09
8467.00	374.58	573.37	-2890.30
8986.00	399.41	603.60	-3071.92
9090.00	404.40	614.04	-3101.03
9183.00	404.45	620.53	-3133.68
9331.00	410.58	627.29	-3186.30

SUBJNO	Factor1	Factor2	Factor3
9747.00	413.99	651.59	-3331.35
10178.00	442.55	679.32	-3476.38
10404.00	455.62	691.96	-3551.44
11219.00	473.27	742.20	-3834.67
11650.00	490.51	768.26	-3985.02
11678.00	493.31	769.54	-3991.21
11682.00	487.52	771.69	-3990.22
11740.00	475.88	776.24	-4015.39
11841.00	502.15	779.27	-4044.74
11842.00	481.98	782.36	-4052.18
12401.00	501.66	814.09	-4241.40
12455.00	505.36	818.51	-4259.99
13134.00	535.55	855.88	-4489.07
13306.00	530.13	868.94	-4553.72
13652.00	547.59	886.52	-4673.98
14313.00	577.94	930.56	-4900.01
15225.00	591.36	985.82	-5212.64
15299.00	596.25	991.44	-5237.48
15300.00	596.95	992.09	-5238.87
15606.00	612.81	1011.04	-5342.35
15652.00	601.85	1012.22	-5358.52
15661.00	623.31	1009.15	-5365.42
15981.00	621.95	1031.78	-5474.40
16051.00	618.83	1038.10	-5497.17
16369.00	650.25	1053.50	-5608.69
17180.00	661.79	1106.12	-5885.94
17201.00	669.32	1101.74	-5892.29
17457.00	664.96	1120.22	-5980.79
17481.00	684.02	1120.23	-5986.77
17502.00	678.16	1125.15	-5994.46
17536.00	675.77	1124.19	-6009.11
17934.00	677.74	1148.98	-6146.05
18037.00	701.61	1153.34	-6181.18
19174.00	720.26	1226.25	-6573.81
19255.00	726.08	1231.33	-6599.82
19262.00	722.90	1229.56	-6607.03
19263.00	736.50	1231.02	-6603.95
19273.00	730.99	1230.42	-6606.45
19311.00	724.88	1237.41	-6614.39
20250.00	753.41	1291.60	-6943.17

SUBJNO	Factor1	Factor2	Factor3
20479.00	760.04	1310.15	-7014.25
20488.00	765.01	1307.91	-7019.65
20807.00	781.72	1324.56	-7135.17
20815.00	779.42	1325.90	-7137.83
20816.00	776.99	1330.23	-7130.38
20822.00	785.34	1325.77	-7138.44
20997.00	786.19	1337.78	-7193.27
21027.00	783.08	1334.66	-7211.91
21036.00	774.87	1338.45	-7212.95
21049.00	780.52	1342.01	-7215.50
21065.00	794.32	1338.00	-7222.00
21257.00	790.10	1353.43	-7286.16
21284.00	798.62	1352.72	-7300.39
21630.00	801.01	1372.18	-7423.57
21631.00	813.10	1372.31	-7418.16
21633.00	804.62	1376.36	-7419.97
21654.00	806.13	1375.67	-7426.87
21660.00	798.08	1379.49	-7427.10
21691.00	812.74	1380.06	-7433.08
21706.00	812.41	1379.42	-7443.07
22128.00	813.89	1404.89	-7588.25
22446.00	836.01	1426.32	-7697.63
22474.00	823.92	1428.02	-7708.66
23058.00	854.91	1460.97	-7908.77
23105.00	851.43	1461.86	-7927.04
23747.00	867.53	1505.58	-8144.51
23934.00	873.64	1514.40	-8211.40
23937.00	878.22	1516.20	-8207.24
23986.00	879.00	1519.82	-8228.71
24290.00	897.03	1534.49	-8332.98
24307.00	896.98	1540.28	-8335.19
24317.00	893.70	1537.23	-8344.36
24586.00	909.68	1555.30	-8430.55
24603.00	899.99	1556.63	-8437.53
24640.00	896.59	1559.41	-8451.25
24667.00	899.77	1559.65	-8459.16
24677.00	896.64	1566.73	-8464.14
24681.00	902.03	1564.76	-8470.00
24690.00	893.62	1561.29	-8471.22
24698.00	892.91	1560.78	-8471.98

SUBJNO	Factor1	Factor2	Factor3
24710.00	896.51	1562.04	-8479.72
24716.00	911.06	1563.56	-8478.04
24756.00	895.78	1565.69	-8492.73
24761.00	904.44	1566.67	-8497.18
24777.00	907.03	1568.24	-8500.12
24854.00	899.85	1571.52	-8527.27
24865.00	912.25	1571.74	-8528.05
24866.00	909.47	1569.90	-8529.94
24867.00	916.77	1573.18	-8529.06
24886.00	907.51	1572.66	-8536.80
24894.00	898.85	1571.99	-8541.57
24895.00	911.42	1576.59	-8539.69
24899.00	901.06	1575.20	-8541.72
24923.00	899.10	1576.38	-8552.83
24939.00	901.63	1578.39	-8551.65
24941.00	903.24	1581.11	-8551.97
24946.00	907.98	1582.38	-8555.52
24947.00	919.71	1574.17	-8558.91
24949.00	905.96	1580.98	-8562.32
24966.00	912.34	1575.20	-8569.05
24971.00	913.82	1574.81	-8570.22
24987.00	909.57	1578.49	-8566.04
24989.00	921.12	1575.18	-8571.67
24990.00	915.47	1579.31	-8570.46
24993.00	915.44	1580.22	-8571.56
25001.00	910.97	1579.21	-8578.49
25043.00	909.59	1589.36	-8591.56
25047.00	917.24	1578.82	-8596.24
25060.00	919.69	1582.55	-8594.19
25065.00	916.01	1583.05	-8601.43
25066.00	912.02	1581.82	-8596.74
25067.00	908.93	1581.15	-8601.83
25070.00	908.73	1584.90	-8599.73
25071.00	911.00	1583.88	-8599.95
25083.00	910.69	1585.97	-8605.95
25088.00	914.90	1585.77	-8603.00
25120.00	905.06	1588.67	-8616.81
25121.00	924.17	1586.96	-8619.27
25128.00	915.67	1585.53	-8622.18
25132.00	918.37	1584.79	-8619.10

SUBJNO	Factor1	Factor2	Factor3
25155.00	922.13	1589.11	-8630.37
25176.00	916.45	1592.27	-8635.14
25180.00	915.66	1588.14	-8639.17
25184.00	921.94	1588.83	-8639.95
25188.00	910.89	1588.55	-8643.16
25200.00	916.26	1588.83	-8647.40
25213.00	914.57	1592.97	-8650.59
25238.00	923.76	1592.81	-8660.71
25252.00	919.15	1594.03	-8666.55
25254.00	916.83	1596.31	-8663.57
25257.00	922.48	1593.80	-8667.93
25325.00	918.67	1598.75	-8684.70
25339.00	920.02	1601.52	-8691.13
25355.00	917.02	1601.58	-8698.66
25494.00	918.80	1610.51	-8748.40
25508.00	930.16	1614.56	-8747.97
25520.00	926.09	1611.69	-8756.65
25990.00	944.45	1641.92	-8914.16
26046.00	936.71	1645.82	-8936.43
26111.00	953.28	1648.15	-8956.36
26151.00	966.84	1648.53	-8971.26
26163.00	947.28	1651.06	-8974.94
26166.00	950.00	1653.93	-8973.12
26231.00	949.19	1653.65	-9000.11
26236.00	950.76	1657.19	-8998.12
26246.00	952.80	1654.26	-9008.40
328.00	120.14	80.65	-89.30
329.00	124.76	75.82	-83.55
330.00	124.54	78.64	-86.19
349.00	125.50	77.75	-98.38
356.00	134.89	82.83	-96.98
361.00	115.41	84.91	-98.82
362.00	132.38	78.55	-100.88
363.00	125.20	79.50	-101.15
508.00	127.51	93.66	-149.41
1121.00	151.42	130.90	-356.44
1160.00	169.46	129.77	-366.77
2092.00	176.85	189.63	-688.17
2439.00	179.70	209.64	-809.31
3824.00	238.33	287.88	-1295.71

SUBJNO	Factor1	Factor2	Factor3
3896.00	236.74	296.45	-1315.81
3950.00	226.88	299.77	-1337.46
3955.00	245.34	300.49	-1331.82
4000.00	241.60	302.12	-1346.56
4065.00	241.10	306.15	-1372.59
4113.00	243.71	308.25	-1389.74
4115.00	245.26	311.20	-1388.80
4120.00	241.42	308.62	-1388.71
4162.00	237.55	313.68	-1407.74
4668.00	258.77	345.05	-1582.05
4683.00	265.18	344.91	-1583.54
4720.00	271.52	345.88	-1596.09
5130.00	286.07	373.08	-1738.92
5134.00	273.40	371.94	-1736.77
5331.00	291.08	377.37	-1808.24
5618.00	290.48	406.99	-1904.49
5688.00	294.64	404.10	-1926.59
6148.00	318.44	432.15	-2090.55
6157.00	307.80	436.23	-2088.08
6343.00	304.01	449.47	-2155.14
6931.00	329.09	484.89	-2356.59
7373.00	344.38	507.95	-2511.77
7374.00	355.55	510.28	-2506.14
7378.00	347.45	506.17	-2510.88
7537.00	357.77	514.45	-2568.43
7757.00	365.09	534.70	-2640.66
7797.00	365.29	530.31	-2659.11
7909.00	365.09	537.48	-2694.80
8021.00	370.99	549.55	-2732.05
8309.00	379.48	567.13	-2832.56
8437.00	384.80	571.95	-2875.09
9533.00	422.33	636.60	-3253.41
9535.00	415.98	636.16	-3255.97
10222.00	444.23	682.04	-3486.64
11205.00	476.88	746.86	-3824.03
11651.00	497.08	768.95	-3979.02
11744.00	492.10	773.46	-4011.86
11749.00	481.59	775.74	-4014.02
12160.00	506.01	797.47	-4158.15
12371.00	502.94	810.26	-4232.08

SUBJNO	Factor1	Factor2	Factor3
12389.00	516.60	813.39	-4235.59
12392.00	514.37	811.50	-4242.71
12394.00	509.88	809.51	-4238.19
12399.00	519.56	813.31	-4238.15
12427.00	506.35	816.93	-4246.22
12551.00	517.54	821.67	-4289.32
12985.00	526.55	849.17	-4439.13
13018.00	530.12	848.84	-4450.47
13125.00	523.23	860.12	-4488.94
13381.00	545.48	874.36	-4581.88
13519.00	544.99	879.45	-4625.70
13607.00	557.75	885.52	-4654.40
13821.00	560.03	898.92	-4730.92
14298.00	573.61	929.75	-4893.13
14317.00	569.28	931.30	-4899.14
14331.00	566.69	931.55	-4908.58
14338.00	575.48	931.22	-4906.29
14341.00	562.83	932.13	-4910.94
15246.00	598.03	985.43	-5218.35
15297.00	590.00	991.02	-5237.28
15633.00	613.79	1009.90	-5353.94
16083.00	625.49	1037.74	-5509.08
16128.00	623.44	1043.09	-5519.34
16455.00	628.62	1059.61	-5632.62
17199.00	651.99	1106.44	-5893.60
17250.00	663.27	1109.53	-5907.03
17459.00	673.35	1120.97	-5981.44
17464.00	673.72	1121.62	-5982.22
17475.00	663.89	1118.13	-5992.93
17478.00	675.88	1122.85	-5988.47
17498.00	665.55	1123.99	-5995.86
17504.00	687.73	1124.99	-5993.81
17748.00	679.21	1140.15	-6078.74
17832.00	685.35	1146.43	-6109.04
17848.00	680.32	1145.74	-6115.72
17872.00	681.56	1149.25	-6123.27
17911.00	684.18	1149.97	-6137.90
19289.00	723.73	1232.84	-6611.47
19367.00	738.87	1237.60	-6639.74
19390.00	734.66	1239.27	-6648.32

SUBJNO	Factor1	Factor2	Factor3
19700.00	739.48	1258.81	-6750.45
19704.00	736.27	1260.31	-6751.78
19765.00	745.85	1261.36	-6770.02
19947.00	761.50	1273.98	-6836.10
20271.00	762.74	1291.03	-6949.10
20459.00	763.17	1304.71	-7012.54
20461.00	771.42	1305.94	-7012.73
20517.00	769.10	1304.82	-7034.89
20781.00	771.76	1323.58	-7121.09
20782.00	780.74	1324.59	-7124.56
20802.00	787.67	1325.97	-7128.24
20819.00	776.71	1328.41	-7135.65
20821.00	780.79	1327.14	-7135.96
20824.00	777.62	1325.56	-7138.78
21006.00	784.12	1335.56	-7203.37
21061.00	782.60	1339.70	-7219.37
21066.00	788.30	1339.02	-7225.21
21250.00	787.04	1352.91	-7284.98
21320.00	791.07	1358.42	-7309.67
21655.00	806.92	1377.78	-7424.93
21692.00	813.92	1377.85	-7439.20
22044.00	809.63	1400.79	-7559.87
22122.00	821.80	1404.75	-7585.87
22153.00	823.44	1411.62	-7593.57
22511.00	830.25	1431.07	-7721.75
23002.00	857.87	1457.17	-7883.27
23030.00	843.65	1463.94	-7893.36
23039.00	849.54	1459.94	-7905.10
23134.00	841.24	1467.95	-7932.88
23745.00	878.11	1503.46	-8140.12
23755.00	875.88	1505.21	-8142.28
23923.00	875.55	1517.48	-8203.44
23980.00	867.89	1519.16	-8224.63
24017.00	885.26	1519.94	-8236.38
24274.00	889.68	1536.32	-8325.43
24297.00	888.93	1539.26	-8332.82
24313.00	897.59	1541.83	-8337.79
24538.00	897.27	1555.11	-8415.31
24644.00	903.58	1561.84	-8451.97
24678.00	907.61	1560.76	-8469.49

SUBJNO	Factor1	Factor2	Factor3
24683.00	895.63	1562.27	-8465.31
24693.00	892.96	1561.54	-8469.95
24694.00	907.12	1560.81	-8473.22
24700.00	898.26	1565.56	-8471.85
24712.00	908.59	1561.67	-8475.81
24755.00	903.17	1567.49	-8490.82
24757.00	906.63	1567.82	-8495.51
24774.00	894.68	1569.39	-8495.84
24793.00	913.11	1563.25	-8503.38
24808.00	896.82	1575.35	-8510.37
24831.00	899.56	1569.15	-8519.88
24844.00	904.54	1569.83	-8520.45
24857.00	907.60	1574.54	-8523.37
24882.00	904.76	1569.95	-8538.24
24887.00	911.57	1578.98	-8532.48
24889.00	904.85	1576.98	-8535.93
24921.00	909.48	1574.40	-8548.99
24967.00	903.75	1578.69	-8565.24
24975.00	905.47	1577.05	-8565.82
24976.00	913.46	1581.57	-8568.39
24984.00	922.54	1578.64	-8570.35
25040.00	909.55	1583.28	-8594.55
25045.00	915.52	1582.45	-8594.76
25116.00	914.81	1587.13	-8617.58
25119.00	921.90	1586.77	-8615.21
25123.00	914.99	1589.03	-8616.69
25131.00	922.02	1587.49	-8619.91
25136.00	916.74	1587.83	-8624.17
25169.00	917.76	1589.84	-8634.21
25182.00	916.29	1590.59	-8642.77
25192.00	919.84	1590.54	-8642.12
25203.00	910.59	1592.45	-8647.40
25209.00	917.19	1595.33	-8643.40
25226.00	913.10	1593.92	-8655.48
25243.00	916.95	1593.87	-8660.83
25246.00	923.03	1595.99	-8662.95
25328.00	925.09	1599.93	-8686.90
25329.00	916.91	1598.81	-8691.69
25332.00	931.42	1598.57	-8691.18
25342.00	929.38	1598.41	-8694.50

SUBJNO	Factor1	Factor2	Factor3
25351.00	922.20	1602.12	-8697.15
25486.00	938.45	1606.08	-8745.40
25493.00	927.69	1612.11	-8743.57
25511.00	929.35	1610.57	-8751.70
25519.00	923.15	1611.22	-8752.23
25988.00	943.40	1641.46	-8915.38
26021.00	937.41	1642.54	-8926.78
26052.00	951.11	1644.77	-8935.94
26055.00	939.81	1644.01	-8942.33
26079.00	950.52	1645.42	-8948.34
26085.00	946.85	1647.09	-8945.72
26090.00	935.16	1646.57	-8950.53
26093.00	956.88	1649.40	-8950.33
26109.00	943.01	1647.21	-8956.70
26116.00	943.30	1651.69	-8958.87
26139.00	953.77	1649.09	-8966.99
26142.00	941.37	1650.41	-8969.40
26144.00	939.63	1651.41	-8968.75
26178.00	953.33	1652.70	-8979.01
26180.00	942.95	1650.99	-8983.44
26185.00	950.77	1654.32	-8983.19
26242.00	947.47	1654.64	-9003.11
152.00	119.10	74.53	-23.62
157.00	105.44	68.93	-29.70
244.00	120.12	77.26	-60.03
274.00	122.53	73.73	-71.64
348.00	116.21	79.62	-93.12
372.00	124.16	79.34	-99.53
436.00	129.66	85.28	-125.92
445.00	126.40	88.34	-127.90
446.00	126.80	86.92	-130.40
464.00	126.80	90.54	-127.13
466.00	129.99	86.80	-131.84
502.00	126.92	91.39	-144.86
505.00	128.10	93.59	-148.13
510.00	116.82	91.66	-148.67
1271.00	147.88	143.65	-406.99
2109.00	174.11	192.74	-698.07
2156.00	185.68	190.81	-717.95
3057.00	214.77	246.94	-1023.56

SUBJNO	Factor1	Factor2	Factor3
3117.00	210.71	251.33	-1048.82
4012.00	240.92	302.60	-1354.79
4079.00	253.36	306.16	-1377.86
4083.00	241.49	308.62	-1378.15
4111.00	246.31	308.60	-1385.49
4121.00	244.13	311.41	-1388.38
4131.00	257.99	310.46	-1395.23
4137.00	249.26	310.27	-1397.60
4661.00	262.33	344.27	-1575.10
4724.00	256.21	347.24	-1602.26
5122.00	268.21	371.53	-1733.96
5610.00	302.22	402.68	-1901.79
5615.00	285.52	408.70	-1901.88
6165.00	304.42	434.03	-2093.75
6170.00	306.65	440.08	-2090.78
7347.00	354.46	508.39	-2499.42
7779.00	356.10	536.57	-2649.40
7780.00	355.78	532.45	-2649.37
7792.00	360.46	531.15	-2654.16
7814.00	361.47	535.33	-2655.95
7873.00	358.06	536.74	-2683.10
7910.00	366.96	541.89	-2694.02
7969.00	365.62	546.30	-2712.75
9616.00	416.65	641.91	-3282.38
9911.00	424.68	664.90	-3382.40
10123.00	432.57	675.63	-3455.82
10184.00	434.41	685.03	-3473.51
10579.00	456.53	699.46	-3612.58
11217.00	467.20	744.92	-3830.77
11652.00	484.61	769.58	-3981.14
11703.00	484.39	775.31	-3997.46
11712.00	469.49	775.57	-4000.87
11770.00	495.35	775.77	-4023.49
11843.00	488.53	780.59	-4040.28
12398.00	505.28	818.17	-4230.54
12403.00	509.10	812.85	-4244.16
12405.00	506.41	812.95	-4243.63
12547.00	527.46	822.16	-4288.16
13001.00	531.64	852.80	-4445.70
13015.00	526.67	854.32	-4452.71

SUBJNO	Factor1	Factor2	Factor3
13017.00	535.07	852.43	-4448.66
13020.00	528.70	855.74	-4451.31
13072.00	524.48	853.09	-4476.79
13109.00	533.04	858.54	-4480.81
13127.00	528.46	859.01	-4484.29
13307.00	531.20	871.74	-4549.87
13375.00	539.60	872.56	-4574.22
13377.00	539.18	871.91	-4580.29
14344.00	570.24	935.45	-4904.49
15219.00	606.52	987.99	-5213.16
15226.00	607.99	985.10	-5213.26
15262.00	600.92	988.37	-5225.53
15636.00	605.20	1010.64	-5356.20
16126.00	618.24	1042.81	-5522.07
16131.00	629.51	1039.46	-5524.56
16506.00	634.70	1065.17	-5656.86
17220.00	661.85	1104.18	-5902.79
17463.00	661.83	1123.94	-5981.61
17951.00	685.06	1152.89	-6148.11
17985.00	687.67	1158.68	-6158.68
17990.00	678.27	1155.36	-6161.67
19370.00	732.48	1235.45	-6637.43
19811.00	745.41	1262.77	-6789.85
19847.00	748.62	1265.17	-6804.55
19945.00	749.16	1273.48	-6838.96
20312.00	756.43	1293.59	-6967.28
20316.00	764.09	1297.43	-6965.67
20460.00	757.49	1305.45	-7014.21
20486.00	769.50	1306.39	-7025.99
20783.00	789.95	1323.29	-7122.08
20793.00	775.74	1323.96	-7127.58
20803.00	768.65	1324.99	-7127.88
20827.00	780.25	1326.83	-7143.13
20989.00	782.41	1339.20	-7195.60
21004.00	786.24	1341.29	-7195.37
21051.00	781.81	1336.61	-7217.04
21052.00	778.97	1341.95	-7215.04
21253.00	774.04	1356.45	-7283.40
21270.00	793.64	1353.75	-7289.77
21280.00	795.60	1351.70	-7301.22

SUBJNO	Factor1	Factor2	Factor3
21632.00	807.73	1376.29	-7416.75
21701.00	807.90	1380.56	-7440.41
22039.00	811.18	1399.90	-7558.98
22146.00	818.29	1406.50	-7592.23
22174.00	821.15	1407.60	-7606.44
22399.00	826.17	1422.38	-7685.95
22954.00	839.05	1455.35	-7873.85
22963.00	845.78	1453.42	-7876.80
23109.00	850.78	1464.57	-7928.47
23753.00	867.28	1503.99	-8147.37
23768.00	876.84	1503.34	-8155.05
23881.00	879.37	1512.46	-8188.16
23930.00	872.11	1513.41	-8207.62
23941.00	886.51	1514.77	-8209.57
24254.00	884.76	1534.10	-8317.38
24295.00	887.90	1534.76	-8337.10
24310.00	877.50	1535.98	-8339.87
24342.00	883.45	1542.20	-8347.84
24601.00	892.57	1558.79	-8437.31
24684.00	896.64	1560.58	-8470.78
24732.00	891.22	1566.19	-8486.70
24740.00	890.91	1565.30	-8492.13
24743.00	907.57	1567.42	-8488.47
24749.00	908.83	1564.10	-8490.65
24750.00	908.46	1566.45	-8490.43
24752.00	917.93	1564.06	-8486.96
24763.00	904.91	1564.42	-8493.98
24773.00	904.11	1567.55	-8493.52
24778.00	904.85	1570.53	-8496.72
24794.00	901.75	1572.69	-8504.48
24848.00	901.70	1569.82	-8523.04
24907.00	909.16	1575.30	-8545.05
24914.00	903.10	1573.58	-8544.29
24919.00	906.19	1578.34	-8546.60
24924.00	905.00	1575.42	-8549.92
24931.00	913.79	1574.63	-8554.06
24968.00	898.13	1581.54	-8565.61
24969.00	908.09	1578.39	-8566.06
24977.00	913.81	1579.28	-8569.47
24979.00	910.58	1579.41	-8570.23

SUBJNO	Factor1	Factor2	Factor3
24992.00	913.04	1582.97	-8570.14
24998.00	907.78	1581.74	-8578.04
25162.00	920.85	1588.00	-8631.20
25183.00	922.98	1594.45	-8638.40
25240.00	915.37	1593.44	-8657.22
25242.00	917.04	1595.11	-8658.18
25343.00	922.75	1600.33	-8697.65
25478.00	934.47	1609.33	-8742.88
25495.00	928.19	1610.53	-8744.16
26076.00	935.45	1648.36	-8945.45
26091.00	949.72	1647.93	-8949.09
26121.00	955.36	1652.18	-8952.57
26225.00	946.72	1659.34	-8994.15
26226.00	948.15	1657.40	-8996.72
262.00	115.54	76.02	-63.87
344.00	121.35	80.31	-93.52
522.00	129.89	92.39	-157.19
523.00	135.04	90.84	-152.08
1953.00	177.14	175.19	-644.42
3849.00	233.94	293.39	-1296.14
4016.00	249.81	306.54	-1356.64
4092.00	255.25	306.94	-1384.42
4142.00	239.92	312.61	-1401.14
5349.00	286.52	382.89	-1811.95
6061.00	303.11	427.80	-2060.23
6128.00	314.96	430.59	-2079.87
7558.00	365.10	516.08	-2573.09
7964.00	370.77	542.08	-2716.65
8019.00	375.97	552.48	-2732.28
10175.00	446.10	676.06	-3479.04
10583.00	454.45	701.15	-3618.11
12973.00	543.21	844.45	-4439.32
13056.00	530.92	854.77	-4468.16
13116.00	535.51	854.82	-4489.07
15210.00	595.57	987.22	-5207.86
15255.00	606.62	986.94	-5223.49
15271.00	612.94	988.91	-5228.41
15612.00	611.26	1008.00	-5349.11
15627.00	624.08	1005.20	-5355.00
15648.00	615.15	1009.18	-5361.09

SUBJNO	Factor1	Factor2	Factor3
15983.00	630.23	1034.12	-5475.52
16431.00	649.53	1061.42	-5625.00
17218.00	672.66	1105.02	-5902.63
17489.00	668.62	1128.79	-5993.10
17760.00	693.61	1138.57	-6084.97
17863.00	685.76	1144.35	-6124.32
17932.00	695.40	1146.57	-6150.39
17946.00	706.49	1150.19	-6148.42
19272.00	744.46	1227.61	-6607.86
19274.00	728.64	1231.10	-6611.42
19373.00	732.81	1238.68	-6640.92
19773.00	768.78	1258.67	-6778.28
19851.00	755.64	1263.96	-6799.82
19917.00	752.03	1274.10	-6828.05
19960.00	751.55	1271.29	-6842.40
20274.00	774.50	1290.74	-6948.19
20304.00	763.74	1290.89	-6961.13
20311.00	766.43	1295.53	-6961.94
20321.00	762.59	1294.09	-6967.08
20787.00	774.55	1323.02	-7128.36
21011.00	792.50	1336.51	-7204.81
21028.00	783.41	1335.59	-7211.03
21259.00	804.58	1350.38	-7289.19
21286.00	785.52	1354.78	-7299.81
21667.00	798.57	1377.98	-7431.30
22077.00	828.39	1402.14	-7564.23
22102.00	834.20	1398.89	-7584.05
22373.00	819.69	1423.91	-7673.75
23915.00	887.53	1515.30	-8200.43
23953.00	875.73	1516.10	-8216.06
23979.00	878.02	1519.81	-8226.70
24548.00	904.85	1552.03	-8422.86
24785.00	913.48	1564.38	-8504.29
24839.00	912.57	1568.10	-8516.61
24883.00	907.72	1573.26	-8536.60
24900.00	906.28	1571.25	-8542.51
25011.00	917.29	1579.82	-8574.85
25022.00	907.25	1583.07	-8586.00
25057.00	920.29	1583.88	-8598.69
25143.00	917.21	1586.45	-8629.04

SUBJNO	Factor1	Factor2	Factor3
25158.00	917.41	1591.44	-8629.22
25212.00	925.35	1589.06	-8652.95
25217.00	924.72	1593.88	-8647.19
25255.00	919.57	1593.84	-8664.05
25321.00	923.01	1600.59	-8687.24
25331.00	923.72	1599.44	-8688.62
25998.00	952.93	1638.58	-8917.90
26031.00	966.16	1641.62	-8930.85
26036.00	956.44	1642.06	-8931.84
26042.00	956.69	1643.26	-8934.45
26160.00	959.67	1648.12	-8975.67
470.00	122.98	87.34	-137.03
1107.00	154.39	126.89	-356.47
2149.00	186.32	189.44	-713.32
2163.00	188.34	189.52	-719.08
2182.00	173.84	199.18	-722.79
3931.00	243.93	297.80	-1329.06
3954.00	240.12	300.62	-1334.87
3973.00	243.11	299.43	-1341.30
4044.00	245.16	304.50	-1368.02
4155.00	236.53	310.10	-1405.67
5123.00	282.35	369.52	-1737.95
5127.00	293.61	370.68	-1740.58
5128.00	274.84	370.82	-1741.11
5286.00	293.47	376.90	-1795.00
5311.00	292.37	382.21	-1802.97
5381.00	288.57	387.73	-1822.24
5596.00	298.46	399.65	-1899.12
5619.00	296.68	401.16	-1904.15
5898.00	301.28	418.41	-2002.50
6048.00	311.13	429.06	-2049.92
6081.00	327.14	425.29	-2060.29
6108.00	297.34	432.71	-2072.25
6111.00	302.82	435.99	-2079.65
6168.00	313.50	434.26	-2098.27
6359.00	326.13	445.51	-2158.84
6692.00	328.70	467.98	-2271.98
6802.00	328.34	472.31	-2314.71
6819.00	336.76	473.94	-2319.65
7177.00	346.23	493.48	-2440.08

SUBJNO	Factor1	Factor2	Factor3
7228.00	335.30	498.19	-2455.70
7232.00	351.36	497.53	-2461.81
7262.00	352.46	502.73	-2473.03
7264.00	343.88	503.48	-2472.10
7448.00	356.15	512.85	-2535.64
7758.00	374.80	529.69	-2642.82
7789.00	373.26	535.20	-2657.50
7806.00	378.10	529.88	-2660.55
7820.00	366.55	536.18	-2664.88
8103.00	381.37	554.02	-2758.95
8316.00	392.47	562.00	-2834.90
8317.00	396.23	565.05	-2838.18
9063.00	405.68	610.32	-3096.42
9540.00	429.41	636.24	-3255.94
9625.00	425.65	644.38	-3281.77
10146.00	437.01	675.65	-3465.67
10161.00	452.59	675.45	-3465.07
10181.00	442.11	676.57	-3472.86
11215.00	480.59	739.09	-3836.88
11722.00	495.13	772.10	-4012.14
12477.00	510.90	820.00	-4267.14
13131.00	528.57	854.95	-4491.38
13349.00	534.60	872.87	-4565.92
13513.00	541.96	883.89	-4620.75
13516.00	552.47	879.33	-4621.91
15274.00	607.49	985.29	-5236.40
15591.00	632.77	1008.26	-5341.53
15637.00	604.56	1013.99	-5357.39
15640.00	617.86	1008.60	-5359.21
16036.00	625.44	1035.26	-5495.10
16063.00	632.96	1032.38	-5507.00
16130.00	627.25	1038.37	-5527.50
16415.00	647.16	1058.64	-5625.92
16459.00	636.36	1066.15	-5632.15
17479.00	674.70	1118.04	-5991.11
17493.00	684.97	1123.30	-5992.50
17494.00	680.66	1125.21	-5992.03
17864.00	689.20	1149.31	-6120.56
17914.00	693.87	1152.34	-6135.68
17939.00	694.99	1149.16	-6146.90

SUBJNO	Factor1	Factor2	Factor3
17940.00	689.26	1154.12	-6144.22
17944.00	691.18	1151.55	-6152.48
17945.00	699.09	1147.24	-6147.32
17947.00	674.84	1150.04	-6150.56
17981.00	697.72	1152.40	-6162.05
18016.00	695.45	1154.74	-6174.97
19267.00	737.17	1230.62	-6603.96
19305.00	734.42	1231.27	-6619.90
19852.00	749.29	1265.45	-6806.11
19926.00	758.24	1270.44	-6829.74
20275.00	763.96	1292.58	-6952.13
20349.00	767.23	1297.28	-6975.90
20470.00	778.08	1306.18	-7007.86
20987.00	789.65	1335.87	-7193.86
21020.00	793.14	1337.07	-7206.29
21050.00	791.35	1336.89	-7218.14
21252.00	797.97	1351.21	-7285.51
21279.00	816.61	1352.01	-7296.08
21311.00	801.94	1355.28	-7304.94
21662.00	801.70	1376.32	-7432.23
21663.00	810.39	1376.26	-7425.79
21695.00	815.18	1379.03	-7437.48
21716.00	812.48	1380.21	-7446.79
22144.00	827.27	1406.57	-7592.46
22493.00	836.31	1425.67	-7715.94
22530.00	834.86	1429.29	-7725.53
23032.00	851.68	1460.13	-7901.22
23106.00	857.15	1463.48	-7922.17
23110.00	850.35	1465.37	-7927.60
23132.00	858.71	1465.78	-7932.20
23151.00	859.50	1467.15	-7937.97
23292.00	872.83	1470.56	-7985.36
23935.00	887.56	1514.41	-8211.94
23938.00	884.87	1513.43	-8210.64
23939.00	893.57	1515.34	-8212.89
24259.00	897.46	1531.33	-8321.47
24263.00	887.20	1533.74	-8321.83
24291.00	882.85	1535.76	-8336.72
24300.00	902.31	1536.16	-8339.42
24301.00	882.15	1538.03	-8335.75

SUBJNO	Factor1	Factor2	Factor3
24551.00	904.35	1552.93	-8422.57
24619.00	898.21	1559.33	-8446.31
24620.00	914.56	1556.20	-8440.73
24687.00	897.45	1563.76	-8468.32
24702.00	904.74	1560.98	-8474.38
24711.00	904.25	1567.92	-8479.29
24717.00	906.50	1558.15	-8483.63
24758.00	902.94	1564.40	-8494.52
24760.00	922.94	1560.11	-8493.13
24769.00	917.35	1564.00	-8493.93
24813.00	908.21	1567.67	-8513.07
24846.00	912.96	1570.68	-8524.14
24847.00	902.78	1569.43	-8526.06
24856.00	918.26	1569.56	-8523.94
24880.00	900.61	1572.79	-8532.67
24922.00	912.26	1578.56	-8551.97
24926.00	918.93	1572.88	-8555.90
24932.00	908.42	1579.30	-8551.66
25024.00	897.16	1582.96	-8583.39
25046.00	925.11	1576.93	-8593.07
25048.00	919.18	1581.77	-8596.36
25062.00	923.83	1580.88	-8599.09
25074.00	916.14	1583.16	-8595.58
25106.00	919.33	1585.46	-8611.06
25129.00	914.84	1594.84	-8614.91
25142.00	921.87	1587.33	-8624.05
25144.00	931.51	1585.60	-8624.62
25193.00	917.94	1590.14	-8646.77
25231.00	921.93	1589.31	-8659.19
25234.00	930.76	1596.44	-8654.71
25244.00	921.08	1595.16	-8660.20
25273.00	916.80	1595.96	-8672.56
25312.00	931.42	1598.27	-8681.22
25327.00	926.23	1601.24	-8690.13
25338.00	929.17	1598.85	-8693.70
25340.00	924.87	1595.24	-8694.18
25356.00	929.56	1602.66	-8699.03
25523.00	925.16	1615.46	-8748.70
26002.00	943.82	1639.67	-8923.76
26004.00	961.40	1637.39	-8918.88

SUBJNO	Factor1	Factor2	Factor3
26038.00	932.90	1640.81	-8936.30
26043.00	950.85	1638.20	-8934.11
26056.00	955.71	1641.73	-8938.06
26088.00	950.45	1643.08	-8950.16
26095.00	944.62	1642.20	-8953.30
26110.00	949.13	1649.39	-8958.63
26136.00	944.75	1649.92	-8968.46
26181.00	954.92	1651.42	-8979.17
26193.00	954.31	1650.71	-8983.81
26212.00	966.87	1655.01	-8988.82
26218.00	951.43	1658.48	-8993.45
26233.00	959.32	1655.52	-9001.59
26239.00	952.78	1652.18	-9000.80
26245.00	953.87	1656.16	-9002.60
245.00	140.05	71.67	-62.07
357.00	139.11	81.48	-93.84
444.00	118.68	87.08	-124.32
467.00	139.00	87.25	-135.84
469.00	133.52	87.63	-134.27
473.00	137.87	91.83	-137.69
474.00	131.21	82.64	-137.23
503.00	128.23	95.02	-146.31
507.00	130.80	90.42	-150.84
509.00	124.45	90.38	-147.97
1105.00	142.05	126.19	-356.03
1115.00	155.49	125.59	-359.55
1128.00	151.97	130.76	-359.97
2171.00	183.25	192.51	-717.52
3925.00	247.35	298.83	-1324.09
3935.00	240.56	297.00	-1326.87
3989.00	248.93	299.66	-1345.56
4045.00	250.14	304.53	-1365.88
4116.00	257.91	310.58	-1392.29
4123.00	251.63	312.24	-1393.94
4132.00	239.17	311.62	-1397.15
5371.00	292.98	388.87	-1821.37
5614.00	301.50	401.61	-1905.42
5620.00	285.82	403.34	-1904.75
5997.00	318.84	425.45	-2033.29
6004.00	304.63	424.31	-2038.41

SUBJNO	Factor1	Factor2	Factor3
6005.00	315.81	426.12	-2035.37
6011.00	306.02	425.66	-2042.99
6068.00	305.58	432.24	-2063.54
6085.00	316.97	429.48	-2069.43
6122.00	310.26	432.59	-2072.95
6125.00	302.76	432.26	-2080.82
6351.00	330.13	443.60	-2158.12
6479.00	327.55	453.13	-2198.88
6721.00	325.24	467.97	-2284.41
6786.00	335.79	472.04	-2311.38
6797.00	328.96	473.68	-2314.99
6822.00	351.10	473.98	-2316.09
6930.00	338.93	480.96	-2357.46
6944.00	349.95	483.78	-2367.15
7241.00	343.45	500.34	-2464.75
7263.00	349.20	503.57	-2472.51
7350.00	356.89	504.19	-2501.06
7534.00	352.03	515.10	-2564.68
7539.00	360.56	516.34	-2567.33
7781.00	359.01	535.47	-2648.73
7782.00	379.12	530.32	-2652.03
7796.00	362.13	535.06	-2654.45
7807.00	363.05	536.08	-2658.07
7818.00	365.58	536.45	-2659.74
7932.00	368.95	544.50	-2696.85
7963.00	372.29	543.52	-2713.31
7966.00	379.39	544.68	-2713.17
8050.00	371.91	550.66	-2740.79
8311.00	380.90	565.35	-2836.43
8452.00	393.39	572.80	-2879.75
8470.00	395.91	573.71	-2890.26
9015.00	406.11	608.49	-3075.51
9175.00	411.62	618.40	-3136.30
9293.00	417.61	627.86	-3167.08
9704.00	430.05	649.12	-3314.13
10132.00	440.33	676.67	-3462.82
10160.00	441.71	675.94	-3468.35
10459.00	457.49	696.76	-3571.22
10476.00	451.07	705.73	-3575.76
10571.00	457.14	701.85	-3612.07

SUBJNO	Factor1	Factor2	Factor3
10576.00	464.47	701.00	-3609.98
11645.00	497.40	767.53	-3982.31
11719.00	498.14	775.01	-4006.71
11728.00	498.91	772.06	-4010.23
11778.00	492.21	772.69	-4028.88
12546.00	516.63	822.88	-4289.11
12997.00	521.54	854.58	-4439.30
13019.00	546.91	848.97	-4452.34
13137.00	546.05	859.82	-4490.28
13379.00	540.25	874.03	-4574.65
14273.00	584.09	922.09	-4885.76
14294.00	586.54	927.35	-4891.69
14327.00	572.00	932.73	-4902.66
14333.00	573.78	931.02	-4905.52
15619.00	621.26	1009.63	-5347.53
15667.00	606.76	1012.37	-5366.71
16479.00	652.21	1059.46	-5644.39
17781.00	681.45	1136.71	-6098.03
17865.00	691.85	1144.31	-6124.17
17973.00	695.42	1152.09	-6162.88
18053.00	707.61	1154.12	-6183.84
18054.00	692.99	1153.84	-6189.95
19171.00	740.43	1227.03	-6573.53
19382.00	736.44	1238.12	-6645.43
19691.00	746.43	1257.13	-6749.22
19813.00	751.49	1261.08	-6788.44
19969.00	757.11	1276.88	-6836.77
20469.00	770.41	1303.19	-7016.83
20487.00	765.92	1304.96	-7020.31
20790.00	780.80	1323.38	-7126.62
20812.00	790.03	1327.31	-7131.99
21045.00	793.23	1339.72	-7213.76
21321.00	805.69	1359.05	-7306.81
21651.00	815.91	1374.66	-7425.05
21676.00	810.25	1377.52	-7432.97
21705.00	815.53	1378.68	-7440.32
21709.00	815.78	1378.24	-7444.70
22132.00	825.58	1405.13	-7586.72
22402.00	828.99	1422.35	-7682.17
22527.00	845.63	1427.57	-7725.42

SUBJNO	Factor1	Factor2	Factor3
22993.00	852.60	1459.50	-7884.28
23750.00	888.55	1501.72	-8142.05
23752.00	877.70	1505.19	-8146.63
23769.00	872.12	1505.45	-8149.63
23978.00	889.76	1518.11	-8225.34
24067.00	883.01	1520.98	-8255.21
24255.00	885.57	1532.19	-8319.51
24303.00	912.83	1538.07	-8334.36
24573.00	900.05	1553.09	-8433.47
24622.00	904.36	1558.56	-8444.77
24699.00	906.24	1558.70	-8471.70
24704.00	895.86	1563.86	-8472.68
24705.00	906.96	1560.96	-8474.87
24729.00	900.68	1566.62	-8482.83
24731.00	898.75	1562.52	-8483.57
24736.00	907.88	1570.69	-8485.67
24739.00	911.72	1563.11	-8487.42
24746.00	908.29	1567.29	-8484.02
24759.00	909.39	1563.01	-8497.00
24772.00	902.78	1565.99	-8496.45
24812.00	906.70	1573.81	-8519.01
24814.00	913.66	1567.42	-8511.20
24845.00	913.96	1570.11	-8525.95
24859.00	908.94	1573.26	-8528.06
24869.00	922.62	1569.18	-8535.33
24872.00	920.84	1571.78	-8533.58
24884.00	909.03	1569.67	-8537.75
24913.00	921.99	1575.29	-8542.29
24915.00	921.05	1573.47	-8546.55
24917.00	908.35	1575.68	-8549.15
24929.00	923.45	1573.64	-8547.96
24944.00	917.16	1572.51	-8561.34
24951.00	914.30	1577.14	-8562.87
24958.00	916.72	1577.01	-8562.46
24960.00	914.27	1574.66	-8566.65
24978.00	922.91	1580.27	-8565.99
25021.00	916.69	1581.44	-8578.82
25030.00	909.03	1583.20	-8587.10
25059.00	904.22	1583.69	-8597.07
25069.00	921.54	1586.15	-8598.10

SUBJNO	Factor1	Factor2	Factor3
25076.00	912.29	1583.94	-8602.00
25079.00	926.25	1586.88	-8601.68
25111.00	915.47	1586.80	-8611.63
25114.00	926.64	1582.83	-8616.05
25126.00	921.68	1586.11	-8619.70
25127.00	911.01	1587.14	-8620.89
25170.00	929.05	1589.11	-8635.97
25172.00	924.58	1587.36	-8639.89
25175.00	924.69	1592.60	-8631.96
25181.00	924.79	1589.58	-8638.36
25235.00	940.26	1595.47	-8658.78
25275.00	939.65	1598.61	-8669.43
25319.00	920.54	1600.57	-8687.02
25330.00	948.18	1597.38	-8690.72
25349.00	938.74	1598.28	-8696.46
25353.00	920.40	1599.46	-8701.81
25367.00	930.27	1605.95	-8699.74
25479.00	936.62	1606.05	-8741.17
25509.00	933.60	1609.29	-8751.59
25512.00	939.93	1607.09	-8753.95
25994.00	939.84	1642.13	-8918.28
26050.00	949.92	1643.23	-8937.70
26061.00	954.91	1641.21	-8939.04
26064.00	954.64	1644.86	-8941.47
26067.00	956.99	1645.05	-8940.93
26074.00	955.16	1644.89	-8946.47
26080.00	948.27	1648.77	-8941.80
26082.00	955.59	1640.79	-8952.70
26086.00	948.46	1644.98	-8951.44
26103.00	946.31	1647.62	-8956.53
26105.00	948.85	1647.81	-8955.74
26113.00	955.64	1645.80	-8957.55
26117.00	949.96	1646.70	-8958.86
26119.00	956.31	1647.28	-8961.38
26124.00	945.28	1649.92	-8963.18
26138.00	954.85	1653.20	-8963.62
26148.00	949.82	1647.00	-8971.57
26176.00	961.60	1652.98	-8977.65
26188.00	956.30	1651.53	-8986.04
26189.00	956.31	1655.06	-8984.26

SUBJNO	Factor1	Factor2	Factor3
26197.00	963.56	1652.96	-8985.04
26206.00	955.08	1655.60	-8991.57
26207.00	957.66	1649.24	-8993.76
26228.00	955.67	1654.83	-8996.33
26240.00	960.69	1653.97	-9001.17
26243.00	947.30	1655.76	-9004.30
26244.00	951.85	1656.66	-9005.87
26250.00	964.87	1652.80	-9009.59
26251.00	953.26	1654.11	-9007.29
336.00	137.21	78.58	-85.61
346.00	128.26	79.69	-91.11
347.00	117.03	81.41	-90.92
359.00	135.54	75.91	-96.74
437.00	124.32	87.75	-124.02
1084.00	151.15	125.99	-349.21
1112.00	145.11	129.23	-359.69
1165.00	153.40	129.52	-375.83
2190.00	181.06	193.51	-724.56
2367.00	183.05	211.62	-789.79
2373.00	193.79	210.33	-787.07
3110.00	224.43	253.43	-1035.90
3153.00	220.36	250.05	-1056.02
4119.00	249.26	309.03	-1390.53
4127.00	265.83	311.39	-1388.26
5125.00	272.55	373.17	-1739.00
5191.00	277.81	376.98	-1759.39
5361.00	287.82	387.98	-1814.36
5497.00	293.06	395.26	-1865.17
5599.00	298.74	399.53	-1898.23
6086.00	304.41	429.42	-2068.98
6358.00	329.83	444.97	-2158.80
6823.00	329.13	472.47	-2317.91
7540.00	364.83	516.91	-2568.05
7561.00	343.28	522.38	-2576.66
7777.00	367.83	527.40	-2650.59
7784.00	365.44	531.56	-2651.98
9569.00	409.68	639.01	-3266.79
10158.00	429.09	684.68	-3465.05
10171.00	434.85	675.87	-3475.33
10209.00	446.03	682.92	-3483.68

SUBJNO	Factor1	Factor2	Factor3
10589.00	468.86	700.08	-3618.07
12388.00	515.35	813.60	-4233.71
12420.00	507.39	817.32	-4242.11
13014.00	530.90	851.70	-4450.21
13016.00	534.33	847.79	-4458.09
13101.00	542.76	856.37	-4483.14
13304.00	552.06	863.40	-4552.50
13305.00	533.87	872.09	-4550.57
13376.00	549.10	871.25	-4576.01
13614.00	549.64	888.99	-4655.03
14332.00	583.58	929.68	-4907.75
15220.00	603.16	984.90	-5213.71
15238.00	615.35	985.92	-5220.56
16125.00	642.05	1041.19	-5521.26
16398.00	645.79	1054.72	-5617.74
16449.00	643.67	1059.91	-5630.32
17228.00	669.05	1108.61	-5899.96
17458.00	681.74	1119.68	-5977.36
17468.00	677.69	1121.64	-5985.22
17535.00	688.17	1125.63	-6008.50
17833.00	699.75	1141.62	-6111.04
17890.00	694.56	1148.92	-6133.39
19307.00	736.85	1234.56	-6619.89
19678.00	752.15	1258.36	-6741.75
19849.00	743.58	1266.00	-6801.91
20258.00	775.84	1293.93	-6939.97
20291.00	770.37	1292.47	-6957.88
20519.00	778.36	1306.76	-7034.27
20784.00	778.52	1323.45	-7120.63
20797.00	789.73	1322.46	-7128.77
20829.00	793.66	1328.13	-7137.91
20830.00	784.93	1324.56	-7141.10
21325.00	804.82	1359.59	-7309.39
21652.00	810.91	1380.24	-7425.46
21659.00	810.34	1375.09	-7425.00
21680.00	812.29	1379.96	-7434.26
21690.00	800.59	1381.14	-7437.81
21708.00	807.91	1380.88	-7443.02
22085.00	807.69	1406.07	-7571.21
22224.00	831.93	1407.38	-7622.04

SUBJNO	Factor1	Factor2	Factor3
22955.00	859.58	1454.96	-7873.74
22966.00	845.60	1454.25	-7879.93
23031.00	847.08	1464.50	-7894.50
23085.00	861.47	1466.98	-7916.75
23900.00	888.36	1510.18	-8197.20
23993.00	887.96	1515.84	-8232.42
24309.00	905.26	1538.37	-8332.65
24631.00	910.31	1555.50	-8448.02
24634.00	914.17	1557.11	-8447.67
24695.00	908.62	1561.67	-8469.17
24706.00	902.04	1564.63	-8467.87
24721.00	899.78	1563.99	-8478.58
24733.00	908.32	1567.23	-8484.74
24852.00	908.32	1567.91	-8525.50
24855.00	920.32	1568.78	-8525.31
24964.00	925.49	1578.75	-8558.67
25056.00	906.26	1585.37	-8593.32
25072.00	929.81	1581.15	-8599.95
25073.00	923.32	1578.36	-8606.42
25080.00	913.17	1583.74	-8604.95
25130.00	936.09	1584.97	-8622.28
25198.00	924.23	1590.99	-8643.84
25317.00	932.84	1595.93	-8686.54
26030.00	950.51	1643.74	-8929.21
26065.00	948.24	1644.38	-8941.50
26066.00	945.13	1645.41	-8942.39
26072.00	939.92	1646.48	-8942.38
26078.00	951.86	1647.76	-8943.10
26083.00	943.20	1645.28	-8949.53
26143.00	944.98	1654.71	-8967.68
26146.00	947.44	1649.24	-8969.43
26157.00	956.53	1647.77	-8976.27
26164.00	951.77	1653.75	-8973.59
26177.00	945.91	1652.22	-8978.51
26199.00	959.28	1649.67	-8987.96
26201.00	961.07	1651.45	-8987.80
26224.00	962.79	1657.26	-8988.12
26248.00	955.85	1656.58	-9004.94
15617.00	600.43	1010.60	-5351.70
17897.00	683.05	1146.16	-6133.62

SUBJNO	Factor1	Factor2	Factor3
21289.00	789.69	1355.33	-7298.65
23295.00	859.55	1474.70	-7989.38
24888.00	895.24	1576.98	-8538.04
25156.00	913.60	1589.84	-8624.14
3098.00	197.61	248.15	-1042.54
7828.00	359.91	536.68	-2666.58
8049.00	375.52	547.16	-2739.32
12981.00	524.47	849.44	-4441.73
15244.00	598.33	988.29	-5218.86
16149.00	633.07	1038.60	-5535.20
20462.00	763.67	1304.75	-7016.23
24615.00	892.07	1559.14	-8445.09
25139.00	907.15	1593.86	-8623.93
5174.00	281.07	377.44	-1755.45
6091.00	302.56	430.74	-2067.91
7040.00	335.96	489.89	-2394.82
12972.00	534.81	846.53	-4438.98
17545.00	679.04	1128.89	-6008.19
20309.00	760.83	1297.22	-6959.33
20473.00	761.12	1309.35	-7016.12
20835.00	775.60	1328.19	-7142.58
20992.00	782.16	1339.78	-7193.31
21290.00	797.44	1355.07	-7298.54
22100.00	812.73	1403.72	-7577.22
358.00	110.05	80.75	-99.55
2177.00	180.07	188.49	-723.26
6169.00	305.69	436.20	-2098.48
13350.00	532.79	873.61	-4561.64
17943.00	672.51	1152.58	-6148.69
19388.00	725.20	1237.49	-6651.23
20791.00	773.68	1326.11	-7124.71
20817.00	782.40	1323.66	-7138.84
1265.00	164.15	137.59	-411.32
24827.00	889.81	1574.50	-8518.12
25228.00	920.73	1590.84	-8654.94
13140.00	528.17	860.53	-4496.34
16145.00	634.81	1037.96	-5529.18
17467.00	663.01	1121.81	-5983.01
17472.00	668.65	1119.70	-5991.91
21038.00	775.81	1337.16	-7212.80

SUBJNO	Factor1	Factor2	Factor3
4117.00	229.07	308.37	-1390.24
11721.00	481.76	774.90	-4008.92
13025.00	527.19	852.47	-4452.29
15231.00	589.48	987.61	-5213.99
22080.00	817.32	1400.97	-7571.20
3870.00	242.19	294.08	-1300.00
11701.00	473.63	774.63	-4000.03
12550.00	512.55	822.02	-4289.50
13079.00	532.91	856.04	-4472.02
13360.00	544.79	871.95	-4569.09
17236.00	664.88	1104.12	-5908.95
2185.00	180.95	195.84	-722.06
12404.00	512.17	814.13	-4243.91
13344.00	543.62	870.64	-4561.35
16136.00	634.04	1040.98	-5525.55
21328.00	786.37	1356.87	-7312.55
8035.00	378.83	548.46	-2733.16
13121.00	535.91	861.86	-4485.77
13378.00	541.31	872.88	-4576.82
22171.00	814.43	1406.68	-7606.76
367.00	121.15	78.72	-101.08
13610.00	545.67	887.61	-4658.60
15218.00	597.28	984.74	-5208.59

SUBJNO	Factor1	Factor2	Factor3
20823.00	783.82	1324.56	-7141.23
3901.00	233.10	296.18	-1317.41
11748.00	484.79	778.95	-4013.78
17460.00	665.82	1120.01	-5982.11
17490.00	679.42	1123.81	-5989.88
19772.00	750.21	1267.75	-6771.51
20255.00	762.98	1289.77	-6941.80
22104.00	836.25	1400.22	-7574.00
23925.00	869.22	1517.55	-8205.70
14275.00	578.59	925.21	-4885.64
15277.00	598.01	988.41	-5230.82
17483.00	673.54	1121.14	-5991.43
17938.00	675.96	1150.41	-6151.68
18000.00	679.69	1155.86	-6168.09
20798.00	764.68	1326.19	-7131.82
21329.00	788.76	1354.17	-7315.23
23758.00	883.41	1505.36	-8142.77
341.00	118.40	78.90	-91.12
5598.00	288.38	402.08	-1901.98
12159.00	515.22	797.14	-4158.60
15217.00	593.63	987.79	-5208.50
17793.00	702.22	1139.29	-6093.38
20482.00	781.21	1305.06	-7020.00

Appendix B Sizing Charts for Method I
Male Sizing Chart Method I

Measurements are in millimeters.

Factor 1

%	THMBLGTH	D1HGHT	D1FUNCLT	D2LGTH	D2HGHT
5th	66	97	121	69	171
25th	62	99	121	72	172
50th	68	104	125	76	180
75th	70	96	132	78	186
95th	81	111	133	82	194
%	**D3LINK**	**D4LGTH**	**D4HGHT**	**D4LINK**	**D5LGTH**
5th	101	71	164	98	52
25th	107	76	173	103	64
50th	111	78	177	111	67
75th	118	83	190	112	69
95th	119	82	192	111	73
%	**PALMLGTH**	**WRCTRGRL**	**WRINFNGL**	**WRTHLGTH**	**D5LINK**
5th	104	63	174	118	72
25th	105	70	171	122	85
50th	108	72	182	125	91
75th	115	73	186	127	88
95th	119	71	195	136	95
%	**D3HGHT**	**CROTCH1**	**CROTCH2**	**CROTCH3**	**CROTCH4**
5th	180	69	105	102	87
25th	188	69	104	104	90
50th	193	69	108	106	93
75th	201	70	112	112	100
95th	210	76	119	115	105
%	**HANDLGTH**	**D2LINK**	**D3LGTH**	**D5HGHT**	**SUBJNO**
5th	184	99	76	125	14198
25th	189	103	83	138	19497
50th	196	109	85	140	16841
75th	197	114	87	154	6555
95th	208	123	92	161	6466

Factor 2

%	D2PIP	D2PCIRC	D2DIP	D2DCIRC	D3PIP	D3PCIRC
5th	21	66.02	18	55.09	20	66.99
25th	23	68.4	20	57.33	22	68.83
50th	25	70.3	21	58.78	23	70.21
75th	23	68.4	20	57.33	25	72.97
95th	27	73.16	24	61.81	25	72.97
%	**D4PCIRC**	**D4DIP**	**D4DCIRC**	**D5PIP**	**D5PCIRC**	**D5DIP**
5th	61.51	16	51.41	19	57.25	16
25th	64.29	18	53.37	19	57.52	17
50th	65.24	18	53.67	20	59.01	18
75th	68.02	20	55.63	18	56.57	18
95th	67.07	20	55.33	20	59.01	18
%	**D4PIP**	**D5DCIRC**	**WRISBRTH**	**D3DIP**	**D3DCIRC**	**SUBJNO**
5th	19	48.24	62	19	56.57	6214
25th	21	48.83	70	19	57.07	4952
50th	22	50.15	66	20	58.18	17290
75th	24	48.69	71	22	60.4	18393
95th	23	50.15	72	22	60.4	18681

Factor 3

%	THUMBBR	THMBCIRC	HANDCIRC	HANDBRTH	WRISCIRC	SUBJNO
5th	23	70.07	194	83	165	24182
25th	23	70.07	200	85	166	23619
50th	24	72.27	209	88	172	12095
75th	24	72.27	206	90	168	6219
95th	25	74.47	234	97	194	20525

Female Sizing Chart for Method I

Measurements are in millimeters.

Factor 1

%	THMBLGTH	D1HGHT	D1FUNCLT	D2LGTH	D2HGHT	D2LINK
5th	67	106	130	80	190	116
25th	57	82	106	68	158	98
50th	66	86	116	73	163	108
75th	60	91	109	66	157	97
95th	62	86	104	66	164	96
%	**D3LINK**	**D4LGTH**	**D4HGHT**	**D4LINK**	**D5LGTH**	**D3LGTH**
5th	106	82	184	105	73	87
25th	94	70	156	95	58	73
50th	101	73	170	98	62	78
75th	97	65	153	92	49	72
95th	98	69	157	95	54	73
%	**PALMLGTH**	**WRINFNGL**	**WRTHLGTH**	**D5HGHT**	**D5LINK**	**D3HGHT**
5th	114	190	127	148	89	200
25th	95	167	115	120	74	168
50th	103	169	120	139	80	180
75th	96	161	112	122	71	168
95th	102	171	116	119	71	175
%	**HANDLGTH**	**CROTCH1**	**CROTCH2**	**CROTCH3**	**CROTCH4**	**SUBJNO**
5th	202	72	118	116	97	1160
25th	176	56	94	94	81	9616
50th	183	63	101	102	88	19382
75th	174	60	96	94	84	24975
95th	184	63	103	101	87	26226

Factor 2

%	D2PIP	D2PCIRC	D2DIP	D2DCIRC	D3PIP	D3PCIRC
5th	20	59.27	15	48.42	17	57.55
25th	19	60.14	17	49.94	18	59.75
50th	19	61.03	18	51.01	19	60.89
75th	19	60.14	17	49.94	18	58.69
95th	20	61.05	17	50.56	19	60.89
%	**D4PCIRC**	**D4DIP**	**D4DCIRC**	**D5PIP**	**D5PCIRC**	**D5DIP**
5th	53.52	14	43.78	14	47.31	14
25th	54.62	14	44.35	16	49.63	14
50th	58.86	17	48.34	17	52.35	17
75th	54.62	14	44.35	16	49.11	13
95th	58.86	17	48.34	17	51.31	15
%	**WRISBRTH**	**WRISCIRC**	**D4PIP**	**HANDBRTH**	**D3DIP**	**D3DCIRC**
5th	55	151	16	78	15	47.57
25th	55	141	17	78	17	50.01
50th	58	155	19	82	17	50.61
75th	56	142	17	80	15	48.17
95th	57	150	19	75	17	50.61
%	**D5DCIRC**	**HANDCIRC**	**SUBJNO**			
5th	40.25	187	1953			
25th	41.57	179	9533			
50th	44.81	191	19367			
75th	40.71	187	24852			
95th	43.09	180	26046			

Factor 3

%	THUMBBR	THMBCIRC	WRCTRGRL	SUBJNO
5th	20	61.8	66	26088
25th	21	63.76	69	24793
50th	20	61.8	60	19373
75th	19	59.84	63	9569
95th	21	63.76	59	2072

Appendix C Specification Limits for Method I
Male Tolerance Limits for Method I

Factor 1

Variable	Percentile	Measurement (cm)	Lower Tolerance Limit (cm)	Upper Tolerance Limit (cm)
Digit 1 Length	**5th**	6.60	5.16	8.04
Digit 1 Length	**25th**	6.20	4.76	7.64
Digit 1 Length	**50th**	6.80	5.36	8.24
Digit 1 Length	**75th**	7.00	5.56	8.44
Digit 1 Length	**95th**	8.10	6.66	9.54
Digit 1 Height	**5th**	9.70	7.48	11.92
Digit 1 Height	**25th**	9.90	7.68	12.12
Digit 1 Height	**50th**	10.40	8.18	12.62
Digit 1 Height	**75th**	9.60	7.38	11.82
Digit 1 Height	**95th**	11.10	8.88	13.32
Digit 1 Link Length	**5th**	12.10	9.94	14.26
Digit 1 Link Length	**25th**	12.10	9.94	14.26
Digit 1 Link Length	**50th**	12.50	10.34	14.66
Digit 1 Link Length	**75th**	13.20	11.04	15.36
Digit 1 Link Length	**95th**	13.30	11.14	15.46
Digit 2 Length	**5th**	6.90	5.43	8.37
Digit 2 Length	**25th**	7.20	5.73	8.67
Digit 2 Length	**50th**	7.60	6.13	9.07
Digit 2 Length	**75th**	7.80	6.33	9.27
Digit 2 Length	**95th**	8.20	6.73	9.67
Digit 2 Height	**5th**	17.10	14.25	19.95
Digit 2 Height	**25th**	17.20	14.35	20.05
Digit 2 Height	**50th**	18.00	15.15	20.85
Digit 2 Height	**75th**	18.60	15.75	21.45
Digit 2 Height	**95th**	19.40	16.55	22.25
Digit 2 Link Length	**5th**	9.90	7.83	11.97
Digit 2 Link Length	**25th**	10.30	8.23	12.37
Digit 2 Link Length	**50th**	10.90	8.83	12.97
Digit 2 Link Length	**75th**	11.40	9.33	13.47
Digit 2 Link Length	**95th**	12.30	10.23	14.37
Digit 3 Length	**5th**	7.60	5.98	9.22
Digit 3 Length	**25th**	8.30	6.68	9.92

Digit 3 Length	**50th**	8.50	6.88	10.12
Digit 3 Length	**75th**	8.70	7.08	10.32
Digit 3 Length	**95th**	9.20	7.58	10.82
Digit 3 Link Length	**5th**	10.10	8.00	12.20
Digit 3 Link Length	**25th**	10.70	8.60	12.80
Digit 3 Link Length	**50th**	11.10	9.00	13.20
Digit 3 Link Length	**75th**	11.80	9.70	13.90
Digit 3 Link Length	**95th**	11.90	9.80	14.00
Digit 4 Length	**5th**	7.10	5.54	8.66
Digit 4 Length	**25th**	7.60	6.04	9.16
Digit 4 Length	**50th**	7.80	6.24	9.36
Digit 4 Length	**75th**	8.30	6.74	9.86
Digit 4 Length	**95th**	8.20	6.64	9.76
Digit 4 Height	**5th**	16.40	13.37	19.43
Digit 4 Height	**25th**	17.30	14.27	20.33
Digit 4 Height	**50th**	17.70	14.67	20.73
Digit 4 Height	**75th**	19.00	15.97	22.03
Digit 4 Height	**95th**	19.20	16.17	22.23
Digit 4 Link Length	**5th**	9.80	7.85	11.75
Digit 4 Link Length	**25th**	10.30	8.35	12.25
Digit 4 Link Length	**50th**	11.10	9.15	13.05
Digit 4 Link Length	**75th**	11.20	9.25	13.15
Digit 4 Link Length	**95th**	11.10	9.15	13.05
Digit 5 Length	**5th**	5.20	3.73	6.67
Digit 5 Length	**25th**	6.40	4.93	7.87
Digit 5 Length	**50th**	6.70	5.23	8.17
Digit 5 Length	**75th**	6.90	5.43	8.37
Digit 5 Length	**95th**	7.30	5.83	8.77
Digit 5 Height	**5th**	12.50	9.68	15.32
Digit 5 Height	**25th**	13.80	10.98	16.62
Digit 5 Height	**50th**	14.00	11.18	16.82
Digit 5 Height	**75th**	15.40	12.58	18.22
Digit 5 Height	**95th**	16.10	13.28	18.92
Digit 5 Link Length	**5th**	7.20	5.43	8.97
Digit 5 Link Length	**25th**	8.50	6.73	10.27
Digit 5 Link Length	**50th**	9.10	7.33	10.87
Digit 5 Link Length	**75th**	8.80	7.03	10.57
Digit 5 Link Length	**95th**	9.50	7.73	11.27
Palm Length	**5th**	10.40	8.60	12.20

Palm Length	**25th**	10.50	8.70	12.30
Palm Length	**50th**	10.80	9.00	12.60
Palm Length	**75th**	11.50	9.70	13.30
Palm Length	**95th**	11.90	10.10	13.70
Wrist To Center of Grip Length	**5th**	6.30	4.86	7.74
Wrist To Center of Grip Length	**25th**	7.00	5.56	8.44
Wrist To Center of Grip Length	**50th**	7.20	5.76	8.64
Wrist To Center of Grip Length	**75th**	7.30	5.86	8.74
Wrist To Center of Grip Length	**95th**	7.10	5.66	8.54
Wrist Index Finger Length	**5th**	17.40	14.67	20.13
Wrist Index Finger Length	**25th**	17.10	14.37	19.83
Wrist Index Finger Length	**50th**	18.20	15.47	20.93
Wrist Index Finger Length	**75th**	18.60	15.87	21.33
Wrist Index Finger Length	**95th**	19.50	16.77	22.23
Crotch 1 Height	**5th**	6.90	5.49	8.31
Crotch 1 Height	**25th**	6.90	5.49	8.31
Crotch 1 Height	**50th**	6.90	5.49	8.31
Crotch 1 Height	**75th**	7.00	5.59	8.41
Crotch 1 Height	**95th**	7.60	6.19	9.01
Crotch 2 Height	**5th**	10.50	8.67	12.33
Crotch 2 Height	**25th**	10.40	8.57	12.23
Crotch 2 Height	**50th**	10.80	8.97	12.63
Crotch 2 Height	**75th**	11.20	9.37	13.03
Crotch 2 Height	**95th**	11.90	10.07	13.73
Crotch 3 Height	**5th**	10.20	8.28	12.12
Crotch 3 Height	**25th**	10.40	8.48	12.32
Crotch 3 Height	**50th**	10.60	8.68	12.52
Crotch 3 Height	**75th**	11.20	9.28	13.12
Crotch 3 Height	**95th**	11.50	9.58	13.42
Crotch 4 Height	**5th**	8.70	6.84	10.56
Crotch 4 Height	**25th**	9.00	7.14	10.86
Crotch 4 Height	**50th**	9.30	7.44	11.16
Crotch 4 Height	**75th**	10.00	8.14	11.86
Crotch 4 Height	**95th**	10.50	8.64	12.36

Digit 3 Height	**5th**	18.00	14.91	21.09
Digit 3 Height	**25th**	18.80	15.71	21.89
Digit 3 Height	**50th**	19.30	16.21	22.39
Digit 3 Height	**75th**	20.10	17.01	23.19
Digit 3 Height	**95th**	21.00	17.91	24.09
Hand Length Measured	**5th**	18.40	15.43	21.37
Hand Length Measured	**25th**	18.90	15.93	21.87
Hand Length Measured	**50th**	19.60	16.63	22.57
Hand Length Measured	**75th**	19.70	16.73	22.67
Hand Length Measured	**95th**	20.80	17.83	23.77

Factor 2

Variable	Percentile	Measurement (cm)	Lower Tolerance Limit (cm)	Upper Tolerance Limit (cm)
D2PIP	**5th**	2.10	1.62	2.58
D2PIP	**25th**	2.30	1.82	2.78
D2PIP	**50th**	2.50	2.02	2.98
D2PIP	**75th**	2.30	1.82	2.78
D2PIP	**95th**	2.70	2.22	3.18
D2PCIRC	**5th**	6.60	6.06	7.14
D2PCIRC	**25th**	6.84	6.30	7.38
D2PCIRC	**50th**	7.03	6.49	7.57
D2PCIRC	**75th**	6.84	6.30	7.38
D2PCIRC	**95th**	7.32	6.78	7.86
D2DIP	**5th**	1.80	1.35	2.25
D2DIP	**25th**	2.00	1.55	2.45
D2DIP	**50th**	2.10	1.65	2.55
D2DIP	**75th**	2.00	1.55	2.45
D2DIP	**95th**	2.40	1.95	2.85
D2DCIRC	**5th**	5.51	5.03	5.99
D2DCIRC	**25th**	5.73	5.25	6.21
D2DCIRC	**50th**	5.88	5.40	6.36
D2DCIRC	**75th**	5.73	5.25	6.21
D2DCIRC	**95th**	6.18	5.70	6.66
D3PIP	**5th**	2.00	1.52	2.48

D3PIP	**25th**	2.20	1.72	2.68
D3PIP	**50th**	2.30	1.82	2.78
D3PIP	**75th**	2.50	2.02	2.98
D3PIP	**95th**	2.50	2.02	2.98
D3PCIRC	**5th**	6.70	6.10	7.30
D3PCIRC	**25th**	6.88	6.28	7.48
D3PCIRC	**50th**	7.02	6.42	7.62
D3PCIRC	**75th**	7.30	6.70	7.90
D3PCIRC	**95th**	7.30	6.70	7.90
D3DIP	**5th**	1.90	1.48	2.32
D3DIP	**25th**	1.90	1.48	2.32
D3DIP	**50th**	2.00	1.58	2.42
D3DIP	**75th**	2.20	1.78	2.62
D3DIP	**95th**	2.20	1.78	2.62
D3DCIRC	**5th**	5.66	5.18	6.14
D3DCIRC	**25th**	5.71	5.23	6.19
D3DCIRC	**50th**	5.82	5.34	6.30
D3DCIRC	**75th**	6.04	5.56	6.52
D3DCIRC	**95th**	6.04	5.56	6.52
D4PCIRC	**5th**	6.15	5.58	6.72
D4PCIRC	**25th**	6.43	5.86	7.00
D4PCIRC	**50th**	6.52	5.95	7.09
D4PCIRC	**75th**	6.80	6.23	7.37
D4PCIRC	**95th**	6.71	6.14	7.28
D4DIP	**5th**	1.60	1.18	2.02
D4DIP	**25th**	1.80	1.38	2.22
D4DIP	**50th**	1.80	1.38	2.22
D4DIP	**75th**	2.00	1.58	2.42
D4DIP	**95th**	2.00	1.58	2.42
D4DCIRC	**5th**	5.14	4.75	5.53
D4DCIRC	**25th**	5.34	4.95	5.73
D4DCIRC	**50th**	5.37	4.98	5.76
D4DCIRC	**75th**	5.56	5.17	5.95
D4DCIRC	**95th**	5.53	5.14	5.92
D5PIP	**5th**	1.90	1.51	2.29
D5PIP	**25th**	1.90	1.51	2.29
D5PIP	**50th**	2.00	1.61	2.39
D5PIP	**75th**	1.80	1.41	2.19

D5PIP	**95th**	2.00	1.61	2.39
D5PCIRC	**5th**	5.73	5.19	6.27
D5PCIRC	**25th**	5.75	5.21	6.29
D5PCIRC	**50th**	5.90	5.36	6.44
D5PCIRC	**75th**	5.66	5.12	6.20
D5PCIRC	**95th**	5.90	5.36	6.44
D5DIP	**5th**	1.60	1.21	1.99
D5DIP	**25th**	1.70	1.31	2.09
D5DIP	**50th**	1.80	1.41	2.19
D5DIP	**75th**	1.80	1.41	2.19
D5DIP	**95th**	1.80	1.41	2.19
D5DCIRC	**5th**	4.82	4.34	5.30
D5DCIRC	**25th**	4.88	4.40	5.36
D5DCIRC	**50th**	5.02	4.54	5.50
D5DCIRC	**75th**	4.87	4.39	5.35
D5DCIRC	**95th**	5.02	4.54	5.50
WRISBRTH	**5th**	6.20	4.85	7.55
WRISBRTH	**25th**	7.00	5.65	8.35
WRISBRTH	**50th**	6.60	5.25	7.95
WRISBRTH	**75th**	7.10	5.75	8.45
WRISBRTH	**95th**	7.20	5.85	8.55
D4PIP	**5th**	1.90	1.45	2.35
D4PIP	**25th**	2.10	1.65	2.55
D4PIP	**50th**	2.20	1.75	2.65
D4PIP	**75th**	2.40	1.95	2.85
D4PIP	**95th**	2.30	1.85	2.75

Factor 3

Variable	**Percentile**	**Measurement (cm)**	**Lower Tolerance Limit (cm)**	**Upper Tolerance Limit (cm)**
THUMBBR	**5th**	2.30	1.91	2.69
THUMBBR	**25th**	2.30	1.91	2.69
THUMBBR	**50th**	2.40	2.01	2.79
THUMBBR	**75th**	2.40	2.01	2.79
THUMBBR	**95th**	2.50	2.11	2.89
THMBCIRC	**5th**	7.01	6.14	7.88
THMBCIRC	**25th**	7.01	6.14	7.88
THMBCIRC	**50th**	7.23	6.36	8.10

THMBCIRC	**75th**	7.23	6.36	8.10
THMBCIRC	**95th**	7.45	6.58	8.32
HANDCIRC	**5th**	19.40	16.46	22.34
HANDCIRC	**25th**	20.00	17.06	22.94
HANDCIRC	**50th**	20.90	17.96	23.84
HANDCIRC	**75th**	20.60	17.66	23.54
HANDCIRC	**95th**	23.40	20.46	26.34
HANDBRTH	**5th**	8.30	7.04	9.56
HANDBRTH	**25th**	8.50	7.24	9.76
HANDBRTH	**50th**	8.80	7.54	10.06
HANDBRTH	**75th**	9.00	7.74	10.26
HANDBRTH	**95th**	9.70	8.44	10.96
WRISCIRC	**5th**	16.50	14.04	18.96
WRISCIRC	**25th**	16.60	14.14	19.06
WRISCIRC	**50th**	17.20	14.74	19.66
WRISCIRC	**75th**	16.80	14.34	19.26
WRISCIRC	**95th**	19.40	16.94	21.86

Female Tolerance Limits for Method I

Factor 1

Variable	Percentile	Measurement (cm)	Lower Tolerance Limit (cm)	Upper Tolerance Limit (cm)
THMBLGTH	**5th**	6.70	5.26	8.14
THMBLGTH	**25th**	5.70	4.26	7.14
THMBLGTH	**50th**	6.60	5.16	8.04
THMBLGTH	**75th**	6.00	4.56	7.44
THMBLGTH	**95th**	6.20	4.76	7.64
D1HGHT	**5th**	10.60	8.41	12.79
D1HGHT	**25th**	8.20	6.01	10.39
D1HGHT	**50th**	8.60	6.41	10.79
D1HGHT	**75th**	9.10	6.91	11.29
D1HGHT	**95th**	8.60	6.41	10.79
D1FUNCLT	**5th**	13.00	10.93	15.07
D1FUNCLT	**25th**	10.60	8.53	12.67
D1FUNCLT	**50th**	11.60	9.53	13.67
D1FUNCLT	**75th**	10.90	8.83	12.97
D1FUNCLT	**95th**	10.40	8.33	12.47
D2LGTH	**5th**	8.00	6.62	9.38
D2LGTH	**25th**	6.80	5.42	8.18
D2LGTH	**50th**	7.30	5.92	8.68
D2LGTH	**75th**	6.60	5.22	7.98
D2LGTH	**95th**	6.60	5.22	7.98
D2HGHT	**5th**	19.00	16.30	21.70
D2HGHT	**25th**	15.80	13.10	18.50
D2HGHT	**50th**	16.30	13.60	19.00
D2HGHT	**75th**	15.70	13.00	18.40
D2HGHT	**95th**	16.40	13.70	19.10
D2LINK	**5th**	11.60	9.68	13.52
D2LINK	**25th**	9.80	7.88	11.72
D2LINK	**50th**	10.80	8.88	12.72
D2LINK	**75th**	9.70	7.78	11.62
D2LINK	**95th**	9.60	7.68	11.52
D3LGTH	**5th**	8.70	7.17	10.23
D3LGTH	**25th**	7.30	5.77	8.83
D3LGTH	**50th**	7.80	6.27	9.33

D3LGTH	**75th**	7.20	5.67	8.73
D3LGTH	**95th**	7.30	5.77	8.83
D3LINK	**5th**	10.60	8.68	12.52
D3LINK	**25th**	9.40	7.48	11.32
D3LINK	**50th**	10.10	8.18	12.02
D3LINK	**75th**	9.70	7.78	11.62
D3LINK	**95th**	9.80	7.88	11.72
D4LGTH	**5th**	8.20	6.70	9.70
D4LGTH	**25th**	7.00	5.50	8.50
D4LGTH	**50th**	7.30	5.80	8.80
D4LGTH	**75th**	6.50	5.00	8.00
D4LGTH	**95th**	6.90	5.40	8.40
D4HGHT	**5th**	18.40	15.52	21.28
D4HGHT	**25th**	15.60	12.72	18.48
D4HGHT	**50th**	17.00	14.12	19.88
D4HGHT	**75th**	15.30	12.42	18.18
D4HGHT	**95th**	15.70	12.82	18.58
D4LINK	**5th**	10.50	8.73	12.27
D4LINK	**25th**	9.50	7.73	11.27
D4LINK	**50th**	9.80	8.03	11.57
D4LINK	**75th**	9.20	7.43	10.97
D4LINK	**95th**	9.50	7.73	11.27
D5LGTH	**5th**	7.30	5.92	8.68
D5LGTH	**25th**	5.80	4.42	7.18
D5LGTH	**50th**	6.20	4.82	7.58
D5LGTH	**75th**	4.90	3.52	6.28
D5LGTH	**95th**	5.40	4.02	6.78
D5HGHT	**5th**	14.80	12.16	17.44
D5HGHT	**25th**	12.00	9.36	14.64
D5HGHT	**50th**	13.90	11.26	16.54
D5HGHT	**75th**	12.20	9.56	14.84
D5HGHT	**95th**	11.90	9.26	14.54
D5LINK	**5th**	8.90	7.28	10.52
D5LINK	**25th**	7.40	5.78	9.02
D5LINK	**50th**	8.00	6.38	9.62
D5LINK	**75th**	7.10	5.48	8.72
D5LINK	**95th**	7.10	5.48	8.72

PALMLGTH	**5th**	11.40	9.69	13.11
PALMLGTH	**25th**	9.50	7.79	11.21
PALMLGTH	**50th**	10.30	8.59	12.01
PALMLGTH	**75th**	9.60	7.89	11.31
PALMLGTH	**95th**	10.20	8.49	11.91
WRINFNGL	**5th**	19.00	16.30	21.70
WRINFNGL	**25th**	16.70	14.00	19.40
WRINFNGL	**50th**	16.90	14.20	19.60
WRINFNGL	**75th**	16.10	13.40	18.80
WRINFNGL	**95th**	17.10	14.40	19.80
WRTHLGTH	**5th**	12.70	10.66	14.74
WRTHLGTH	**25th**	11.50	9.46	13.54
WRTHLGTH	**50th**	12.00	9.96	14.04
WRTHLGTH	**75th**	11.20	9.16	13.24
WRTHLGTH	**95th**	11.60	9.56	13.64
CROTCH1	**5th**	7.20	5.82	8.58
CROTCH1	**25th**	5.60	4.22	6.98
CROTCH1	**50th**	6.30	4.92	7.68
CROTCH1	**75th**	6.00	4.62	7.38
CROTCH1	**95th**	6.30	4.92	7.68
CROTCH2	**5th**	11.80	10.09	13.51
CROTCH2	**25th**	9.40	7.69	11.11
CROTCH2	**50th**	10.10	8.39	11.81
CROTCH2	**75th**	9.60	7.89	11.31
CROTCH2	**95th**	10.30	8.59	12.01
CROTCH3	**5th**	11.60	9.80	13.40
CROTCH3	**25th**	9.40	7.60	11.20
CROTCH3	**50th**	10.20	8.40	12.00
CROTCH3	**75th**	9.40	7.60	11.20
CROTCH3	**95th**	10.10	8.30	11.90
CROTCH4	**5th**	9.70	7.96	11.44
CROTCH4	**25th**	8.10	6.36	9.84
CROTCH4	**50th**	8.80	7.06	10.54
CROTCH4	**75th**	8.40	6.66	10.14
CROTCH4	**95th**	8.70	6.96	10.44
D3HGHT	**5th**	20.00	17.06	22.94
D3HGHT	**25th**	16.80	13.86	19.74

D3HGHT	**50th**	18.00	15.06	20.94
D3HGHT	**75th**	16.80	13.86	19.74
D3HGHT	**95th**	17.50	14.56	20.44
HANDLGTH	**5th**	20.20	17.26	23.14
HANDLGTH	**25th**	17.60	14.66	20.54
HANDLGTH	**50th**	18.30	15.36	21.24
HANDLGTH	**75th**	17.40	14.46	20.34
HANDLGTH	**95th**	18.40	15.46	21.34

Factor 2

Variable	Percentile	Measurement (cm)	Lower Tolerance Limit (cm)	Upper Tolerance Limit (cm)
D2PIP	**5th**	2.00	1.61	2.39
D2PIP	**25th**	1.90	1.51	2.29
D2PIP	**50th**	1.90	1.51	2.29
D2PIP	**75th**	1.90	1.51	2.29
D2PIP	**95th**	2.00	1.61	2.39
D2PCIRC	**5th**	5.93	5.33	6.53
D2PCIRC	**25th**	6.01	5.41	6.61
D2PCIRC	**50th**	6.10	5.50	6.70
D2PCIRC	**75th**	6.01	5.41	6.61
D2PCIRC	**95th**	6.11	5.51	6.71
D2DIP	**5th**	1.50	1.14	1.86
D2DIP	**25th**	1.70	1.34	2.06
D2DIP	**50th**	1.80	1.44	2.16
D2DIP	**75th**	1.70	1.34	2.06
D2DIP	**95th**	1.70	1.34	2.06
D2DCIRC	**5th**	4.84	4.27	5.41
D2DCIRC	**25th**	4.99	4.42	5.56
D2DCIRC	**50th**	5.10	4.53	5.67
D2DCIRC	**75th**	4.99	4.42	5.56
D2DCIRC	**95th**	5.06	4.49	5.63
D3PIP	**5th**	1.70	1.31	2.09
D3PIP	**25th**	1.80	1.41	2.19
D3PIP	**50th**	1.90	1.51	2.29
D3PIP	**75th**	1.80	1.41	2.19
D3PIP	**95th**	1.90	1.51	2.29

D3PCIRC	**5th**	5.76	5.19	6.33
D3PCIRC	**25th**	5.98	5.41	6.55
D3PCIRC	**50th**	6.09	5.52	6.66
D3PCIRC	**75th**	5.87	5.30	6.44
D3PCIRC	**95th**	6.09	5.52	6.66
D3DIP	**5th**	1.50	1.17	1.83
D3DIP	**25th**	1.70	1.37	2.03
D3DIP	**50th**	1.70	1.37	2.03
D3DIP	**75th**	1.50	1.17	1.83
D3DIP	**95th**	1.70	1.37	2.03
D3DCIRC	**5th**	4.76	4.25	5.27
D3DCIRC	**25th**	5.00	4.49	5.51
D3DCIRC	**50th**	5.06	4.55	5.57
D3DCIRC	**75th**	4.82	4.31	5.33
D3DCIRC	**95th**	5.06	4.55	5.57
D4PCIRC	**5th**	5.35	4.78	5.92
D4PCIRC	**25th**	5.46	4.89	6.03
D4PCIRC	**50th**	5.89	5.32	6.46
D4PCIRC	**75th**	5.46	4.89	6.03
D4PCIRC	**95th**	5.89	5.32	6.46
D4DIP	**5th**	1.40	1.07	1.73
D4DIP	**25th**	1.40	1.07	1.73
D4DIP	**50th**	1.70	1.37	2.03
D4DIP	**75th**	1.40	1.07	1.73
D4DIP	**95th**	1.70	1.37	2.03
D4DCIRC	**5th**	4.38	3.90	4.86
D4DCIRC	**25th**	4.44	3.96	4.92
D4DCIRC	**50th**	4.83	4.35	5.31
D4DCIRC	**75th**	4.44	3.96	4.92
D4DCIRC	**95th**	4.83	4.35	5.31
D5PIP	**5th**	1.40	1.07	1.73
D5PIP	**25th**	1.60	1.27	1.93
D5PIP	**50th**	1.70	1.37	2.03
D5PIP	**75th**	1.60	1.27	1.93
D5PIP	**95th**	1.70	1.37	2.03
D5PCIRC	**5th**	4.73	4.22	5.24

D5PCIRC	**25th**	4.96	4.45	5.47
D5PCIRC	**50th**	5.24	4.73	5.75
D5PCIRC	**75th**	4.91	4.40	5.42
D5PCIRC	**95th**	5.13	4.62	5.64
D5DIP	**5th**	1.40	1.07	1.51
D5DIP	**25th**	1.40	1.07	1.51
D5DIP	**50th**	1.70	1.37	1.81
D5DIP	**75th**	1.30	0.97	1.41
D5DIP	**95th**	1.50	1.17	1.61
D5DCIRC	**5th**	4.03	3.58	4.48
D5DCIRC	**25th**	4.16	3.71	4.61
D5DCIRC	**50th**	4.48	4.03	4.93
D5DCIRC	**75th**	4.07	3.62	4.52
D5DCIRC	**95th**	4.31	3.86	4.76
HANDCIRC	**5th**	18.70	16.12	21.28
HANDCIRC	**25th**	17.90	15.32	20.48
HANDCIRC	**50th**	19.10	16.52	21.68
HANDCIRC	**75th**	18.70	16.12	21.28
HANDCIRC	**95th**	18.00	15.42	20.58
WRISBRTH	**5th**	5.50	4.48	6.52
WRISBRTH	**25th**	5.50	4.48	6.52
WRISBRTH	**50th**	5.80	4.78	6.82
WRISBRTH	**75th**	5.60	4.58	6.62
WRISBRTH	**95th**	5.70	4.68	6.72
WRISCIRC	**5th**	15.10	13.03	17.17
WRISCIRC	**25th**	14.10	12.03	16.17
WRISCIRC	**50th**	15.50	13.43	17.57
WRISCIRC	**75th**	14.20	12.13	16.27
WRISCIRC	**95th**	15.00	12.93	17.07
D4PIP	**5th**	1.60	1.24	1.96
D4PIP	**25th**	1.70	1.34	2.06
D4PIP	**50th**	1.90	1.54	2.26
D4PIP	**75th**	1.70	1.34	2.06
D4PIP	**95th**	1.90	1.54	2.26
HANDBRTH	**5th**	7.80	6.66	8.94
HANDBRTH	**25th**	7.80	6.66	8.94

HANDBRTH	**50th**	8.20	7.06	9.34
HANDBRTH	**75th**	8.00	6.86	9.14
HANDBRTH	**95th**	7.50	6.36	8.64

Factor 3

Variable	Percentile	Measurement (cm)	Lower Tolerance Limit (cm)	Upper Tolerance Limit (cm)
THUMBBR	**5th**	2.00	1.61	2.39
THUMBBR	**25th**	2.10	1.71	2.49
THUMBBR	**50th**	2.00	1.61	2.39
THUMBBR	**75th**	1.90	1.51	2.29
THUMBBR	**95th**	2.10	1.71	2.49
THMBCIRC	**5th**	6.18	5.43	6.93
THMBCIRC	**25th**	6.38	5.63	7.13
THMBCIRC	**50th**	6.18	5.43	6.93
THMBCIRC	**75th**	5.98	5.23	6.73
THMBCIRC	**95th**	6.38	5.63	7.13
WRCTRGRL	**5th**	6.60	5.13	8.07
WRCTRGRL	**25th**	6.90	5.43	8.37
WRCTRGRL	**50th**	6.00	4.53	7.47
WRCTRGRL	**75th**	6.30	4.83	7.77
WRCTRGRL	**95th**	5.90	4.43	7.37

Appendix D Male Sizing Chart for Method II
All values are in millimeters.

SIZE #	SUBJNO	THMBLGTH	D1HGHT	THUMBBR	THMBCIRC
Size 1	15174	66	96	23	70.07
Size 2	24177	69	95	23	70.07
Size 3	13811	65	97	23	70.07
Size 4	220	69	100	26	76.67
Size 5	11297	73	95	25	74.47
Size 6	520	74	101	27	78.87
Size 7	24415	76	113	25	74.47
SIZE #	**D2LGTH**	**D2HGHT**	**D2PIP**	**D2PCIRC**	**D2DIP**
Size 1	73	172	22	68.17	21
Size 2	71	170	24	69.59	21
Size 3	74	175	22	67.21	19
Size 4	74	181	24	69.11	20
Size 5	81	183	22	67.69	20
Size 6	79	186	24	69.59	21
Size 7	81	194	23	68.4	20
SIZE #	**D2LINK**	**D3LGTH**	**D3HGHT**	**D3PIP**	**D3PCIRC**
Size 1	99	82	183	22	69.29
Size 2	106	83	186	23	70.67
Size 3	102	86	194	22	68.83
Size 4	109	83	194	23	70.67
Size 5	111	92	200	22	69.29
Size 6	111	88	202	23	70.21
Size 7	116	91	211	25	72.05
SIZE #	**D3DCIRC**	**D3LINK**	**D4LGTH**	**D4HGHT**	**D4PIP**
Size 1	57.93	102	74	165	21
Size 2	59.04	109	78	173	23
Size 3	57.07	110	78	176	21
Size 4	59.04	106	82	180	21
Size 5	57.93	119	84	186	20
Size 6	58.18	113	83	191	21
Size 7	58.68	120	88	196	23
SIZE #	**D4DIP**	**D4DCIRC**	**D4LINK**	**D5LGTH**	**D5HGHT**
Size 1	18	53.37	98	63	126
Size 2	19	54.65	106	67	139
Size 3	18	53.37	105	58	137
Size 4	19	54.05	107	62	139

Size 5	17	52.39	115	71	153
Size 6	19	54.05	110	68	158
Size 7	19	54.65	119	71	156
SIZE #	**D5PCIRC**	**D5DIP**	**D5DCIRC**	**D5LINK**	**HANDLGTH**
Size 1	57.79	18	49.42	78	180
Size 2	58.06	19	50.01	87	188
Size 3	58.74	17	49.56	80	197
Size 4	57.52	17	48.83	80	197
Size 5	56.3	17	48.1	95	199
Size 6	57.79	18	49.42	90	203
Size 7	59.01	18	50.15	98	208
SIZE #	**PALMLGTH**	**HANDBRTH**	**WRISBRTH**	**WRISCIRC**	**WRCTRGRL**
Size 1	101	89	65	172	63
Size 2	103	96	70	172	62
Size 3	109	90	63	165	67
Size 4	111	93	69	174	70
Size 5	108	94	64	172	69
Size 6	114	95	72	188	77
Size 7	120	92	67	187	77
SIZE #	**WRTHLGTH**	**CROTCH1**	**CROTCH2**	**CROTCH3**	**CROTCH4**
Size 1	114	66	105	101	87
Size 2	120	66	102	99	87
Size 3	118	71	108	110	96
Size 4	132	67	111	107	92
Size 5	126	69	107	109	99
Size 6	131	72	114	116	106
Size 7	132	79	120	119	104
SIZE #	**WRINFNGL**	**HANDCIRC**	**D5PIP**	**D4PCIRC**	**D3DIP**
Size 1	166	214	19	64.29	20
Size 2	172	224	19	66.63	21
Size 3	176	212	20	64.29	19
Size 4	185	217	19	64.73	21
Size 5	187	221	18	62.9	20
Size 6	189	227	19	64.73	20
Size 7	191	218	20	66.63	20
SIZE #	**D2DCIRC**	**D1FUNCLT**			
Size 1	57.79	116			
Size 2	58.45	127			
Size 3	56.21	118			
Size 4	57.66	123			

Size 5	57	129			
Size 6	58.45	121			
Size 7	57.33	129			

Appendix E Female Sizing Chart for Method II
All values are in millimeters.

SIZE #	SUBJNO	THMBLGTH	D1HGHT	THUMBBR	D1FUNCLT
Size 1	522	64	100	20	108
Size 2	4115	63	99	22	111
Size 3	5898	65	96	20	109
Size 4	7792	57	99	22	104
Size 5	11770	71	106	21	123
Size 6	13121	62	95	22	111
Size 7	15642	69	92	20	111
Size 8	17781	64	86	18	109
Size 9	19701	60	96	20	108
Size 10	20821	66	92	22	120
Size 11	22138	60	81	21	107
Size 12	24017	64	97	21	120
Size 13	24976	64	88	20	119
Size 14	26079	64	91	21	110
SIZE #	**THMBCIRC**	**D2LGTH**	**D2HGHT**	**D2PIP**	**D2PCIRC**
Size 1	61.8	67	162	20	60.16
Size 2	65.72	72	168	20	61.94
Size 3	61.8	67	159	18	59.23
Size 4	65.72	65	164	18	58.34
Size 5	63.76	73	171	21	61.96
Size 6	65.72	68	168	22	64.65
Size 7	61.8	68	167	20	62.83
Size 8	57.88	69	155	18	57.45
Size 9	61.8	68	170	21	62.85
Size 10	65.72	71	164	20	61.94
Size 11	63.76	67	157	19	60.14
Size 12	63.76	69	174	24	65.58
Size 13	61.8	74	168	21	64.63
Size 14	63.76	75	170	20	61.05
SIZE #	**D2DIP**	**D2DCIRC**	**D2LINK**	**D3LGTH**	**D3HGHT**
Size 1	16	49.49	104	76	175
Size 2	18	51.63	99	79	174
Size 3	17	49.32	97	76	174
Size 4	16	48.25	97	73	174
Size 5	17	51.18	106	79	181
Size 6	19	53.94	98	75	178

Size 7	19	52.7	102	80	182
Size 8	15	47.18	109	74	171
Size 9	18	52.25	96	74	176
Size 10	18	51.63	102	79	178
Size 11	17	49.94	96	74	172
Size 12	18	54.11	105	74	183
Size 13	20	54.39	99	80	181
Size 14	17	50.56	105	80	180
SIZE #	**D3PIP**	**D3PCIRC**	**D3DIP**	**D3DCIRC**	**D3LINK**
Size 1	18	60.28	18	50.93	97
Size 2	20	62.03	17	51.21	103
Size 3	19	60.36	16	49.69	101
Size 4	18	58.69	15	48.17	96
Size 5	20	62.03	17	51.21	102
Size 6	22	65.37	19	54.25	108
Size 7	20	63.09	19	53.05	103
Size 8	17	58.08	16	48.49	102
Size 9	20	62.56	18	52.13	94
Size 10	20	62.56	18	52.13	103
Size 11	19	61.42	18	51.53	95
Size 12	21	63.17	17	51.81	99
Size 13	21	63.7	18	52.73	104
Size 14	20	62.03	17	51.21	106
SIZE #	**D4LGTH**	**D4HGHT**	**D4PIP**	**D4PCIRC**	**D4DIP**
Size 1	70	160	19	58.18	16
Size 2	73	156	18	57.08	16
Size 3	69	159	18	56.4	15
Size 4	68	160	16	54.2	15
Size 5	78	168	19	58.86	17
Size 6	73	168	19	58.86	17
Size 7	73	170	19	58.86	17
Size 8	70	163	16	53.52	14
Size 9	68	160	19	58.86	17
Size 10	76	165	19	58.86	17
Size 11	70	160	18	57.08	16
Size 12	73	169	18	56.4	15
Size 13	74	168	21	61.06	17
Size 14	75	167	18	57.08	16
SIZE #	**D4DCIRC**	**D4LINK**	**D5LGTH**	**D5HGHT**	**D5PIP**
Size 1	47.39	95	56	125	17

Size 2	46.82	97	58	123	16
Size 3	45.87	94	54	128	17
Size 4	44.73	92	53	127	15
Size 5	48.34	101	58	129	17
Size 6	48.34	104	61	135	19
Size 7	48.34	101	58	135	17
Size 8	43.78	97	56	135	15
Size 9	48.34	93	56	128	16
Size 10	48.34	101	62	132	16
Size 11	46.82	94	57	131	16
Size 12	45.87	97	57	136	16
Size 13	49.48	100	58	137	17
Size 14	46.82	103	63	137	17
SIZE #	**D5PCIRC**	**D5DIP**	**D5DCIRC**	**D5LINK**	**HANDLGTH**
Size 1	50.79	14	42.23	74	175
Size 2	50.15	15	42.43	77	184
Size 3	50.79	14	42.23	75	181
Size 4	48.99	15	41.77	71	174
Size 5	50.79	14	42.23	74	188
Size 6	54.67	17	46.13	82	183
Size 7	51.83	16	43.95	81	190
Size 8	48.47	14	40.91	76	172
Size 9	50.15	15	42.43	73	182
Size 10	50.67	16	43.29	83	180
Size 11	50.15	15	42.43	75	174
Size 12	49.63	14	41.57	77	184
Size 13	51.31	15	43.09	80	179
Size 14	51.31	15	43.09	85	181
SIZE #	**HANDCIRC**	**PALMLGTH**	**HANDBRTH**	**WRISBRTH**	**WRISCIRC**
Size 1	178	99	77	54	148
Size 2	188	97	79	56	150
Size 3	189	99	82	54	153
Size 4	176	102	77	50	148
Size 5	189	101	80	60	151
Size 6	197	104	82	59	160
Size 7	193	102	83	59	154
Size 8	170	98	71	50	140
Size 9	192	102	82	59	152
Size 10	193	99	82	58	157
Size 11	183	99	79	58	146

Size 12	189	109	81	55	148
Size 13	193	100	82	59	158
Size 14	190	101	81	61	153
SIZE #	**WRCTRGRL**	**WRINFNGL**	**WRTHLGTH**	**CROTCH1**	**CROTCH2**
Size 1	58	164	115	66	101
Size 2	63	173	116	65	97
Size 3	60	167	123	61	96
Size 4	61	167	115	62	100
Size 5	67	177	128	66	101
Size 6	70	171	124	67	103
Size 7	64	175	119	59	101
Size 8	67	163	114	60	98
Size 9	69	171	120	61	103
Size 10	69	169	121	62	98
Size 11	63	164	114	60	96
Size 12	70	176	118	68	105
Size 13	62	169	121	61	98
Size 14	58	173	116	62	102
SIZE #	**CROTCH3**	**CROTCH4**			
Size 1	100	88			
Size 2	95	80			
Size 3	98	85			
Size 4	99	86			
Size 5	101	86			
Size 6	104	90			
Size 7	103	90			
Size 8	100	91			
Size 9	101	88			
Size 10	96	84			
Size 11	95	84			
Size 12	104	92			
Size 13	97	89			
Size 14	100	88			

Appendix F Male Tolerance Limits for Method II

Variable	Size	Measurement (cm)	Lower Tolerance Limit (cm)	Upper Tolerance Limit (cm)
Digit 1 Length	1	6.6	5.16	8.04
Digit 1 Length	2	6.9	5.46	8.34
Digit 1 Length	3	6.5	5.06	7.94
Digit 1 Length	4	6.9	5.46	8.34
Digit 1 Length	5	7.3	5.86	8.74
Digit 1 Length	6	7.4	5.96	8.84
Digit 1 Length	7	7.6	6.16	9.04
Digit 1 Height	1	9.6	7.38	11.82
Digit 1 Height	2	9.5	7.28	11.72
Digit 1 Height	3	9.7	7.48	11.92
Digit 1 Height	4	10	7.78	12.22
Digit 1 Height	5	9.5	7.28	11.72
Digit 1 Height	6	10.1	7.88	12.32
Digit 1 Height	7	11.3	9.08	13.52
Digit 1 Link Length	1	11.6	9.44	13.76
Digit 1 Link Length	2	12.7	10.54	14.86
Digit 1 Link Length	3	11.8	9.64	13.96
Digit 1 Link Length	4	12.3	10.14	14.46
Digit 1 Link Length	5	12.9	10.74	15.06
Digit 1 Link Length	6	12.1	9.94	14.26
Digit 1 Link Length	7	12.9	10.74	15.06
Digit 2 Length	1	7.3	5.83	8.77
Digit 2 Length	2	7.1	5.63	8.57
Digit 2 Length	3	7.4	5.93	8.87
Digit 2 Length	4	7.4	5.93	8.87
Digit 2 Length	5	8.1	6.63	9.57
Digit 2 Length	6	7.9	6.43	9.37
Digit 2 Length	7	8.1	6.63	9.57
Digit 2 Height	1	17.2	14.35	20.05
Digit 2 Height	2	17	14.15	19.85
Digit 2 Height	3	17.5	14.65	20.35
Digit 2 Height	4	18.1	15.25	20.95
Digit 2 Height	5	18.3	15.45	21.15
Digit 2 Height	6	18.6	15.75	21.45
Digit 2 Height	7	19.4	16.55	22.25

Digit 2 Link Length	1	9.9	7.83	11.97
Digit 2 Link Length	2	10.6	8.53	12.67
Digit 2 Link Length	3	10.2	8.13	12.27
Digit 2 Link Length	4	10.9	8.83	12.97
Digit 2 Link Length	5	11.1	9.03	13.17
Digit 2 Link Length	6	11.1	9.03	13.17
Digit 2 Link Length	7	11.6	9.53	13.67
Digit 3 Length	1	8.2	6.58	9.82
Digit 3 Length	2	8.3	6.68	9.92
Digit 3 Length	3	8.6	6.98	10.22
Digit 3 Length	4	8.3	6.68	9.92
Digit 3 Length	5	9.2	7.58	10.82
Digit 3 Length	6	8.8	7.18	10.42
Digit 3 Length	7	9.1	7.48	10.72
Digit 3 Link Length	1	10.2	8.1	12.3
Digit 3 Link Length	2	10.9	8.8	13
Digit 3 Link Length	3	11	8.9	13.1
Digit 3 Link Length	4	10.6	8.5	12.7
Digit 3 Link Length	5	11.9	9.8	14
Digit 3 Link Length	6	11.3	9.2	13.4
Digit 3 Link Length	7	12	9.9	14.1
Digit 4 Length	1	7.4	5.84	8.96
Digit 4 Length	2	7.8	6.24	9.36
Digit 4 Length	3	7.8	6.24	9.36
Digit 4 Length	4	8.2	6.64	9.76
Digit 4 Length	5	8.4	6.84	9.96
Digit 4 Length	6	8.3	6.74	9.86
Digit 4 Length	7	8.8	7.24	10.36
Digit 4 Height	1	16.5	13.47	19.53
Digit 4 Height	2	17.3	14.27	20.33
Digit 4 Height	3	17.6	14.57	20.63
Digit 4 Height	4	18	14.97	21.03
Digit 4 Height	5	18.6	15.57	21.63
Digit 4 Height	6	19.1	16.07	22.13
Digit 4 Height	7	19.6	16.57	22.63
Digit 4 Link Length	1	9.8	7.85	11.75
Digit 4 Link Length	2	10.6	8.65	12.55
Digit 4 Link Length	3	10.5	8.55	12.45

Digit 4 Link Length	4	10.7	8.75	12.65
Digit 4 Link Length	5	11.5	9.55	13.45
Digit 4 Link Length	6	11	9.05	12.95
Digit 4 Link Length	7	11.9	9.95	13.85
Digit 5 Length	1	6.3	4.83	7.77
Digit 5 Length	2	6.7	5.23	8.17
Digit 5 Length	3	5.8	4.33	7.27
Digit 5 Length	4	6.2	4.73	7.67
Digit 5 Length	5	7.1	5.63	8.57
Digit 5 Length	6	6.8	5.33	8.27
Digit 5 Length	7	7.1	5.63	8.57
Digit 5 Height	1	12.6	9.78	15.42
Digit 5 Height	2	13.9	11.08	16.72
Digit 5 Height	3	13.7	10.88	16.52
Digit 5 Height	4	13.9	11.08	16.72
Digit 5 Height	5	15.3	12.48	18.12
Digit 5 Height	6	15.8	12.98	18.62
Digit 5 Height	7	15.6	12.78	18.42
Digit 5 Link Length	1	7.8	6.03	9.57
Digit 5 Link Length	2	8.7	6.93	10.47
Digit 5 Link Length	3	8	6.23	9.77
Digit 5 Link Length	4	8	6.23	9.77
Digit 5 Link Length	5	9.5	7.73	11.27
Digit 5 Link Length	6	9	7.23	10.77
Digit 5 Link Length	7	9.8	8.03	11.57
Palm Length	1	10.1	8.3	11.9
Palm Length	2	10.3	8.5	12.1
Palm Length	3	10.9	9.1	12.7
Palm Length	4	11.1	9.3	12.9
Palm Length	5	10.8	9	12.6
Palm Length	6	11.4	9.6	13.2
Palm Length	7	12	10.2	13.8
Wrist To Center of Grip Length	1	6.3	4.86	7.74
Wrist To Center of Grip Length	2	6.2	4.76	7.64
Wrist To Center of Grip Length	3	6.7	5.26	8.14
Wrist To Center of Grip Length	4	7	5.56	8.44
Wrist To Center of Grip	5	6.9	5.46	8.34

Length				
Wrist To Center of Grip Length	6	7.7	6.26	9.14
Wrist To Center of Grip Length	7	7.7	6.26	9.14
Wrist Index Finger Length	1	16.6	13.87	19.33
Wrist Index Finger Length	2	17.2	14.47	19.93
Wrist Index Finger Length	3	17.6	14.87	20.33
Wrist Index Finger Length	4	18.5	15.77	21.23
Wrist Index Finger Length	5	18.7	15.97	21.43
Wrist Index Finger Length	6	18.9	16.17	21.63
Wrist Index Finger Length	7	19.1	16.37	21.83
Crotch 1 Height	1	6.6	5.19	8.01
Crotch 1 Height	2	6.6	5.19	8.01
Crotch 1 Height	3	7.1	5.69	8.51
Crotch 1 Height	4	6.7	5.29	8.11
Crotch 1 Height	5	6.9	5.49	8.31
Crotch 1 Height	6	7.2	5.79	8.61
Crotch 1 Height	7	7.9	6.49	9.31
Crotch 2 Height	1	10.5	8.67	12.33
Crotch 2 Height	2	10.2	8.37	12.03
Crotch 2 Height	3	10.8	8.97	12.63
Crotch 2 Height	4	11.1	9.27	12.93
Crotch 2 Height	5	10.7	8.87	12.53
Crotch 2 Height	6	11.4	9.57	13.23
Crotch 2 Height	7	12	10.17	13.83
Crotch 3 Height	1	10.1	8.18	12.02
Crotch 3 Height	2	9.9	7.98	11.82
Crotch 3 Height	3	11	9.08	12.92
Crotch 3 Height	4	10.7	8.78	12.62
Crotch 3 Height	5	10.9	8.98	12.82
Crotch 3 Height	6	11.6	9.68	13.52
Crotch 3 Height	7	11.9	9.98	13.82
Crotch 4 Height	1	8.7	6.84	10.56
Crotch 4 Height	2	8.7	6.84	10.56
Crotch 4 Height	3	9.6	7.74	11.46
Crotch 4 Height	4	9.2	7.34	11.06

Crotch 4 Height	5	9.9	8.04	11.76
Crotch 4 Height	6	10.6	8.74	12.46
Crotch 4 Height	7	10.4	8.54	12.26
Digit 3 Height	1	18.3	15.21	21.39
Digit 3 Height	2	18.6	15.51	21.69
Digit 3 Height	3	19.4	16.31	22.49
Digit 3 Height	4	19.4	16.31	22.49
Digit 3 Height	5	20	16.91	23.09
Digit 3 Height	6	20.2	17.11	23.29
Digit 3 Height	7	21.1	18.01	24.19
Hand Length Measured	1	18	15.03	20.97
Hand Length Measured	2	18.8	15.83	21.77
Hand Length Measured	3	19.7	16.73	22.67
Hand Length Measured	4	19.7	16.73	22.67
Hand Length Measured	5	19.9	16.93	22.87
Hand Length Measured	6	20.3	17.33	23.27
Hand Length Measured	7	20.8	17.83	23.77
D2PIP	1	2.20	1.72	2.68
D2PIP	2	2.40	1.92	2.88
D2PIP	3	2.20	1.72	2.68
D2PIP	4	2.40	1.92	2.88
D2PIP	5	2.20	1.72	2.68
D2PIP	6	2.40	1.92	2.88
D2PIP	7	2.30	1.82	2.78
D2PCIRC	1	6.82	6.28	7.36
D2PCIRC	2	6.96	6.42	7.50
D2PCIRC	3	6.72	6.18	7.26
D2PCIRC	4	6.91	6.37	7.45
D2PCIRC	5	6.77	6.23	7.31
D2PCIRC	6	6.96	6.42	7.50
D2PCIRC	7	6.84	6.30	7.38
D2DIP	1	2.10	1.65	2.55
D2DIP	2	2.10	1.65	2.55
D2DIP	3	1.90	1.45	2.35
D2DIP	4	2.00	1.55	2.45
D2DIP	5	2.00	1.55	2.45
D2DIP	6	2.10	1.65	2.55
D2DIP	7	2.00	1.55	2.45
D2DCIRC	1	5.78	5.30	6.26

D2DCIRC	2	5.85	5.37	6.33
D2DCIRC	3	5.62	5.14	6.10
D2DCIRC	4	5.77	5.29	6.25
D2DCIRC	5	5.70	5.22	6.18
D2DCIRC	6	5.85	5.37	6.33
D2DCIRC	7	5.73	5.25	6.21
D3PIP	1	2.20	1.72	2.68
D3PIP	2	2.30	1.82	2.78
D3PIP	3	2.20	1.72	2.68
D3PIP	4	2.30	1.82	2.78
D3PIP	5	2.20	1.72	2.68
D3PIP	6	2.30	1.82	2.78
D3PIP	7	2.50	2.02	2.98
D3PCIRC	1	6.93	6.33	7.53
D3PCIRC	2	7.07	6.47	7.67
D3PCIRC	3	6.88	6.28	7.48
D3PCIRC	4	7.07	6.47	7.67
D3PCIRC	5	6.93	6.33	7.53
D3PCIRC	6	7.02	6.42	7.62
D3PCIRC	7	7.21	6.61	7.81
D3DIP	1	2.00	1.58	2.42
D3DIP	2	2.10	1.68	2.52
D3DIP	3	1.90	1.48	2.32
D3DIP	4	2.10	1.68	2.52
D3DIP	5	2.00	1.58	2.42
D3DIP	6	2.00	1.58	2.42
D3DIP	7	2.00	1.58	2.42
D3DCIRC	1	5.79	5.31	6.27
D3DCIRC	2	5.90	5.42	6.38
D3DCIRC	3	5.71	5.23	6.19
D3DCIRC	4	5.90	5.42	6.38
D3DCIRC	5	5.79	5.31	6.27
D3DCIRC	6	5.82	5.34	6.30
D3DCIRC	7	5.87	5.39	6.35
D4PCIRC	1	6.43	5.86	7.00
D4PCIRC	2	6.66	6.09	7.23
D4PCIRC	3	6.43	5.86	7.00
D4PCIRC	4	6.47	5.90	7.04
D4PCIRC	5	6.29	5.72	6.86

D4PCIRC	6	6.47	5.90	7.04
D4PCIRC	7	6.66	6.09	7.23
D4DIP	1	1.80	1.38	2.22
D4DIP	2	1.90	1.48	2.32
D4DIP	3	1.80	1.38	2.22
D4DIP	4	1.90	1.48	2.32
D4DIP	5	1.70	1.28	2.12
D4DIP	6	1.90	1.48	2.32
D4DIP	7	1.90	1.48	2.32
D4DCIRC	1	5.34	4.95	5.73
D4DCIRC	2	5.47	5.08	5.86
D4DCIRC	3	5.34	4.95	5.73
D4DCIRC	4	5.41	5.02	5.80
D4DCIRC	5	5.24	4.85	5.63
D4DCIRC	6	5.41	5.02	5.80
D4DCIRC	7	5.47	5.08	5.86
D5PIP	1	1.90	1.51	2.29
D5PIP	2	1.90	1.51	2.29
D5PIP	3	2.00	1.61	2.39
D5PIP	4	1.90	1.51	2.29
D5PIP	5	1.80	1.41	2.19
D5PIP	6	1.90	1.51	2.29
D5PIP	7	2.00	1.61	2.39
D5PCIRC	1	5.78	5.24	6.32
D5PCIRC	2	5.81	5.27	6.35
D5PCIRC	3	5.87	5.33	6.41
D5PCIRC	4	5.75	5.21	6.29
D5PCIRC	5	5.63	5.09	6.17
D5PCIRC	6	5.78	5.24	6.32
D5PCIRC	7	5.90	5.36	6.44
D5DIP	1	1.80	1.41	2.19
D5DIP	2	1.90	1.51	2.29
D5DIP	3	1.70	1.31	2.09
D5DIP	4	1.70	1.31	2.09
D5DIP	5	1.70	1.31	2.09
D5DIP	6	1.80	1.41	2.19
D5DIP	7	1.80	1.41	2.19
D5DCIRC	1	4.94	4.46	5.42
D5DCIRC	2	5.00	4.52	5.48

D5DCIRC	3	4.96	4.48	5.44
D5DCIRC	4	4.88	4.40	5.36
D5DCIRC	5	4.81	4.33	5.29
D5DCIRC	6	4.94	4.46	5.42
D5DCIRC	7	5.02	4.54	5.50
WRISBRTH	1	6.50	5.15	7.85
WRISBRTH	2	7.00	5.65	8.35
WRISBRTH	3	6.30	4.95	7.65
WRISBRTH	4	6.90	5.55	8.25
WRISBRTH	5	6.40	5.05	7.75
WRISBRTH	6	7.20	5.85	8.55
WRISBRTH	7	6.70	5.35	8.05
D4PIP	1	2.10	1.65	2.55
D4PIP	2	2.30	1.85	2.75
D4PIP	3	2.10	1.65	2.55
D4PIP	4	2.10	1.65	2.55
D4PIP	5	2.00	1.55	2.45
D4PIP	6	2.10	1.65	2.55
D4PIP	7	2.30	1.85	2.75
THUMBBR	1	2.30	1.91	2.69
THUMBBR	2	2.30	1.91	2.69
THUMBBR	3	2.30	1.91	2.69
THUMBBR	4	2.60	2.21	2.99
THUMBBR	5	2.50	2.11	2.89
THUMBBR	6	2.70	2.31	3.09
THUMBBR	7	2.50	2.11	2.89
THMBCIRC	1	7.01	6.14	7.88
THMBCIRC	2	7.01	6.14	7.88
THMBCIRC	3	7.01	6.14	7.88
THMBCIRC	4	7.67	6.80	8.54
THMBCIRC	5	7.45	6.58	8.32
THMBCIRC	6	7.89	7.02	8.76
THMBCIRC	7	7.45	6.58	8.32
HANDCIRC	1	21.40	18.46	24.34
HANDCIRC	2	22.40	19.46	25.34
HANDCIRC	3	21.20	18.26	24.14
HANDCIRC	4	21.70	18.76	24.64
HANDCIRC	5	22.10	19.16	25.04
HANDCIRC	6	22.70	19.76	25.64

HANDCIRC	7	21.80	18.86	24.74
HANDBRTH	1	8.90	7.64	10.16
HANDBRTH	2	9.60	8.34	10.86
HANDBRTH	3	9.00	7.74	10.26
HANDBRTH	4	9.30	8.04	10.56
HANDBRTH	5	9.40	8.14	10.66
HANDBRTH	6	9.50	8.24	10.76
HANDBRTH	7	9.20	7.94	10.46
WRISCIRC	1	17.20	14.74	19.66
WRISCIRC	2	17.20	14.74	19.66
WRISCIRC	3	16.50	14.04	18.96
WRISCIRC	4	17.40	14.94	19.86
WRISCIRC	5	17.20	14.74	19.66
WRISCIRC	6	18.80	16.34	21.26
WRISCIRC	7	18.70	16.24	21.16

Appendix G Female Tolerance Limits for Method II

Variable	Size	Measurement (cm)	Lower Tolerance Limit (cm)	Upper Tolerance Limit (cm)
THMBLGTH	1	6.40	4.96	7.84
THMBLGTH	2	6.30	4.86	7.74
THMBLGTH	3	6.50	5.06	7.94
THMBLGTH	4	5.70	4.26	7.14
THMBLGTH	5	7.10	5.66	8.54
THMBLGTH	6	6.20	4.76	7.64
THMBLGTH	7	6.90	5.46	8.34
THMBLGTH	8	6.40	4.96	7.84
THMBLGTH	9	6.00	4.56	7.44
THMBLGTH	10	6.60	5.16	8.04
THMBLGTH	11	6.00	4.56	7.44
THMBLGTH	12	6.40	4.96	7.84
THMBLGTH	13	6.40	4.96	7.84
THMBLGTH	14	6.40	4.96	7.84
D1HGHT	1	10.00	7.81	12.19
D1HGHT	2	9.90	7.71	12.09
D1HGHT	3	9.60	7.41	11.79
D1HGHT	4	9.90	7.71	12.09
D1HGHT	5	10.60	8.41	12.79
D1HGHT	6	9.50	7.31	11.69
D1HGHT	7	9.20	7.01	11.39
D1HGHT	8	8.60	6.41	10.79
D1HGHT	9	9.60	7.41	11.79
D1HGHT	10	9.20	7.01	11.39
D1HGHT	11	8.10	5.91	10.29
D1HGHT	12	9.70	7.51	11.89
D1HGHT	13	8.80	6.61	10.99
D1HGHT	14	9.10	6.91	11.29
THUMBBR	1	2.00	1.61	2.39
THUMBBR	2	2.20	1.81	2.59
THUMBBR	3	2.00	1.61	2.39
THUMBBR	4	2.20	1.81	2.59
THUMBBR	5	2.10	1.71	2.49
THUMBBR	6	2.20	1.81	2.59
THUMBBR	7	2.00	1.61	2.39
THUMBBR	8	1.80	1.41	2.19

THUMBBR	9	2.00	1.61	2.39
THUMBBR	10	2.20	1.81	2.59
THUMBBR	11	2.10	1.71	2.49
THUMBBR	12	2.10	1.71	2.49
THUMBBR	13	2.00	1.61	2.39
THUMBBR	14	2.10	1.71	2.49
D1FUNCLT	1	10.80	8.73	12.87
D1FUNCLT	2	11.10	9.03	13.17
D1FUNCLT	3	10.90	8.83	12.97
D1FUNCLT	4	10.40	8.33	12.47
D1FUNCLT	5	12.30	10.23	14.37
D1FUNCLT	6	11.10	9.03	13.17
D1FUNCLT	7	11.10	9.03	13.17
D1FUNCLT	8	10.90	8.83	12.97
D1FUNCLT	9	10.80	8.73	12.87
D1FUNCLT	10	12.00	9.93	14.07
D1FUNCLT	11	10.70	8.63	12.77
D1FUNCLT	12	12.00	9.93	14.07
D1FUNCLT	13	11.90	9.83	13.97
D1FUNCLT	14	11.00	8.93	13.07
THMBCIRC	1	6.18	5.43	6.93
THMBCIRC	2	6.57	5.82	7.32
THMBCIRC	3	6.18	5.43	6.93
THMBCIRC	4	6.57	5.82	7.32
THMBCIRC	5	6.38	5.63	7.13
THMBCIRC	6	6.57	5.82	7.32
THMBCIRC	7	6.18	5.43	6.93
THMBCIRC	8	5.79	5.04	6.54
THMBCIRC	9	6.18	5.43	6.93
THMBCIRC	10	6.57	5.82	7.32
THMBCIRC	11	6.38	5.63	7.13
THMBCIRC	12	6.38	5.63	7.13
THMBCIRC	13	6.18	5.43	6.93
THMBCIRC	14	6.38	5.63	7.13
D2LGTH	1	6.70	5.32	8.08
D2LGTH	2	7.20	5.82	8.58
D2LGTH	3	6.70	5.32	8.08
D2LGTH	4	6.50	5.12	7.88
D2LGTH	5	7.30	5.92	8.68

D2LGTH	6	6.80	5.42	8.18
D2LGTH	7	6.80	5.42	8.18
D2LGTH	8	6.90	5.52	8.28
D2LGTH	9	6.80	5.42	8.18
D2LGTH	10	7.10	5.72	8.48
D2LGTH	11	6.70	5.32	8.08
D2LGTH	12	6.90	5.52	8.28
D2LGTH	13	7.40	6.02	8.78
D2LGTH	14	7.50	6.12	8.88
D2HGHT	1	16.20	13.50	18.90
D2HGHT	2	16.80	14.10	19.50
D2HGHT	3	15.90	13.20	18.60
D2HGHT	4	16.40	13.70	19.10
D2HGHT	5	17.10	14.40	19.80
D2HGHT	6	16.80	14.10	19.50
D2HGHT	7	16.70	14.00	19.40
D2HGHT	8	15.50	12.80	18.20
D2HGHT	9	17.00	14.30	19.70
D2HGHT	10	16.40	13.70	19.10
D2HGHT	11	15.70	13.00	18.40
D2HGHT	12	17.40	14.70	20.10
D2HGHT	13	16.80	14.10	19.50
D2HGHT	14	17.00	14.30	19.70
D2PIP	1	2.00	1.61	2.39
D2PIP	2	2.00	1.61	2.39
D2PIP	3	1.80	1.41	2.19
D2PIP	4	1.80	1.41	2.19
D2PIP	5	2.10	1.71	2.49
D2PIP	6	2.20	1.81	2.59
D2PIP	7	2.00	1.61	2.39
D2PIP	8	1.80	1.41	2.19
D2PIP	9	2.10	1.71	2.49
D2PIP	10	2.00	1.61	2.39
D2PIP	11	1.90	1.51	2.29
D2PIP	12	2.40	2.01	2.79
D2PIP	13	2.10	1.71	2.49
D2PIP	14	2.00	1.61	2.39
D2PCIRC	1	6.02	5.42	6.62
D2PCIRC	2	6.19	5.59	6.79

D2PCIRC	3	5.92	5.32	6.52
D2PCIRC	4	5.83	5.23	6.43
D2PCIRC	5	6.20	5.60	6.80
D2PCIRC	6	6.47	5.87	7.07
D2PCIRC	7	6.28	5.68	6.88
D2PCIRC	8	5.75	5.15	6.35
D2PCIRC	9	6.29	5.69	6.89
D2PCIRC	10	6.19	5.59	6.79
D2PCIRC	11	6.01	5.41	6.61
D2PCIRC	12	6.56	5.96	7.16
D2PCIRC	13	6.46	5.86	7.06
D2PCIRC	14	6.11	5.51	6.71
D2DIP	1	1.60	1.24	1.96
D2DIP	2	1.80	1.44	2.16
D2DIP	3	1.70	1.34	2.06
D2DIP	4	1.60	1.24	1.96
D2DIP	5	1.70	1.34	2.06
D2DIP	6	1.90	1.54	2.26
D2DIP	7	1.90	1.54	2.26
D2DIP	8	1.50	1.14	1.86
D2DIP	9	1.80	1.44	2.16
D2DIP	10	1.80	1.44	2.16
D2DIP	11	1.70	1.34	2.06
D2DIP	12	1.80	1.44	2.16
D2DIP	13	2.00	1.64	2.36
D2DIP	14	1.70	1.34	2.06
D2DCIRC	1	4.95	4.38	5.52
D2DCIRC	2	5.16	4.59	5.73
D2DCIRC	3	4.93	4.36	5.50
D2DCIRC	4	4.83	4.26	5.40
D2DCIRC	5	5.12	4.55	5.69
D2DCIRC	6	5.39	4.82	5.96
D2DCIRC	7	5.27	4.70	5.84
D2DCIRC	8	4.72	4.15	5.29
D2DCIRC	9	5.23	4.66	5.80
D2DCIRC	10	5.16	4.59	5.73
D2DCIRC	11	4.99	4.42	5.56
D2DCIRC	12	5.41	4.84	5.98
D2DCIRC	13	5.44	4.87	6.01

D2DCIRC	14	5.06	4.49	5.63
D2LINK	1	10.40	8.48	12.32
D2LINK	2	9.90	7.98	11.82
D2LINK	3	9.70	7.78	11.62
D2LINK	4	9.70	7.78	11.62
D2LINK	5	10.60	8.68	12.52
D2LINK	6	9.80	7.88	11.72
D2LINK	7	10.20	8.28	12.12
D2LINK	8	10.90	8.98	12.82
D2LINK	9	9.60	7.68	11.52
D2LINK	10	10.20	8.28	12.12
D2LINK	11	9.60	7.68	11.52
D2LINK	12	10.50	8.58	12.42
D2LINK	13	9.90	7.98	11.82
D2LINK	14	10.50	8.58	12.42
D3LGTH	1	7.60	6.07	9.13
D3LGTH	2	7.90	6.37	9.43
D3LGTH	3	7.60	6.07	9.13
D3LGTH	4	7.30	5.77	8.83
D3LGTH	5	7.90	6.37	9.43
D3LGTH	6	7.50	5.97	9.03
D3LGTH	7	8.00	6.47	9.53
D3LGTH	8	7.40	5.87	8.93
D3LGTH	9	7.40	5.87	8.93
D3LGTH	10	7.90	6.37	9.43
D3LGTH	11	7.40	5.87	8.93
D3LGTH	12	7.40	5.87	8.93
D3LGTH	13	8.00	6.47	9.53
D3LGTH	14	8.00	6.47	9.53
D3HGHT	1	17.50	14.56	20.44
D3HGHT	2	17.40	14.46	20.34
D3HGHT	3	17.40	14.46	20.34
D3HGHT	4	17.40	14.46	20.34
D3HGHT	5	18.10	15.16	21.04
D3HGHT	6	17.80	14.86	20.74
D3HGHT	7	18.20	15.26	21.14
D3HGHT	8	17.10	14.16	20.04
D3HGHT	9	17.60	14.66	20.54
D3HGHT	10	17.80	14.86	20.74

D3HGHT	11	17.20	14.26	20.14
D3HGHT	12	18.30	15.36	21.24
D3HGHT	13	18.10	15.16	21.04
D3HGHT	14	18.00	15.06	20.94
D3PIP	1	1.80	1.41	2.19
D3PIP	2	2.00	1.61	2.39
D3PIP	3	1.90	1.51	2.29
D3PIP	4	1.80	1.41	2.19
D3PIP	5	2.00	1.61	2.39
D3PIP	6	2.20	1.81	2.59
D3PIP	7	2.00	1.61	2.39
D3PIP	8	1.70	1.31	2.09
D3PIP	9	2.00	1.61	2.39
D3PIP	10	2.00	1.61	2.39
D3PIP	11	1.90	1.51	2.29
D3PIP	12	2.10	1.71	2.49
D3PIP	13	2.10	1.71	2.49
D3PIP	14	2.00	1.61	2.39
D3PCIRC	1	6.03	5.46	6.60
D3PCIRC	2	6.20	5.63	6.77
D3PCIRC	3	6.04	5.47	6.61
D3PCIRC	4	5.87	5.30	6.44
D3PCIRC	5	6.20	5.63	6.77
D3PCIRC	6	6.54	5.97	7.11
D3PCIRC	7	6.31	5.74	6.88
D3PCIRC	8	5.81	5.24	6.38
D3PCIRC	9	6.26	5.69	6.83
D3PCIRC	10	6.26	5.69	6.83
D3PCIRC	11	6.14	5.57	6.71
D3PCIRC	12	6.32	5.75	6.89
D3PCIRC	13	6.37	5.80	6.94
D3PCIRC	14	6.20	5.63	6.77
D3DIP	1	1.80	1.47	2.13
D3DIP	2	1.70	1.37	2.03
D3DIP	3	1.60	1.27	1.93
D3DIP	4	1.50	1.17	1.83
D3DIP	5	1.70	1.37	2.03
D3DIP	6	1.90	1.57	2.23
D3DIP	7	1.90	1.57	2.23

D3DIP	8	1.60	1.27	1.93
D3DIP	9	1.80	1.47	2.13
D3DIP	10	1.80	1.47	2.13
D3DIP	11	1.80	1.47	2.13
D3DIP	12	1.70	1.37	2.03
D3DIP	13	1.80	1.47	2.13
D3DIP	14	1.70	1.37	2.03
D3DCIRC	1	5.09	4.58	5.60
D3DCIRC	2	5.12	4.61	5.63
D3DCIRC	3	4.97	4.46	5.48
D3DCIRC	4	4.82	4.31	5.33
D3DCIRC	5	5.12	4.61	5.63
D3DCIRC	6	5.43	4.92	5.94
D3DCIRC	7	5.31	4.80	5.82
D3DCIRC	8	4.85	4.34	5.36
D3DCIRC	9	5.21	4.70	5.72
D3DCIRC	10	5.21	4.70	5.72
D3DCIRC	11	5.15	4.64	5.66
D3DCIRC	12	5.18	4.67	5.69
D3DCIRC	13	5.27	4.76	5.78
D3DCIRC	14	5.12	4.61	5.63
D3LINK	1	9.70	7.78	11.62
D3LINK	2	10.30	8.38	12.22
D3LINK	3	10.10	8.18	12.02
D3LINK	4	9.60	7.68	11.52
D3LINK	5	10.20	8.28	12.12
D3LINK	6	10.80	8.88	12.72
D3LINK	7	10.30	8.38	12.22
D3LINK	8	10.20	8.28	12.12
D3LINK	9	9.40	7.48	11.32
D3LINK	10	10.30	8.38	12.22
D3LINK	11	9.50	7.58	11.42
D3LINK	12	9.90	7.98	11.82
D3LINK	13	10.40	8.48	12.32
D3LINK	14	10.60	8.68	12.52
D4LGTH	1	7.00	5.50	8.50
D4LGTH	2	7.30	5.80	8.80
D4LGTH	3	6.90	5.40	8.40
D4LGTH	4	6.80	5.30	8.30

D4LGTH	5	7.80	6.30	9.30
D4LGTH	6	7.30	5.80	8.80
D4LGTH	7	7.30	5.80	8.80
D4LGTH	8	7.00	5.50	8.50
D4LGTH	9	6.80	5.30	8.30
D4LGTH	10	7.60	6.10	9.10
D4LGTH	11	7.00	5.50	8.50
D4LGTH	12	7.30	5.80	8.80
D4LGTH	13	7.40	5.90	8.90
D4LGTH	14	7.50	6.00	9.00
D4HGHT	1	16.00	13.12	18.88
D4HGHT	2	15.60	12.72	18.48
D4HGHT	3	15.90	13.02	18.78
D4HGHT	4	16.00	13.12	18.88
D4HGHT	5	16.80	13.92	19.68
D4HGHT	6	16.80	13.92	19.68
D4HGHT	7	17.00	14.12	19.88
D4HGHT	8	16.30	13.42	19.18
D4HGHT	9	16.00	13.12	18.88
D4HGHT	10	16.50	13.62	19.38
D4HGHT	11	16.00	13.12	18.88
D4HGHT	12	16.90	14.02	19.78
D4HGHT	13	16.80	13.92	19.68
D4HGHT	14	16.70	13.82	19.58
D4PIP	1	1.90	1.54	2.26
D4PIP	2	1.80	1.44	2.16
D4PIP	3	1.80	1.44	2.16
D4PIP	4	1.60	1.24	1.96
D4PIP	5	1.90	1.54	2.26
D4PIP	6	1.90	1.54	2.26
D4PIP	7	1.90	1.54	2.26
D4PIP	8	1.60	1.24	1.96
D4PIP	9	1.90	1.54	2.26
D4PIP	10	1.90	1.54	2.26
D4PIP	11	1.80	1.44	2.16
D4PIP	12	1.80	1.44	2.16
D4PIP	13	2.10	1.74	2.46
D4PIP	14	1.80	1.44	2.16
D4PCIRC	1	5.82	5.25	6.39

D4PCIRC	2	5.71	5.14	6.28
D4PCIRC	3	5.64	5.07	6.21
D4PCIRC	4	5.42	4.85	5.99
D4PCIRC	5	5.89	5.32	6.46
D4PCIRC	6	5.89	5.32	6.46
D4PCIRC	7	5.89	5.32	6.46
D4PCIRC	8	5.35	4.78	5.92
D4PCIRC	9	5.89	5.32	6.46
D4PCIRC	10	5.89	5.32	6.46
D4PCIRC	11	5.71	5.14	6.28
D4PCIRC	12	5.64	5.07	6.21
D4PCIRC	13	6.11	5.54	6.68
D4PCIRC	14	5.71	5.14	6.28
D4DIP	1	1.60	1.27	1.93
D4DIP	2	1.60	1.27	1.93
D4DIP	3	1.50	1.17	1.83
D4DIP	4	1.50	1.17	1.83
D4DIP	5	1.70	1.37	2.03
D4DIP	6	1.70	1.37	2.03
D4DIP	7	1.70	1.37	2.03
D4DIP	8	1.40	1.07	1.73
D4DIP	9	1.70	1.37	2.03
D4DIP	10	1.70	1.37	2.03
D4DIP	11	1.60	1.27	1.93
D4DIP	12	1.50	1.17	1.83
D4DIP	13	1.70	1.37	2.03
D4DIP	14	1.60	1.27	1.93
D4DCIRC	1	4.74	4.26	5.22
D4DCIRC	2	4.68	4.20	5.16
D4DCIRC	3	4.59	4.11	5.07
D4DCIRC	4	4.47	3.99	4.95
D4DCIRC	5	4.83	4.35	5.31
D4DCIRC	6	4.83	4.35	5.31
D4DCIRC	7	4.83	4.35	5.31
D4DCIRC	8	4.38	3.90	4.86
D4DCIRC	9	4.83	4.35	5.31
D4DCIRC	10	4.83	4.35	5.31
D4DCIRC	11	4.68	4.20	5.16
D4DCIRC	12	4.59	4.11	5.07

D4DCIRC	13	4.95	4.47	5.43
D4DCIRC	14	4.68	4.20	5.16
D4LINK	1	9.50	7.73	11.27
D4LINK	2	9.70	7.93	11.47
D4LINK	3	9.40	7.63	11.17
D4LINK	4	9.20	7.43	10.97
D4LINK	5	10.10	8.33	11.87
D4LINK	6	10.40	8.63	12.17
D4LINK	7	10.10	8.33	11.87
D4LINK	8	9.70	7.93	11.47
D4LINK	9	9.30	7.53	11.07
D4LINK	10	10.10	8.33	11.87
D4LINK	11	9.40	7.63	11.17
D4LINK	12	9.70	7.93	11.47
D4LINK	13	10.00	8.23	11.77
D4LINK	14	10.30	8.53	12.07
D5LGTH	1	5.60	4.22	6.98
D5LGTH	2	5.80	4.42	7.18
D5LGTH	3	5.40	4.02	6.78
D5LGTH	4	5.30	3.92	6.68
D5LGTH	5	5.80	4.42	7.18
D5LGTH	6	6.10	4.72	7.48
D5LGTH	7	5.80	4.42	7.18
D5LGTH	8	5.60	4.22	6.98
D5LGTH	9	5.60	4.22	6.98
D5LGTH	10	6.20	4.82	7.58
D5LGTH	11	5.70	4.32	7.08
D5LGTH	12	5.70	4.32	7.08
D5LGTH	13	5.80	4.42	7.18
D5LGTH	14	6.30	4.92	7.68
D5HGHT	1	12.50	9.86	15.14
D5HGHT	2	12.30	9.66	14.94
D5HGHT	3	12.80	10.16	15.44
D5HGHT	4	12.70	10.06	15.34
D5HGHT	5	12.90	10.26	15.54
D5HGHT	6	13.50	10.86	16.14
D5HGHT	7	13.50	10.86	16.14
D5HGHT	8	13.50	10.86	16.14
D5HGHT	9	12.80	10.16	15.44

D5HGHT	10	13.20	10.56	15.84
D5HGHT	11	13.10	10.46	15.74
D5HGHT	12	13.60	10.96	16.24
D5HGHT	13	13.70	11.06	16.34
D5HGHT	14	13.70	11.06	16.34
D5PIP	1	1.70	1.37	2.03
D5PIP	2	1.60	1.27	1.93
D5PIP	3	1.70	1.37	2.03
D5PIP	4	1.50	1.17	1.83
D5PIP	5	1.70	1.37	2.03
D5PIP	6	1.90	1.57	2.23
D5PIP	7	1.70	1.37	2.03
D5PIP	8	1.50	1.17	1.83
D5PIP	9	1.60	1.27	1.93
D5PIP	10	1.60	1.27	1.93
D5PIP	11	1.60	1.27	1.93
D5PIP	12	1.60	1.27	1.93
D5PIP	13	1.70	1.37	2.03
D5PIP	14	1.70	1.37	2.03
D5PCIRC	1	5.08	4.57	5.59
D5PCIRC	2	5.02	4.51	5.53
D5PCIRC	3	5.08	4.57	5.59
D5PCIRC	4	4.90	4.39	5.41
D5PCIRC	5	5.08	4.57	5.59
D5PCIRC	6	5.47	4.96	5.98
D5PCIRC	7	5.18	4.67	5.69
D5PCIRC	8	4.85	4.34	5.36
D5PCIRC	9	5.02	4.51	5.53
D5PCIRC	10	5.07	4.56	5.58
D5PCIRC	11	5.02	4.51	5.53
D5PCIRC	12	4.96	4.45	5.47
D5PCIRC	13	5.13	4.62	5.64
D5PCIRC	14	5.13	4.62	5.64
D5DIP	1	1.40	1.07	1.73
D5DIP	2	1.50	1.17	1.83
D5DIP	3	1.40	1.07	1.73
D5DIP	4	1.50	1.17	1.83
D5DIP	5	1.40	1.07	1.73
D5DIP	6	1.70	1.37	2.03

D5DIP	7	1.60	1.27	1.93
D5DIP	8	1.40	1.07	1.73
D5DIP	9	1.50	1.17	1.83
D5DIP	10	1.60	1.27	1.93
D5DIP	11	1.50	1.17	1.83
D5DIP	12	1.40	1.07	1.73
D5DIP	13	1.50	1.17	1.83
D5DIP	14	1.50	1.17	1.83
D5DCIRC	1	4.22	3.77	4.67
D5DCIRC	2	4.24	3.79	4.69
D5DCIRC	3	4.22	3.77	4.67
D5DCIRC	4	4.18	3.73	4.63
D5DCIRC	5	4.22	3.77	4.67
D5DCIRC	6	4.61	4.16	5.06
D5DCIRC	7	4.40	3.95	4.85
D5DCIRC	8	4.09	3.64	4.54
D5DCIRC	9	4.24	3.79	4.69
D5DCIRC	10	4.33	3.88	4.78
D5DCIRC	11	4.24	3.79	4.69
D5DCIRC	12	4.16	3.71	4.61
D5DCIRC	13	4.31	3.86	4.76
D5DCIRC	14	4.31	3.86	4.76
D5LINK	1	7.40	5.78	9.02
D5LINK	2	7.70	6.08	9.32
D5LINK	3	7.50	5.88	9.12
D5LINK	4	7.10	5.48	8.72
D5LINK	5	7.40	5.78	9.02
D5LINK	6	8.20	6.58	9.82
D5LINK	7	8.10	6.48	9.72
D5LINK	8	7.60	5.98	9.22
D5LINK	9	7.30	5.68	8.92
D5LINK	10	8.30	6.68	9.92
D5LINK	11	7.50	5.88	9.12
D5LINK	12	7.70	6.08	9.32
D5LINK	13	8.00	6.38	9.62
D5LINK	14	8.50	6.88	10.12
HANDLGTH	1	17.50	14.56	20.44
HANDLGTH	2	18.40	15.46	21.34
HANDLGTH	3	18.10	15.16	21.04

HANDLGTH	4	17.40	14.46	20.34
HANDLGTH	5	18.80	15.86	21.74
HANDLGTH	6	18.30	15.36	21.24
HANDLGTH	7	19.00	16.06	21.94
HANDLGTH	8	17.20	14.26	20.14
HANDLGTH	9	18.20	15.26	21.14
HANDLGTH	10	18.00	15.06	20.94
HANDLGTH	11	17.40	14.46	20.34
HANDLGTH	12	18.40	15.46	21.34
HANDLGTH	13	17.90	14.96	20.84
HANDLGTH	14	18.10	15.16	21.04
HANDCIRC	1	17.80	15.22	20.38
HANDCIRC	2	18.80	16.22	21.38
HANDCIRC	3	18.90	16.32	21.48
HANDCIRC	4	17.60	15.02	20.18
HANDCIRC	5	18.90	16.32	21.48
HANDCIRC	6	19.70	17.12	22.28
HANDCIRC	7	19.30	16.72	21.88
HANDCIRC	8	17.00	14.42	19.58
HANDCIRC	9	19.20	16.62	21.78
HANDCIRC	10	19.30	16.72	21.88
HANDCIRC	11	18.30	15.72	20.88
HANDCIRC	12	18.90	16.32	21.48
HANDCIRC	13	19.30	16.72	21.88
HANDCIRC	14	19.00	16.42	21.58
PALMLGTH	1	9.90	8.19	11.61
PALMLGTH	2	9.70	7.99	11.41
PALMLGTH	3	9.90	8.19	11.61
PALMLGTH	4	10.20	8.49	11.91
PALMLGTH	5	10.10	8.39	11.81
PALMLGTH	6	10.40	8.69	12.11
PALMLGTH	7	10.20	8.49	11.91
PALMLGTH	8	9.80	8.09	11.51
PALMLGTH	9	10.20	8.49	11.91
PALMLGTH	10	9.90	8.19	11.61
PALMLGTH	11	9.90	8.19	11.61
PALMLGTH	12	10.90	9.19	12.61
PALMLGTH	13	10.00	8.29	11.71
PALMLGTH	14	10.10	8.39	11.81

HANDBRTH	1	7.70	6.56	8.84
HANDBRTH	2	7.90	6.76	9.04
HANDBRTH	3	8.20	7.06	9.34
HANDBRTH	4	7.70	6.56	8.84
HANDBRTH	5	8.00	6.86	9.14
HANDBRTH	6	8.20	7.06	9.34
HANDBRTH	7	8.30	7.16	9.44
HANDBRTH	8	7.10	5.96	8.24
HANDBRTH	9	8.20	7.06	9.34
HANDBRTH	10	8.20	7.06	9.34
HANDBRTH	11	7.90	6.76	9.04
HANDBRTH	12	8.10	6.96	9.24
HANDBRTH	13	8.20	7.06	9.34
HANDBRTH	14	8.10	6.96	9.24
WRISBRTH	1	5.40	4.38	6.42
WRISBRTH	2	5.60	4.58	6.62
WRISBRTH	3	5.40	4.38	6.42
WRISBRTH	4	5.00	3.98	6.02
WRISBRTH	5	6.00	4.98	7.02
WRISBRTH	6	5.90	4.88	6.92
WRISBRTH	7	5.90	4.88	6.92
WRISBRTH	8	5.00	3.98	6.02
WRISBRTH	9	5.90	4.88	6.92
WRISBRTH	10	5.80	4.78	6.82
WRISBRTH	11	5.80	4.78	6.82
WRISBRTH	12	5.50	4.48	6.52
WRISBRTH	13	5.90	4.88	6.92
WRISBRTH	14	6.10	5.08	7.12
WRISCIRC	1	14.80	12.73	16.87
WRISCIRC	2	15.00	12.93	17.07
WRISCIRC	3	15.30	13.23	17.37
WRISCIRC	4	14.80	12.73	16.87
WRISCIRC	5	15.10	13.03	17.17
WRISCIRC	6	16.00	13.93	18.07
WRISCIRC	7	15.40	13.33	17.47
WRISCIRC	8	14.00	11.93	16.07
WRISCIRC	9	15.20	13.13	17.27
WRISCIRC	10	15.70	13.63	17.77
WRISCIRC	11	14.60	12.53	16.67

WRISCIRC	12	14.80	12.73	16.87
WRISCIRC	13	15.80	13.73	17.87
WRISCIRC	14	15.30	13.23	17.37
WRCTRGRL	1	5.80	4.33	7.27
WRCTRGRL	2	6.30	4.83	7.77
WRCTRGRL	3	6.00	4.53	7.47
WRCTRGRL	4	6.10	4.63	7.57
WRCTRGRL	5	6.70	5.23	8.17
WRCTRGRL	6	7.00	5.53	8.47
WRCTRGRL	7	6.40	4.93	7.87
WRCTRGRL	8	6.70	5.23	8.17
WRCTRGRL	9	6.90	5.43	8.37
WRCTRGRL	10	6.90	5.43	8.37
WRCTRGRL	11	6.30	4.83	7.77
WRCTRGRL	12	7.00	5.53	8.47
WRCTRGRL	13	6.20	4.73	7.67
WRCTRGRL	14	5.80	4.33	7.27
WRINFNGL	1	16.40	13.70	19.10
WRINFNGL	2	17.30	14.60	20.00
WRINFNGL	3	16.70	14.00	19.40
WRINFNGL	4	16.70	14.00	19.40
WRINFNGL	5	17.70	15.00	20.40
WRINFNGL	6	17.10	14.40	19.80
WRINFNGL	7	17.50	14.80	20.20
WRINFNGL	8	16.30	13.60	19.00
WRINFNGL	9	17.10	14.40	19.80
WRINFNGL	10	16.90	14.20	19.60
WRINFNGL	11	16.40	13.70	19.10
WRINFNGL	12	17.60	14.90	20.30
WRINFNGL	13	16.90	14.20	19.60
WRINFNGL	14	17.30	14.60	20.00
WRTHLGTH	1	11.50	9.46	13.54
WRTHLGTH	2	11.60	9.56	13.64
WRTHLGTH	3	12.30	10.26	14.34
WRTHLGTH	4	11.50	9.46	13.54
WRTHLGTH	5	12.80	10.76	14.84
WRTHLGTH	6	12.40	10.36	14.44
WRTHLGTH	7	11.90	9.86	13.94
WRTHLGTH	8	11.40	9.36	13.44

WRTHLGTH	9	12.00	9.96	14.04
WRTHLGTH	10	12.10	10.06	14.14
WRTHLGTH	11	11.40	9.36	13.44
WRTHLGTH	12	11.80	9.76	13.84
WRTHLGTH	13	12.10	10.06	14.14
WRTHLGTH	14	11.60	9.56	13.64
CROTCH1	1	6.60	5.22	7.98
CROTCH1	2	6.50	5.12	7.88
CROTCH1	3	6.10	4.72	7.48
CROTCH1	4	6.20	4.82	7.58
CROTCH1	5	6.60	5.22	7.98
CROTCH1	6	6.70	5.32	8.08
CROTCH1	7	5.90	4.52	7.28
CROTCH1	8	6.00	4.62	7.38
CROTCH1	9	6.10	4.72	7.48
CROTCH1	10	6.20	4.82	7.58
CROTCH1	11	6.00	4.62	7.38
CROTCH1	12	6.80	5.42	8.18
CROTCH1	13	6.10	4.72	7.48
CROTCH1	14	6.20	4.82	7.58
CROTCH2	1	10.10	8.39	11.81
CROTCH2	2	9.70	7.99	11.41
CROTCH2	3	9.60	7.89	11.31
CROTCH2	4	10.00	8.29	11.71
CROTCH2	5	10.10	8.39	11.81
CROTCH2	6	10.30	8.59	12.01
CROTCH2	7	10.10	8.39	11.81
CROTCH2	8	9.80	8.09	11.51
CROTCH2	9	10.30	8.59	12.01
CROTCH2	10	9.80	8.09	11.51
CROTCH2	11	9.60	7.89	11.31
CROTCH2	12	10.50	8.79	12.21
CROTCH2	13	9.80	8.09	11.51
CROTCH2	14	10.20	8.49	11.91
CROTCH3	1	10.00	8.20	11.80
CROTCH3	2	9.50	7.70	11.30
CROTCH3	3	9.80	8.00	11.60
CROTCH3	4	9.90	8.10	11.70
CROTCH3	5	10.10	8.30	11.90

CROTCH3	6	10.40	8.60	12.20
CROTCH3	7	10.30	8.50	12.10
CROTCH3	8	10.00	8.20	11.80
CROTCH3	9	10.10	8.30	11.90
CROTCH3	10	9.60	7.80	11.40
CROTCH3	11	9.50	7.70	11.30
CROTCH3	12	10.40	8.60	12.20
CROTCH3	13	9.70	7.90	11.50
CROTCH3	14	10.00	8.20	11.80
CROTCH4	1	8.80	7.06	10.54
CROTCH4	2	8.00	6.26	9.74
CROTCH4	3	8.50	6.76	10.24
CROTCH4	4	8.60	6.86	10.34
CROTCH4	5	8.60	6.86	10.34
CROTCH4	6	9.00	7.26	10.74
CROTCH4	7	9.00	7.26	10.74
CROTCH4	8	9.10	7.36	10.84
CROTCH4	9	8.80	7.06	10.54
CROTCH4	10	8.40	6.66	10.14
CROTCH4	11	8.40	6.66	10.14
CROTCH4	12	9.20	7.46	10.94
CROTCH4	13	8.90	7.16	10.64
CROTCH4	14	8.80	7.06	10.54

Appendix H Hand Anthropometric Dimensions

Taken from Technical Report written by Griener (1991).

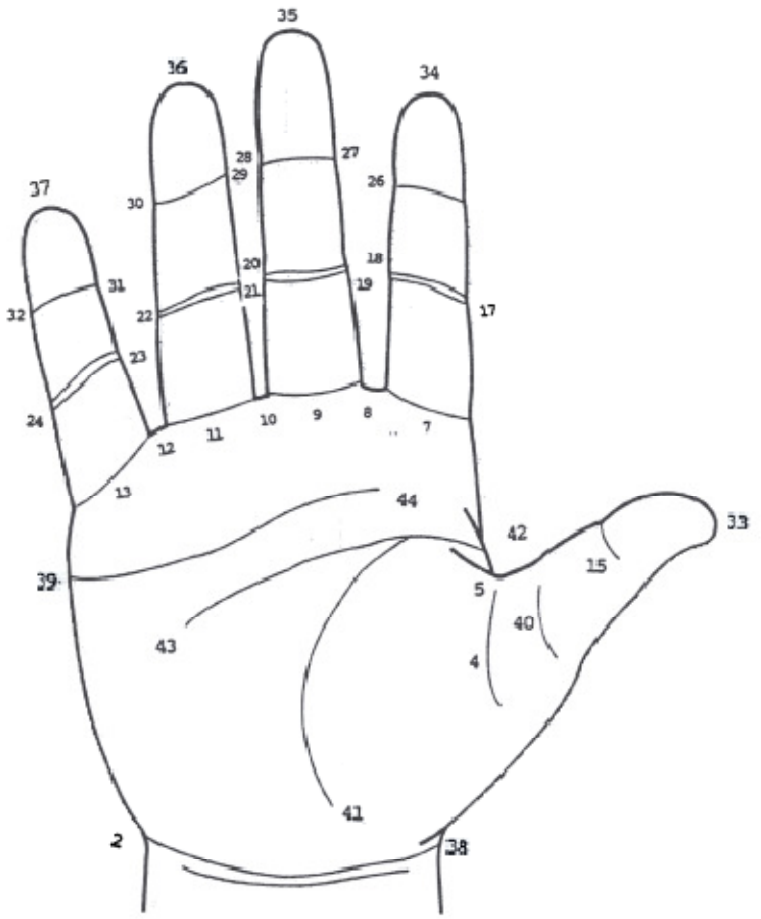

Figure The Hand Landmarks

1. Digit 1 Length - The distance between points 4 and 33.

2. Digit 1 Height - The perpendicular distance from point 33 to the wrist crease base line.

3. Digit 1 Tip to Wrist Crease Length - The distance from point 33 to the wrist crease base line measured along the axis of the digit.

Digit 1 Interphalangeal Joint Breadth - Measured directly during the survey as "Thumb Breadth."

5.* Digit 1 Interphalangeal Joint Circumference - Calculated using a regression equation that uses Digit 1 Interphalangeal Joint Breadth.

6. Digit 1 Link Length - The distance between points 33 and 41.

7. Digit 1 Metacarpal Link Length - The distance between points 40 and 41.

8. Digit 1 Proximal Phalanx Link Length - The distance between points 40 and 15.

9. Digit 1 Distal Phalanx Link Length - The distance between points 33 and 15.

Digit 2 Length - The distance between points 7 and 34

11. Digit 2 Height - The perpendicular distance from point 34 to the wrist crease base line.

12. Digit 2 Tip to Wrist Crease Length - The distance from point 34 to the wrist crease base line measured along the axis of the digit.

13. Digit 2 Proximal Interphalangeal Joint Breadth - The distance between points 17 and 18.

Digit 2 Proximal Interphalangeal Joint Circumference - Calculated from a regression equation that uses the breadths of the finger at the proximal and distal interphalangeal joints.

15. Digit 2 Distal Interphalangeal Joint Breadth - The distance between points 25 and 26.

Digit 2 Distal Interphalangeal Joint Circumference - Calculated from a regression equation that uses the breadths of the finger at the proximal and distal interphalangeal joints.

17. Digit 2 Link Length - The distance from point 34 to the proximal transverse palm crease measured along the axis of the digit.

18. Digit 2 Metacarpal Link Length - The distance from the proximal transverse palm crease to the wrist crease baseline measured along the axis of the digit.

19. Digit 2 Distal Phalanx Link Length - The distance from point 34 to the center of the distal interphalangeal joint measured along the axis of the digit.

20. Digit 2 Medial Phalanx Link Length - The distance between the centers of the proximal and distal interphalangeal joints measured along the axis of the digit.

21. Digit 2 Proximal Phalanx Link Length - The distance from the center of the proximal interphalangeal joint to the proximal transverse palm crease measured along the axis of the digit.

22. Digit 3 Length - The distance between points 9 and 35.

23. Digit 3 Height - The perpendicular distance from point 35 to the wrist crease base line.

24. Digit 3 Tip to Wrist Crease Length - The distance from point 35 to the wrist crease base line measured along the axis of the digit.

25. Digit 3 Proximal Interphalangeal Joint Breadth - The distance between points 19 and 20.

Digit 3 Proximal Interphalangeal Joint Circumference - Calculated from a regression equation that uses the breadths of the finger at the proximal and distal interphalangeal joints.

27. Digit 3 Distal Interphalangeal Joint Breadth - The distance between points 27 and 28.

28.* Digit 3 Distal Interphalangeal Joint Circumference - Calculated from a regression equation that uses the breadths of the finger at the proximal and distal interphalangeal joints.

Digit 3 Link Length - The distance from point 35 to the distal transverse palm crease measured along the axis of the digit.

30. Digit 3 Metacarpal Link Length - The distance from the distal transverse palm crease to the wrist crease baseline measured along the axis of the digit.

31. Digit 3 Distal Phalanx Link Length - The distance from point 35 to the center of the distal interphalangeal joint measured along the axis of the digit.

32. Digit 3 Medial Phalanx Link Length - The distance between the centers of the proximal and distal interphalangeal joints measured along the axis of the digit.

33. Digit 3 Proximal Phalanx Link Length - The distance from the center of the proximal interphalangeal joint to the distal transverse palm crease measured along the axis of the digit.

34. Digit 4 Length - The distance between points 11 and 36.

35. Digit 4 Height - The perpendicular distance from point 36 to the wrist crease base line.

Digit 4 Tip to Wrist Crease Length - The distance from point 36 to the wrist crease base line measured along the axis of the digit.

37. Digit 4 Proximal Interphalangeal Joint Breadth - The distance between points 21 and 22.

38.* Digit 4 Proximal Interphalangeal Joint Circumference - Calculated from a regression equation that uses the breadths of the finger at the proximal and distal interphalangeal joints.

Digit 4 Distal Interphalangeal Joint Breadth - The distance between points 29 and 30.

40.* Digit 4 Distal Interphalangeal Joint Circumference - Calculated from a regression equation that uses the breadths of the finger at the proximal and distal interphalangeal joints.

41. Digit 4 Link Length - The distance from point 36 to the distal transverse palm crease measured along the axis of the digit.

Digit 4 Metacarpal Link Length - The distance from the distal transverse palm crease to the wrist crease baseline measured along the axis of the digit.

Digit 4 Distal Phalanx Link Length - The distance from point 36 to the center of the distal interphalangeal joint measured along the axis of the digit.

Digit 4 Medial Phalanx Link Length - The distance between the centers of the proximal and distal interphalangeal joints measured along the axis of the digit.

Digit 4 Proximal Phalanx Link Length - The distance from the center of the proximal interphalangeal joint to the distal transverse palm crease measured along the axis of the digit.

Digit 5 Length - The distance between points 13 and 37.

Digit 5 Height - The perpendicular distance from point 37 to the wrist crease base line.

48. Digit 5 Tip to Wrist Crease Length - The distance from point 37 to the wrist crease base line measured along the axis of the digit.

Digit 5 Proximal Interphalangeal Joint Breadth - The distance between points 23 and 24.

50.* Digit 5 Proximal Interphalangeal Joint Circumference - Calculated from a regression equation that uses the breadths of the finger at the proximal and distal interphalangeal joints.

51. Digit 5 Distal Interphalangeal Joint Breadth - The distance between points 31 and 32.

52.* Digit 5 Distal Interphalangeal Joint Circumference - Calculated from a regression equation that uses the breadths of the finger at the proximal and distal interphalangeal joints.

Digit 5 Link Length - The distance from point 37 to the distal transverse palm crease measured along the axis of the digit.

54. Digit 5 Metacarpal Link Length - The distance from the distal transverse palm crease to the wrist crease baseline measured along the axis of the digit.

55. Digit 5 Distal Phalanx Link Length - The distance from point 37 to the center of the distal interphalangeal joint measured along the axis of the digit.

Digit 5 Medial Phalanx Link Length - The distance between the centers of the proximal and distal interphalangeal joints measured along the axis of the digit.

Digit 5 Proximal Phalanx Link Length - The distance from the center of the proximal interphalangeal joint to the distal transverse palm crease measured along the axis of the digit.

Hand Length from Digitizer - The perpendicular distance from point 35 to the wrist crease base line. This dimension is identical to measurement 23 (Digit 3 Height).

59.* Hand Length Measured - Measured directly during the survey.

60.* Hand Circumference - Measured directly during the survey.

Palm Length - The perpendicular distance from point 9 to the wrist crease base line.

62. Hand Breadth from Digitizer - The distance from point 6 to point 14.

Hand Breadth Measured - Measured directly during the survey.

64. Wrist Breadth - The distance from point 38 to point 2.

Wrist Circumference - Measured directly during the survey.

Wrist-Center of Grip Length - Measured directly during the survey.

Wrist-Index Finger Length - Measured directly during the survey.

Wrist-Thumbtip Length - Measured directly during the survey.

Crotch 1 Height - The perpendicular distance from point 5 to the wrist crease base line.

70. Crotch 2 Height - The perpendicular distance from point 8 to the wrist crease base line.

Crotch 3 Height - The perpendicular distance from point 10 to the wrist crease base line.

72. Crotch 4 Height - The perpendicular distance from point 12 to the wrist crease base line.

Forearm-Hand Length - Measured directly during the survey.

Elbow-Wrist Length - Calculated from survey dimensions

Elbow-Center of Grip Length - Calculated from survey dimensions.

76.* Radiale-Stylion Length - Measured directly during the survey.

77.* Forearm Circumference, Flexed - Measured directly during the survey.

78.* Biceps Circumference, Flexed - Measured directly during the survey.

79.* Arm Length - Calculated from survey dimensions.

80.* Shoulder-Elbow Length - Measured directly during the survey.

81.* Acromion-Radiale Length - Measured directly during the survey.

82.* Thumbtip Reach - Measured directly during the survey.

83.* Wrist Wall Length - Measured directly during the survey.

84.* Wrist Wall Length, Extended - Measured directly during the survey.

85.* Stature - Measured directly during the survey.

86.* Weight - Measured directly during the survey.

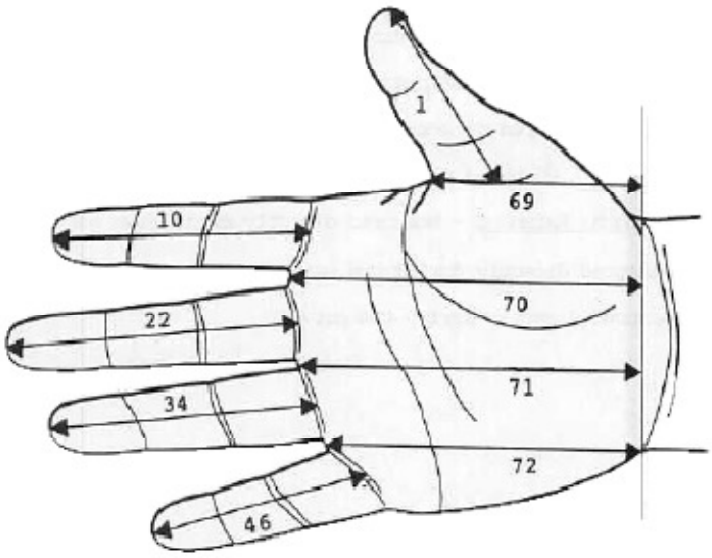

Figure 7. VISUAL INDEX

Page numbers refer to the location of the summary statistics.

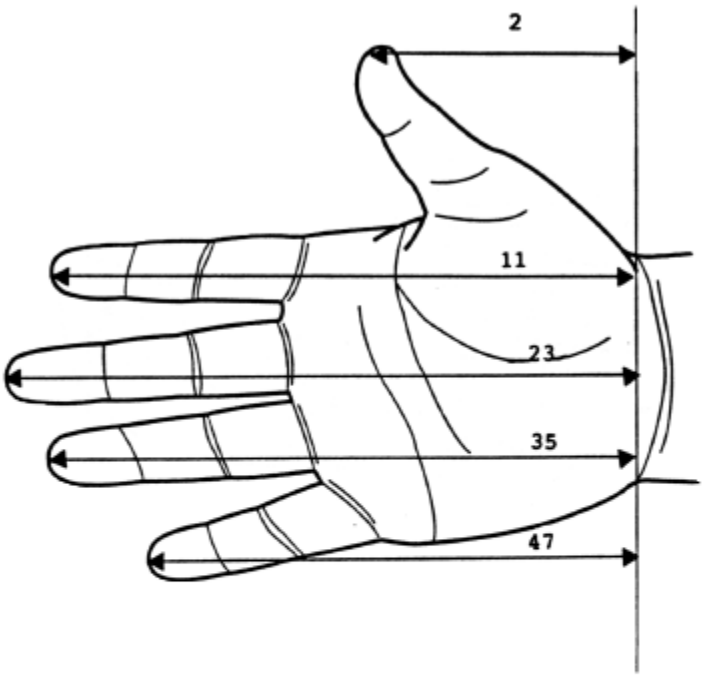

Figure 7. VISUAL INDEX (Continued)

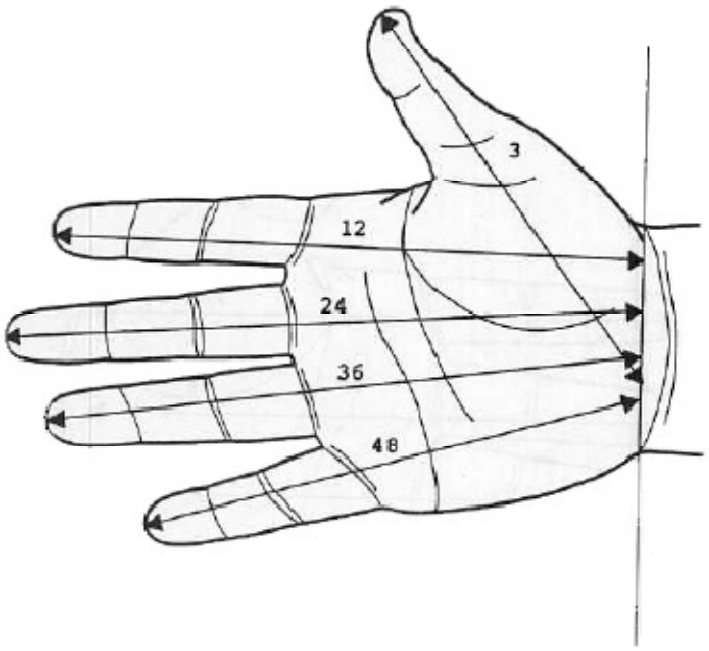

Figure 7 VISUAL INDEX (Continued)

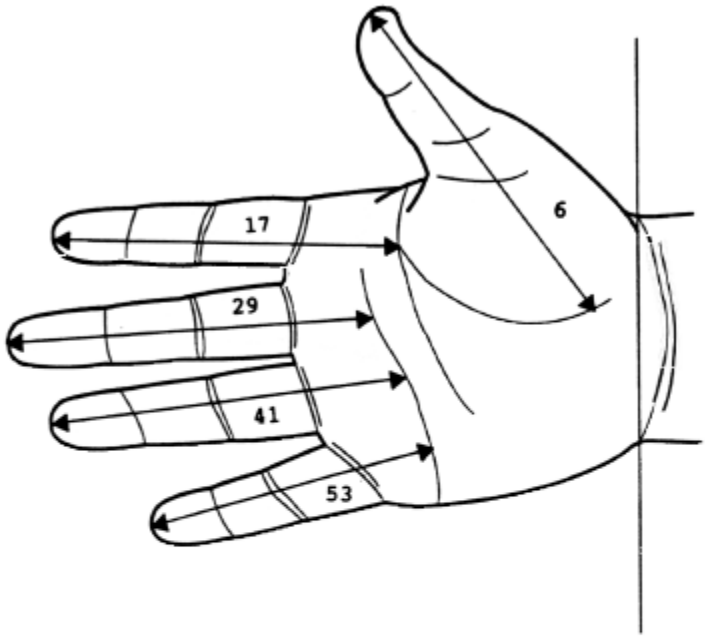

Figure 7. VISUAL INDEX (Continued)

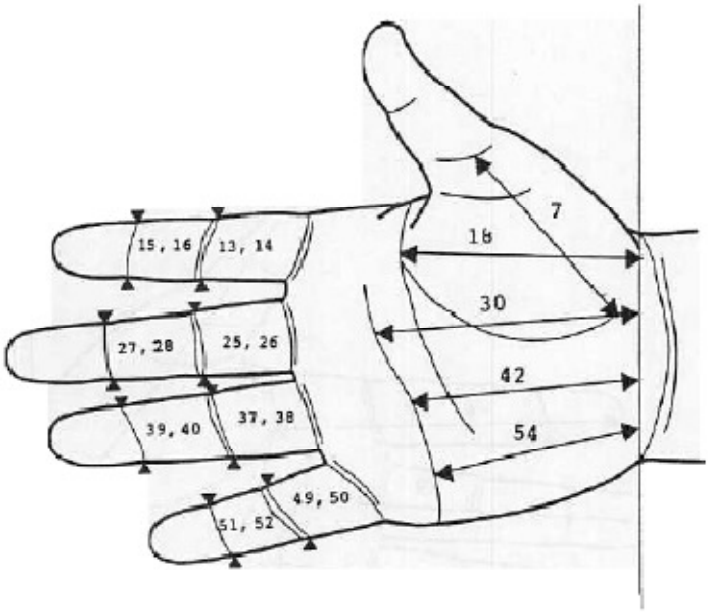

Figure 7. VISUAL INDEX (Continued)

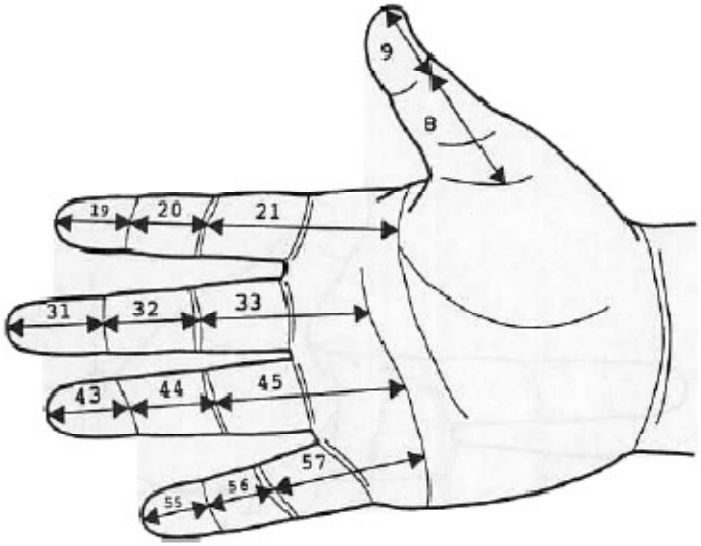

Figure 7. VISUAL INDEX (Continued)

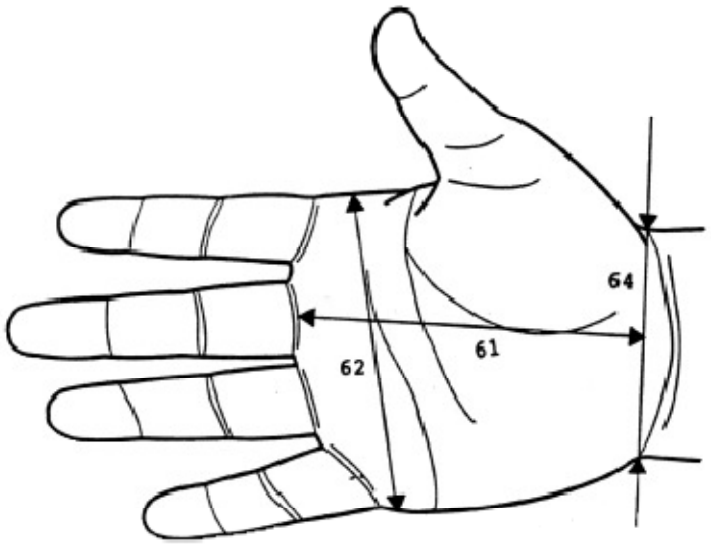

Figure 7. VISUAL INDEX (Continued)

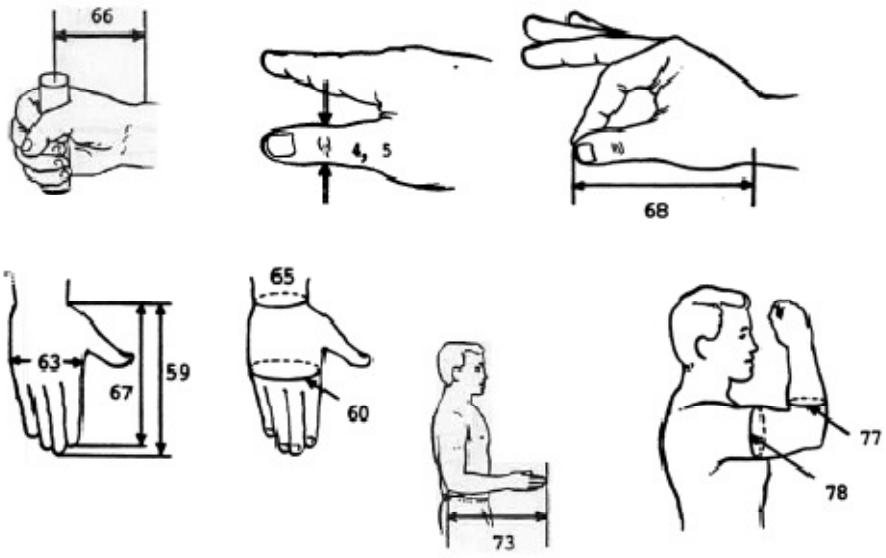

Figure 7. VISUAL INDEX (Continued)

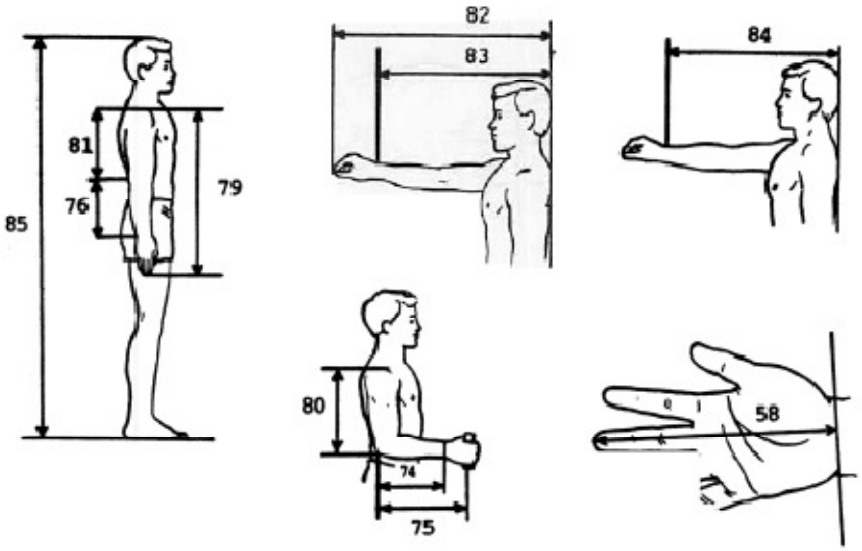

Figure 7. VISUAL INDEX (Continued)

Appendix I Paired t-test Sample Calculations

The following is a sample of the Excel Table for Method I Male Hand Length.

SUBJNO	HANDLGTH	Distance to Size: FA	Distance to Size: Kwon's System
16966	169	15	6
13570	169	15	6
23835	170	14	5
5300	171	13	4
23567	171	13	4
20197	171	13	4
14192	172	12	3
19484	172	12	3
19180	172	12	3
7199	172	12	3
20674	173	11	2
12003	173	11	2
23597	174	10	1
682	174	10	1
20070	174	10	1
6218	175	9	0
14182	175	9	0
3041	175	9	0
5014	175	9	0
19985	175	9	0
23260	175	9	0
15799	175	9	0
22691	176	8	1
12095	176	8	1
16271	176	8	1

The means were calculate for the distance for FA method and the method created by Kwon et al. (2009). The data was entered in Minitab (Version 14.2) and a one tailed paired t-test was computed. The following is the output from Minitab.

```
Paired T for FA - Kwon

               N       Mean     StDev   SE Mean
FA          1003    2.54935   2.72130   0.08593
Kwon        1003    3.19143   2.08244   0.06575
Difference  1003  -0.642074  3.212765  0.101445


95% upper bound for mean difference: -0.475058
T-Test of mean difference = 0 (vs < 0): T-Value = -6.33  P-Value = 0.000
```