

TAILORING THE UNIQUE FIGURE

Niina Hernández



GÖTEBORG UNIVERSITY
Department of Home Economics



TAILORING THE UNIQUE FIGURE

GÖTEBORG UNIVERSITY
Department of Home Economics



Tailoring the unique figure
Research report 30, 2000
© Niina Hernández

Illustration front page: Helene Berglin

Department of Home Economics
Göteborg University
Box 122 04, 402 42 Göteborg, Sweden
Phone: +46 (0)31-773 10 00
Fax: +46 (0)31-773 10 09

[Http://www.ped.gu.se/ihu](http://www.ped.gu.se/ihu)

ISSN 1403-7033

Preface and acknowledgements

I am glad to see that the technical equipment needed for mass customisation is available today. The industry can use it to gain more satisfied customers, which would benefit everybody. Tailors could use it in order to speed up the process of making a high quality suit and keep their close contact with the customers. The know-how to adapt a pattern for a unique figure is important to master even if we have technical equipment that facilitates and speeds up the process. Through this study I have learned about the variations of the body figures and a lot about how to make an individual pattern that gives a well-fitting and comfortable garment.

This study has been finalised in a short and intensive period. I have lived closely with these chapters and not had much time over for other things. First of all I want to thank my dear, wonderful, and supportive husband *Jaime Hernández* for all the excellent dinners he cooked and fortified me with. Always welcoming me home with a smile and a kiss – even if it was late!

There are many people that have helped me through this work. *Marianne Thorén* who encouraged me to enter the field of research while working in the EASYTEX project. When it comes to pattern construction I want to thank my mentor *Inger Öberg* who has been my discussion partner all through this process. My supervisor *Jan Paulsson*, who has spent many hours reading and coming up with great suggestions to improve the material. *Helena Shanahan* who has always been there to answer my questions. In the EASYTEX project we struggled and supported each other side by side, *Helene Berglin* and *Camilla Svensson*. Extra thanks to *Helene Berglin* who has given this report the great illustrations of the unique figures.

Last but not least, thanks to the EASYTEX project and to all the test persons who volunteered for the benefit of this research.

Göteborg May 2000

Niina Hernández

Table of contents

INTRODUCTION	7
IMPORTANCE OF DRESS.....	8
PROBLEMS WITH CLOTHING	10
WHAT CAUSES THE DISADVANTAGE?	13
<i>Standard sizing system</i>	13
<i>Market supply</i>	14
A CONCEPTUAL FRAMEWORK FOR CLOTHING STUDIES	16
IMPAIRMENT, DISABILITY, AND HANDICAP.....	16
CONCEPTS CONCERNING GARMENTS AND PATTERN CONSTRUCTION	17
PERSPECTIVES	19
EARLIER INITIATIVES.....	21
CLASSIFICATION OF BODY SHAPE	23
THE EASYTEX PROJECT	25
OBJECTIVES OF THIS STUDY	28
DELIMITATION OF THIS STUDY	28
METHODOLOGY AND PROCEDURES.....	30
METHODS	30
<i>Method discussion</i>	31
EMPIRICAL DATA.....	32
<i>Test persons</i>	33
<i>Evaluation of made-up garments</i>	34
IMPLEMENTATION	35
<i>Figure registration</i>	35
<i>Individual pattern</i>	36
<i>Test garment</i>	37
<i>Making-up</i>	37
<i>Evaluation of made-up garments</i>	37
<i>Summary</i>	38
MADE-TO-MEASURE GARMENTS.....	40
REGISTRATION OF THE BODY FIGURE	43
PREPARATIONS	43
<i>Landmarks</i>	44
MEASURING	45
MEASUREMENTS	46
FIGURE ANALYSIS.....	54
PATTERN ADAPTATIONS.....	55
KEY TO THE ADAPTATION PLAN.....	56
SINGLE ADAPTATIONS	57
<i>Short/tall stature</i>	58
<i>Warped figure</i>	62
<i>Prominent disfigurements</i>	67
<i>Wheelchair user</i>	75
<i>Other adaptations</i>	77

INDIVIDUAL PATTERNS	77
<i>Test person A</i>	78
<i>Test person B</i>	84
EVALUATION OF MADE-UP GARMENTS	90
REFLECTIONS	92
FINDING SUITABLE CLOTHES	92
PRODUCING SUITABLE GARMENTS.....	93
<i>Possibilities with newly developed solutions</i>	94
<i>The necessary know-how</i>	94
METHOD.....	95
FIGURE REGISTRATION	95
MADE-TO-MEASURE GARMENTS.....	97
<i>Measurements and adaptations</i>	98
<i>Test garment</i>	99
<i>Making-up</i>	100
EVALUATION OF MADE-UP GARMENTS	100
CONCLUSION	101
SAMMANFATTNING.....	102
REFERENCES	105
LIST OF ILLUSTRATIONS.....	110
LIST OF FIGURES.....	110
LIST OF TABLES.....	111
APPENDICES	112

Introduction

To find clothes in a retail store is a problem for quite a lot of individuals. The problem always exists because we wear clothes all the time. It is a very widespread problem, which can affect anyone, all depending on their figure, the supply of clothes in the stores, and the individual's demands. However, there are many individuals within the categories elderly, impaired, and/or disabled who have exceptional problems with finding suitable clothes.

There are individuals who have unique figures, which do not always fit into the standard sizes that are available in the stores. There is a gap between the stores' supply and the demands from the customers. The more the figure diverges from the standard figure the more difficult it is to find suitable clothes in retail stores. It is almost impossible for an individual with a hunched back to find suitable garments. The customer demands a more flexible market when it comes to clothes, a market that can provide them with suitable garments.

Before garments were produced in large quantities clothes were produced by tailors, seamstresses, and/or by a family member. The garments were automatically individualised according to the customer. Now there are very few tailors and seamstresses and they have difficulties to compete with the manufacturers low prices. The retail stores can attract more buyers due to greater quantities, lower prices, and more advertisement. Most people buy their clothes from retail stores.

It is impossible to estimate how many people are affected by not finding suitable garments. The individuals that have this problem are not registered anywhere. No statistic is available in the matter either. The affected are spread out over the whole community. One group asking for made-to-measure might have a *disfigurement* of some sort. Another group might have rather *high demands* on the garment, which makes it difficult to find suitable clothes according to their desire.

Today, it is possible to offer customers a garment to order according to their desires and body figure. The new, more automatic, equipment and software make the process faster and possible to realise. However it is important to have the basic knowledge about how to adapt the patterns according to the many variations of figures that exists. Pattern construction for unique figures is covered in this study. The report begins with a background to the problem concerning finding suitable garments, followed by earlier initiatives. The main body of the study contains three main sections: *body figure registration* – including measurements, *single pattern adaptations*, and *individual patterns*.

Importance of dress

The environment¹ has certain expectations on how to dress² in certain situations. The way of dressing depends on the environment and the willingness of the individual to adapt³ to the environment's expectations. Clothing⁴ has both a functional value⁵ and a symbolic value⁶ to the human being (Rosenblad-Wallin 1983). There are innumerable ways of dressing, there are certain dress codes depending on in which country, society, social status, circumstance and group we find ourselves. With the way we dress we communicate things about us as individuals e.g. our personality, what we stand for, to what group we belong etc. (Feather & Jenkins, 1993; Ryan, 1966).

There is an oversupply of clothes on the market in the industrialised countries. People have more clothes than they actually need for the protection of the physical body. "Everyone enjoys wearing clothes that are comfortable, pleasant to the eye, and that make them feel self-confident." (The Disabled Living Foundation, 1994, p.1). The style⁷ and colour advisers, whose numbers have increased over recent decades, also give witness in how important it is to dress the so-called correct way. It is important for our wellbeing that we feel attractive, "Beauty provides feelings of serenity, well-being and happiness, and lessens feelings of tension, anger, hostility, and depression." (Hoffman 1979, p.36). Attractive and comfortable clothing leads to the feeling to be a part of a group, e.g. social integration (Hallenbeck 1966; Kratz 1996).

Jacobson (1994) describes how important dress is for the personal development and which signals the dress sends. The dress plays an essential role when establishing the individual's position in various groups, e.g. work-mates, friends etc. It also builds self-confidence, recognition and influence, which are all included in developing a social position. Our dress declares our position and what we stand for (Jacobson, 1994). Dress has become of such importance for the personal development and social establishment because it is used everyday, most of the time in a public display and it is easy to manipulate (Feinberg, Mataro, & Burroughs, 1992).

Dress plays an essential role in *how* the first impression of an individual will be (Ryan 1966; Molloy 1988; Thorén 1992). "Appearance is an index to what people think of themselves and what they strive for." (Feather, 1993, p.1). A person's dress usually gives the viewer clues about the person on meeting. The sex, age, occupation, attitudes and personality are some of the information we might get by observing the dress (Ryan 1966). Dress communicates the

¹ "surroundings and circumstances affecting a person's life" (Elliott, 1997, p.249)

² Dress "Clothing, esp. whole outfit" (Elliott, 1997) The dress includes the whole out-fit, both modifications of the body and supplements to the body are included in the definition *dress*. (Roach-Higgins & Eicher, 1992)

³ To modify and change something, e.g. the pattern. Synonyms are adjust and alter.

⁴ Clothes "Things worn to cover body and limbs"(Elliott, 1997). Clothing, which is a combination of various garments, is a general word for articles of dress.

⁵ protection and comfort (Rosenblad-Wallin, 1983)

⁶ self-esteem, appearance, and decency (Rosenblad-Wallin, 1983)

⁷ A style is created when style lines and details such as collar, button stand, pockets etc. are added to the block pattern. Also *design*.

identity better than the verbal conversation, due to the fact that the dress often guides the succeeding verbal communication (Roach-Higgins & Eicher, 1992; Ryan, 1966).

There are many authors that underline the importance of dress used as a strong communication tool at the first meeting. Feinberg (1992) gives a counterweight to this discussion. He means that not all garments⁸ give the same clear signals of the wearer's identity. Consequently the dress can reflect other things than identity or simply reflect nothing. The communication signals sent by a unique dress might not be understood as the message is intended. How the observed individual is perceived depends highly on the viewer (Ryan 1966). It is difficult for the viewer to "read" the signals of the dress if it is generally acceptable among many cultures, groups and social levels e.g. jeans wear. Feinberg (1992) also underlines that even though their dress reflects the wearer's self-identity it is impossible for the dress to reflect all aspects of the individual and therefore it is not totally reliable.

For the physically disabled⁹/impaired¹⁰ individual the attractiveness of clothing is very important. The observer should not be immediately aware that a person is disabled/impaired, person but should see a well-dressed person and maybe after that the disadvantage or disfigurement¹¹ (Hoffman 1979). "The disabled person does not want to appear different from others in his social group, irrespective of his age, sex or financial circumstances." (Gamwell 1966, p.18). The importance of clothing is a highly individual experience for the impaired, disabled or disfigured person. However, active individuals, i.e. the ones who meet a lot of people seem to think that clothing is of great importance (Thorén 1992). It is therefore most important that an individual is free to chose clothes according to his/her own style and through that establish various personal priorities (The Disabled Living Foundation, 1994).

⁸ "Article of dress" (Elliott, 1997) The combination of garments creates the clothing.

⁹ "... a disability is any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being" (WHO, 1980, p.28).

¹⁰ "... an impairment is any loss or abnormality of psychological, physiological, or anatomical structure or function" (WHO, 1980, p.27).

¹¹ A disfigurement is a spoiled or deformed appearance. In dictionaries this word is explained from a negative angle. In this study the word "disfigurement" simply means a kind of larger figure deformity which does not fit within the parameters of a standard body figure.

Problems with clothing

Thus it is important to be able to select the clothing we wish to wear. However, this is not a possibility for everybody¹². The reasons can vary and have different impact. Groups, that have the greatest problems with finding well-fitting¹³ garments, are the elderly¹⁴, and disabled and/or impaired adults and children (Kärrholm, 1976). Nevertheless, a person might not fit into one or more of these categories but still have difficulty in finding clothes, depending on their figure¹⁵. Bergenheim (1986) states that a person is handicapped¹⁶/*disadvantaged* in the matter of clothing if he/she does not fit into the standard sized garments.

There are individuals who can not find suitable garments in today's stores. There is a problem and dissatisfaction among consumers concerning the inconsistency in sizing of the off-the-peg garments (Caldwell & Workman, 1991). Customers have for a long time wanted more individualised fit of the garments they are about to buy (Hey, 1998).

Cednäs (1973) made a survey¹⁷ of women's satisfaction with off-the-peg garments available in the stores. She found that it is difficult to find suitable clothes for the short (<162cm) and tall (>170cm) and for those with a bust circumference over 100cm¹⁸. The problem with finding suitable clothes also increases with age (Cednäs, 1973).

A survey among elderly persons showed that this group has problems with the standard sizes because their shoulders and bodice are too narrow in relation to the waist and hips. They might also have a disability and/or impairment, which effects the garment's fit (Kernaleguen 1978). The biggest problem is to find garments in the larger sizes, 46-48, within the 20-series¹⁹. Women seem to have greater difficulties than men in finding clothes (Rosenblad-Wallin, 1977). One of the reasons might be that made-to-measure²⁰ garments are not as common in ladies wear as in men's wear (Thorén, 1992). Another reason might be that in

¹² The problem of finding suitable clothes seems to exist in some countries. The studied literature in this chapter is mainly from Sweden and Great Britain, but there is also literature from USA, Canada, and Finland.

¹³ Garment fit: The way the garment forms to the body in the matter of tolerance and harmony with the covered body parts.

¹⁴ Person who is 65 years old or older (Cednäs & Kjellnäs, 1977; Kernaleguen, 1978).

¹⁵ The external form/outline of the human body, includes the posture. Also *body figure*.

¹⁶ "... a handicap is a disadvantage for a given individual, resulting from an impairment or a disability, that limits or prevents the fulfilment of a role that is normal (depending on age, sex, and social and cultural factors) for that individual" (WHO, 1980, p.29).

¹⁷ The survey was done together with a measurement survey. The participants were 664 women living in different parts of Sweden and between 16-65 years of age.

¹⁸ No large survey of this kind has been carried out in Sweden since this time. Even if this is for a long time ago some of the problems seem to remain. However, nowadays some companies have their own collections supplying the plus sized women with clothes, ranging from C40 up to C54. It varies quite a bit from company to company. Hennes & Mauritz has sizes from C32-C46, their collection for the plus sized starts on XS (38/40). Kappahl has sizes C34-C46, they carry some trousers in the 20-series. Their plus sized collection includes the sizes C42-C52. Lindex has the largest range of sizes between these three companies. The sizes available range from C34-C48, they carry trousers and skirts in the 20-series, D18-D24. They also have variety of inside seam length of the trousers. Their collection for plus sized includes C46-C54.

¹⁹ 20-series is made for woman with full length as 160 cm +4 cm.

²⁰ A garment made according to the individual measurements, produced by the clothing industry.

men's wear the stores offer a wider range of sizes, both in length and width, than in women's wear.

Thorén (1992) has mapped out the problem disabled, impaired, and/or disfigured people have to find suitable clothes. She has used Rosenblad-Wallin's method for *problem analysis*²¹ in order to identify the problem for this group of people. Thorén has shown, in her survey²², that 73 percent (N=66) think that they were not able to choose the clothes according to their desire. Eighty percent of the individuals interviewed think that garment fit is poor because they have body proportions which differ from the standard figure²³. The possibility to find clothes depends first of all on the physical *disfigurement* and secondly on the disability and/or impairment (Thorén 1992).

The elderly, and disabled and/or impaired people are not the only groups that have difficulties in finding well-fitting garments. There are individuals, with more or less a standard figure, who have difficulty in finding suitable garments. They probably have different body proportions that do not match to the standard sizes in the stores. The fit is the most important factor when choosing a garment (Hogge, Baer, & Kang-Park, 1988). Trousers cause many problems in the area of fit and comfort (Gamwell, 1966; Kärrholm, Dahlman, & Wallin, 1977). In Cednäs' (1973) survey more than half of the individuals in all ages had difficulties in finding suitable trousers. In another study women used a five-point scale to identify how satisfied they were with garment fit²⁴. For trousers the result showed that the hips, buttocks, thighs, crotch, and leg length were the parts of the body that received the lowest satisfaction (LaBat & DeLong, 1990).

There are other factors than poor fit that cause problems when selecting a garment. There might be a problem with agility and with incontinence. If the agility is low the garment has to be designed accordingly, with the right opening and technical solutions²⁵ needed for the specific individual. The goal is to make it possible for individuals with disability/impairments to dress themselves by using various technical solution and aids (Kärrholm, Dahlman, & Wallin, 1977). For some individuals it is of great importance that the garment has the right design, material, fastenings, and technical solutions (The Disabled Living Foundation, 1994). Clothing can also be designed in a way that it facilitates the dressing intellectually by making a clear difference between front/back, left/right, and up/down (Kärrholm, 1976). Some individuals have the problem when they shop for clothes, since they are not able to get into the store or the fitting room. They might not be able to try the garment on before they buy it due to lack of space in the fitting room or lack of assistance (Thorén 1992).

Even though there are some obstacles to find a garment to fit we all wear clothes everyday. We ignore certain aspects of the garment in order to be able to buy it. We might accept the

²¹ Rosenblad-Wallin divides the analyses into two main sections each with subcategories. *Problem's characteristics*: (1)Why is it a problem?, (2)What causes the problem?, (3)How did the problem arise?, (4)What can effect the problem?, (5)Under which conditions does the problem exist?. *The user and the user situation*: (1)Who are effected by the problem?, (2)Who are the effected?, (3)How many are effected?, (4)Where are the effected?, (5)Do these have any specific qualities? (Rosenblad-Wallin, 1983, p.25-26) the author's translation.

²² The criteria for the interviewees was to have a great variety with respect to the type of disability and/or impairment, age, sex and living locality, N=66 (Thorén, 1992).

²³ The standard figure is illustrated by the IP-dummy, size C38, which should be considered as a standard figure.

²⁴ The areas which were scaled were: "neck, shoulders, armscye, upper arm, lower arm, bust, shoulder blades, midriff, waist, abdomen, hip, bottocks, crotch, thigh, calf, lengths of waist to knee and ankle, and back and arm lengths" (LaBat & DeLong, 1990, p.45).

²⁵ Details added to a garment, usually in order to enable/facilitate dressing e.g. Velcro instead of buttons or zippers, zippers along the sides of the trousers etc.

design and colour because the garment fit is just what we want or the opposite. Individuals with disabilities, impairments and/or disfigurements might ignore quite extensive inappropriate aspects of the garment in order to get any clothes at all. Rosenblad-Wallin (1983) says that we satisfy our purchase instead of maximise it. For the impaired, disabled, and/or disfigured the off-the-peg garment usually has to be altered²⁶ in order to fit the figure and to facilitate/enable dressing (Ernström, 1981; Gamwell, 1966). The altered garment is more comfortable than the of-the-peg garment and contributes to the ease of movement and the individual's social activity (Kratz, 1996; Lodge, 1989). Until today there have been three main ways for the individual with special needs to get suitable clothes; Off-the-peg garments that have been altered, specially designed garments for a specific target group²⁷, and individual garments made at a tailor's shop, dressmaker or by a family member (Hoffman 1979).

Among the individuals in need of special garments there are very few that are interested in sewing or altering their own clothes. They want to be able to buy the ready-made clothes as everybody else (Gamwell, 1966; Thorén, 1994). The clothing should not differ too much from the off-the-peg garments available in the stores (Bergenheim, 1986). The accessibility, selection of garments, fabrics, designs, and prices are important factors for individuals with special needs (Thorén 1994). These individuals desire attractive clothes that do not stigmatise their image (Lamb & Kallal, 1992). The garments should call attention to the attractive parts, camouflage the bad ones and above all give a psychological lift to the wearer (Kernaleguen 1978).

There is a lot of published material presenting technical solutions for garments in order to facilitate/enable dressing (Kernaleguen 1978; Benktzon 1980; The Disabled Living Foundation, 1994). Individuals with functional impairments need individually designed garments (Kratz 1996). Nevertheless, we can not forget the individuals who need individually made garments because of a fitting problem and are **not** in need of technical solutions (Kärrholm 1976). Only 7 percent (N=66) state that the openings are unsuitable to enable them to get dressed. Small companies that manufacture clothing for individuals with special needs or disfigurements, have made the wrong priorities. They often put the function of the garment foremost and address the design and material secondly . It is very important for the disabled/impaired individual to decide the style themselves, the function of the garment is secondary. (Thorén 1992)

There are many aspects that should be taken into consideration when buying clothes especially if we want to maximise our purchase instead of just satisfy it. According to Hoffman (1979) there are six major factors that a customer wants to be satisfied with in the garment; fashion, design, colour, comfort, fit, and cost. Clothing can be a complex matter. The actual garment can be summed up in three areas; the pattern construction, the anatomical structure, and the fabric (Caldwell & Workman, 1991). Gamwell (1966) expressed the categories in a slightly different way. She mentions fabric, design, comfort, and fit as four main components of a garment. Thorén (1992) adds the importance of delivery and service quality.

²⁶ To modify and change something, in this case the ready-made garment. Synonyms are adapt and adjust.

²⁷ Ready-made garments for a specific target group are garments that are produced, in smaller quantities, in order to supply a specific group's need (Bergenheim, 1986).

What causes the disadvantage?

The problem with finding clothes depends for example on the individual's figure, the need for technical solutions, the market's supply of clothes, and the material/immaterial resources the individual has access to.

The environment is an important variable when determining how extensive a disadvantage is going to be. There are three main environmental factors, with reference to clothing; the existing sizing system, the supply in the stores, and people's expectations regarding the importance of dress. The importance of dress and people's expectations have been discussed in previous chapters. The focus of this chapter is on the other two factors; the sizing system and the supply in the stores.

Standard sizing system

Before standard sized garments were available on the market all garments were produced for a specific individual. The tailor was very important. His work was the foundation of a garment's good fit. During the 17th century the tailor measured his customer with a paper strip²⁸. He cut notches in the strip in order to mark the individual's dimensions. He marked out the garment's pieces with a chalk directly on the material. He used the tailors' greatest trade secret, the paper pattern, which was tried out in order to give the right model and fit – these were sometimes referred to as “gods”(Kindwell, 1979). When ordering a suit from a tailor one could not get it right away. The customer had to be measured, the garment had to be cut, and then sewn. Not all customers, such as sailors for example, could wait for the suit to be produced. Garments in standard sizes could therefore be found at busy ports during the 17th century. Tailors had a stock of standard sized garments for their maritime customers (Hulme, 1946).

The drafting-systems for patterns, developed during the 19th century, were time-saving for tailors and dressmakers. When using such a system it was not required to have as much knowledge within the field of cutting as was needed before. A drafting-system reduced the cutting errors and was the foundation for the sizing system which followed. Three main drafting-systems developed; one based all body measurements being proportional to one single body measurement. Another system used direct body measurements and the third was a hybrid drafting system²⁹. While these systems developed and were used, tailors found that the human body was not shaped according to any set formula. Few individuals have a similar figure, each individual is unique. Even though the systems didn't work for all figures, a system was better than no system at all (Kindwell 1979).

Throughout the world there are many sizing systems suitable for each country's population. The latest sizing system for women in Sweden is the one compiled during the 1970's. This system was meant to facilitate sizing for the industry, the retail store, the consumer, and for the trade education. Better fit, fewer sizes, and ease in finding the right size were among the things that would be improved by a new sizing system (Cednäs & Kjellnäs, 1977). The

²⁸ The yardstick was not used until the end of the 18th century (Kindwell, 1979).

²⁹ The hybrid drafting system was a combination of the proportional system and the one using direct measurements. This is the system that has most in common with our drafting system today. We use direct measurements with ease, for example the bust measurement. In addition to this we calculate certain measurements, for example $1/10^{\text{th}} - 1/8^{\text{th}}$ of the bust girth is usually the armscye width.

system includes four length classes³⁰, three variations of relation between bust and waist/hip³¹, and two age groups, 16-65 years old and 65 years and over (65+). For the elderly (65+) there are only two length classes³² and only the medium relation between bust and waist/hip are included. This is the official standard system for women's clothing available in Sweden at the moment. The standard figure is illustrated by the IP-dummy³³, size 38C, which should be considered as a *standard figure*.

For the moment, a standard sizing system is being developed within the European committee for standardisation. Four topics are addressed within this research; (1) Where and how the measurements are going to be taken on the body. (2) What name the sizes should have. (3) Which measurements are important for certain garment types. (4) Which intervals are suitable between the sizes (Lundgren, 1999). So far, only the first topic has been presented in a draft by the European committee for standardization (1998).

There are measurement charts for different disfigurements. Individuals with Down's syndrome have similarities of the body figure, and research has been carried out in order to standardise this figure and create a measurement chart for this target group (Tam & Harwood, 1993). Similar research has been done with the target group, of short stature (Kohvakka, 1996). The elderly might be in need of specially designed garments to suit the physiological changes and the consequences of various diseases common within this category. The changes and consequences are mapped out and considered in the design of the elderly woman's dress in the Rosenblad-Wallin's study (1977).

Body measurements and the proportions of the figure are continuously changing (Cednäs & Kjellnäs, 1977). The standard sizing system in use today is from the 70's. Based on previous references the proportions of today's Swedish women have probably changed slightly. Even if the standard sizing system from the 70's were updated there would still be people who do not fit into the system (Thorén, 1994). These people have unique figures, they probably do not fit into any standard system.

Market supply

The reason why women who are short, tall and/or have a large circumference have difficulty in finding suitable off-the-peg garments is that stores supplies are limited when it comes to sizes (Cednäs, 1973). If stores had all the sizes that exist in the standard sizing system, more individuals would be able to find suitable clothing. The clothing companies do not manufacture all the sizes, because it is too expensive and consequently the stores do not carry them.

The stores do not have a large assortment of sizes for women clothing (Rosenblad-Wallin, 1977). This has also been established in later reports concerning available clothing for a special target group such as plus-sized or short women. Some stores have special collections for plus-sized women and some carry a few garment types in the 20-series (Blom, 1998; Nyman, 1999).

³⁰ For women with full length as 160 cm (20-series), 164 cm, 168 cm (40-series), and 172 cm.

³¹ B for thin waist and hip, C for medium waist and hip, and D for fuller waist and hip.

³² 160 cm and 168 cm

³³ This tailor's dummy is produced and sold by IP datamönster in Borås, Sweden, +46 (0)33-444480.

Cednäs (1977) made various classifications according to age, full length, bust circumference, and relation between bust and hip girth. By using six of Cednäs' classification combinations 83 percent of the population would be represented. The sizes available in the stores come from the classification C32-C52, which represents only 22 percent of the population, Figure 1.

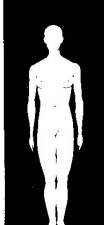





KROPPSLÄNGD 160 ± 4 cm	SMAL STUSS	MEDELSTUSS	STOR STUSS	43%
				
	B16-27 13%	C16-27 23%	D16-27 7%	
KROPPSLÄNGD 168 ± 4 cm				40%
	B32-54 11%	C32-54 22%	D32-54 7%	
	Summa	24%	45%	

Figure 1: The share of the market for the different sizes (Cednäs, 1977, p.14)

However, most women find clothes. The manufacturers solve the problem by changing the measurement chart so that it suits their target group, which might be, for example, middle-aged women. This means that more than 22 percent of the population might find clothing that fit even if their bodies do not fit into the standard chart. The manufacturers do not always follow the standard measurement charts, which leads to that the standard sizes can vary from company to company, this makes it more difficult to find the suitable size when shopping (Rosenblad-Wallin, 1977).

Manufacturers tend to offer a small range of sizes. One reason for this is that it is usually more expensive to produce few garments per size compared to many garments per size. A further limitation in size range is the system with small, medium and large. This tends to favour the manufacturer more than it favours the customer. The one-size-label, which is supposed to fit everyone limits the supply even more (Lundgren, 1999).

A conceptual framework for clothing studies

It is sometimes said that we all can be more or less handicapped when it comes to clothing and its fit. It might surprise some to be classified as handicapped. Therefore I want to discuss some basic concepts concerning what causes a handicap but also concepts in relation to pattern construction for the unique figure³⁴. A model gives an overview of clothing studies within the areas of *design* and *making up*.

Impairment, disability, and handicap

What kind of and degree of handicap an individual has depends on the impairment and/or disability and on the environment. The impairment and/or disability can be the consequences of a disease or a disorder. Which disease or disorder that are the cause does not matter when classifying the impairment and disability.

WHO, World Health Organisation, is now revising the manual from 1980. I will refer mostly to this official manual, but will bring up some interesting definition changes from the revised manual (WHO, 1999).

“... an impairment is any loss or abnormality of psychological, physiological, or anatomical structure or function” (WHO, 1980, p.27). The impairments that will be of interest when studying the garment fit are the ones that cause disfigurement of the outward body – the anatomical structure such as, dwarfism, spinal curvature, and gigantism³⁵ (WHO, 1980).

“... a disability is any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being” (WHO, 1980, p.28)³⁶. It does not matter which impairment causes the disability, only the activity is considered when classifying the disability. A disability that effects clothing is the decreased *ability in dressing/undressing*. If clothes were altered or adapted for a specific disability the degree of the handicap would decrease, as well as if the proper aids were used to facilitate/enable dressing. The other disability effecting clothes is the inability *to walk*; the need for a wheelchair for mobility. The sitting position causes problems with clothing, both in garment fit and in the sitting comfort of the garment.

The environment includes the material society, the man-made artefacts, as well as the social and cultural context, e.g. the family members and friends. The environment plays an essential part in how extensive the handicap is going to be for a specific individual with an impairment and/or disability. WHO (1980) defines handicap as follows “... a handicap is a disadvantage for a given individual, resulting from an impairment or a disability, that limits or prevents the

³⁴ When the measurements or figure falls outside the defined standard measurements or defined standard figure it is considered a unique figure.

³⁵ *Dwarfism* includes short stature. *Spinal curvature* includes scoliosis, lordosis, kyphosis. *Giantism* is extremely tall stature (WHO, 1980).

³⁶ The concept *disability* is not used in the same way in the revised manual from WHO. The new concept is *activity limitation* and is defined as follows “**Activity limitations** are difficulties an individual may have in the performance of activities” (WHO, 1999, p.14)

fulfilment of a role that is normal (depending on age, sex, and social and cultural factors) for that individual” (p.29). In the revised manual of classification they call this category for *participation*³⁷ *restrictions*. It is defined as follows; “Participation Restrictions are problems an individual may have in the manner or extent of involvement in life situations.” (WHO, 1999, p.14). One individual can be handicapped/disadvantaged in one group but not in another (WHO, 1980). It is the individual’s experience that decides how extensive the handicap is going to be (Hallberg, 1992).

When a person can not dress properly or as normally expected, it can be to his/her disadvantage. They can not mix in with the group in the matter of clothing – They experiencing a disadvantage with regard to clothing. It is a psychological need to feel attractive and not set apart from the group by the clothes one wears. (Hallenbeck 1966). The policy goals are that all individuals are going to be a part of the society. The society should not be handicap friendlier but *human* friendlier. Everybody’s needs should be met. When changing something in order for the individual with impairments or disabilities to be able to take part in society, it benefits more people than just the individual experiencing a handicap (Kohlström, 1996). The degree of the handicap, in relation to the disability or impairment, also depends on the values the society stands for. In the Western world the values are “...health, youth, beauty, and effectiveness...” (p. 41). The outward appearance has a high value, which makes individuals with visible impairments and disabilities severely handicapped (Kohlström, 1996). The individual can feel embarrassment and shyness because of defects of the self-image caused by disfigurement, impairment and/or disability. This can cause the individual to avoid participation in social activities (WHO, 1980). Clothes are an essential part of the outward appearance. If the individuals, who are disadvantaged in the matter of clothing could get clothes that fit them, both in style and fit, it would improve their participation in life situations. If an impaired or disabled individual does not have any problems finding well-fitting clothes there is no disadvantage.

Concepts concerning garments and pattern construction

Adapt, Adjust, Alter

To modify and change something, e.g. the pattern. These words are sometimes used as synonyms to each other.

Block pattern /Block

The block pattern is a foundational pattern constructed to fit the average individual or a unique figure. “The designer uses the foundation pattern (block) as a basis for making the pattern for a design.” (Aldrich, 1982, p.8).

Body figure/ Figure

The external form/outline of the human body, including the posture.

Clothes

Clothes “Things worn to cover body and limbs” (Elliott, 1997). Clothing, which is a combination of various garments, is a more general word for articles of dress.

Deformed

The shape is not conformed to the standard form.

³⁷ “**Participation** is an individual’s involvement in life situations in relation to Health Conditions, Body Functions and Structure, Activities, and Contextual factors.” (WHO, 1999, p.14)

Design, Style

A design is created when style lines and details such as collar, button stand, pockets etc. are added to the block pattern.

Disfigurement

A disfigurement is a spoiled or deformed appearance. In the dictionaries this word is explained from a negative angle. In this study the word “disfigurement” simply means a kind of deformity which does not fit within the parameters of a standard body figure.

Dress

“clothing, esp. whole outfit” (Elliott, 1997). The dress includes the whole out-fit, both modifications of the body³⁸ and supplements to the body are included in the definition dress. (Roach-Higgins & Eicher, 1992)

Fit

See garment fit

Garment

“Article of dress” (Elliott, 1997). Is a single piece, a combination of garments creates the clothing.

Garment fit

The way the garment forms to the body in the matter of tolerance and harmony with the covered body parts.

Tolerance

The tolerance is the difference between the body measurement and the garment’s measurement. For example, bust girth: 88cm the garment bust width is 102cm, the tolerance is in this case 14cm over the bust.

Individual pattern

A pattern that is made to fit only one individual.

Landmark

Points on the body that are essential for the measurements.

Made-to-measure garments

A garment made according to the individual measurements; produced by the clothing industry.

Mass customisation

A new concept within the clothing industry. The manufacturer offers the customer to design their own garment by selecting from a predestined range of details and fabrics.

Posture

The way a person carries themselves, the back and shoulders are in focus.

Standard figure

The standard female figure is illustrated by the IP-dummy, size C38, which should be considered as a standard figure. This tailor’s dummy is produced and sold by IP datamönster in Borås, Sweden, +46 (0)33-444480.

Standard measurement

The standard measurements are the ones included in the official standard measurement chart, in this study the Swedish one (Johansson, 1987).

Style

See design.

Unique figure

We all are unique creations with individual body figures. When the measurements or figure fall outside the defined standard measurements or defined standard figure it is considered a unique figure.

³⁸ Includes for example colored skin, pierced ears, coiffed hair etc. (Roach-Higgins & Eicher, 1992).

Perspectives

Linked to a model, the importance of dress has been studied in various ways. Anttila (1995) gives an overview in her model for studies within the areas of *designing* and *making up*, Figure 2. The individual sits at the top with both the personal and social environments. Forming the pyramid are the four pillars springing from the different environmental aspects; ecological³⁹, cultural⁴⁰, economic⁴¹, and technological environments. The technological environment symbolises the production of clothing, including the patterns, fabrics, machines etc.

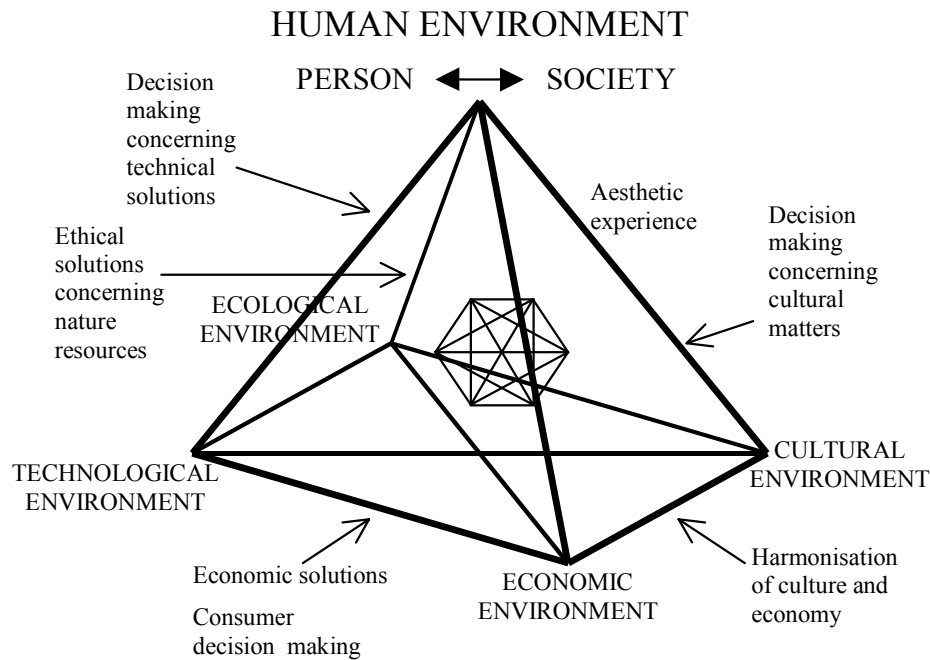


Figure 2: Studies within the areas of *designing* and *making up* (Anttila, 1995, p.50)

Clothing has previously been studied from many different perspectives, here follows some examples. Dress is important for the communication between individuals and groups. The individual can send signals about their personality, social status, sex, career, opinion etc. (Feather & Jenkins, 1993; Jacobson, 1994; Molloy, 1988; Roach-Higgins & Eicher, 1992). The way we use our body language is closely associated with what signals we send to the individuals we meet (Broby-Johansen, 1953). The garment's function and meaning throughout various historical epochs has also been studied (Centergran, 1996). Clothing from a social-psychological perspective (Ryan, 1966). The social meaning of clothes (Kaiser, 1997; Nagasawa, Hutton, & Kaiser, 1991) and how important clothes are for self-perception (Liskey-Fitzwater, Moore, & Gurel, 1993). The design and making up process for exclusive haute couture garments have been studied (Koskennurmi-Sivonen, 1998). Technical studies carried out are; functions of clothing such as protection, mobility, fastenings, possible body

³⁹ "The results can be evaluated in terms of economy of natural resources, recycling or reproduction." (Anttila, 1995, p.51)

⁴⁰ "... includes aesthetic, historical, ethnological, fashion and tradition related criteria." (Anttila, 1995, p.51)

⁴¹ "... production and products are evaluated in terms of economic inputs and outputs, economic profits, marketing, and consumption." (Anttila, 1995, p.50)

function etc. (Watkins, 1984) and product development for specific target groups (Rosenblad-Wallin, 1977; 1983). Groups of individuals need special garments and technical solutions in order to be able to get dressed, use and care for the clothes (Benktzon, 1980; Kärholm, Dahlman, & Wallin, 1977; Lodge, 1989; The Disabled Living Foundation, 1994).

Earlier initiatives

To find clothing in the regular retail market has been a great problem for a long time for individuals with special needs and/or disfigurements. Some regular retail stores⁴² do offer, for a fee, to alter ready-made garments e.g. shortening of the sleeves and trousers and increasing/decreasing of the waist. Today, there are a few companies selling clothing to a specific target group such as wheel chair users e.g. Sitting Feathers⁴³, and Combino⁴⁴. These companies supply a part of the market with products. The garments are not individualised and therefore not all wheelchair users are able to find well-fitting garments at these companies. Because of the relatively small market for these companies they can not have as many variations of designs as are available in the regular retail store.

The elderly are a large and growing group of people who are in great need of specially designed garments. They would not be in need of individualised garments if the stores carried clothing designed according to the size chart for elderly women. Suitable garments for the elderly were designed within Rosenblad-Wallin's (1977) product development project. Both the garment fit and the technical solutions to facilitate/enable dressing were identified (Rosenblad-Wallin, 1977). In yet another study, women with osteoporosis were the target group. Garments were developed to fit the needs of this target groups with regard to fit and comfort (Benktzon, 1993). A different project was carried out in Finland aiming to design and make garments for individuals of short stature. A spring/summer collection was developed for this target group (Kohvakka, 1996). As said before, a sizing chart has also been developed for women with Down's syndrome (Tam & Harwood, 1993).

The new special sizing charts cover a great number of individuals with a specific figure e.g. short stature and Down's syndrome. However, there will always be individuals who do not fit into any standard system. They have such unique figures that it is impossible to gather them as a group and create a size chart. They are in need of an individual garment. Frost (1987) has developed a system for measuring the disfigured body and then creating a suitable basic pattern. The measurements are taken both on right and left side of the body, in order to register the difference between the two body halves. A mean value is calculated and then used when constructing the symmetrical block pattern. With the symmetrical pattern as a base the differences between right and left side are made by increasing/decreasing the pattern at appropriate places, see Appendix A. The individual block pattern is the starting point when creating the desired design (Frost, 1987). Klädverkstån [Clothing workshop]⁴⁵ was a project that taught how to make garments for individuals with disfigurements. Interested seamstresses, family members and the disfigured individuals could participate in the workshop. Frost's method was conceived and practised for individual garment construction (Lejring, 1996).

Patterns for various disfigurements and disabilities have been developed, and many sewing courses have been held for the concerned individuals and their families. In spite of all efforts,

⁴² Birgitta, JC, Ströms, all in Gothenburg Sweden

⁴³ Sitting Feather, Åsele, Sweden, <http://www.algonet.se/~sitting/> (May 2000)

⁴⁴ Combino, Gothenburg, Sweden, <http://www.internetbutikerna.com/combino/> (May 2000)

⁴⁵ Implemented during the years 1992-1995.

it seems that the affected individuals do not feel as though they have been helped in the matter of getting suitable clothes (Thorén, 1992). Many projects have finished without consequent activities to carry on with the results produced by the project (Bergenheim, 1986). One reason is the high costs inherent in the development of clothing for special target groups (Stenström, 1997).

Bergenheim (1986) finds that documentation is missing on the designs, materials, patterns, colours and structures that should be used in order to camouflage a disfigurement. However, Lodge (1989) maps out which clothes are suitable for specific impairments, disabilities, and handicaps. Information to the manufacturers and the retailers is essential. Further training is needed in the areas of pattern construction and ergonomics with regard to clothing (Benktzon, 1980).

Thorén (1992; 1994) identified and attempted to solve the clothing problem for the target group impaired, disabled, and/or disfigured individuals. She used the *product development* method created by Rosenblad-Wallin (1983). This method works in steps, from the identification of the problem all the way through to the evaluation of the final product, see footnote 21, page 11. The process is used in order to increase the user value of the product. Within Rosenblad-Wallin's study, the end users were always a group of individuals. The clothes were developed for the groups; elderly, different categories of workers, military etc. (Rosenblad-Wallin, 1983). Thorén's (1992) identification and analyses of the problem has been covered in previous chapters. Thorén presents three steps, which could solve the problem of finding suitable clothes for impaired and disabled individuals. (1) The methods for getting the measurements from analysis of photos need to be further tested. (2) Rationalisation of made-to-measure and/or altering of ready-made garments needs to be done. (3) Finally, an improvement of software for pattern construction and education of specialists within this field is needed (Thorén, 1992). The possibility of sending information between the different production sites increases when the pattern construction is computerised. However, this was not tested within the project. The made-to-measure for individuals with large disfigurements was carried out with experts within the clothing industry. Frost's method for creating individual patterns was used, but it was computerised⁴⁶. When the individual pattern was evaluated the fitted jackets were sewn at Oscar Jacobson⁴⁷. Even though the pattern construction was computerised it was still time-consuming and not without problems. It takes longer time to cut one single garment compared to regular production. The production of the fitted jackets was time-consuming (Thorén, 1994).

It is difficult to make an accurate two-dimensional garment pattern to fit comfortably and stylishly on the complex three-dimensional human body (Roebuck, 1995). The hardship is greatly increased when a disfigurement is included. The pattern construction is the difficult part of the made-to-measure concept (Thorén, 1994). Draping is another method of creating a individual pattern. In draping the garment is formed directly on the person by smoothing the fabric over the body. The individual figure is taken into account and the design of the garment is created directly on the individual body (Heisey, Brown, & Johnson, 1988).

Made-to-measure is becoming more and more common in the industry thanks to better computer software available for this purpose. The concept of mass customisation has been developed and improved over the recent years. Today, made-to-measure is most common

⁴⁶ The pattern construction was carried out at Lectra System AB in Borås, Sweden.

⁴⁷ Oscar Jacobson is a manufacturer of men's suits, in Borås, Sweden.

within men's wear, e.g. suits and shirts. However, the manufacturers offering made-to-measure in Sweden today mainly produce uniforms and working clothes. Their customers are companies, for example bus and airline companies, and not the single consumer. The share of made-to-measure garments these companies produce is about ten percent of the standard production. The percentage depends on the type of garment and the company's demands on the garment fit⁴⁸. Of the made-to-measure garments produced 20 percent are returned because they do not fit the individual (Eriksson, 1999). The procedure, how the made-to-measure garment is ordered and produced, varies between the different companies. It is becoming more and more common to offer the customer the service of more or less made-to-measure. Some companies only adjust off-the-peg garments while others use the whole concept of made-to-measure garments, the garment is not produced until it has a buyer.

Classification of body shape

Surveys on the outward human body have taken place earlier. Sheldon (1940) made a large survey involving 4000 students, all of whom were classified. He used somatotyping⁴⁹ in order to classify the individuals. Sheldon found three main figure types⁵⁰ within this group of students. No large disfigurements were represented within the studied group. Dysplasias⁵¹ became a problem when classifying the whole human body. In order to classify the body he discovered that he had to divide the body into five regions⁵² and analyse each part separately. Sheldon wrote that it was difficult to find a technique to classify people because they tend to differ in almost innumerable ways (Sheldon, 1940).

Cednäs(1977) has measured the human body and created standard measurement charts for the Swedish woman. She grouped the measured women into two age categories, in addition to that, she created four length categories and three width categories, see the chapter *Standard sizing system*.

Farrel-Beck & Pouliot (1983) used Sheldon's method of studying the body shapes but applied it to the female figure. Two photos were taken one from the back and one in profile⁵³. The figures were studied and the body angle and body proportions were determined. This determination was used together with traditional measurements of length and circumference in order to establish which alterations are needed to achieve a good fit. The body shape analysis gave a better fit of the trousers in four critical areas⁵⁴. When analysing the lower part of the female bodies they found five figure variations. "... round hip, pear-shaped hip, average hip, weight in front, and weight in back" (Farrel-Beck & Pouliot, 1983, p.95).

⁴⁸ An airline company has higher demands on the garment fit than a bus company. A bus company usually chooses a unified, but more loose-fitting uniform (Eriksson, 1999).

⁴⁹ Somatotyping has three main steps. Photographs, three views (front, back and profile) are taken of the individual. Measuring the diameters of the different body parts on the negative. Calculating with a formula to get the percentage of the stature.

⁵⁰ *Endomorphy* – round and soft, *mesomorphy* – muscles and bones make a compact impression and *ectomorphy* – thin and fragile (Sheldon, 1940).

⁵¹ Dysplasias is when the body's different parts belong to different categories, (Sheldon, 1940).

⁵² Head, face and neck make the first region. The thoracic and the abdominal trunk make the second and forth region respectively. The third region includes arms, shoulder and hands. Legs and feet make the fifth region.

⁵³ The profile photo helped to identify if the person had a figure with weight-in-front or a figure with weight-in-back. The photo taken from the back helped to identify if the person had round or pear-shaped hips. Both views were needed in order to identify the average/normal figure. (Farrel-Beck & Pouliot, 1983).

⁵⁴ The four areas were; (1) waist placement in front, (2) sizes of darts in front, (3) curve of the back crotch, and (4) horizontal grain.

Ilmola (1996) categorised the female figure according to three different relations of the body⁵⁵. This analysis was used as a starting point when developing basic patterns suitable to the different categories.

The dysplasias problem, which Sheldon had, was also faced in the EASYTEX project. In the project the body was divided into two main sections, upper part of the body and the lower part of the body. Garments for the upper part of the body are, for example, fitted jackets, blouses, shirts, dresses⁵⁶. Garments for the lower part of the body are trousers and skirts.

The classification of body shapes has been an ongoing process in the EASYTEX project. First, an identification of the disfigurements which cause problems in the matter of finding well-fitting clothes was mapped out⁵⁷. Another approach was used in the next step. The classification was made according to how the pattern adaptations would be done, Table 1 page 34. Neither the disability, nor the impairment or the handicap was of interest for the classification. Only the outward/visual disfigurement and its impact on the garments were taken into account. The five categories were; short/ tall stature, warped figure, prominent figure, wheelchair user and elderly. The category elderly was later included in the other four categories because this age group was not more homogeneous than any other age group.

⁵⁵ The three categories were: (1) figure type according to the relation between the bust and waist; hip/waist (2) figure type according to bust and back relation (3) figure type according to relation between the bust/abdomen and between back/buttocks.

⁵⁶ A dress covers both the upper and the lower part of the body but it has most of the contact points on the upper part of the body.

⁵⁷ Short stature, tall stature, low weight, heavy weight, warped body, prominent deformity, wheelchair user, other technical aid, and other (Berglin & Hernández, 1997c).

The EASYTEX project

EASYTEX is a project financed by the European Commission, carried out January 1997 – June 2000. It aims to improve the living conditions concerning textiles and clothing for the elderly, disabled, and impaired individuals. Five countries participate in EASYTEX: Great Britain⁵⁸, Greece⁵⁹, Finland⁶⁰, France,⁶¹ and Sweden⁶². The project is to produce a database, equipment and software for automatic measurements, and software for automatic pattern construction.

The EASYTEX project task for the Department of Home Economics at Göteborg University (GU) was to collaborate with Lectra Systèmes in order to develop the software FitNet⁶³ used for production of made-to-measure garments see box below. The software had to be tested to check if it could handle large disfigurements such as those represented among the impaired, disabled, and elderly. The software uses various alteration files in making an individual garment. These files contain data of how to alter a pattern when a certain value is entered. These files were created by GU.

The tasks carried out at Göteborg University (Commission of the European communities directorate general XIII, 1998, ANNEX 1 p.24)

- T3.1 Analysis of different adaptations of clothing needed for disabled people. A study of people with scolios, kyphosis, shortstatured, people in wheelchairs, with deformed arms and legs, paraplegies or other deformations of importance to garment design.
- T3.2 Definition of special pattern adaptations not available in software products for clothing. Produce a list of relevant transformations regarding basic garment + a list of relevant measurements lines.
- T3.3 Development of Lectra's software programs in order to include adaptations for the disabled; Integration of Body Click with Modaris. Integration with the 3D measurement system. Modification of Body Click/Modaris for asymmetrical bodies. Development of the manual alteration method. Data management by order to follow an order.
- T3.4 Validation of the software for individual pattern-construction in the initial phase at GU. Later on validation on site of the previous step in production.
- T3.5 Validation of garment construction within this project regarding styles, fitting and cost. Validation in production at the demonstration site.

The research started with finding out which alterations are suitable for specific disfigurements. This research was carried out in close collaboration with the test persons. The test persons have large disfigurements and difficulties with finding suitable clothing in a retail store. Each test person was deeply involved, from figure analysis all the way to the evaluation of the final garment. With the help of newly developed software, this procedure was made

⁵⁸ De Montfort University, Leicester: database

⁵⁹ Clotefi, Athens: properties of materials

⁶⁰ VTT, Tamerfors: Co-ordinator and properties of materials

⁶¹ Lectra Systèm, Bordeaux: Development of software for pattern construction and made-to-measure.

Telmat, Strasbourg: Automatic 3D measurement

⁶² Chalmers, Gothenburg: Collaboration with Telmat

Göteborg University, Gothenburg: Collaboration with Lectra Systèmes

⁶³ FitNet is a software used to speed up the process of made-to-measure. It is a Netscape based program. A user-friendly order form guides the user through the process of creating the individual garment. The style, basic fabric, details, contrast fabric, and adjustments for a better garment fit are selected. When the order is complete it is sent to production, see also Appendix B.

quicker than the previous attempt in making individual patterns on the computer. However, while working with the software some needed improvements and changes were noted and documented in the deliverables within the project, see box below.

The reports delivered by Göteborg University for the EASYTEX project

Report	Comments	Authors
<i>Deviations in body constitution and adaptation of patterns (1997b)</i>	The purpose was to get acquainted with various disfigurements and documented pattern adaptations.	Berglin & Hernández
<i>Datoriserad mönsterkonstruktion: en beskrivning av Modaris version 2.1 [Computerised pattern construction: a description of Modaris version 2.1] (1997a)</i>	This report was done in order to document what was possible to do in the software Modaris version 2.1.	Berglin & Hernández
<i>Special adaptations to clothing needed to be done for the disabled user: deliverable 3:1 (1997c)</i>	The first official deliverable within the EASYTEX project	Berglin & Hernández
<i>Definition of automatized [automated] pattern adaptations not available in software products for clothing: primary report Deliverable 3.2 (1998)</i>	Individuals with large disfigurements are presented along with the automatically adapted patterns.	Berglin & Hernández
<i>Definition of automatized [automated] pattern adaptations not available in software products for clothing Deliverable 3.3 (1999)</i>	Continuation of previous deliverable.	Berglin & Hernández

The technique needed for the mass customisation concept is now available on the market. The made-to-measure concept was presented at the final conference, *The made-to-measure concept available to everybody*, November 23, 1999. The concept presents one way of how a manufacturer could use the made-to-measure system in the future, Appendix B.

The manufacturer has to decide which fabrics, details, and alterations to offer to the customer, Figure 3, page 27. The system has to be built up in such a way that errors⁶⁴ are prevented, as far as possible. When it comes to large disfigurements, a greater know-how is needed both for the building-up process and for the entering of the alteration values according to the customers body figure. The computer stores and mediates the information but the computer does not have the human knowledge.

The section that demands most knowledge from the manufacturers is the building-up of the alteration files. The manufacturer has to know how, where, and with which restriction values the alterations should be created. When it comes to smaller alterations, such as moderate lengthening/shortenings and smaller increasing/decreasing of circumferences the alterations files are not that difficult to create. When it comes to larger alterations for specific

⁶⁴ Especially errors connected to alterations, their values, and the combination of large alterations.

disfigurements the creation is a bit more complicated. Experience is needed in this specific area. It also requires more of the person entering the alteration values when making an order. These areas have been thoroughly tested within the project. This experience and information forms the base of this study.

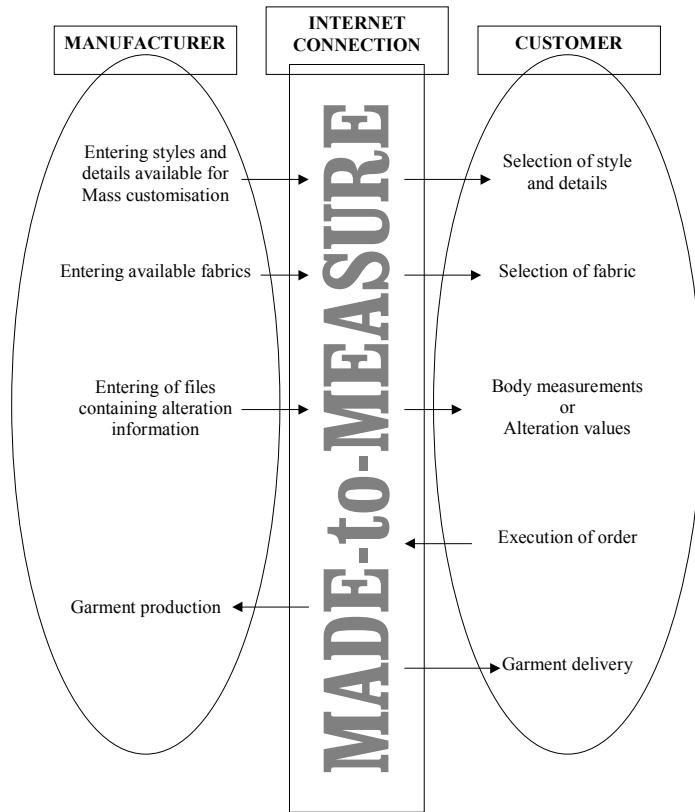


Figure 3: The communication between the manufacturer and the customer via Internet

Objectives of this study

In order for an individual to obtain an esthetical and well-fitting made-to-measure garment the technical solutions have to be available. But there must also be know-how of how to adapt the patterns in order to obtain an esthetical and well-fitting garment.

The empirical work and the development of alteration methods has been done within the EASYTEX project. The purpose of our part of the project was to use and develop software for mass customisation in collaboration with Lectra Systèmes. In order to make realistic tests of the software, real garments were used and altered for individuals with extensive disfigurements. *This* gathered data forms the base of this study.

This study looks at clothing from a technological perspective, it deals with links in the chain of making the made-to-measure concept available to everybody. The approach is problem oriented and explorative. The objectives are to report and to discuss the experience of how to alter a pattern to fit a disfigured body. The alteration methods are not tied to a specific disability/impairment but are developed to fit various and extensive disfigurements, regardless of the cause. Methodology and experience are discussed with two main areas in focus:

- THE INDIVIDUAL PATTERNS – PROCESS
By which steps are the individual patterns developed? Is it possible to follow the same process for all combinations of disfigurement?
- THE PATTERN CONSTRUCTION
In what way does the pattern have to be adapted in order to obtain a well-fitting garment for the individuals with large disfigurements?

Delimitation of this study

When producing an individual garment there are many aspects to consider, Figure 10, page 40. However, the focus of this study is on the figure registration and the individual pattern and not on the other links in the chain such as designing, the making-up process and the delivery. The evaluation is used in order to check if a comfortable and well-fitting garment was produced.

A garment is created of many elements and attributes such as design, fabric, comfort, and fit. In addition to these, specific technical solutions can be essential for the user with special needs. These technical solutions will not be considered in this piece of research. Many reports have already presented technical solutions in order to decrease a specific handicap.

The goal of the EASYTEX project has always been to be able to apply alteration information, using software for automatic made-to-measure. Here is the clearest distinction between a garment created by a tailor and one produced by a manufacturer⁶⁵. The alterations should be

⁶⁵ The tailor usually tries on the garment during the process, adjustments can be made through the process. The manufacturer on the other hand produces the garment without meeting the customer during the making-up process.

identified only by measurements and figure analysis. Small alterations, which can only be discovered when testing the garment, are not considered.

Clothes designed for a particular impairment, disability, or disfigurement are not specifically covered in this research. The garments used within the EASYTEX project are standard garments, which could be sold off-the-peg at any retail store. The focus is on the garment fit and not on special designs suitable for a specific target group.

The automatic made-to-measure software, FitNet was developed and used within the project. This software will not be explained or illustrated in detail. The alteration methods can be applied either in a made-to-measure program, “manually” in the computer, or when making the pattern without the assistance of the computer. The same is true for the measurements, they can be obtained manually or automatically. The presentation of the measurements focuses on the manual way of obtaining measurements but to some extent the automatic method will be discussed. How the body scanner that obtains the automatic measurements works will not be covered in detail⁶⁶.

The evaluations, filled in by the test persons, include questions that were of interest for the EASYTEX project but not particularly for this study. These answers will not be reported in this study.

⁶⁶ More information can be found in the licentiate report *Range camera imaging with application to human body measurements*, by Gaël Nueze, PhD student at Department of Signals and Systems, Chalmers, May 2000.

Methodology and procedures

Not many studies have been carried out within the area of pattern construction in order to handle large disfigurements on a general basis. The more extensive studies have mainly been based on Frost's (1987) method for creating individual basic blocks. In this study a combination of conventional knowledge within the field of pattern construction and explorative research has developed the methods of adapting patterns for individuals with large disfigurements.

Methods

Frost (1987) has developed a method for creating an individual basic pattern, Figure 4. The method starts with the process of measuring the disfigured body and after that the constructing of a suitable basic block. The measurements are taken on both right and left side of the body⁶⁷. This is done in order to register the difference between the two body halves. A mean value is then calculated and used when constructing the symmetrical basic pattern. With the symmetrical pattern as a base the differences on right and left side are applied by increasing/decreasing the pattern at appropriate places, Appendix A shows a slashed pattern piece. The individual basic block later becomes the starting point when creating the desired design (Frost, 1987).

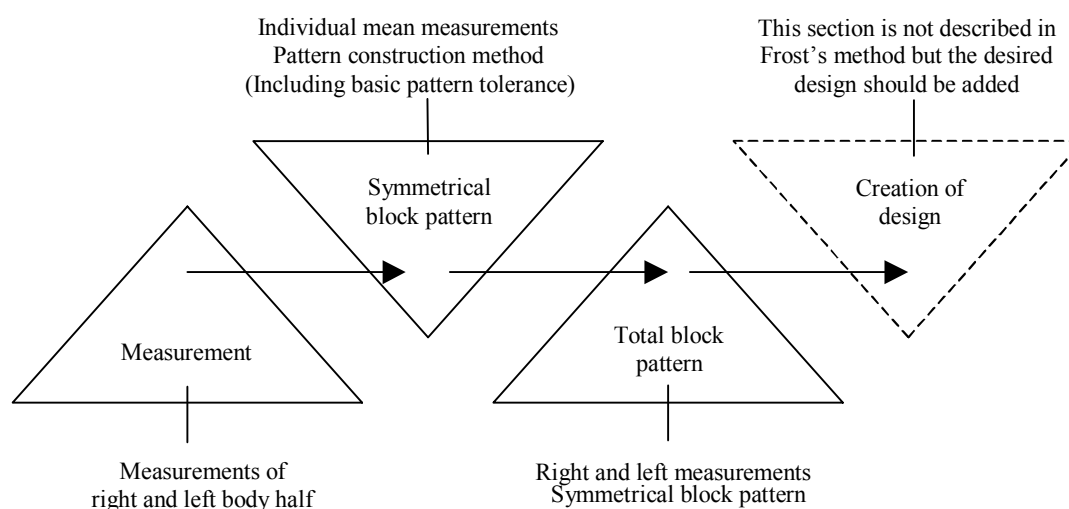


Figure 4: The process of creating an individual basic pattern with Frost's (1987) method

Previous projects⁶⁸ have used Frost's method and, but outcome of those does not present a complete and ongoing solution for the disfigured individuals' problem in finding clothes. The method was tested, both manually and by computer and the main shortcomings is that it is too

⁶⁷ Except for measurements such as length of garment centre front and centre back (Frost, 1987).

⁶⁸ A project lead by Thorén (1994) and the project Klädverkstån (Lejring, 1996).

time-consuming. This is because a basic block is first created to be followed by the making of the designed pattern (Thorén, 1994).

Roebuck (1995) outlines how to prepare the different aspects of the measuring procedure. He mentions three main points; (1) imagine in what way the measurements are going to be used, (2) perform an analysis of the future data, and (3) ask potential users what data they need. When these aspects are analysed the number of measurements can be limited. In order to carry out the measurement plan Roebuck mentions a number of practical things to think about; facilities, equipment, checking the software and the procedures, personnel, training, scheduling, and administrative concerns⁶⁹.

Johansson (1987) presents the Swedish standard measurement charts for women. She includes the basic measurements long with explanations of how the measurements should be taken.

Vigede (1988) presents a way of registering the body constitution by using *set* drawing presented on paper. These drawings illustrate a number of variations in posture and the outline of shoulders and abdomen. When registering the figure, the drawings illustrating the subject's body figure just have to be marked.

Method discussion

Registering the variations in body constitution by using *set* illustrations was presented by Vigede (1988). This was not applicable within this study because variations of the disfigurements are so many, both in shape and size. However, a body illustration was necessary in order to register the measurements of highly unique disfigurements, such as hunchback.

The three aspects of the measuring procedure presented by Roebuck (1995) are used within this study. However, the measurers and the users of the measurements have been the same team and therefore there has not been a clear dividing line between the three aspects. Right from the start it was clear that the measurements were not going to be used for anything else than to determine how a standard block patterns should be altered to create an individual pattern. The measurements presented by Johansson (1987) were used as a starting point when deciding which measurements to use. In addition to these basic measurements some special measurements were needed in order to register larger disfigurements. These special measurements were at the start obtained according to Frost's (1987) method. At the beginning many measurements were registered in order not to be without an important measurement when later on creating the individual pattern. During the process the measurements were limited to only the useful ones. Some measurements were ignored and some were modified in order to mediate clearer information about the body figure in connection with the pattern

⁶⁹ *The facility*: A practical room where the measuring can take place and a place to store instruments and supplies. *Equipment*: The equipment has to be available for each measuring team. *Checking the software and the procedures*: It is essential that the procedures are clear so that human errors are eliminated as far as possible. It is also important that computer software is checked. *Personnel*: Each measuring team should include at least two persons, one to conduct the measurements and one to record them. *Training*: It is important that all measurers use the same equipment and techniques when measuring. *Scheduling*: When measuring for long periods the measurer and the recorder should alternate tasks in order to keep focused. *Administrative concerns*: Administration such as payment for the subjects, renting of facilities, scheduling both the measuring teams and the measured individual etc. (Roebuck, 1995).

construction. The final measurements are presented in the chapter *Registration of the body figure*.

The practical measurement preparations described by Roebuck (1995) have been used within the project. However, many of his concerns were automatically taken care of, as we were fortunate enough to be stationed in one facility all the time. It was not necessary to clear the space for upcoming activities. The measuring was shared by all four experts⁷⁰ throughout the project. Most of the time one was taking the measurements and one writing down their values.

The measurement method used by Frost (1987) has the purpose of registering measurements needed for the construction of an individual block pattern. A lot of measurements are registered and many are taken both on the right and the left side of the body. This is not necessary for symmetrical parts of the body. Within this study the number of measurements was limited to only the ones necessary and therefore the right/left measurements were only registered when needed⁷¹. As far as possible only the total circumference of each measurement was registered.

The pattern construction method used by Frost (1987) has been evaluated in previous studies and shown to be very time-consuming (Thorén, 1994). Instead of drawing the individual block pattern from scratch, a standard block is *altered* to create the individual block pattern⁷². When using a block pattern as a starting point the proportions of the designed garment are already evaluated⁷³. The individual proportions of course have to be added but they should just make the garment harmonise with the body figure, not change the design. Even more knowledge is needed when drawing an individual basic block from scratch for such disfigured bodies.

Empirical data

The empirical data has been gathered in three phases, A, B and C, Figure 5. The different phases have been in successive time periods. The experimental method has differed in each phase. A more detailed explanation and overview of the three phases will be given further on.

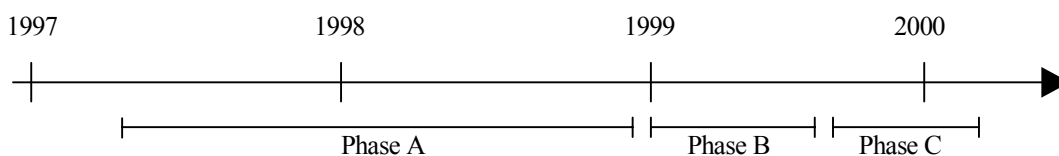


Figure 5: Timetable for gathering of empirical material

⁷⁰ The four experts were individuals with qualifications within pattern construction, design, and textile.

⁷¹ These measurements are necessary when the individual has an asymmetrical body.

⁷² FitNet, the made-to-measure software, creates the individual block from a standard block pattern on which the needed adaptations are applied.

⁷³ Including proportions between different details and tolerances of different parts of the garment.

Test persons

Test persons have been recruited at different times during the project. In order to inform individual and get them to sign up at the beginning of the project an information meeting was held (February 26, 1997) and later on an advertisement was placed in a newspaper (September 5, 1999). Key persons⁷⁴ and test persons who had participated in previous projects⁷⁵ and conferences⁷⁶ were invited to the information meeting. From this, the information spread and 43 individuals signed up. The advertisement was placed in Göteborgs Posten, a widely read newspaper in this region, and 41 test persons signed up after the advertisement. In total 84⁷⁷ signed up and 29 of these were selected to participate in the research, the distribution between the phases is illustrated in Figure 6. Everybody that participated in phase A, also participated in phase B. One of the test persons in phase C participated partly in phase B. The final test persons were all women. The reason for focusing on women's clothing is because the know-how about women's clothing was greater in the EASYTEX-project than for men's clothing and the lack of made-to-measure garments available for women.

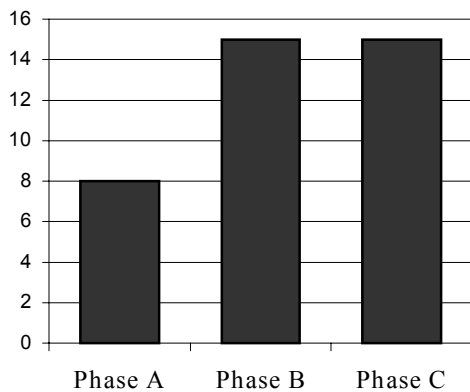


Figure 6: Test persons' participation in the different phases

Not all 84 individuals who signed up were of interest for the study. The individuals with small deviations from the standard figure were sorted out. The remaining number of test persons were grouped according to how the pattern adaptations would be done, Table 1, page 34. The four categories were; short/tall stature, warped figure, prominent figure, wheelchair user. The ambition was that the test persons should be well distributed between the different categories. An effort was also made in order to get a large age range among the test persons. However, they had to have passed puberty so that their bodies would have developed a female figure.

⁷⁴ Project leaders from previous project

⁷⁵ One of them, *Klädverkstán* (1992-1995), taught how to make garments for individuals with disfigurements.

⁷⁶ A conference was held in order to present the results from *klädverkstán*, May 3 1994.

⁷⁷ More people contacted us after the final selection of the test persons needed. They wanted to be a part of the test person team, but we had enough test persons. They are not included in this number.

Table 1: Categories of disfigurements

Disfigurement/Category	Adaptation of pattern
Short/long stature	The pattern has to be shortened/lengthened.
Warped figure	The pattern has to be warped; the balance between left and right has to be adapted.
Prominent figure	The pattern has to be enlarged over the projecting body part.
Wheelchair user	The pattern has to be adapted for sitting position. The balance between front and back has to be altered.

The 29 test persons selected to participate in the research were spread out over the categories, as Figure 7 illustrates. An individual could be placed in two different categories if their upper and lower parts of the body had different disfigurements. The classification was therefore made according to the individual's upper and lower parts of the body respectively. Not all test persons are represented with both their upper and lower parts of the body. The grouping of the test persons was always made according to the largest disfigurement.

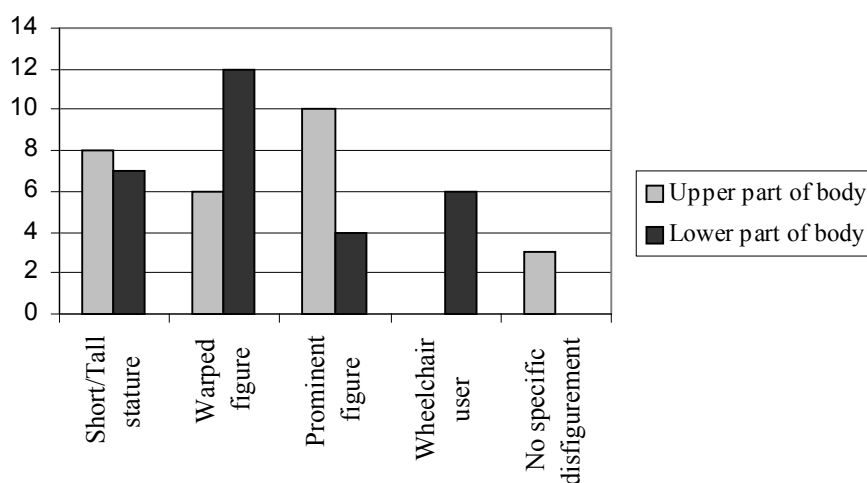


Figure 7: The categorising of the test persons

All selected test persons were living in the western part of Sweden at the time of the project. They could not be anonymous, it was not practical due to the many appointments. They were not given any remuneration. They were informed that if the final garment fitted them and they would like to keep it they could do so without any cost.

Evaluation of made-up garments

In order to evaluate the results of the pattern construction the experts as well as the test persons evaluated each final garment. The experts evaluated the garment in detail while the

test persons were asked about a few specific areas of the garment in addition to the overall comfort of the garment. The evaluation forms include more questions than what is relevant for this particular study. The questions dealing with the fit and comfort of the garment will be considered in this report as well as how frequent they have used the final garments will be mentioned. The other information was of interest for the EASYTEX project and for possible further studies within the field of style selection for individuals with disfigurements.

In phase A the expert evaluated the test garments. In phase B 37 final garments were evaluated⁷⁸. About a total of 30 garments will be made-up and evaluated in phase C. Due to lack of time and delays from the commissioned seamstresses only 10 garment are evaluated⁷⁹ and included in this study. There was also a *follow-up* evaluation filled in by all test persons in phase B. The evaluation form for the follow-up evaluation was mailed, along with a letter, to all 15 test persons in phase B about 4-6 month after the first evaluation. The test persons had the chance to use the clothes and then evaluate them once more. All evaluations sent out were filled in and sent back without the need for any written reminders. The used forms and the cover letter are presented in Appendices C – I.

Implementation

The procedure of making an *individual* garment can be divided into five *main* sections; *figure registration*, *individual pattern*, *test garment*⁸⁰, *making-up*⁸¹, and *evaluation*. The implementations within these sections are described in this chapter. The needed equipment and material will be mentioned along with the different sections.

Figure registration

The figure registration was performed by the experts. Most of the time at least two experts were present when taking the measurements, one measuring and one registering the values. The procedure when measuring an individual is illustrated in Figure 8, page 36. The subject is measured while wearing underwear or close fitting garments. If the subject normally uses shoes with different heel heights, they have to wear them when being measured⁸². In order to get as accurate measurements as possible certain *landmarks*⁸³ should be marked out on the body. This was done with small round stickers, which marked the neck point, shoulder point and the 7th cervical vertebra. If the test person had a prominent disfigurement it was necessary to define landmarks on this projection as well. The waist was marked with a cotton band⁸⁴. The measurements were taken with a tape measure, graded in centimetres. A set square was used in order to facilitate the obtaining of certain measurements. A horizontal surface or a stool was used for the individual to sit on when obtaining the measurement in the sitting position. All measurements were registered on a form, Appendix J. If required, a body illustration was used in order to register measurements around a large disfigurement such as a hunchback or any other prominent body part, Appendix K. As a final registration, a few

⁷⁸ 12 fitted jackets, 13 skirts, and 12 trousers

⁷⁹ 5 jackets, 1 skirt, 3 trousers, 1 dress

⁸⁰ The goal is to produce the garment without any test garment in the process.

⁸¹ This was done by appointed manufacturers and seamstresses.

⁸² If they did not wear the shoes they would become more warped in the body than they would be when, later on, wearing the garment.

⁸³ Points marked on the body that serve as guidelines to where specific measurements should be taken.

⁸⁴ The cotton band has a width of 15mm.

photos were taken with a Polaroid camera in order to visually illustrate the test person's figure. From one to six photos were taken depending on how the disfigurement looked. Sometimes the individuals were photographed with more clothes on than during the measuring procedure⁸⁵.

The measurements and the figure illustrations are when making the *figure analysis* included in the next step – *individual pattern*.

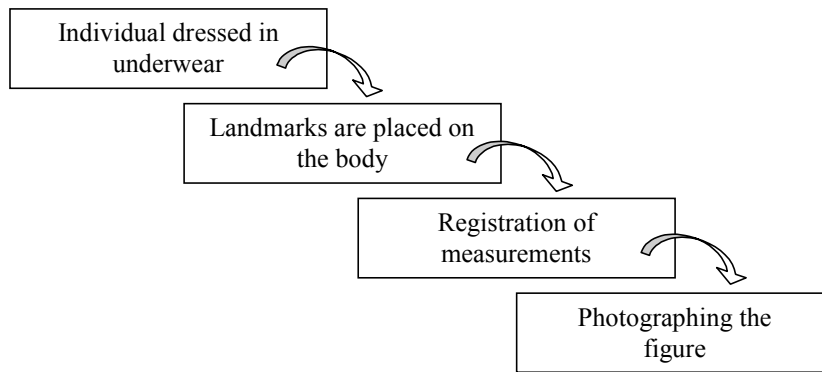


Figure 8: The process of the body figure registration

Individual pattern

The garments used in all phases are the ones where fit is of great importance, such as trousers, skirt, and fitted jacket⁸⁶. The patterns differed between the phases. In phase A, graded block patterns⁸⁷ for skirt, trousers and fitted jacket were used. Note that these patterns do not have any details - no designs were added, Appendix L. The designs available for phase B and C were ready for production, Appendix M. The patterns ranged in sizes from C32 through C54.

Individual patterns are created by *figure analysis*, *style selection*, *selection of size*, and *applied adaptations*, Figure 11, page 41. There was no style selection in phase A, only a selection of the garment type. In phase B style selections were possible between two trousers and the length of the skirt – short or long. The fitted jacket was available in just one design. In phase C the selection was made between a coat and a fitted jacket for the upper part of the body. For the lower part of the body a pair of trousers, and a skirt short/long were available. A dress in tow lengths was also available.

The measurements and the body figure were analysed in order to select the most suitable *size* and to plan which *adaptations* of the pattern were needed. Each individual pattern was made

⁸⁵ Sometimes it was awkward to take the photos. Especially if the test person was not wearing a bra and sometimes because of their personality/shyness.

⁸⁶ If too loose garments had been used the alteration methods could not have been evaluated fully because loose fitting garments do not conform to the body shape as well as close fitting garments.

⁸⁷ The block patterns used in phase A have been developed by I. Öberg and H. Ersman and are included in their latest book (1999).

with the help of software⁸⁸, which made the process much faster. The adjustments were always made on a standard block; a new basic block was never drawn from scratch⁸⁹.

Test garment

The test garments were sewn in a cotton fabric. For the fitted jackets a rather compact fabric was used but the skirts and trousers were made of a more flexible fabric. The test garments were sewn in a way so that the garment fit could be evaluated in the best way. All the skirts and the trousers had a waistband and material was added along the centre front to facilitate closure of the garments. Various thicknesses of shoulder pads were used for the fitted jacket, all according to the requirements of the disfigurement in combination with the pattern adaptations. The designed garments in phase B were sewn as a test garment but not all the details were fully sewn on this garment, only marked in some way.

Making-up

This section of the process of making an individual garment will not be covered within this study. A manufacturer and seamstresses were commissioned to do the making-up of the final garments. Fabric and haberdashery were needed for the final garment in phase B and C, but will not be brought up here.

Evaluation of made-up garments

A systematic evaluation was used with different evaluation forms for the different phases. The expert panel was present at every evaluation and made direct observations. The experts worked in rotation with at least two of the four present at each evaluation⁹⁰. The experts used an *objective* evaluation form, when evaluating the *test garment*, Appendix C. This evaluation was to establish how to adapt a pattern in order to obtain a good garment fit. The focus was therefore on which adaptations were used and what results those gave. The first evaluation of the *final* garment took place when the test persons tried on the garment for the first time. When evaluating the *final* garments two different forms were used, a *subjective* evaluation form for the test person to fill in, Appendix D (phase B) and Appendix F (phase C), and an *objective* evaluation form for the expert to use, Appendix E (phase B) and Appendix G (phase C). These evaluations focus on the end result. The criteria and the scale for this evaluation are described in Table 2, page 38. If the evaluation was marked as *fair* an explanation was asked for in order to be able to examine the cause. This is why the evaluation was not anonymous, it was necessary to be able to analyse the answers relation to the unique figure and the individual patterns. A photo taken at the evaluation registered the final result in phase B and C.

⁸⁸ The software Modaris, FitNet, Diamino, and Vigiprint were used in the production of individually made garments. The software was provided by Lectra System, Bordeaux, France

⁸⁹ It is better to use patterns with a design because the tolerance, details, and the balance in the garment is already developed and tested (Thorén, 1994). Another reason of why standard blocks were used as a starting point is that the made-to-measure software FitNet is based on using standard garments available for regular customers.

⁹⁰ Except for one evaluation of the *test garments* and at one evaluation in phase C, were only one expert was present.

Table 2: Criteria used when evaluating the final garment

Evaluator	Criteria	Evaluation scale
The experts' objective evaluation	<i>Ease allowance</i> at various parts of the garment ⁹¹	too small, excellent or too large
	<i>Harmony</i> of the garment, does the garment harmonise with the disfigured body ⁹²	fair or excellent
	<i>Details and style lines</i> of the garment	fair or excellent
The test person's subjective evaluation	<i>Comfort</i> of the garment - in general - at specific areas ⁹³	fair, good or excellent
	<i>Overall impression</i> of the garment	fair, good or excellent

The *follow up* evaluation, Appendix H, was mailed to the test persons participating in phase B. This evaluation was built up, and evaluated the garment, in a similar way as in the previous evaluation made by the test persons. A couple of questions were asked on behalf of the EASYTEX project covering areas not in focus in this study.

Summary

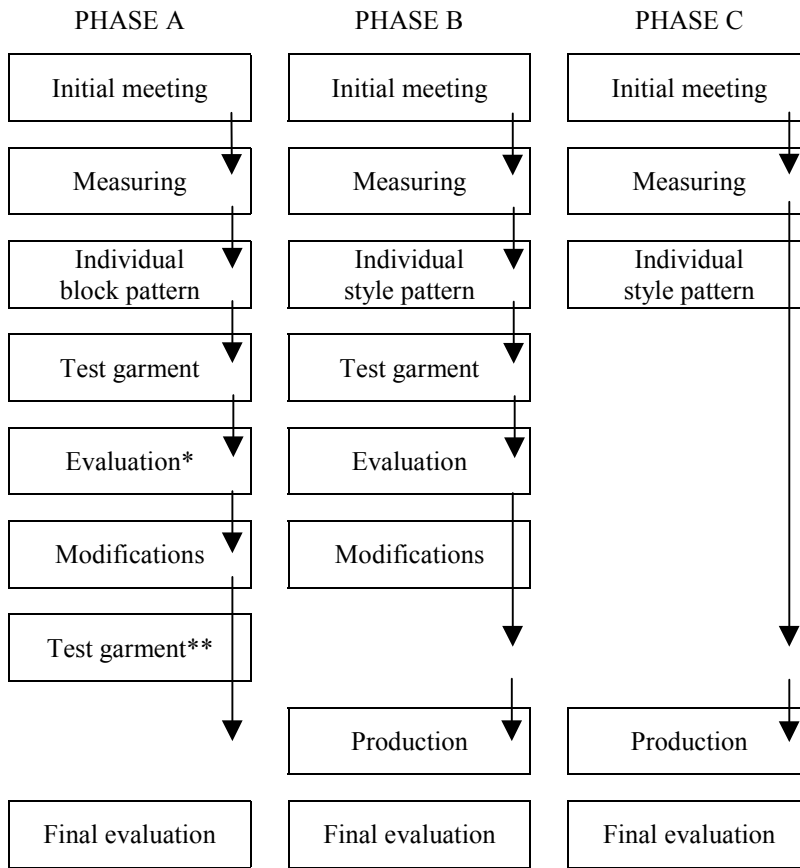
As previously stated, the empirical data has been gathered in three phases. The overall purpose of the different phases has been to produce garments with a good fit. This has been done in different ways in the three phases, figure 9, page 39. Phase A was a learning period where the individual garments were block patterns, with no design added. During this phase the basic methods of pattern adaptations for large disfigurements were established. At the evaluations in phase A modifications were noted, and a second test garment was sewn if large modifications were needed in order to obtain a good fit. If only minor modifications were needed these were noted but no second test garment was sewn. During phase B the alterations were made on fashionable styles. Test garments were still sewn in order to evaluate the garment fit before the garment went into customary production. When phase C started the methods for adapting patterns for large disfigurements had been tested quite extensively so this phase was carried out without any test garments⁹⁴.

⁹¹ Critical areas: Bust, waist, hip and sleeve.

⁹² Critical areas: Shoulder, scye, sleeve, waist and hip.

⁹³ Waist, hip, crutch, shoulders, armhole, neck, bust, and sleeve.

⁹⁴ Except for when the test persons have difficult combinations of disfigurements. Test garments are sewn for them.



* If the test garment has a good fit, the final evaluation was made on this level. Small modifications were noted.

** The second test garment was sewn if necessary.

Figure 9: Overview of the different proceedings included in the different phases

Made-to-Measure garments

A well-fitting garment starts with a well-made pattern and of course a suitable design. It can either be a pattern in various standard sizes or an individually made pattern. The standard sizes are produced before they actually have a buyer, while made-to-measure garments are produced only when an order is placed. With the technical solutions available today, the made-to-measure garments originate from a designed standard block pattern. The adaptations needed in order to get an *individual pattern* are added to the block pattern. The unique garment is made-up and delivered to the individual. Figure 10 illustrates the different steps to go through when creating a unique garment. The section *test garment* is marked with a dotted line because this step does not exist when the industry makes a made-to-measure garment. However, within this study the *test garments* have been sewn in order to develop reliable adaptation methods for large disfigurements.

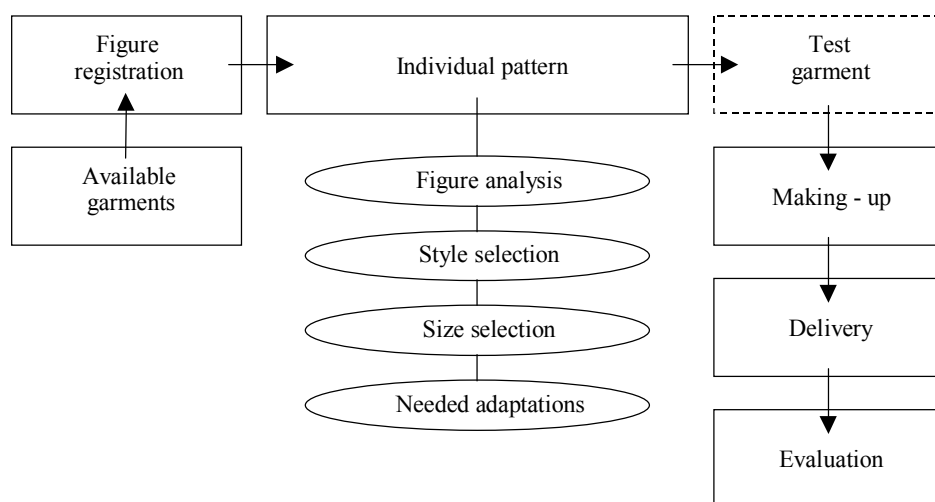


Figure 10: The process for creating made-to-measure garments

The individual garment has to be in harmony with the individual body shape. Nevertheless the disfigurement should not be more visible than necessary⁹⁵. It is the interplay between the body shape and the final shape of the garment that gives a suitable dress. The garment should not be changed more than necessary, on the other hand it has to be altered enough in order to feel comfortable for the wearer and harmonise with the body shape. Within this interplay certain accessories can be used in order to fill the difference between the disfigured body and the garment. An extra shoulder pad can easily be used in order to compensate a low shoulder. The garment would look more symmetrical and would still harmonise with the body shape and give a good fit and comfort. If accessories such as shoulder pads are necessary this has to be already taken into account when adapting the pattern.

⁹⁵ Hasvén (1992) describes the same goal as tackled by tailors of not revealing the disfigurements. Instead, they used artefacts such as shoulder pads to hide the disfigurements in order to give the impression that the individual had the ideal figure.

The actual creation of the *individual pattern* is one of many links in the process of making a made-to-measure garment. There are a lot of factors that influence the outcome of the individual pattern. Figure 11 gives a description of the different decisions needed and what influence them. The individual measurements and figure illustrations⁹⁶ describes the body shape⁹⁷. The garment should form to this shape but of course with some tolerance. This tolerance makes the garment more flexible and certain disfigurements are hidden simply because of the tolerance of the garment⁹⁸. Due to this, not all disfigurements need to be taken into consideration when altering the pattern. Neither are all body measurements used exactly according to the measured value⁹⁹. The goal is to create a garment that is esthetical and has a good fit, harmony in style lines and designed shape. Finding a balance between the body shape, the designed style, and the necessary adaptations accomplishes an individual pattern. When the pattern is created it goes into the making-up production – cutting the fabric according to the individual pattern and from there the pieces are assembled into a customised garment.

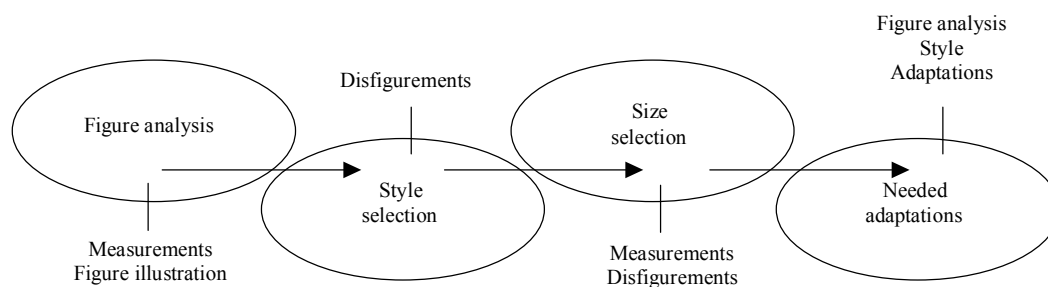


Figure 11: The process of creating individual patterns

The designed shape is of great importance for the final result. Certain designs are more suitable to certain body shapes than others. When making individual garments for individuals with large disfigurements it is important that the garment has the correct style lines. If the garment pattern does not have enough style lines, the adjustment of the garment could be impossible to make. The style lines make it possible to form the garment in accordance with the body shape. The garment pattern should be available in many sizes, preferable C32-C54¹⁰⁰. It is important to select the correct size as a starting point for the individual garment. The fewer and smaller adjustments needed on the pattern the more certain the final garment

⁹⁶ The body measurements is one of two sets of data that are used in pattern development, the other data is the visual assessment of the body figure, done by the trained eye (Gazzuolo, DeLong, Lohr, LaBat, & Bye, 1992).

⁹⁷ The identification of the problem is the beginning of the design (Lamb & Kallal, 1992). Both the kind and degree of disfigurement of the body have to be determined by the analyst (Heisey, Brown, & Johnson, 1988).

⁹⁸ It is a benefit if a basic pattern includes more tolerance (more than Frost's method with +6cm for the bust) since this minimises the adaptations and their values. Also individuals with disfigurements rarely wear garments that conform closely to the body (Thorén, 1994).

⁹⁹ The body and the garment are not identical to each other. Therefore, the body measurements can not be used directly to create a garment. The body measurements should therefore be used primarily as guidelines and approximations (Gazzuolo, DeLong, Lohr, LaBat, & Bye, 1992)

¹⁰⁰ These are the sizes for women with a total length of 168+-4cm tall (40-series). If patterns for the shorter length class 160+-4cm (20-series) were available one would think that it should result in fewer alterations. However, Nyman (1999) shows that when adapting a pattern for a short individual the number of alterations were as many when she used the pattern from the 40-series as when she used the patterns from the 20-series. The values were, however, smaller. (Nyman, 1999).

will be. The *hip*¹⁰¹ and *bust*¹⁰² circumferences are the most common guidelines when selecting a size. In addition to these measurements the disfigurement has to be taken into consideration. If an individual has a hunch on the right side of the back it probably would be more suitable to select one size smaller than indicated by the bust circumference. An adaptation will be added to the pattern in order for the garment to have a good fit over the hunch. If the larger size would have been selected the final garment would have been too large.

The altering of the pattern is divided into two categories; measurement deviation and body shape disfigurement. The *measurement deviation* includes small adaptations such as shortening/lengthening of trousers/skirt, increasing/decreasing of hip circumference. The *body shape disfigurement* includes larger adaptations for disfigurements such as, prominent figure, warped figure, and balance between front/back etc. The measurement deviations are always used when making an individual garment. These are, however, small modifications, which are conventional knowledge among pattern constructors. These will not be explained in detail but used when combining the adaptations on a whole body figure in the chapter, *Individual patterns*.

¹⁰¹ For garments such as skirts and trousers.

¹⁰² For garments such as fitted jackets, blouses/shirts, and dresses

Registration of the body figure

In this section my experience, gained from this study, when it comes *body figure registration* is reported. Literature, concerning body figure registration, was studied and used as a starting point. These references are mentioned and discussed along with the experience gained. In this chapter, the references are in footnotes in order to facilitate reading of the text.

Registration of the body figure includes *measurements* and *photos/figure illustrations*. The whole process takes about 30-45 minutes, depending on the number of measurements and if the individual needs to rest during the measuring. In this study the purpose of registering the body figure is to determine how a garment should be adjusted in order to give a good fit. To decide how to improve the garment fit it is necessary to analyse both the measurements and the illustrations of the figure. Whether it is a single measurement or several analysed together they always need to be connected to the figure illustration.

Reliability of measurement depends on the experience of the measuring person. Practice is needed in order to measure consistently. The first step to consistent measuring is, however; to be clear on how and where the measurements should be taken. This is of great importance, especially if there are many persons who are going to measure the individuals. It is an advantage to have two persons measuring, one measures and the other assists by registering the values.

The photos are usually taken from the front, the back, and from the sides. The number required depends on the disfigurements. The purpose of the photos is to register the body figure and especially the parts of the body that are disfigured. It is important that the photos show the relation between different body parts.

Preparations

The individual who will be measured is dressed only in their underwear or in some close fitting clothes¹⁰³. Underwear especially can change the body form. However, it is essential that the body form is the same when measuring as it will be when wearing the planned garment. The subject should stand erect, with the feet slightly apart, relaxed shoulders, arms and abdomen, and looking straight ahead¹⁰⁴. The posture should be the same as it will be when wearing the planned garments. If the subject normally uses shoes with different heel heights, they have to wear them when being measured. If the shoes are not worn the posture and body figure change and the individual will usually be more warped than if measured with the shoes.

¹⁰³ (DeCosse, 1998a; Huxley, 1996; Öberg & Ersman, 1999)

¹⁰⁴ (DeCosse, 1998b; Huxley, 1996; Lewin & Svensson, 1975; Liechty, Pottberg, & Rasband, 1994)

Landmarks

In order to measure as correctly as possible different landmarks are placed on the body. These landmarks serve as guidelines to where specific measurements should be taken. Each landmark is placed according to the anatomy - the skeleton and the muscles are important in order to locate the proper location of the landmarks¹⁰⁵.

The *waistline* is marked with a cotton band¹⁰⁶. The waist is usually the narrowest circumference of the abdomen. It is located between the lowest rib and the top of the pelvis¹⁰⁷. It is very important that the subject relaxes the abdomen and breathes normally¹⁰⁸. Sometimes it is difficult to determine where the waist is located, in this event the test person is asked to place the band where she would like to have the waist band of a skirt.

Some of the landmarks are marked with small round stickers¹⁰⁹; they are placed on both sides of the body. Figure 12 illustrates the placement of the landmarks. The *neck point (NP)* is located at the intersection between the base of the neck and the shoulder. The *shoulder point (SP)* is located at the utmost part of the acromion. The *7th cervical vertebra (CV)*, also called nape, is also marked. If the individual has a hunch, this needs to be marked. The highest point of the hunch is marked with a landmark called *hunch1 (H1)*, the landmark located vertically above H1 on the shoulder line is called *hunch2 (H2)*, see Figure 12.

The landmarks make it easier to find the correct locations when measuring. The measurer can concentrate more on all other aspects of measuring.

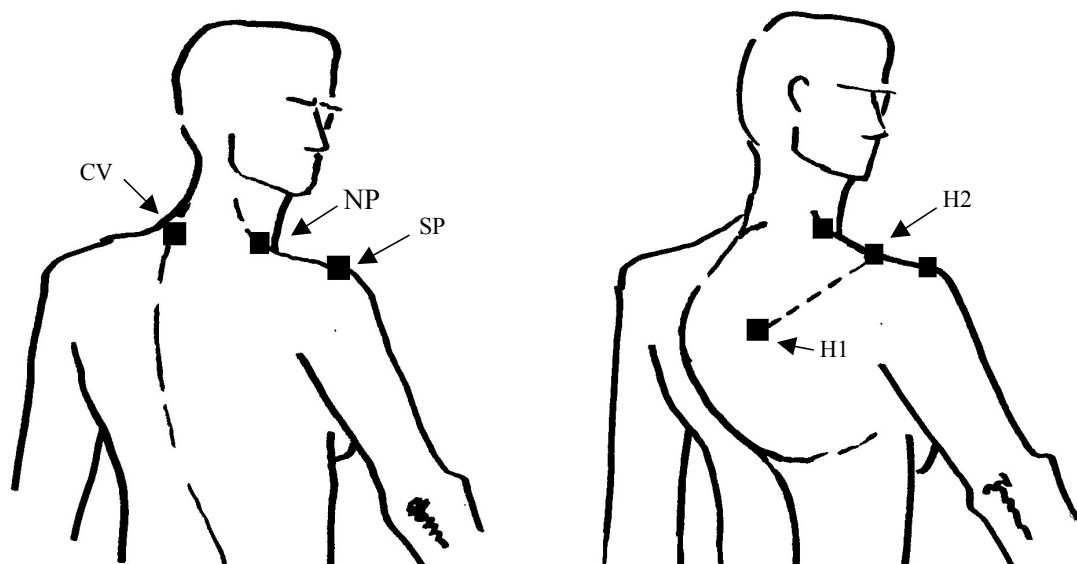


Figure 12: The locations of the landmarks Illustration Helene Berglin

¹⁰⁵ (Roebuck, 1995)

¹⁰⁶ The cotton band has a width of 15mm.

¹⁰⁷ (European Committee for Standardization, 1998; Lewin & Svensson, 1975; Telmat Industrie, 1998)

¹⁰⁸ (European Committee for Standardization, 1998; Landroy, 1949; Telmat Industrie, 1998)

¹⁰⁹ The stickers come of very easy so they do not cause any discomfort for the individual.

Measuring

All measurements are taken with the upcoming pattern construction in mind. The measurements that are not necessary when deciding how to alter a pattern are therefore not measured. Most of the measurements listed in the next chapter need to be registered for all individuals, while some are just for individuals with specific disfigurements, such as the measurements 21-23, page 52. The goal is to measure only the measurements necessary to determine how the garments should be altered. The circumference of the body halves are just registered if necessary¹¹⁰, otherwise only the total value is registered. This measuring should therefore not be seen as a detailed figure registration. Each measurement is not directly connected to a specific pattern alteration. Most of the time it is necessary to analyse a few measurements and in combination with a figure illustration in order to determine the adaptations needed.

The measurements is taken with a tape measure following the body figure without being too tight or too loose. It is important that the measuring is done consistently and in such a way that it decreases the possibility of incorrect measurements. If possible the measurements should be measured successively, for example, the shoulder and arm length should be measured at the same time without moving the tape measure at the shoulder point. The shoulder measurement is registered as well as the total length value at the wrist. The shoulder value is subtracted from the total value, the remainder is the arm length. When measuring the left/right or front/back part of a circumference it is extremely important to measure them successively in order to avoid errors of measurement.

Whether the measuring is done manually or automatically does not really matter. The measurements presented need to be taken in a way that relates to the pattern construction. Some measurements are easier to take automatically¹¹¹ and some are easier to take manually¹¹². The body scanner Symcad¹¹³ has been used in the EASYTEX project to register the automatic measurements.

The systems that measure the human body automatically can be built up in different ways. Existing techniques for 3D body measurements include conventional passive video cameras, active range cameras based on structured light, acoustic, infrared emissive and possibly other innovative approaches. Because of the need for accuracy, a system that is safe and fast must be considered. The structured light principle satisfies these criteria. Based on this principle, Symcad provides accurate 2D&3D measurements at predefined landmarks such as chest, waist, hips, etc.¹¹⁴

¹¹⁰ The necessity is judged by the expert's trained eye.

¹¹¹ For example; height off shoulder point and height of neck point

¹¹² For example; inside leg length. Sometimes the thighs do not separate all the way up to the crutch. The automatic measurement is taken from the floor up to the landmark where the legs intersect. Additional software makes it possible to modify this landmark in order to measure all the way up to the anatomical crutch.

¹¹³ Manufactured by Telmat Industries in France.

¹¹⁴ However, the Telmat/Symcad system is optimised for measuring individuals with normal body shapes and cannot be used for individuals with large disfigurements, without significant software modifications. Therefore, an interface, based on data provided by Symcad, has been developed at Chalmers university of Technology in Sweden. With this interface, it is possible to modify and add landmarks/measurements, according to needs.

Measurements

The measurements used, and described further on, are either a *circumference*¹¹⁵ or a *linear measurement* – including *width*¹¹⁶ and *length*¹¹⁷ measurements. There are measurements that follow the *outline* of the body¹¹⁸, those that only measure the *distance* without including the outline of the body¹¹⁹, and those combining the outline of the body and the distance¹²⁰. Some measurements are taken as *control measurements*, they are only used to check that the width/circumference of the garment is large enough at that particular area. All measurements have been taken with a tape measure but sometimes with the help of other tools such as a set square. Most of the measurements are *body* measurement but sometimes it is good to measure *garment* measurements, for example to decide the length of the skirt. This is usually registered when the designed garment is picked out. In this chapter only body measurements are presented. They are described according to how they are generally measured, which tools are suitable to use, and how they are used in the pattern construction. In addition, the experience of measuring individuals with large disfigurements is added. The measurements are presented in the order they were usually measured. The measurements are numbered, and shown in the illustrations in Figures 13-18.

When measuring individuals with large disfigurements one has to be inventive and think about what is necessary to know in order to handle the upcoming adaptation of the pattern. It might be necessary to take some more measurements in order to register the disfigurement.

1. Height

The height, Figure 13, is the vertical measurement from the top of the head to the soles of the feet¹²¹. It can be either measured with an anthropometer¹²² or against a wall with a set square, a tape measure. This was not always measured; the test person could usually give this information.

The height is not used in direct connection to any alteration but serves more as an information of the subjects proportions when comparing with other length measurements.

2. Bust circumference

The bust circumference, Figure 13, is taken with a tape measure over the most prominent part of the bust, under the arms, and vertically at the back while the subject is breathing normally¹²³. Some authors write that the bust circumference should be measured horizontally¹²⁴. This is not possible when measuring individuals who do not have an erect and straight posture of the upper body. It is most common to register the total circumference but it

¹¹⁵ For example; bust, waist, hip etc.

¹¹⁶ More or less horizontal measurements, for example shoulder width and back width.

¹¹⁷ More or less vertical measurements, such as sleeve length, inside leg length etc.

¹¹⁸ For example; bust point, waist circumference, and thigh circumference.

¹¹⁹ For example the inside leg length.

¹²⁰ For example; bust circumference, nape to waist – front, outside leg length etc.

¹²¹ (Cednäs & Kjellnäs, 1977; DeCosse, 1998a; European Committee for Standardization, 1998; Lewin & Svensson, 1975; Shoben & Ward, 1987)

¹²² (Cednäs & Kjellnäs, 1977) An anthropometer is a straight vertical bar on which a horizontal measurement arm slides up and down (Lewin & Svensson, 1975).

¹²³ (Landroy, 1949; Shoben & Ward, 1987; Öberg & Ersman, 1989; Öberg & Ersman, 1999).

¹²⁴ (Cednäs & Kjellnäs, 1977; European Committee for Standardization, 1998; Morris & McCann, 1997; Telmat Industrie, 1998; Zieman, 1994; Öberg & Ersman, 1989)

is also possible to register the left and right value of the circumference¹²⁵. This is used when the difference between left and right circumference is significant.

The garment size for the upper part of the body is usually selected according to this measurement. A small alteration might be necessary in order to harmonise with the bust circumference of the individual.

3. Waist circumference

The waist, Figure 13, is measured with a tape measure at the narrowest circumference of the abdomen, marked with a waistband. More details about the location of the waist are given in the chapter *Landmarks*. As with the bust measurement, some authors emphasise that the waist measurement should be taken horizontally¹²⁶. Often this is not possible when measuring an individual with large disfigurements. If necessary the left and right side of the waist circumference are registered.

Most of the time, especially with trousers and skirts, it is necessary to alter the waist in order to make it fit comfortably. How the alterations should be carried out depends also on how the figure looks around the high hip and hip.

4. High hip circumference

The high hip, Figure 13, is measured with a tape measure over the most projecting part of the hipbone/iliac crest¹²⁷. About 10cm below the waistline¹²⁸ or between the waist and hip, but slightly closer to the waist. The measurement should be horizontal¹²⁹ but as said before this is not possible when measuring large disfigurements.

The high hip measurement is mostly for controlling that the pattern is not too small/tight over this area. The waist and hip

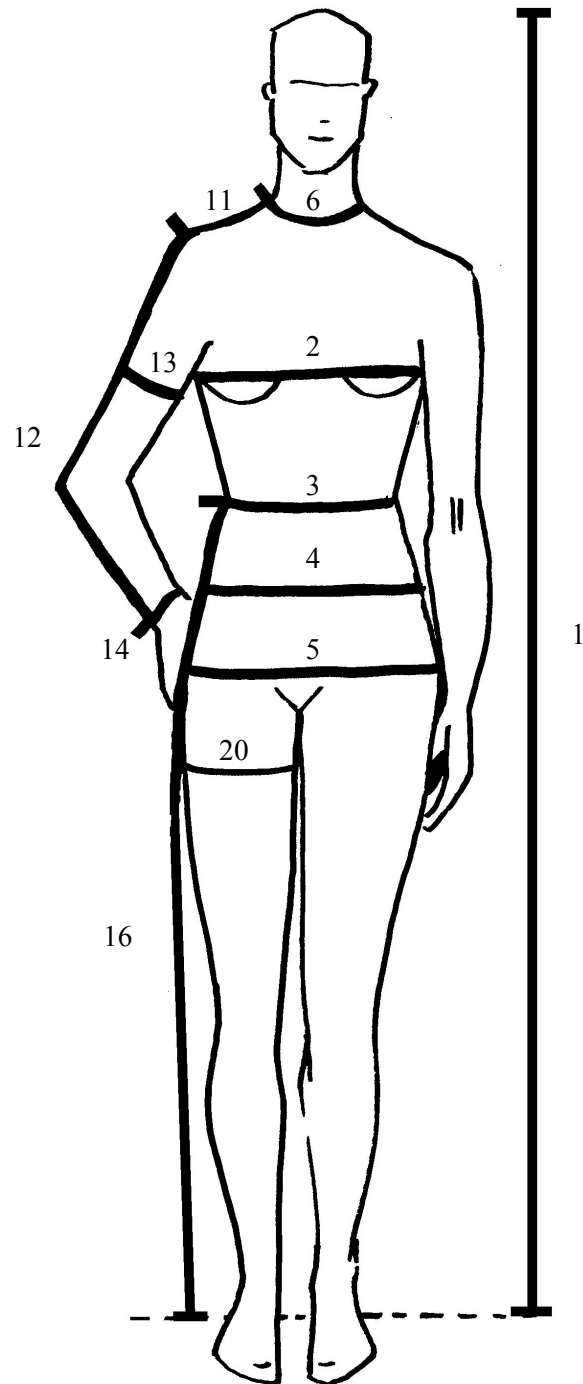


Figure 13: Full-length body figure, front view
Illustration Helene Berglin

¹²⁵ (Frost, 1987)

¹²⁶ (Gaarder, 1995; Zieman, 1994)

¹²⁷ (Lewin & Svensson, 1975; Shoben & Ward, 1987)

¹²⁸ (Shoben & Ward, 1987; Taylor & Shoben, 1984; Öberg & Ersman, 1999)

¹²⁹ (Öberg & Ersman, 1999)

are the guidelines, the pattern lines have to be smooth and therefore the high hip measurement can not be strictly considered.

5. Hip circumference

The hip, Figure 13, is measured *horizontally* at the fullest part of the hip including the buttock/glutaeus maximus, about 18-23cm¹³⁰ below the waistline depending on the height of the subject. It is important to include a protruding stomach¹³¹. The tape measure should not be so tight so that it is pulled in under a protruding stomach. If the subject is confined to a sitting position the hip measurement can not be taken horizontally. Instead the hip is measured diagonally from the buttock to the groin¹³². If necessary the left and right side of the hip circumference are registered.

The garment size for the lower part of the body is usually selected according to this measurement. A small alteration might be necessary in order to harmonise with the hip circumference of the individual.

Two additional measurements might be necessary if the subject has prominent buttocks. The hip circumference should be measured in halves; the *front* and the *back*. Measure from side to side, imagine a side seam straight down from the side of the waistline and measure according to these "seams". These measurements are used in order to determine how the hip width has to be rearranged between the front and back piece.

6. Neck circumference

The neck circumference, Figure 13, is taken with a tape measure, placed on edge, at the base of the neck, it goes through the landmark for the 7th cervical vertebra¹³³ and through the neck point¹³⁴. The measurement should correspond to a plain basic neckline.

Small alterations might be necessary, especially if the garment has a high buttoned collar.

7. Nape to waist back

The nape to waist, Figure 14, is an outline measurement from the 7th cervical vertebra, measured along the projections of the back down to the waist. The projections should include the outline of the shoulder blades/scapula¹³⁵.

This measurement is primarily used to identify the length of the garment, from the neck down to the waist. It is important to bear in mind that this measurement can include a large hunchback. In this case the measurement includes information that should be used when deciding how the garment should be lengthened/shortened but *also* information about how the garment should be altered in order to get the correct balance between front and back.

¹³⁰ (DeCosse, 1998a; Öberg & Ersman, 1999)

¹³¹ (Frost, 1987; (Liechty, Pottberg, & Rasband, 1994)

¹³² (Bergenheim, 1986)

¹³³ (European Committee for Standardization, 1998; Telmat Industrie, 1998)

¹³⁴ The intersection between the base of neck and the shoulder.

¹³⁵ (Telmat Industrie, 1998; Öberg & Ersman, 1999)

8. Back width

The back width, Figure 14, is measured with a tape measure across the back: between the right and left arm crease and over the shoulder blades/scapula. About 2.5cm above the arm hinge¹³⁶/10cm down from the nape¹³⁷. If it is necessary the left and right side of the back width is registered¹³⁸.

If the subject does not have a hunchback on one side of the back, the back width is considered a control measurement. It is measured in order to check that the back width does not get too small. If the subject has a hunchback it is necessary to analyse the difference between left and right side in order to be able to enlarge the garment at the prominent side.

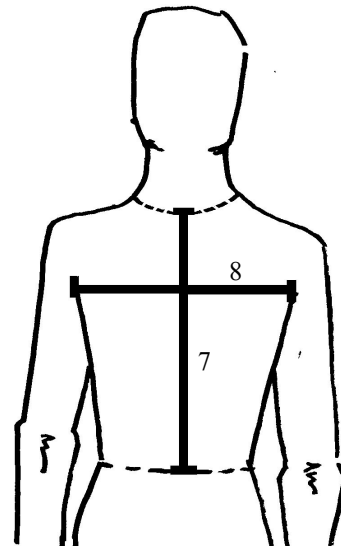


Figure 14: Body figure, back view
Illustration Helene Berglin

9. Bust point

The bust point, Figure 15, is an outline measured from the 7th cervical vertebra, around the back neck through the neck point, and down to the bust point¹³⁹. The location of the bust point can vary depending on if and how a bra is worn. This measurement has a great number of variations in the literature¹⁴⁰.

If a garment has a dart pointing toward the bust it is important that the point of the dart is at the correct level.

10. Nape to waist front

The nape to waist front, Figure 15, measurement is successive to the bust point measurement. It is measured from the 7th cervical vertebra, around the back neck, through the neck point, over the bust point, and straight down to the waist.

This measurement is used in combination with *nape to waist back* to determine if alterations are needed in order to achieve a good balance between the front and back.

11. Shoulder width

The shoulder width, Figure 13, is measured with a tape measure between the neck point and the shoulder point. This measurement is usually taken on both the left and right side of the body. It can also be useful to take a control measurement between the uttermost part of the left and right shoulder point¹⁴¹.

¹³⁶ (Huxley, 1996; (Liechty, Pottberg, & Rasband, 1994)

¹³⁷ (Melliari, 1968; Shoben & Ward, 1987)

¹³⁸ (Frost, 1987)

¹³⁹ (Frost, 1987; Öberg & Ersman, 1999).

¹⁴⁰ Measure from the waist up to the bust point (Huxley, 1996; (Liechty, Pottberg, & Rasband, 1994). Measures from the bust point to the centre front/neckline and from bust point to the outside of shoulder/acromion (DeMont, 1994).

¹⁴¹ (Corke, 1996; Huxley, 1996; Liechty, Pottberg, & Rasband, 1994)

The pattern is altered according to this measurement. If the left and right shoulder are of different widths the aim should be to make the shoulders harmonise with the shoulders of the individual but the garment should look as symmetrical as possible. In reality this usually means not to alter the shorter shoulder as much as the measurement indicates.

12. Arm length

The measurement *arm length*¹⁴², figure 13, is also called *sleeve length*¹⁴³, which actually is a garment measurement. In the literature both terms are used. In this report the term *arm length* will be used.

The arm length is measured with a tape measure in succession to the shoulder measurement, over a slightly bent elbow - approximately 120°¹⁴⁴, and down to the wrist just below the prominent wrists bone. This measurement is usually taken on both the left and the right side of the body. When the proportions of the arms are very different from standard, it is sometimes necessary to ask the subject which full sleeve length she would prefer.

The alteration to shorten/lengthen the sleeve should be made both above and below the elbow, approximately half of the alteration value on each side of the elbow.

13. Upper arm circumference

The upper arm, Figure 13, is measured around the fullest part of the upper arm, around a relaxed biceps and triceps¹⁴⁵.

This is mainly used as a control measurement, to check that the sleeve not will be too tight fitting.

14. Wrist circumference

The wrist circumference is measured around the wrist, over the prominent wrist bone.

This measurement is also used as a control measurement.

15. Waist to floor – front & Waist to floor – back

The waist to floor – front¹⁴⁶/back¹⁴⁷, Figure 15 is measured with a tape measure from the centre front/back waistline, following the contour of the stomach/buttocks, and then vertically down to the floor¹⁴⁸.

These measurements are taken for comparison, in order to determine if a balance adjustment between the front and back is necessary. It should be noted that if the waistline is sloping

¹⁴² (European Committee for Standardization, 1998; Huxley, 1996; Lewin & Svensson, 1975; (Liechty, Pottberg, & Rasband, 1994; Telmat Industrie, 1998)

¹⁴³ (Aldrich, 1980; Kindwell, 1979; Yoon, 1994; Öberg & Ersman, 1999)

¹⁴⁴ (Telmat Industrie, 1998)

¹⁴⁵ (Lewin & Svensson, 1975; Liechty, Pottberg, & Rasband, 1994; Shoben & Ward, 1987)

¹⁴⁶ (Frost, 1987; Huxley, 1996; Liechty, Pottberg, & Rasband, 1994)

¹⁴⁷ (Frost, 1987; Liechty, Pottberg, & Rasband, 1994)

¹⁴⁸ (Telmat Industrie, 1998)

toward the front or the back it would affect the measurements and later on the judgement of the pattern adaptations.

16. Outside leg length

The outside leg, Figure 13, is measured with a tape measure from the waistline on the side, following the side contour down to the hip level, and from there vertically down to the floor¹⁴⁹. This measurement is usually taken on both the left and the right side of the body.

These measurements show clearly if the subject has a warped waist. Sometimes the measurements can also indicate if one side of the body is more prominent than the other. A figure analysis is necessary to identify the disfigurements. The measurements also serve as control measurements in combination with measurements for the inside leg length and the body rise.

17. Body rise – centre front

The body rise measurement, Figure 15, is taken with the help of a set square and a tape measure. The subject stands close to a wall with the feet slightly apart. The set square is placed between the subjects legs right below the crotch, and at a right angle toward the wall. The distance between the centre front waistline and the horizontal set square is measured.

The measurement of the body rise does not indicate if the subject is warped or if the subject has a prominent body part on either side of the body. These facts are included in the outside leg length and the body rise measured on the subject's sides. This measurement indicates the body rise without including a warped waist or a prominent body part.

18. Inside leg length

The inside leg length, Figure 15, is measured in succession to the *body rise – centre front*. From the horizontal set square the inside leg length is measured vertically down to the floor. If the subject is confined to a wheelchair the set square is placed between the legs just in front of the crotch. The inside leg length is then measured with a tape measure along the inside of the leg, following the angle at the knee.

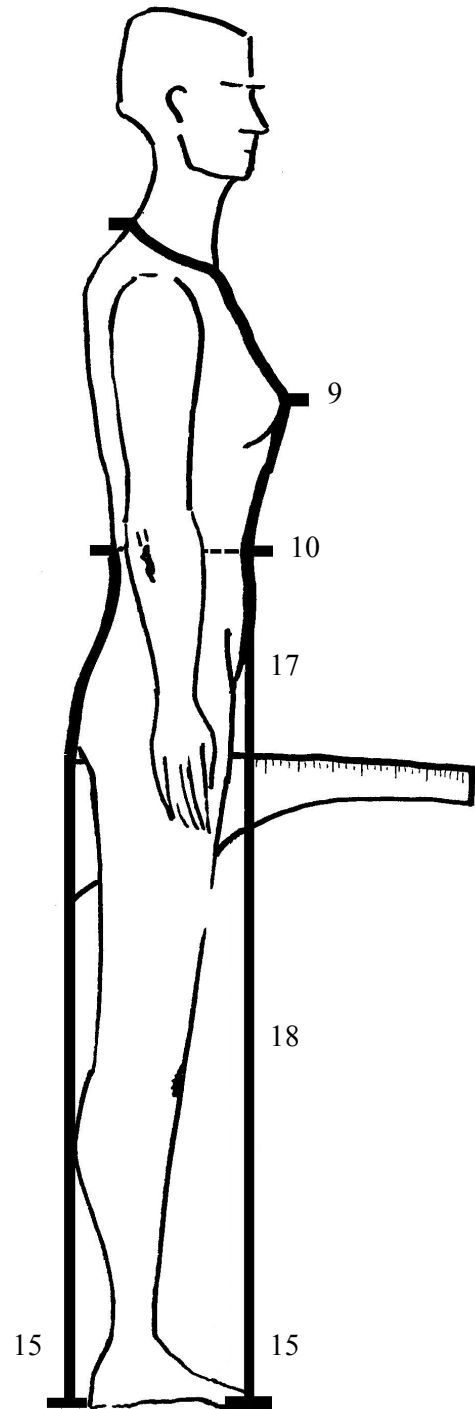


Figure 15: Full-length body figure, side view
Illustration Helene Berglin

¹⁴⁹ (Cednäs & Kjellnäs, 1977; Telmat Industrie, 1998)

This measurement determines the trouser leg length. The alteration to shorten/lengthen should be done both above and below the knee, approximately half of the alteration value on each side of the knee.

19. Body rise

The body rise, Figure 16, is measured with a tape measure, with the subject sitting on a horizontal surface. It is measured from the waistline on the side following the contour down to the widest part of the hip, and then vertically down to the horizontal surface¹⁵⁰.

This measurement, along with *outside leg length*, indicates if the subject is warped in the waist. The garment is usually made to look best when standing; in consideration of this the *outside leg length* should be the more important because it is measured in the standing position. When measuring a subject confined to a wheelchair the measurement *outside leg length* is not measured. In this case the body rise is the only measurement that indicates if the subject has a warped waist.

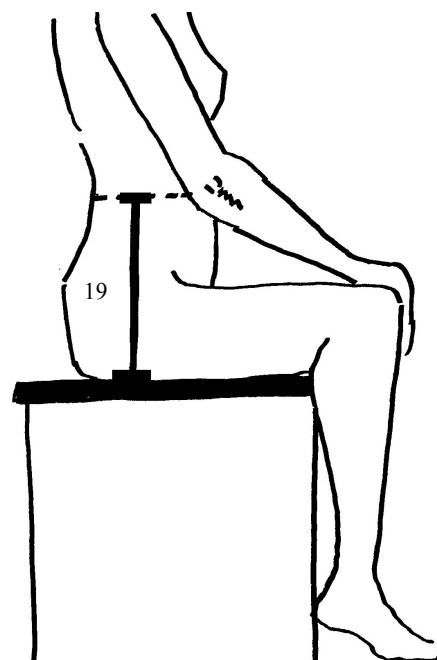


Figure 16: Body figure, sitting position
Illustration Helene Berglin

20. Thigh circumference

The thigh, Figure 13, is measured around the fullest part of the leg above the knee¹⁵¹, approximately 5cm below the crotch¹⁵².

This measurement is mainly used as a control measurement in order to check that the garment will have enough tolerance.

21. Height of neck point - front & back

The height of neck point, Figure 17, is measured with a tape measure and the front and back measurements are obtained in succession. In the literature the height of neck point is measured down to the waistline¹⁵³. This does not work well when measuring a subject with a warped waistline. When measuring down to the waistline the height of neck point includes the disfigurement of a warped waistline as well. This makes it more difficult to determine what the value actually describes. Instead, it should be measured from a horizontal line below the waist¹⁵⁴. Measure from the horizontal line in the back, through the landmark of the neck point, and down to the horizontal line in the front.

¹⁵⁰ (Telmat Industrie, 1998; Öberg & Ersman, 1999)

¹⁵¹ (Cednäs & Kjellnäs, 1977; Lewin & Svensson, 1975; Liechty, Pottberg, & Rasband, 1994; Telmat Industrie, 1998)

¹⁵² (Öberg & Ersman, 1999)

¹⁵³ (Frost, 1987; Huxley, 1996; Liechty, Pottberg, & Rasband, 1994)

¹⁵⁴ The horizontal line should be a fixed line such as the floor. Placing an elastic band around the hips can also create this horizontal line, it can, however, be difficult to place the line totally horizontal.

This measurement shows if the subject has a large difference between the height of the neck points of the left and right side. It is not an easy measurement to “read” because many factors can affect the value, for example asymmetrical disfigurements such as hunchback, different sizes of bust etc. A figure analysis is necessary to determine if a specific alteration is needed to modify the level of the neck points.

22. Height of shoulder point – front & back

The height of shoulder point, Figure 17, is measured with a tape measure, and the front and back measurements are obtained in succession. In the literature this measurement is taken from the side of the waistline, through the shoulder point, and down to the waistline¹⁵⁵. This causes the same problem as described under *height of neck point*. Instead, it should be measured from and to a horizontal line. The subject can be standing beside a low table and the measurement starts and ends at this horizontal surface.

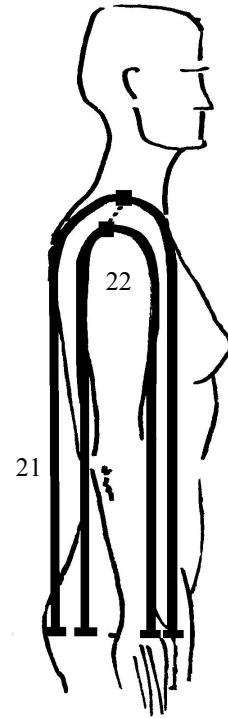


Figure 17: Body figure, side view
Illustration Helene Berglin

This measurement is used to identify if and how warped a subject is in the shoulder area. If the subject is warped in this area the first move is to compensate with different shoulder pads. If this is not enough, the pattern has to be adjusted.

23. Location and size of a hunch

How these measurements are taken in detail depends on what the hunch looks like, this should be seen as just an example. The purpose is, however, to determine the location and the size of the hunch. The size of the hunch has to some extent already been registered by other measurements. The back width taken on the left and right sides of the back registers the hunch widthways. The hunch also has to be registered lengthways. This is done by measuring from the landmark *H2*, through the landmark *H1*, and down to a horizontal line placed approximately at the waistline, Figure 18. The location of the landmark *H1* should also be registered. The location of *H2* is registered by measuring from the neck point to *H2*. These are the most important measurements in order to be able to adjust the pattern to fit the individual with a hunchback. It might be necessary to add some more measurements in order to get enough information about the hunch. In that case it is important to also register the

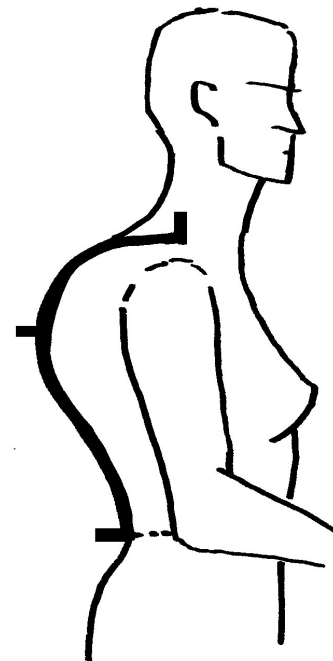


Figure 18: Body figure with hunch
Illustration Helene Berglin

¹⁵⁵ (Cednäs & Kjellnäs, 1977; Frost, 1987)

location of the measurement is also registered.

These measurements are used in order to determine how much additional length is needed around the prominent part. This can be done by comparing the measurement taken on the projection with the measurements taken on the other side of the body *or* it can be determined by measuring the pattern.

Figure analysis

The figure is registered by measurements and by photos. The photo is a reminder of how the individual actually looked and is essential when analysing the measurements. The figure illustration is extremely important in order to understand what information the measurements are giving. Two highly individual body figures can both have a bust circumference of 100cm. It would not be possible to determine where the largest volume is present on these body figures by only looking at the bust circumference. When analysing the photo it is easily seen where the volume is present. One individual might have a large bust while the other has a hunchback – but their bust circumference may be the same. Other measurements which need a clarification by figure illustrations are for example; *hip circumference*¹⁵⁶, *waist to floor front & back*¹⁵⁷, *outside leg length and body rise*¹⁵⁸, *height of neck point*¹⁵⁹.

It is important to analyse the body figure from different points and to use all means possible in order to make the best judgement getting to know the body figure by analysing the measurements and the figure illustrations!

¹⁵⁶ How the volume is distributed between front and back.

¹⁵⁷ Is the measurement indicating prominent buttocks/stomach or is it indicating a sloping waistline?

¹⁵⁸ Is the measurement showing a warped waistline or is it a prominent body part on one side?

¹⁵⁹ Is the measurement indicating warped shoulders or a prominent body part?

Pattern adaptations

The adaptations presented in this study are not easy and most of the time not possible to make when the garment is already produced. The presented adaptations increase or rearrange the length or the width of certain parts of the garment, which should be done on the pattern, before the pieces are cut.

When making an individual pattern many combinations of adaptations are usually needed. How and with what value an adaptation will be used is related to the individual figure, the design, and the other adaptations used. These three considerations are based on various information, see Figure 19. The size selection is a separate judgement done before deciding which adaptations are needed. The measurements of the selected size are compared strictly mathematically with the individual measurements. All aspects have to be considered when deciding which adaptations are going to be applied to the pattern. The adaptations and their values have to be used in a way that does not draw attention to the disfigurement. It is important to find a balance between camouflaging the disfigurement and creating a garment in harmony with the individual figure.

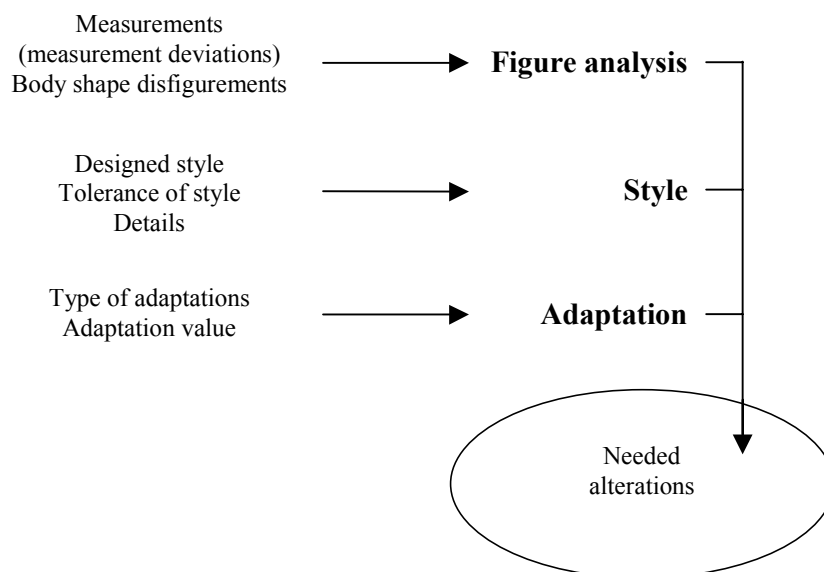


Figure 19: Factors affecting the decision of which alterations are needed

All the examples of adaptations given in this report are taken from the EASYTEX project. The individuals presented have been examined thoroughly, in the matter of body figure in relation to pattern construction. It is important to see them as examples. Before using these examples it is important to study and really understand how the different adaptations are related to various disfigurements. This is essential if correct combinations of adaptations with the right value are to be used on the individual pattern.

It is difficult to distinguish each adaptation if presented in *combination* with others. Therefore the adaptations will first be presented separately in a general presentation – in the chapter

Single adaptations. Further on they will be presented in combination with each other, applied on two unique body figures – in the chapter *Individual patterns*. The alterations are applied to a basic skirt, trousers, and fitted jacket¹⁶⁰. The reason for not using patterns with a specific design and details is that it would make it more difficult to see the individual alterations. In this study the alterations are in focus and have to be presented as clearly as possible. This is why the outline of the pattern cuts into the darts instead of just marking the dart with notches and a point. The adaptations affecting the darts are illustrated more clearly when the outline cuts into the darts. The tolerances of the garments are an important factor when deciding how to alter a pattern. In Table 3 the tolerance of the basic garments skirt, trousers, and fitted jacket are presented.

Table 3: The tolerances of the plain basic garments

Location	Garment type		
	Trousers	Skirt	Fitted jacket
Bust			+14
Waist	+4	+4	+12
Hip	+4	+4	+9
Upper sleeve			+9

The measurements for each adaptation will be presented and discussed. In many cases the body measurements do not correspond exactly to the individual garment¹⁶¹. An *alteration plan* is made on a basic pattern. On this plan all adaptations used are marked out with their values. These alterations are then applied to a pattern in the software FitNet. The *final adapted pattern* is presented on top of the basic pattern in order to illustrate the differences. The pattern outlined with a thick line is the altered pattern and the one with the thin line is the standard sized pattern. The patterns will be placed in a way that illustrates the differences as clearly as possible. In order not to take up too much space on the pages, only the pattern pieces including the main adaptations are presented.

Key to the adaptation plan

In order to understand the *alteration plans* some symbols have to be explained. The unit of measurement is the centimetre and it is always prefixed with plus or minus sign if it is a positive or negative value. If the waist circumference has to increase the adaptation values around the waist are all positive. Notice that a positive value marked at the dart indicates that the waist will be increased by decreasing the size of the dart. If the value has a circle around it the adaptation is meant to be vertical – without a circle the adaptation is horizontal. Sometimes a value will be marked between two pattern pieces placed pretty close to each other. In these cases the value is meant to be adapted on both pattern pieces. When it comes to the sleeves the same adaptations are often done on both the right and the left side, but the value might be different. In these cases the adaptation plan shows only the left sleeve but both the right and the left value are illustrated.

¹⁶⁰ Same block patterns, without a design added that were used in phase A.

¹⁶¹ As said before, not all body measurements are used exactly according to the measured value, see chapter *Made-to-Measure garments*.

Single adaptations

In this chapter the single adaptation are explained. They are explained and executed on garments with the standard size C38. These adaptations are divided into four main categories. The same grouping is used as with the classification of the disfigurements, short/tall stature, warped figure, prominent figure, and wheelchair user. Adaptations representative of each group are presented. The adaptations presented might not be the only way to alter the pattern to fit a specific disfigurement. However, most of the individual garments, produced within the EASYTEX project, are adapted with a combination of these adaptations.

Each adaptation is developed according to a specific disfigurement. A description will be given concerning how the disfigurements affect the body shape and the garment fit. The important measurements for each disfigurement are also presented. Note that these single adaptations are isolated from the whole body figure, they are not analysed in combination with any other adaptations. The various adaptations will be combined when applied on a complete body shape, see chapter *Individual patterns*. These final patterns have to have pieces that fit together and are easy to assemble.

Short/tall stature

Individuals with a short or tall stature have problems with the length of the garment. The garment is either too long or too short or maybe a combination of both but in different parts of the clothing. Some adjustments are possible to make on the produced garment, such as small shortenings of sleeves or trouser legs. This can, however, be difficult if the garment has details in the areas where the shortening needs to be done. The adaptations needed for individuals with a short or tall stature is simply a shortening or lengthening of the pattern. This can be done in different places on the pattern pieces, depending on the proportions of the individual.



Figure 20: Individual with short stature
Illustration Helene Berglin

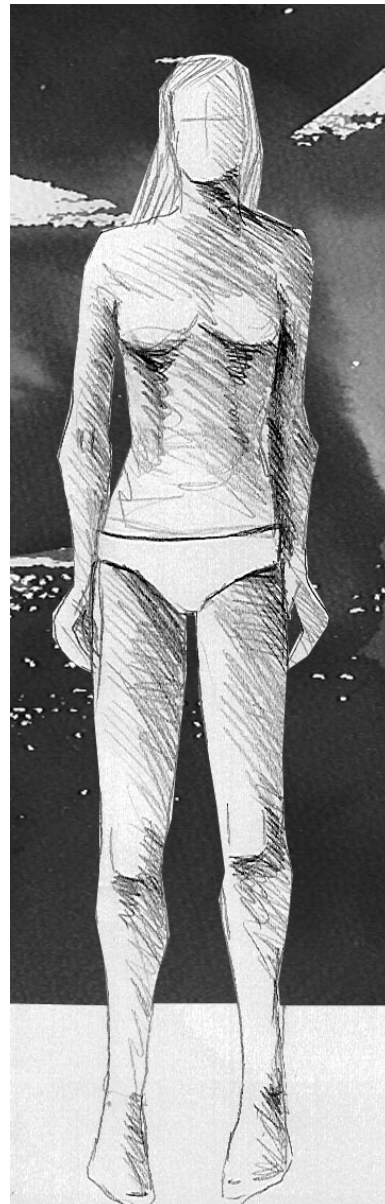


Figure 21: Individual with tall stature
Illustration Helene Berglin

Short stature

The test persons with a short stature can have a proportional body figure, Figure 20, page 58. However, it is also quite usual that they have a disproportion between the extremities and the torso. The short individual has problems with the length of the ready-made garments, Figure 22. Smaller alterations are possible to make on the ready-made garment but larger alterations create bad proportions, for example, by shortening the length of the jacket only at the hemline. It is necessary to shorten the pattern for a fitted jacket between the waist and the armpit in order to get the waist at the correct place. The adaptations have to be made on the garment pattern.

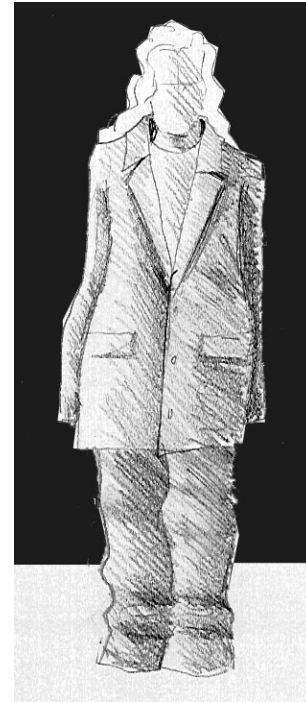


Figure 22: Fitting problems caused by the short stature
Illustration Helene Berglin

The main measurement indicating a short stature is the *height* of the individual. In addition to this, other *length* measurements are necessary to study in order to learn about the proportions of the figure. For the lower part of the body the *body rise* and the *inside leg length* are essential. For the upper part of the body the *nape to waist* and the *arm length* are the important measurements. In this example it is clear that the extremities¹⁶² are very short, -14cm for the arms and -27.5cm for the legs. The torso on the other hand is only -5.5cm shorter, all compared to the standard C38, Table 4.

Table 4: Measurements that indicate the short stature

Measurements	Individual measurements				Difference			
	Total	Right	Left	C38	Total	Right	Left	Averag
Height	137			168	-31			
Nape to waist	35.5			41	-5.5			
Arm length	46			60	-14			
Inside leg length	50.5			78	-27.5			
Body rise	23			26	-3			

The trousers will be shortened both according to the *inside leg length* and in relation to the *body rise*, Figure 23, page 60. It is important to consider that the length and width of the trousers legs are proportionate. In this example only the length is considered due to the *single* adaptation presentation. The trousers legs and the body rise are shortened according to the measurement, -27cm and -3cm respectively. The darts are shortened -1.5cm. If a designed pair of trousers are adapted one have to know if they have a waistline that is cut low, in this case it is important not to make the trousers too low especially at the back.

¹⁶² Extremities are the legs and arms.

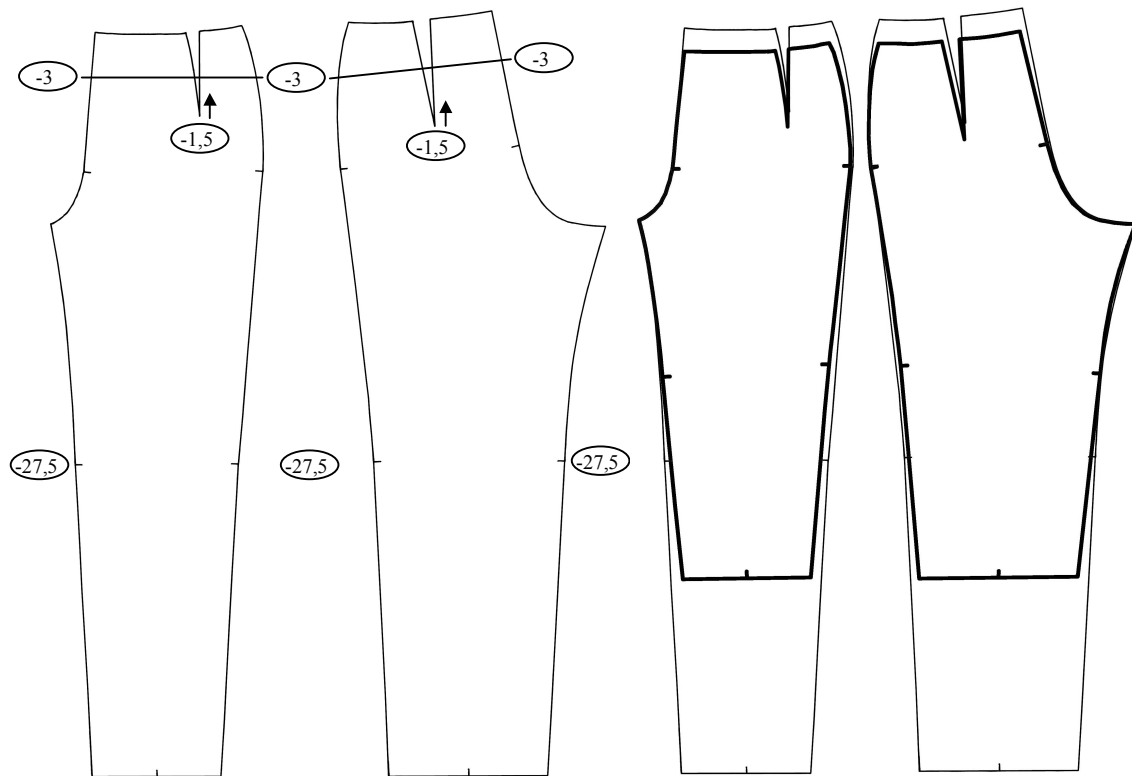


Figure 23: A pair of trousers for the short individual

The *nape to waist* and the *arm length* are the most important measurements when deciding how to adapt the fitted jacket according to a short stature. The bodice will be shortened according to two measurements, the nape to waist and the body rise. As it is illustrated in Figure 24, page 61, the nape to waist is shortened in two places, totally -5.5cm . The shortening in the scye has to be done with great care. A little bit of the shortening is placed in this area in order not to make the armhole depth too deep and cut too close to the waist. The goal is to keep the proportions of the garment. On the other hand it is important not to get a too small/tight scye. If the scye is too tight it affects the comfort of the garment. When adapting the scye the sleeve head has to be adjusted as well.

In addition to the shortening according to the nape to waist the total length of the garment is also shortened at the hemline, -4cm . The body rise measurement serves as a *guideline* but it is important that the lengths of the different parts of the garment are proportionate as well as harmonising with the individual figure. The sleeves are shortened according to the measurement. It might be necessary to adjust the width around the wrist when shortening the sleeve, in this example that is not done.

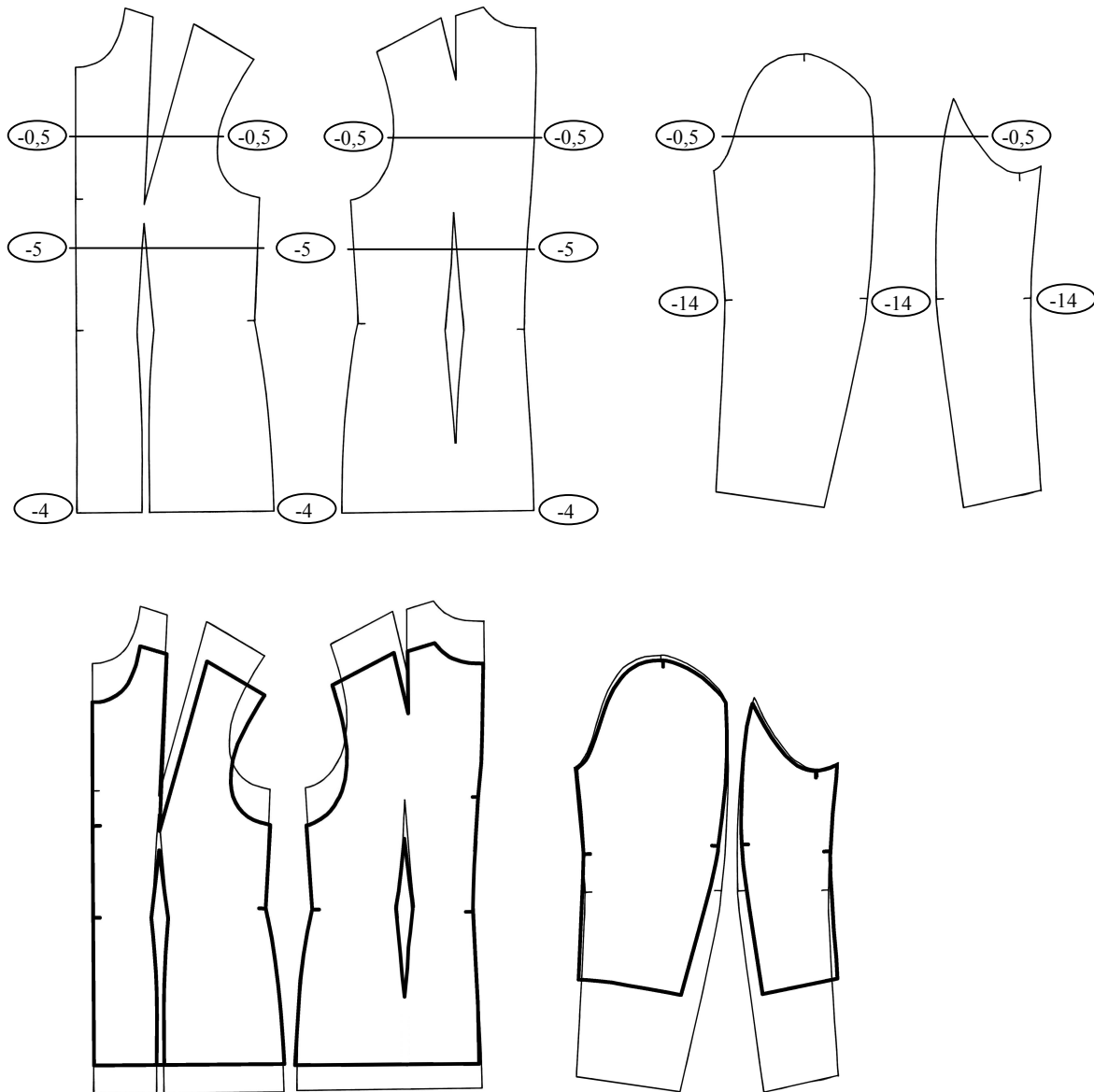


Figure 24: Fitted jacket for the short individual

Tall stature

An individual with a tall stature, Figure 21, page 58, would need to have the patterns adjusted at the same places as an individual with a short stature, but of course with increasing values instead of decreasing.

Warped figure

The individuals with warped figures have a balance problem with standard garments. The balance between right and left side of the garment does not harmonise with the figure. This can lead to a down-slanting hemline or uncomfortable gathers of fabric.



Figure 25: Body figure with warped shoulders
Illustration Helene Berglin



Figure 26: Body figure with warped waist A
Illustration Helene Berglin



Figure 27: Body figure with warped waist B
Illustration Helene Berglin

Warped shoulders

An individual with warped shoulders does not have the shoulders aligned horizontally, Figure 25, page 62. This gives problems with the garment fit of a standard jacket. One side of the jacket is pulled up in relation to the other side, which creates a down-slanting hemline, Figure 28.



Figure 28: Fitting problems caused by the warped shoulders
Illustration Helene Berglin

The measurements indicating warped shoulders are first of all, *height of shoulder points*, and secondly *height of neck points*. The measurement used in this example, *height of shoulder points*, does not have a standard measurement to be compared with. The measurements from the left and right side of the body are compared, here the difference is 8cm, Table 5.

Table 5: Measurements that indicate the warped shoulders

Measurements	Individual measurements				C38	Difference			
	Total	Right	Left			Total	Right	Left	Average
Height of shoulder point front		50	58						

The garment needs to be adjusted in order to get a straight hemline. On the other hand the shoulders should not look as warped as they actually are. The lower shoulder is built up by adding a 2cm thick shoulder pad. When a shoulder pad is added the inner circumference of the scye becomes smaller, Figure 29, and needs to be compensated. Enlarging the scye depth with half of the shoulder pad's thickness solves this. The sleeve head has to be modified in order to fit into the scye. In addition to the extra shoulder pad the garment has to be warped, Figure 30, page 64. The right side seam will be shortened -3cm. In total 5cm out of the 8cm in difference is considered. This adaptation also affects the centre front and back. These are moved in order to keep them *aligned* with the grain line.

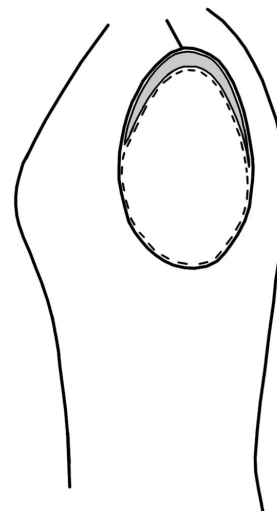


Figure 29: Inner circumference of scye

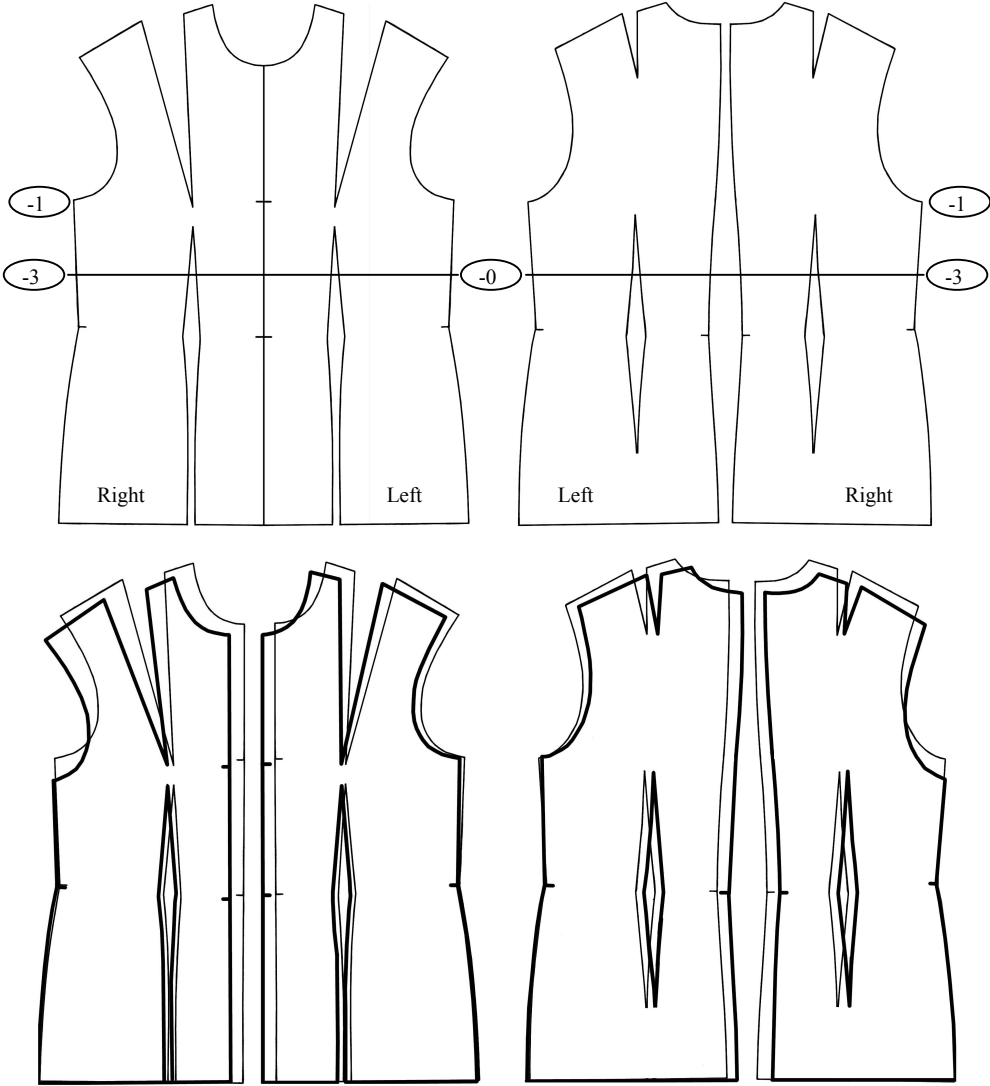


Figure 30: Fitted jacket for the individual with warped shoulders

Warped waist

The individual with a warped waist does not have a horizontal waist line, Figure 26 & 27, page 62. The warped waist usually creates problems with the standard trousers and skirts. The trousers usually create an uncomfortable gathering of material on the lower side, Figure 31. When it comes to standard skirts the down-slanting hemline is the most visible. The balance between right and left side of the garment has to be adjusted.

The measurements indicating a warped waist is the *outside leg length* and sometimes the *body rise*. If the body rise value is added to the inside leg length value their sum should approximate to the outside leg length. In this example the sum does not add up exactly to the outside leg length. However, the measurements, along with the figure illustration, show that the left side is quite a bit lower than the right side. As usual, not the whole value will be used when the adaptation value is decided. The difference between left and right is about 6-8cm, Table 6. Two ways of adapting the trousers to fit the warped waist will be presented.

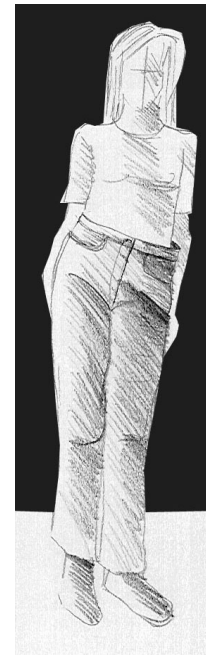


Figure 31: Fitting problems caused by the warped waist
Illustration Helene Berglin

Table 6: Measurements for indicating a warped waist

Measurements	Individual measurements				Difference			
	Total	Right	Left	C38	Total	Right	Left	Average
Outside leg length		105	97					
Inside leg length	78			78				
Body rise		26	20	26	0		-6	

Alternative one

The height of the right side will be kept while the left side is lowered -4.5cm, Figure 32A+B. The whole difference will not be taken into consideration because it would create too warped a waistline. This alternative should be used if the individual wants to have the waistband in the anatomical waist. Otherwise it is preferable to use alternative two.

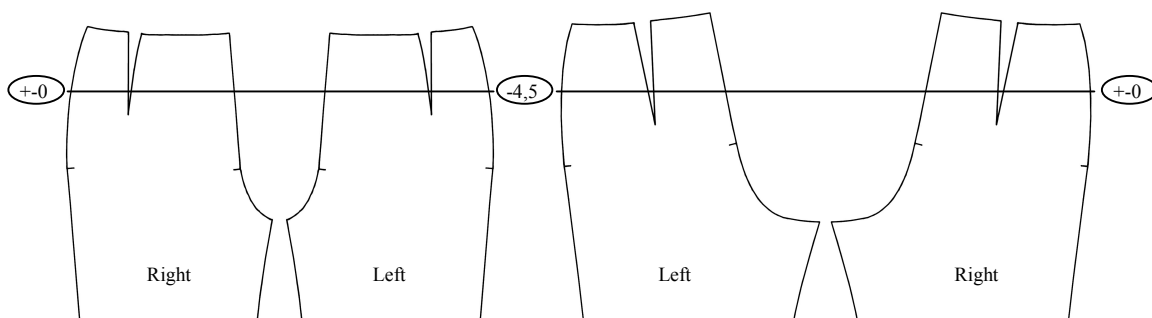


Figure 32A: A pair of trousers for the individual with a warped waist, alternative 1

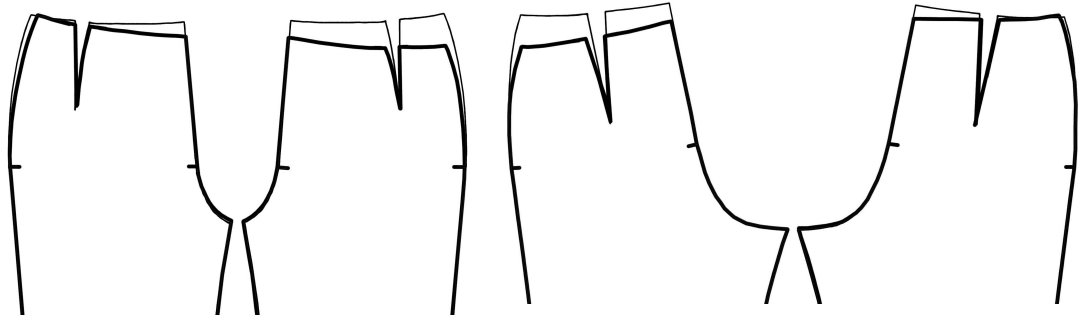


Figure 32B: A pair of trousers for the individual with a warped waist, alternative 1

Alternative two

The height of the left side will be lowered according to the body rise, -6cm, Figure 33. In order to avoid a very warped waistline the right side is lowered by -3cm *along the side seam*. The right side of the waist will not be placed in the defined anatomical waist but lowered towards the high hip. The new placement of the waist in the right side demands a larger circumference. This is why the waist is lowered along the side seam instead of straight down with the same waist circumference. It is important to be aware of the waist and hip tolerance of the garment. Usually the hip has more tolerance than the waist, this has to be taken into consideration when moving the waist along the side seam. The waist circumference is not allowed to increase too much.

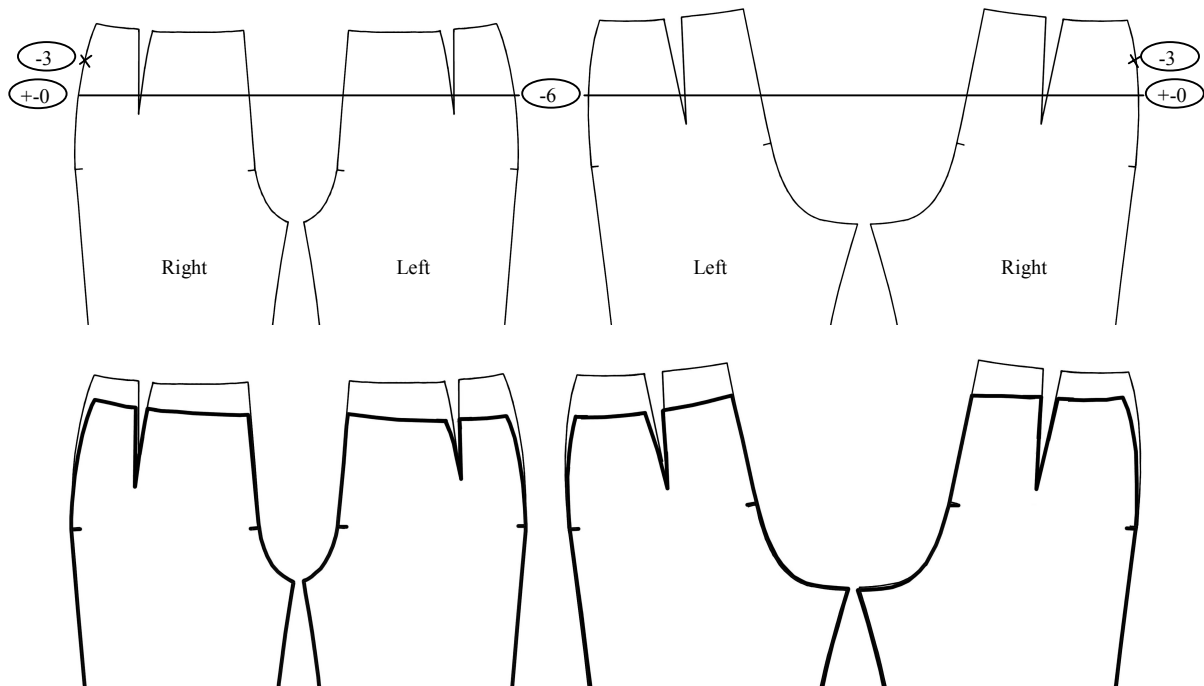


Figure 33: A pair of trousers for the individual with a warped waist, alternative 2

The two alternatives have the practical action of warping the garment pattern in common. The two front and back garment pieces are put together along the centre front and the centre back respectively. The waist is warped according to the planned value. The front and back pieces are separated and the adaptation is finished.

Prominent disfigurements

Individuals with a prominent disfigurement have problem with the garment fit because the projection does not fit into the garment. Usually they have to select a garment with a larger size. The projection might fit into the garment but the larger size makes the garment too big in other areas. The adaptations need to enlarge the pattern over the prominent body part without enlarging the whole garment. The increase of the pattern can be made either lengthways, widthways, or with a combination of both.



Figure 34: Body figure with arched back
Illustration Helene Berglin



Figure 35: Body figure with prominent buttocks
Illustration Helene Berglin

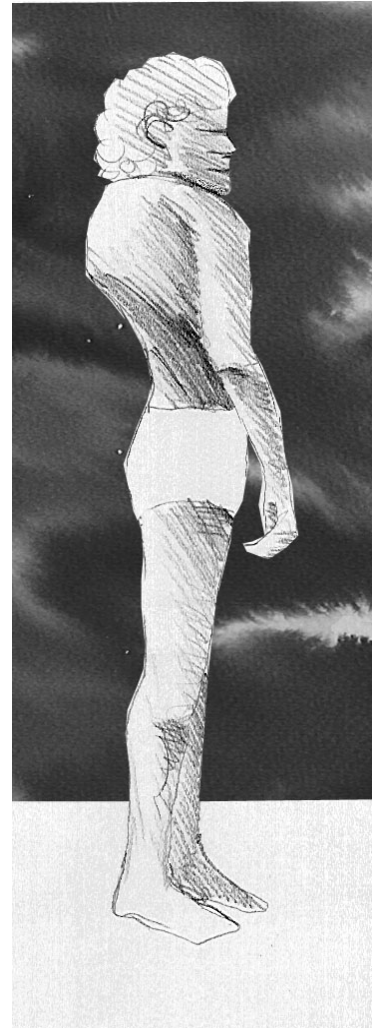


Figure 36: Body figure with hunchback
Illustration Helene Berglin

Arched back

An individual with an arched back has a long back and a shorter front, Figure 34, page 67. The vertical measurement of the trunk is shorter because the spine has changed from straight to very curved. The problems with fit are that a standard jacket pulls up in the back and is too long and baggy in the front. The balance between the front and back needs to be adjusted.

The measurements *nape to waist* and *nape to waist front* indicate that the balance between front and back is not according to the standard measurements. The back has to be lengthened while the front has to be shortened, Table 7.

Table 7: Measurements indicating the arched back

Measurements	Individual measurements			C38	Difference			
	Total	Right	Left		Total	Right	Left	Average
Nape to waist back	42			41	+1			
Bust point		32		35		-3		
Nape to waist front		42		52		-10		

The front has to be shortened -10cm and the back lengthened +1cm, according to the actual body measurements. However, the total balance difference of 11cm will not be taken into consideration. A difference of 9cm will be enough to give the garment a good fit and comfort. The length of the back will be kept while the front will be shortened -9cm, Figure 37A+B. Note that the bust dart is made smaller when shortening the front. The length of the scye front and back is rearranged, the front is shortened and the back is lengthened. This affects the sleeve as well. The shoulder notch has to be moved in order to match with the shoulder seam, in this case 2cm to the front.

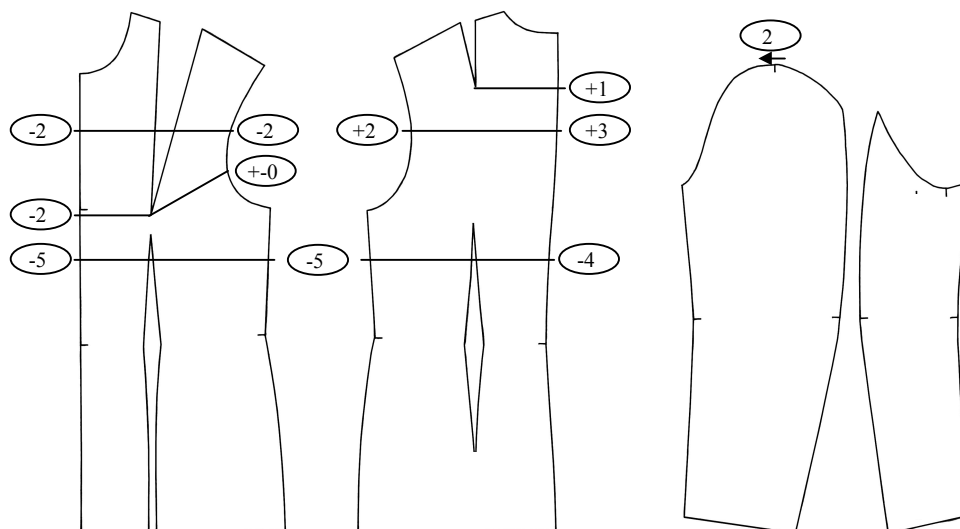


Figure 37A: Fitted jacket for an individual with arched back

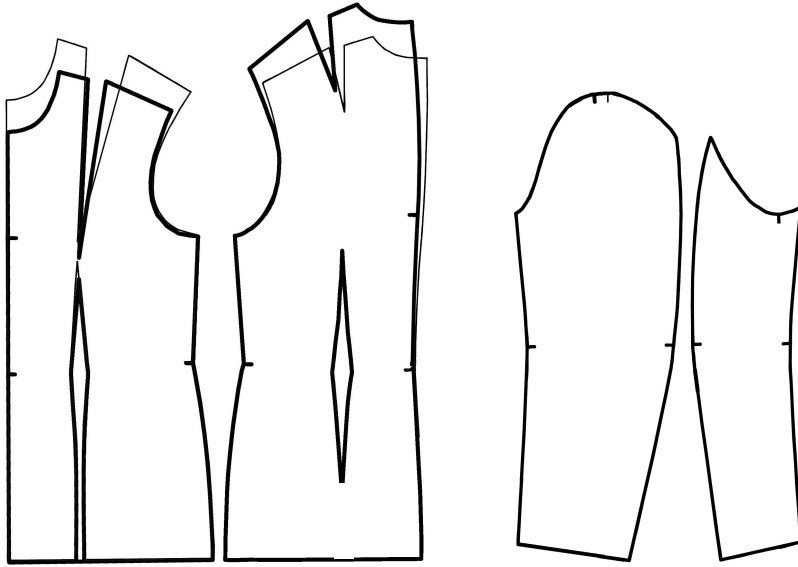


Figure 37B: Fitted jacket for an individual with arched back

Prominent stomach

An individual with a prominent stomach is illustrated in Figure 34, page 67. This disfigurement usually leads to problems, with for example a skirt. The prominent stomach makes a standard skirt pull up at the front, which causes a hemline that is not horizontal as desired. The front piece of the skirt has to be lengthened and formed considering the stomach. Another way of handling the prominent stomach is to enlarge the waist of the skirt so that the waistband does not go all the way up to the anatomical waistline in the front. This is preferred if the disfigurement is quite small.

There are no clear measurements indicating this disfigurement. However, the balance between the measurements waist to floor - front and waist to floor - back can be used as a guideline, but only as a guideline. Otherwise, it is important to analyse the figure illustrations from the side view. The two measurements presented in Table 8 can not be compared with standard measurements. The difference between the front and the back indicates that there is a prominent stomach and/or rather flat buttocks. When studying the figure illustration it is confirmed that a prominent stomach gives the large value for the waist to floor front. As said before these measurements can only be compared and used as guidelines.

Table 8: Measurements that can be used a guideline for the prominent stomach

Measurements	Individual measurements				C38	Difference			
	Total	Right	Left			Total	Right	Left	Average
Waist to floor front	105								
Waist to floor back	100								

The centre front of the skirt will be lengthened +2cm, Figure 38. This has to be done without lengthening *the side seam*. *The centre front is lengthened* and a dart is added along the waistline. This lengthens the piece and adds more form to it as well. The alteration shown here does not change the circumference of the waist. However, it would be suitable to give the waist of the garment more tolerance than usual. This would prevent the prominent stomach from being emphasised and makes the garment more comfortable. Note that the side seam of the front piece does not have much form. This has to be considered when adding other alterations to this area of the pattern.

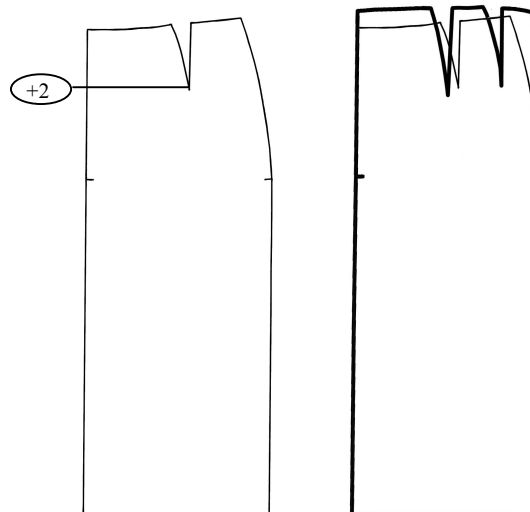


Figure 38: Skirt for the individual with prominent stomach

Prominent buttocks

The condition of having prominent buttocks is considered to exist when the largest volume around the hip area is placed at the back, Figure 35, page 67. The individual with prominent buttocks usually has problems with the garment fit when it comes to the relation between the seat and the waist. The individual has to select the garment according to the hip measurement. The waist on the garment is then usually too large, especially at the back, Figure 39. Prominent buttocks in combination with a flat stomach also create an S-formed side seam. The width of the trousers has to be rearranged, increasing the back piece and decreasing the front piece. The waist usually has to be decreased as well.



Figure 39: Fitting problems caused by the prominent buttocks
Illustration by Helene Berglin

The measurements indicating prominent buttocks would be the hip circumference measured *at the front* and *at the back*. The difference between the front and the back hip measurement is 8cm, Table 9.

Table 9: Measurements indicating the prominent buttocks

Measurements	Individual measurements				Difference			
	Total	Front	Back	C38	Total	Front	Back	Average
Hip circumference	96	44	52	96	0	-4	+4	

When planning this adaptation it is very important to know the proportions of the standard garment. The standard garments presented here have the hip circumference divided evenly between the front and the back piece of the garment¹⁶³. In this case, and according to the measurements, the front pieces need to decrease, -4cm and the back pieces need to increase, +4cm around the hip area, Figure 40, page 72. The increasing/decreasing value marked at the waist relates exactly to the rearrangement value. However, the increasing/decreasing will not be as large at the hip area due to the zero value at the hemline. Note that this adaptation, in addition to the rearrangement of the width also decreases the waist circumference of the garment, in this example, -4cm in total. The crutch length is increased on the back piece.

¹⁶³ There are, for example, skirts where the front piece is larger than the back one.

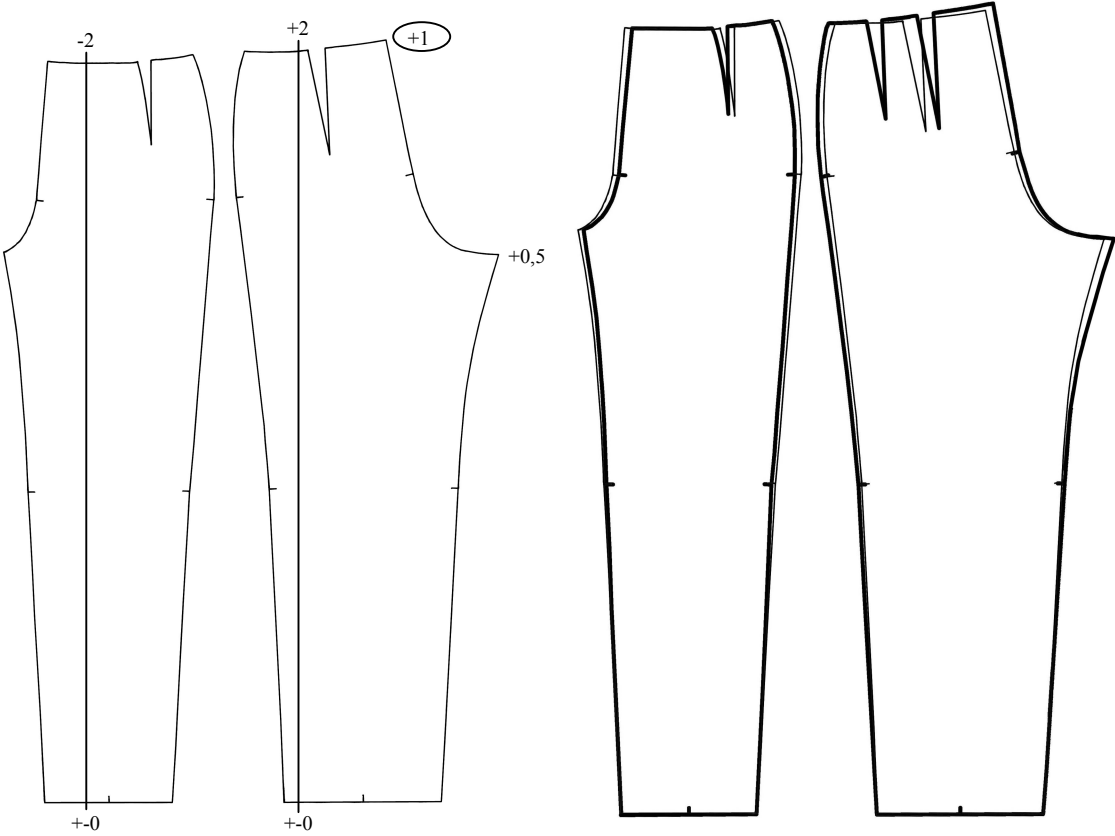


Figure 40: A pair of trousers for the individual with prominent buttocks

Hunchback

A hunchback is a projection of the back, Figure 36, page 67. The test persons with hunchback in this study have the main projection on either the left *or* the right side of the back. The individual with a hunchback has problems with a standard garment because it is not large enough over the actual hunch. The garment pulls up at the hunch and it is usually too tight widthways, Figure 41. The pattern has to be increased over the hunch without increasing other parts of the garment. This has to be done in a way that does not draw attention to the hunch.

When an individual has a hunchback, extra measurements are taken in order to determine how large the hunch is and where it is placed, see the chapter *Measurements*. The style used as a starting point has to have style lines on the back piece, from the shoulder seam and down. This is necessary in order to form the back piece around the hunch without adding too many darts, pointing toward the projection. The style lines keep down the number of darts or pleats necessary for the good fit.

It is important to select a smaller size than indicated by the bust circumference. The extra width needed due to the hunch is indicated by the *back width*. By comparing the right and left side of this measurement the approximate size of the hunch widthways is determined. The extra width needed should be subtracted from the total bust circumference, the remainder is the circumference that should serve as a guideline when deciding the size of the standard garment. In this example the bust circumference is $92.5\text{cm} - 4.5\text{cm} = 88 \rightarrow$ size C38, Table 10.

The measurements tell us quite a bit, but it is important to analyse these in combination with the figure illustrations. In this example the hunch is placed on the right side of the back. The back width indicates that the right side of the back is approximately 4.5cm larger than the left side. Lengthways, the right side is about +4.5cm longer than the left side and the nape to waist is 1 cm longer than the standard pattern.



Figure 41: Fitting problems caused by the hunchback illustration Helene Berglin

Table 10: The measurements indicating the hunchback

Measurements	Individual measurements				Difference			
	Total	Right	Left	C38	Total	Right	Left	Average
Bust circumference	92.5			88	+4.5			
Back width	40.5	22.5	18	35.8	+4.7	+4.6	+0,1	
Nape to waist	42			41	+1			
H2 to waist through H1		47.5	43					

The pattern has to be increased both lengthways and widthways, Figure 42. The increase is not as large as the measurements indicate. +3.5cm will be added both lengthways and widthways. In order to get an acceptable form of the pattern pieces a dart is added along the shoulder seam and a fold is placed on the scye line. The dart and the folds prevent the seam over the hunch from being too curved. It is possible to change the dart to a fold and visa versa¹⁶⁴. The right pattern piece is increased by +2cm at the hemline, which gives a looser fit around the waist under the hunch. This is to decrease the visible difference between the projection and the waist. The pattern pieces on the left side are altered very little, not only to compensate for the longer nape to waist but also to smoothen the contour of the back from the hunch on the right side over to the flatter left side.

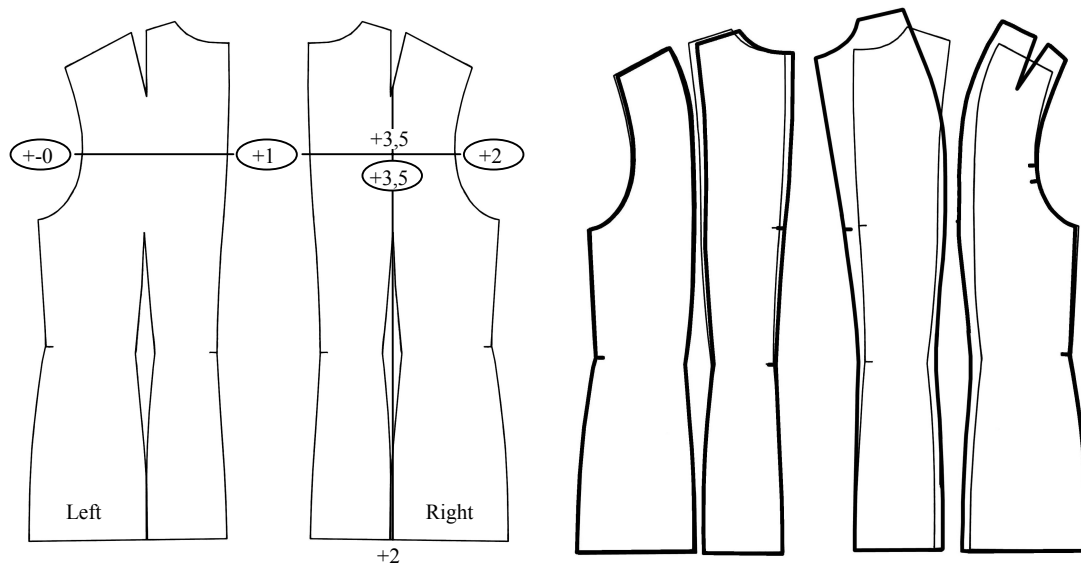


Figure 42: Fitted jacket for the individual with a hunchback

¹⁶⁴ It could also be suitable to modify the design and include the darts in a yoke.

Wheelchair user

Wheelchair users, Figure 43, have specific fitting problems with garments for the lower part of the body. Their problems for the upper part of the body are more concerned with the design of the garment¹⁶⁵. The jacket should not be too long because it can be uncomfortable and unpractical to sit on the garment. Another design detail is that the sleeves wear out by constantly touching the wheels, reinforcement might be the solution. These two example problems are not taken care of by only adjusting the garment according to the individual figure. The standard garment first has to be designed to fit the user demands. With that garment as a base, modifications can be made according to the figure in order to get a better garment fit. The trousers on the other hand have to be adapted in order to get a good garment fit.



Figure 43: Individual confined to a wheelchair
Illustration Helene Berglin

¹⁶⁵ They might be in need of individual garments for the upper part of the body as well but then it deals with disfigurements that are not specific for the wheelchair user, such as warped shoulder, hunchback etc.

The trousers available in the regular retail stores are made for a standing position. To fit the sitting position the balance between the front and the back needs to be rearranged, decreased at the front and increased at the back, Figure 44.

There are no measurements that indicate how much the balance needs to be rearranged. In this study the opportunity was given to try out how the adaptation should be applied on standard trousers. It is important to study the profile view of the individual. The adaptations and values presented here are for an individual with a rather horizontal waistline. If the waistline is sloping either forward or backward other adaptation values might be necessary. The balance between the front and back of the trousers is rearranged. The crutch is lengthened on the back and shortened on the front, Figure 45. In total the crutch length is also lengthened. Note that the side seam of the front piece has much form. This has to be considered when adding other alterations to this area of the pattern.

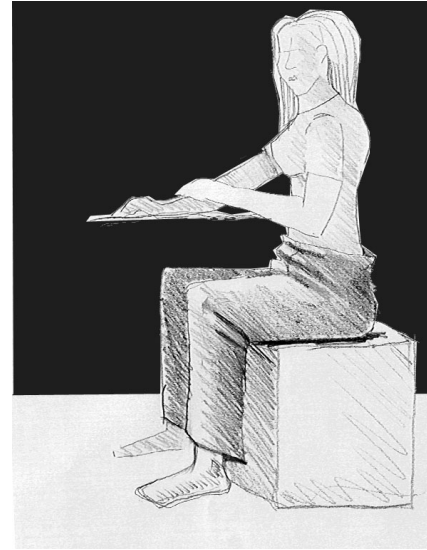


Figure 44: Fitting problems caused by the sitting position
Illustration Helene Berglin

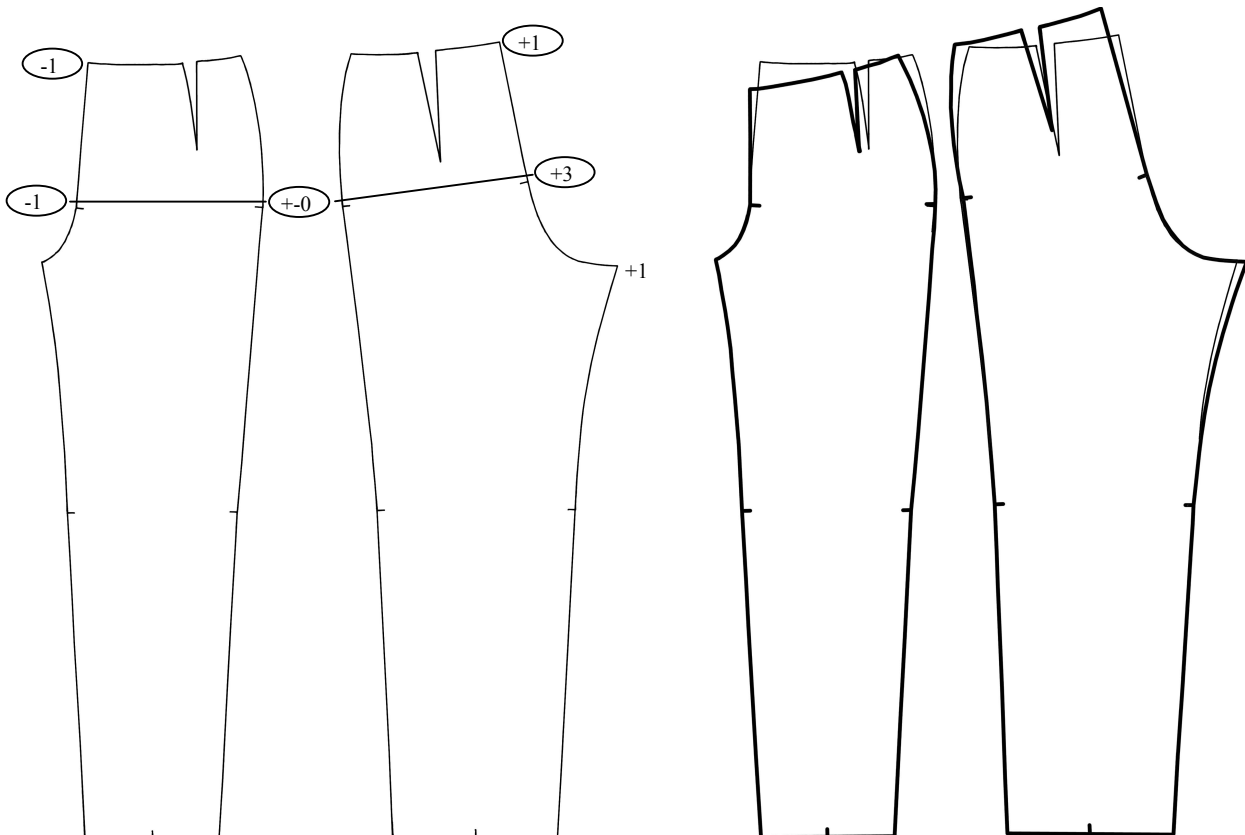


Figure 45: A pair of trousers for the individual confined to a wheel chair

Other adaptations

The adaptations presented above are examples of adaptations which change the pattern according to a *body shape disfigurement*. Adaptations, which are common knowledge among pattern constructors, were not to be brought up here. However, a frequently used adaptation is the decreasing of the waist circumference. This can be carried out in many ways with and without additional darts. A couple of words should be said about this adaptation.

The hip circumference is usually used to identify the garment size suitable for the lower part of the body. Due to this the hip circumference usually corresponds quite well with the circumference of the garment. Adjustments are usually needed in the waist area. A *larger* decrease has to be done by adding extra darts along the waistline. A figure analysis is necessary in order to determine where the extra darts should be placed. By looking at the relation between the hip and waist area it is possible to determine where the decrease should be placed. If the largest difference between the hip and waist is at the back, the decrease should be added on the back piece. If the largest difference is at the front the extra darts should be placed on the front piece. However, it is as common that the decrease is evenly divided around the waist.

Individual patterns

The goal with altering patterns is to achieve well-fitting garments for individuals with various disfigurements. In this chapter single adaptations will be combined to fit a unique figure. The small *measurement deviations* and the larger adaptations according to the *body shape disfigurements* are both included in these *individual patterns*.

Each individual pattern will be presented according to the process presented in the chapter *Made-to-Measure garments*¹⁶⁶. The style selection will not however be brought up in detail because the adaptations will be presented on the basic blocks without any styles added¹⁶⁷. The measurements necessary for the specific garment and the individual body figure are presented and discussed. The presentation of the adaptations will be done in the same way as in the chapter *Single adaptations*. The *adaptation plan* illustrates the placement and values of the adaptations, this is done on a standard C38 block. The adapted pattern on the other hand will be compared with a standard block of the selected size, for example size C42.

The two individuals exemplified here are selected because they have disfigurements, which need various combinations of adaptations in order to get a well-fitting garment. The two test persons are called **A** and **B**.

¹⁶⁶ Figure analysis → Style selection → Size selection → Needed adaptations

¹⁶⁷ As said before, the reason for not using patterns with a specific style and details is that it would make it more difficult to see the specific alterations.

Test person A

The most obvious disfigurements when **analysing the figure** of test person A are the arched back in combination with a prominent stomach, Figure 46. The buttocks are rather flat and almost aligned with the lower back. The hipbone on the left side is slightly prominent. Due to an operation on one of the hipbones she was not able to sit down for the measurement *body rise*. Instead the warped waist was determined only by the *outside leg length*.

The garments that will be presented here are the fitted jacket and the trousers. There were only a limited amount of styles within the project from which to choose.

However, when **selecting a style** there are a couple of things to think about when it comes to this kind of body figure represented by test person A. Because of the prominent stomach it would be most suitable to select a fitted jacket that does not have a narrow emphasised waist. The fitted jacket has to have at least one seam on the back piece. Due to the arched back it is necessary to give the back piece more form than the standard jacket has. Considering the warped waist it would be more comfortable if the waistband had a little section of elastics¹⁶⁸.

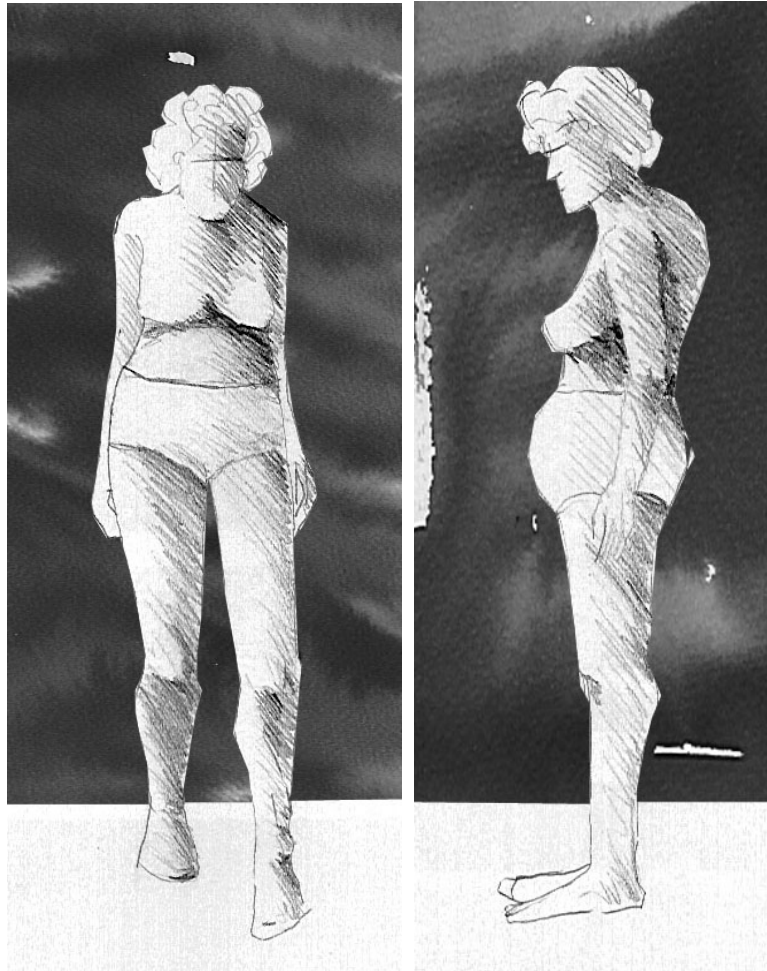


Figure 46: Figure illustration of test person A
Illustration Helene Berglin

¹⁶⁸ Elastics were available on some of the garments offered in the project and the outcome was more comfort and ease in obtaining a good fit around the waist.

Trousers

The **size selection** for the trousers is done according to the hip circumference that is exactly in-between two standard sizes. The larger size, C42, was selected in order to make the adaptation for the waist circumference a little smaller, Table 11.

Table 11: The needed measurements for test person A's trousers

Measurements	Individual measurements				Difference			
	Total	Right	Left	C42	Total	Right	Left	Average
Height	154							
Waist circumference	85			78	+7			
High hip circumference	98			95	+3			
Hip circumference	100			102	-2			
Waist to floor – front	103.5							
Waist to floor – back	97.5							
Outside leg length		99	103					
Inside leg length	72			78	-6			

The individual measurements related to the trousers are listed in Table 11. A few **adaptations are needed** in order to get a well-fitting pair of trousers. The *measurement deviations* are the hip and waist circumference, and the inside leg length. The prominent stomach and the warped waist will be considered according the single adaptations *prominent stomach* and *warped waist alternative 1* explained in the chapter *Single adaptations*. The waist will be increased +7cm, as seen in Figure 47, page 80; some of the increase is done at the back darts but nothing at the front ones. This is because the flat buttocks do not need as much form as the prominent stomach¹⁶⁹. The warped waist is adapted according to the outside leg length measurements. The whole difference is used because A's warped waist is an ageing disfigurement, which probably will increase in the near future. In Figure 48, page 80, the adapted pattern is illustrated and compared with the standard size C42 trousers. Extra darts are added along the front waistline in order to give the length and form needed for the prominent stomach. The final pair of trousers are illustrated in Figure 51, page 83.

¹⁶⁹ The right and the left waist measurements were not obtained at the start. The decision to add more width to the left side of the waist was taken after an evaluation of the test garment.

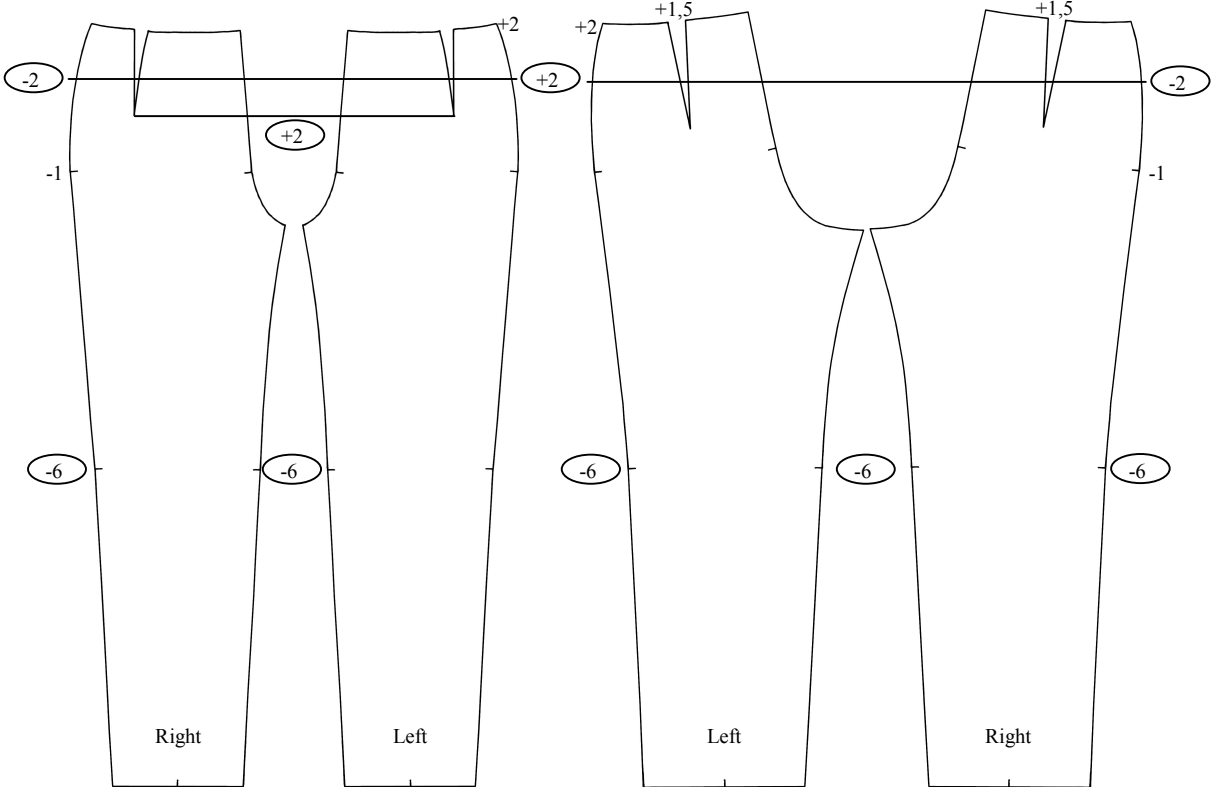


Figure 47: Adaptation plan for test person A's trousers

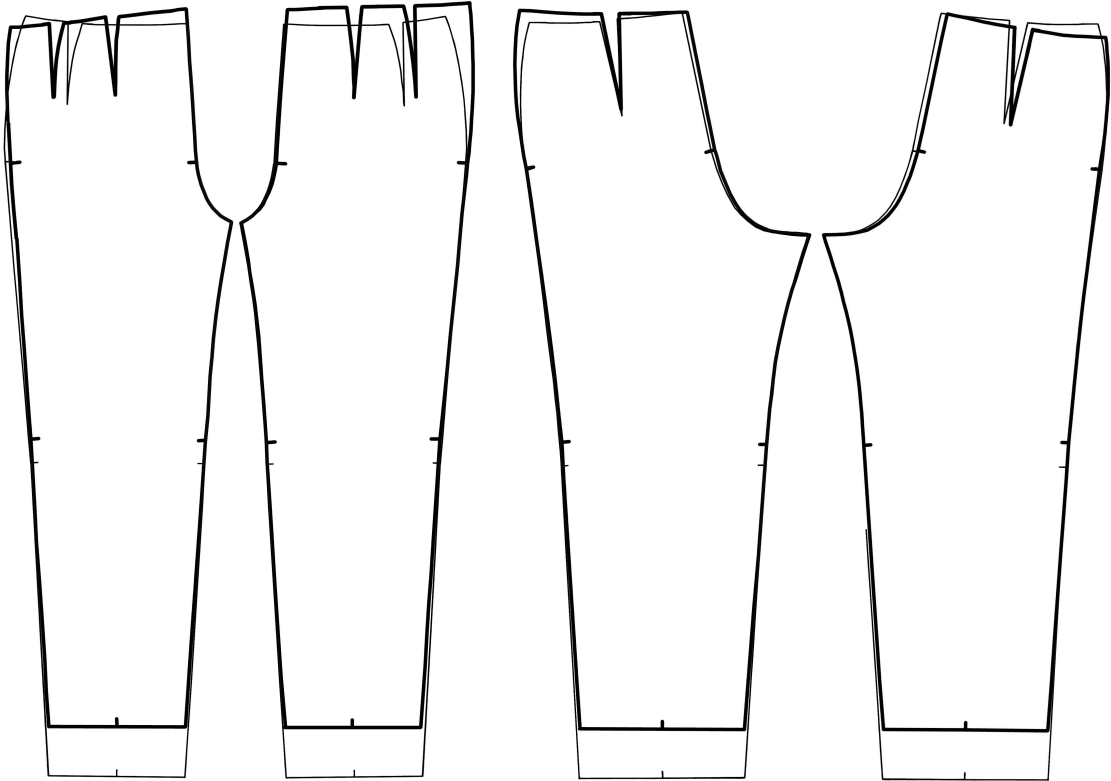


Figure 48: Test person A's adapted trousers

Fitted jacket

The **size selection** of the fitted jacket is done according to the bust circumference, Table 12. With size C44 as a starting point the *measurement deviations* are quite small. The arched back is the disfigurement on the upper part of the body that affects the garment fit the most. This is indicated by the measurements *nape to waist back* and *nape to waist front*.

Table 12: Needed measurements for test person A's fitted jacket

Measurements	Individual measurements				Difference			
	Total	Right	Left	C44	Total	Right	Left	Average
Height	154							
Bust circumference	99			100	-1			
Waist circumference	82			82	0			
Hip circumference	100			106	-6			
Neck circumference	41.5			39.3	+2.2			
Nape to waist back	42.5			41.6	+0.9			
Back width	37			38.8	-1.8			
Bust point		35	33	37.7		-2.7	-4.7	
Nape to waist front		45	42.5	54.1		-9.1	-11.6	-10.3
Shoulder width		12.5	12.5	13.6		-1.1	-1.1	
Arm length		60	61	60.6		-0.6	+0.4	
Upper arm circumference	28			30	-2			
Wrist circumference	16.5			18	-1.5			

The individual measurements related to the fitted jacket for test person A are presented in Table 12. The figure illustration and the measurements show that there are a few **adaptations needed** in order to get a well-fitting garment. Figure 49, page 82, illustrates how the *measurement deviations* for the bust, hip, shoulder width, arm length, and wrist are all adapted according to the difference value of each measurement. The waist measurement indicates that no adaptation is needed. However, due to the prominent stomach the waist of the garment has to be enlarged by +3cm. The neck measurement should be enlarged according to the measurement. When analysing the figure illustration this does not seem reasonable. The measurement was probably taken too loosely or the illustration lies. Due to the type of garment – a fitted jacket it is not critical to consider this measurement deviation¹⁷⁰. The arched back is altered according to the single adaptation *arched back* explained in the chapter *Single adaptations*. The length of the *nape to waist* will be kept while the *nape to waist front* will be shortened -9cm. The shortening of the armhole depth of the front piece also takes care of the adaptation needed for the *bust point*. The length of the garment from the waist to the hemline is not adapted because the proportions were nice as they were.

¹⁷⁰ The garment has tolerance added to this part of the garment.

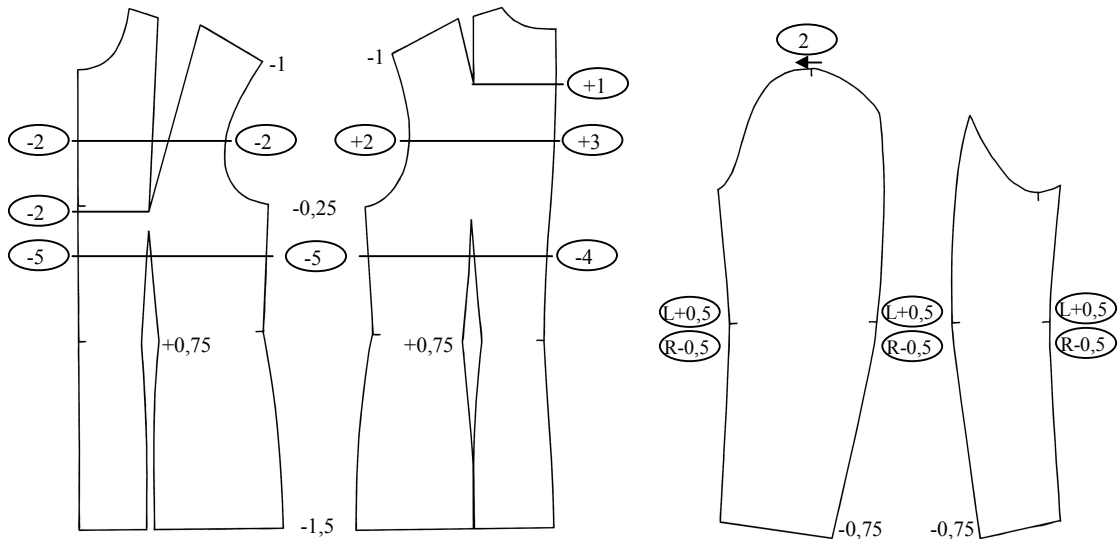


Figure 49: Adaptation plan for test person A's fitted jacket

In Figure 50 the adapted pattern is illustrated and compared with the standard size C44. The back piece is lengthened considerably, the larger shoulder dart gives more form to the back along with the formed centre back seam. The front piece is shortened and the bust dart is smaller.

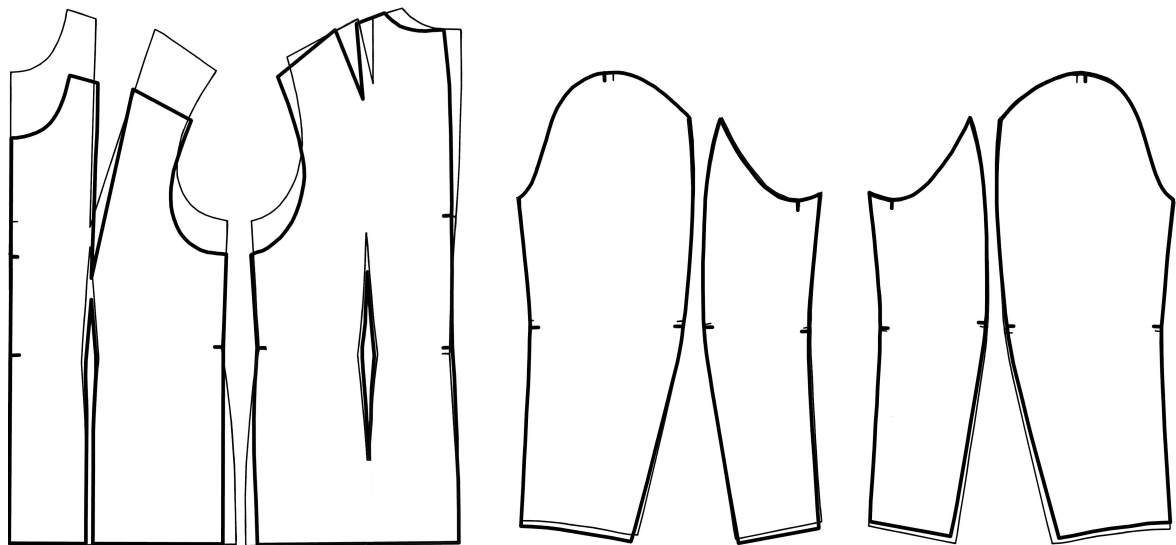


Figure 50: Test person A's adapted fitted jacket

The final result of test person A's fitted jacket and trousers are shown in Figure 51, page 83. In order to get a balance between upper and lower part of the body test person A should wear a fitted jacket, cardigan, or blouse that covers the waist, as shown in the illustration to the right.

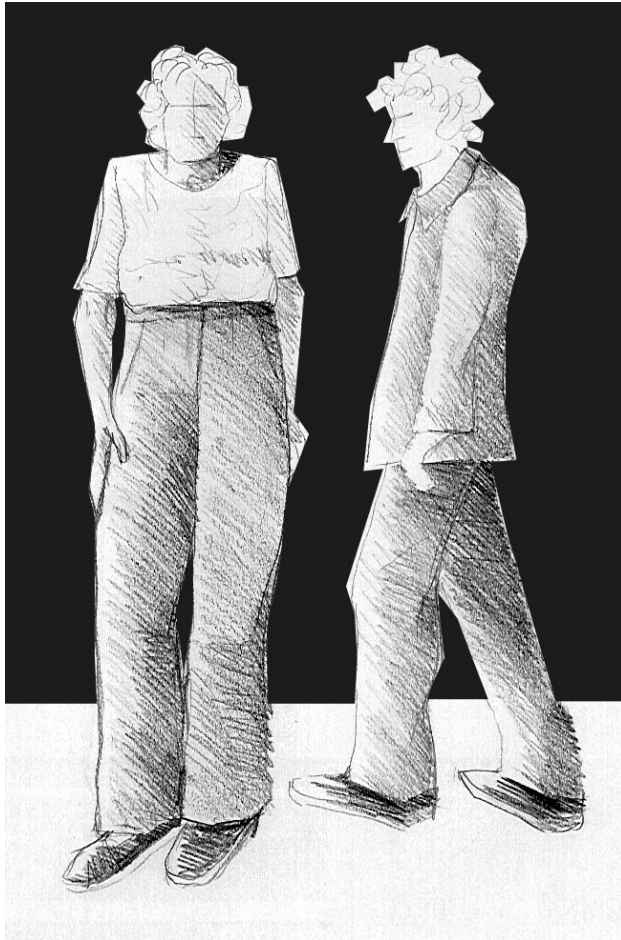


Figure 51: Test person A's final garments
Illustration Helene Berglin

Test person B

When **analysing the figure** of test person B, the most visible disfigurement is the warped waist, Figure 52. The crooked spine compensates the warped waist and the shoulders are almost horizontal. The right and left sides of the back are not symmetrical. The right side is just a little prominent while the left side is rather flat. B's neck is quite short, which should be considered when selecting the garment for the upper part of the body. The waist circumference is quite large when compared with the hip circumference.

When **selecting a style** there are a few things to think about when it comes to this kind of body figure. The garment for the upper body should be quite a straight design, without a narrow waist. This style is suitable considering the large waist circumference in relation to other body circumferences. The fitted jacket should have a collar and lapel and not a centre front that is buttoned all the way up. A collar and lapel fits better around a short neck. If the difference in the back width is going to be considered it is preferable if the garment has style lines from the shoulder and down on the back pieces. A pair of trousers should not be too wide in the lower part of the legs. Test person B has thin elegant legs, which look very nice in a short skirt. It is suitable and comfortable to have a little bit of elastic in the waistband due to the warped waist.

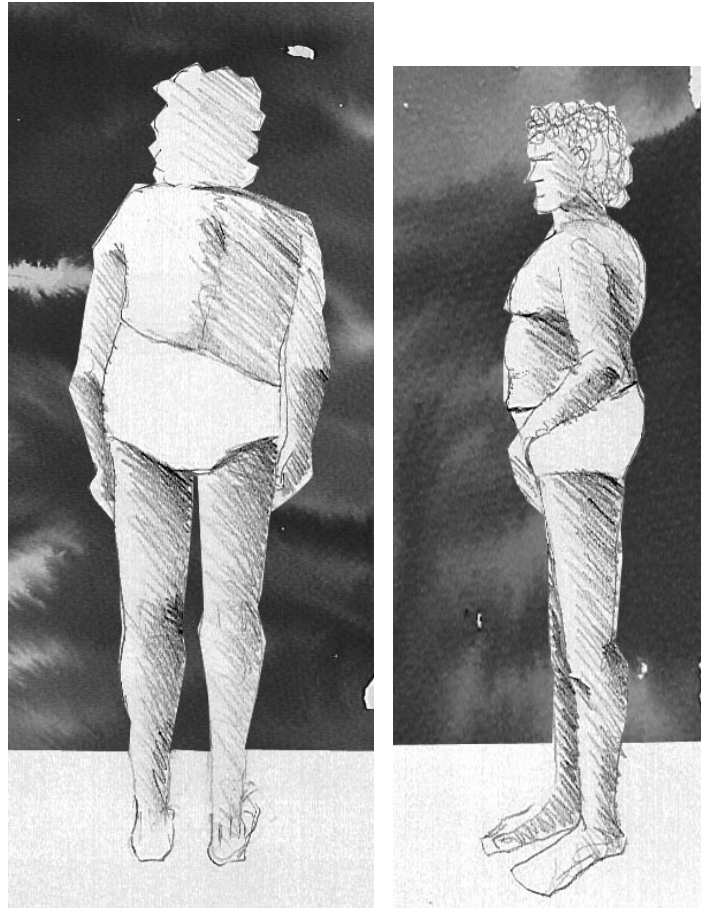


Figure 52: Figure illustration of test person B
Illustration Helene Berglin

Skirt

The **size selection** for the skirt is done according to the hip measurement. The closest size in this case is C46, Table 13. The largest disfigurement for the lower part of the body is the warped waist, 7-10cm difference between left and right side of the body.

Table 13: Needed measurements for test person B's skirt

Measurements	Individual measurements				Difference			
	Total	Right	Left	C46	Total	Right	Left	Average
Height	136							
Waist circumference	96	49	47	86	+10	+6	+4	
Hip circumference	108	53.5	54.5	110	-2	-1.5	-0.5	
Outside leg length		81.5	91.5					
Inside leg length	62.5			78	-15.5			
Body rise		20	27	27.6		-7.6	-0.6	

The useful measurements for the skirt are listed in Table 13. There are few **adaptations needed** in order to get a well-fitting skirt. There are some *measurement deviations* to consider in addition to some larger adaptations needed to compensate for the *disfigurements*, Figure 53, page 86. The waist and hip are adjusted according to the total difference value of each measurement. More width is added on the right side of the waist, indicated by the waist measurement. The warped waist is compensated according to the body rise measurement by using the single adaptation for *warped waist alternative 2* explained in the chapter *Single adaptations*. The right side is shortened, -7cm and the left side is shortened -4cm and *along the side seam*, which increases the waist and places the waistband on the hip instead of in the anatomical waist.

If the garment measurement *skirt length* is not taken the skirt could be adapted in proportion to the inside leg length. If it is a long skirt it is shortened according to the inside leg length. On the other hand for a short skirt; to the knees – half of the leg – only half of the adaptation for the inside leg length is used. By doing so the length of the skirt will have approximately the same proportions on the test person as on a standard figure. However it is best is to have the desired garment measurement. This skirt, for test person B, is altered according to the inside leg length. It is a short skirt so half of the value will be used, -8cm. Due to the large size and the length of the test person the width of the lower skirt is decreased in order to get nice proportions between width and length. In Figure 54, page 86, the individual pattern is presented and compared to the standard size C46. The final skirt is illustrated in Figure 57, page 89.

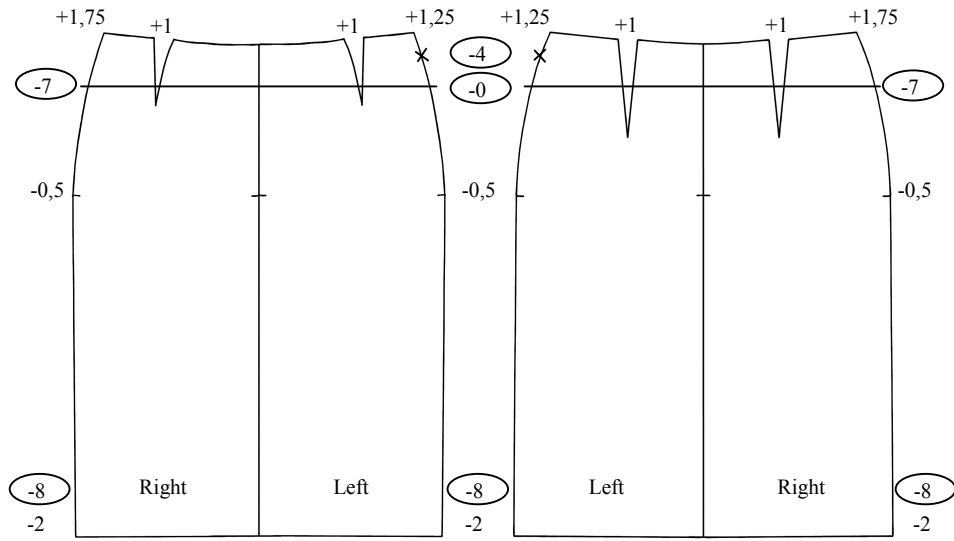


Figure 53: Adaptation plan for test person B's skirt

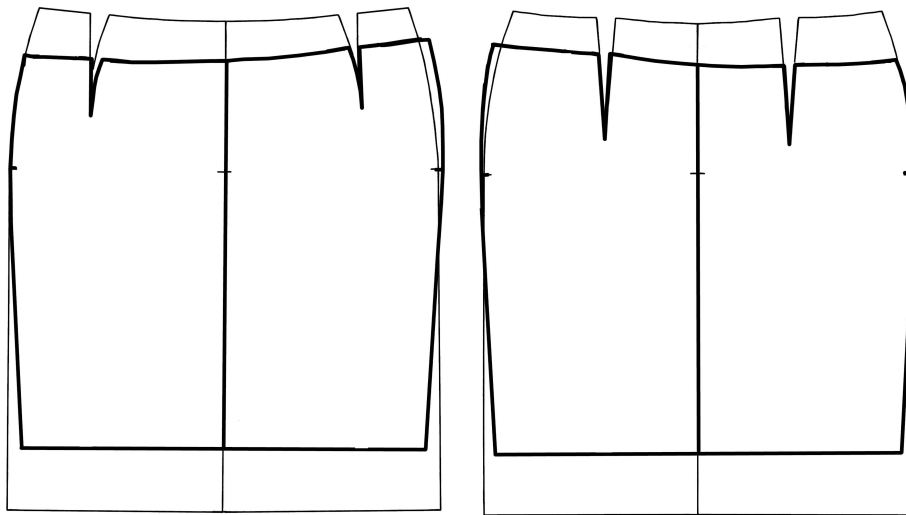


Figure 54: Test person B's adapted skirt

Fitted jacket

The **size selection** for the fitted jacket is made according to the bust circumference, Table 14. C46 is the most suitable size for test person B.

Table 14: Needed measurements for test person B's fitted jacket

Measurements	Individual measurements				Difference			
	Total	Right	Left	C46	Total	Right	Left	Average
Height	136							
Bust circumference	106			104	+2			
Waist circumference	96	49	47	86	+10	+6	+4	
Hip circumference	108	53.5	54.5	110	-2	-1.5	-0.5	
Neck circumference	38			40	-2			
Nape to waist back	29			41.8	-12.8			
Back width	40	21.5	18.5	39.8	+0.2	+1.6	-1.4	
Bust point		35	37.5	38.6		-3.6	-1.1	
Nape to waist front		44.5	43	54.8		-10.3	-11.8	-11
Shoulder width		12.5	12	13.8		-1.3	-1.8	
Arm length		50.5	49.5	60.8		-10.3	-11.3	
Upper arm circumference		30.5	30	31		-0.5	-1	
Wrist circumference		15	15	18.5		-3.5	-3.5	
Body rise		20	27	27.6	-4.1	-7.6	-0.6	23.5

The measurements that need to be studied are presented in Table 14. These measurements reveal that there is a **need for some adaptations** to be added to the pattern in order to get a well-fitting garment. All adaptations are presented in Figure 55, page 88. The bust, waist, shoulders, sleeves, neck, and wrists are all altered according to the measurement values. The *nape to waist back* needs to be shortened with almost -13cm while the *nape to waist front* needs a shortening of only -11cm, according to the average value. The shortening of the *nape to waist* is done in two places, with the total value of -11cm. Increasing the centre front with +1cm compensates it, the *nape to waist front* is shortened -10cm in total. The lengthening of the centre front increases the bust dart, which adds more form to the garment. The total length of the garment is also shortened according to the average *body rise* measurement, -4cm. The back width is altered, the left side is decreased by -1cm, while the right side is increased by +1.5cm. In Figure 56, page 89 the adapted pattern is illustrated and compared with the standard size C46. The final result of test person B's fitted jacket and skirt are shown in Figure 57, page 89.

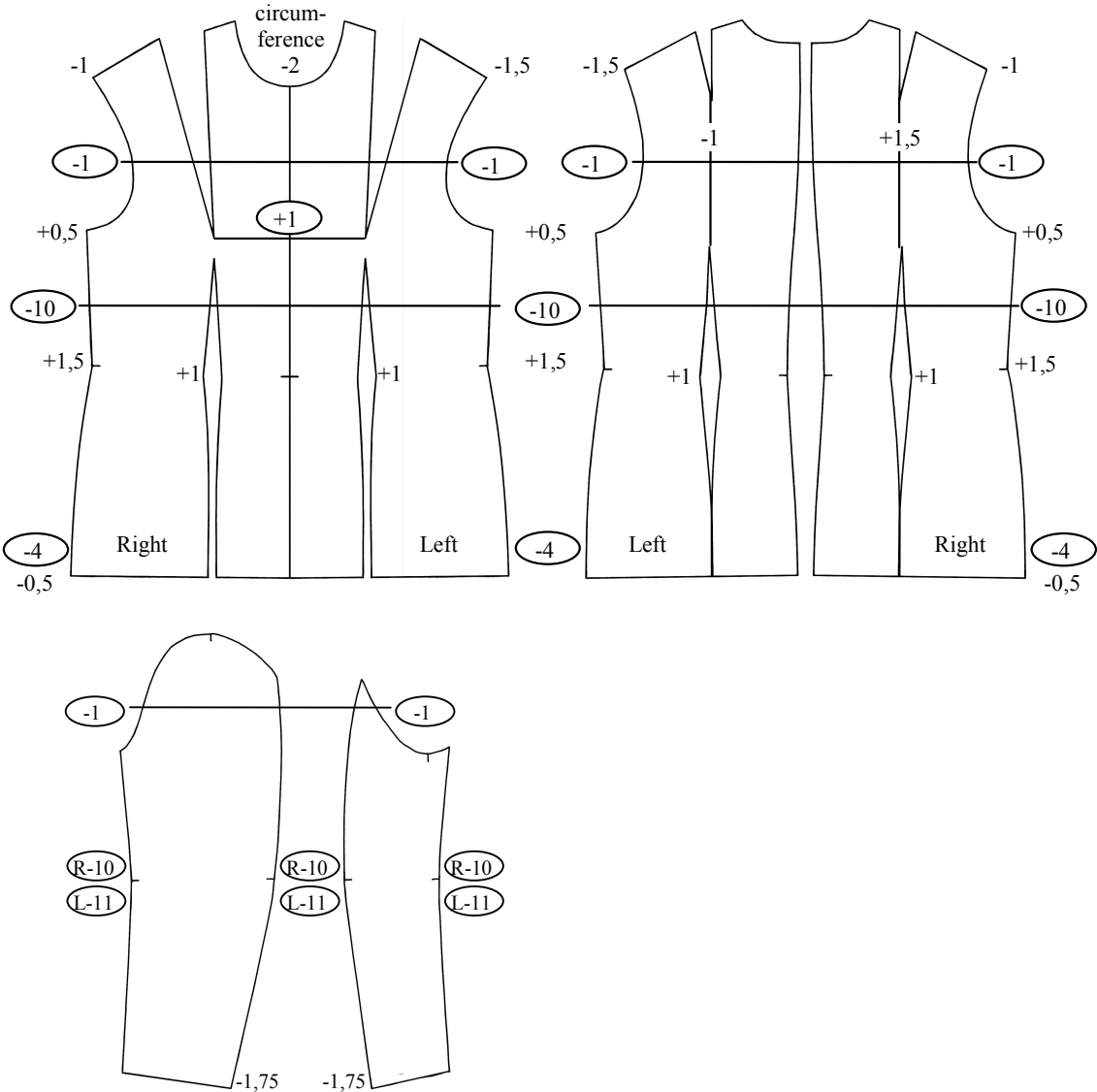


Figure 55: Adaptation plan for test person B's fitted jacket

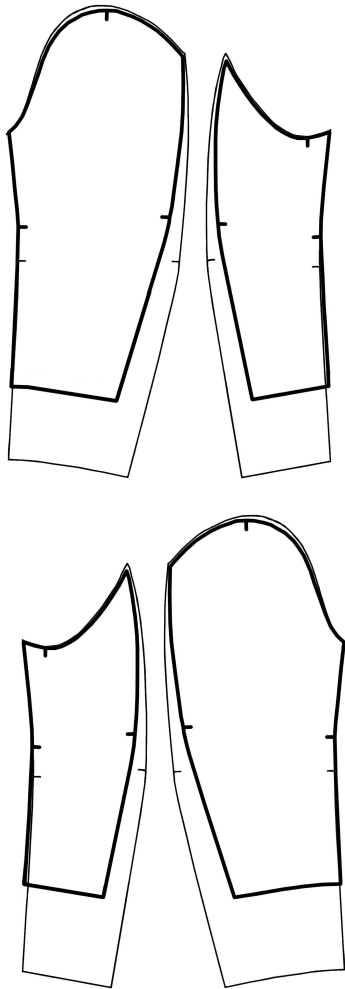
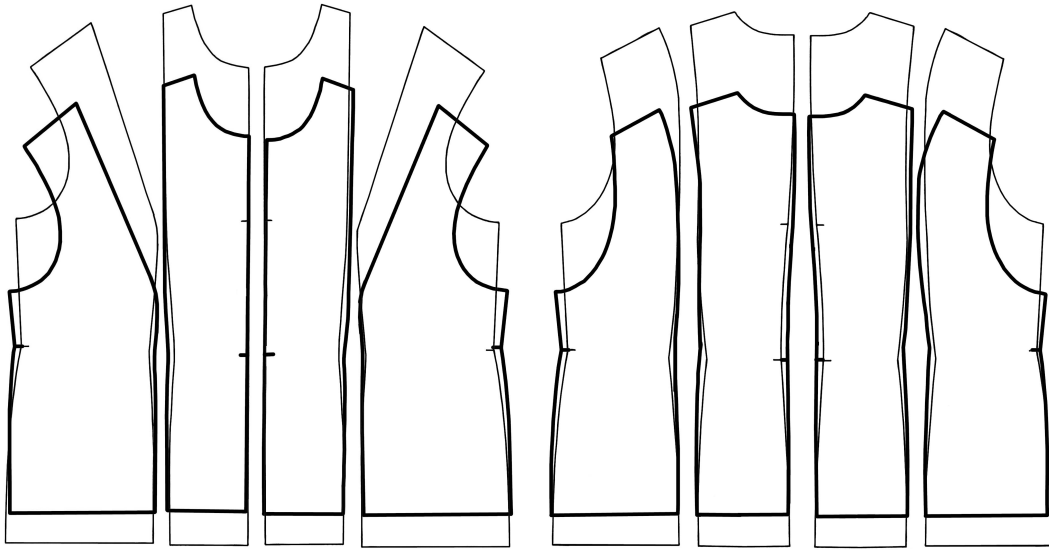


Figure 56: Test person B's adapted fitted jacket

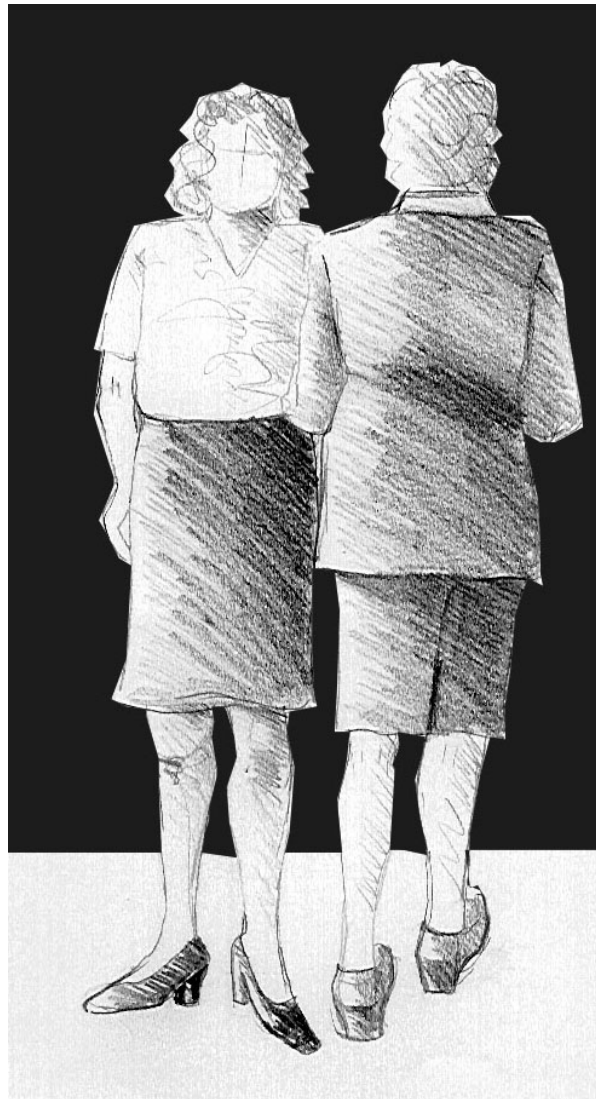


Figure 57: Test person B's final garments
Illustration Helene Berglin

Evaluation of made-up garments

The evaluations of the *test* garments aimed to establish how to adapt a pattern for a certain disfigurement in order to obtain a good fitting and comfortable garment. This evaluation was done by the experts only. When evaluating the *final* garments the end result was in focus. If the criteria *fair* was marked the cause was studied in relation to the figure analysis, style of the garment, size and used adaptations. An explanation to the evaluation *fair* evaluation was usually found. Sometimes the individual had lost/gained weight, which affected the measurements. The different sections of the *final* garments were usually evaluated as excellent. In phase B there were 25 different evaluation points to be judged by the experts¹⁷¹. Thirty-seven garments divided between the 15 test persons were evaluated, the experts marked 94 percent of all evaluation points as good (N 294). The experts evaluated 10 garments for five test persons in phase C. Each section were evaluated and the experts marked 85 percent of the points as good (N 95).

The evaluations have two purposes. The first is to evaluate the adaptations of the garment, e.g. point out possible improvements of the *single* and the *combined* adaptations. The second one is to evaluate the *final* made-to-measure garment. The individuals using the garments are the only ones who can evaluate the comfort of the garment. The test persons evaluated critical areas of the garments, such as waist, hip, shoulders etc. The evaluation of these critical areas was used in the process of improving the adaptation methods. The test persons were also asked to evaluate the *overall comfort* of the *final* garment. Figure 58 shows that the majority of the test persons in phase B marked the overall comfort of the garment as excellent.

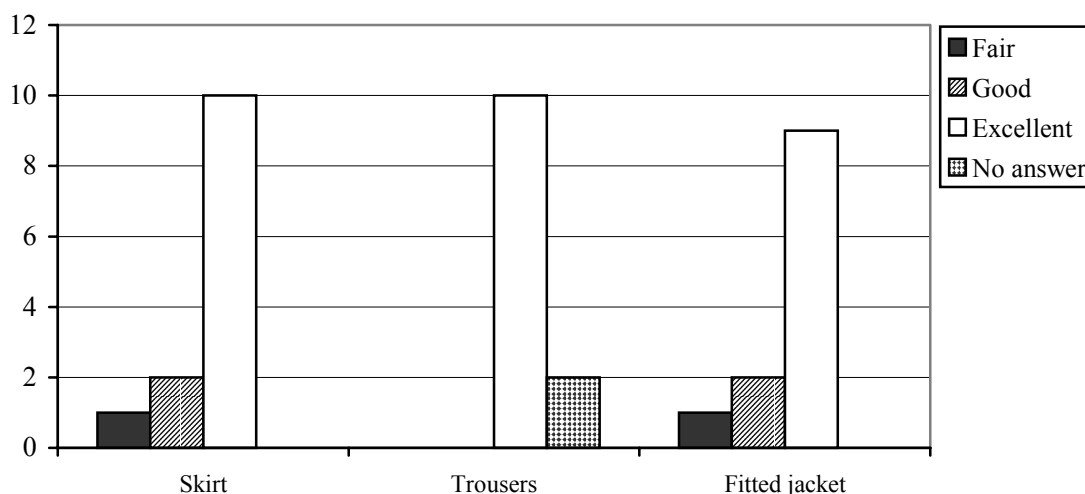


Figure 58: Evaluation of the overall comfort, phase B skirt (N=13), trousers (N=12), and fitted jacket (N=12)

The evaluation of phase C is not completed and can not fully be reported and analysed in this study. Only ten garments have been evaluated in phase C. Six of these garments were evaluated, by the test persons, to have a *good* overall comfort and 4 were marked to have an *excellent* overall comfort.

¹⁷¹ Thirteen evaluation points for the fitted jacket, six for the skirt and the trousers respectively. See Appendix 5.

A *follow-up* evaluation was done among the test persons who participated in phase B. The test persons reported how many times they have used the garment, Figure 59. Most of the test persons had used their garments 1-5 times or more. The test persons who have answered that they had never used their garments explain why. Some of the explanations are; the waist is too big due to loss of weight, the colour is too light and gets dirty too easy, the details are not as desired, and the trousers are too thin to wear in the winter time.

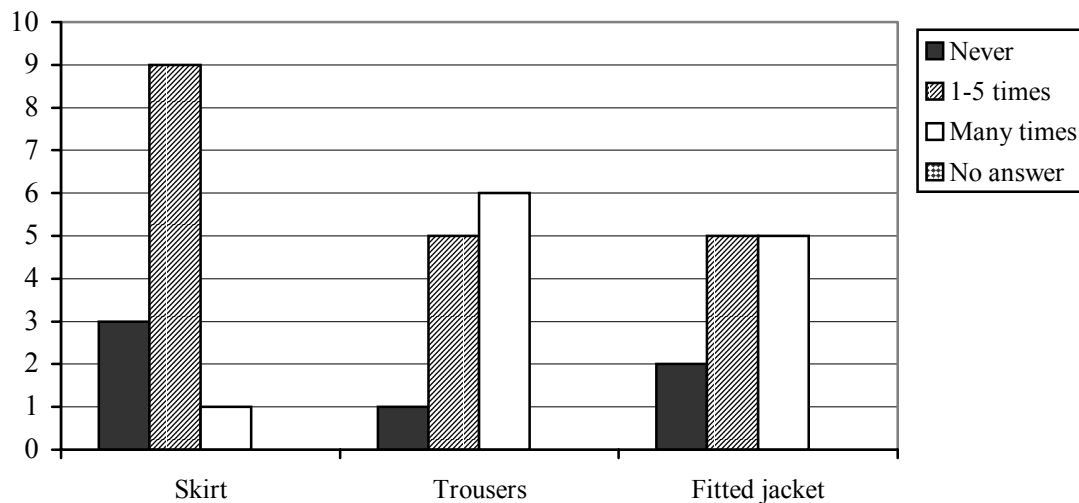


Figure 59: The use of the final garments, phase B, skirt(N=13), trousers (N=12), fitted jacket (N=12)

The comfort of the garments was evaluated after the test persons had a chance to use their garments, Figure 60. The skirt shows the largest evaluation difference compared to the *first* evaluation.

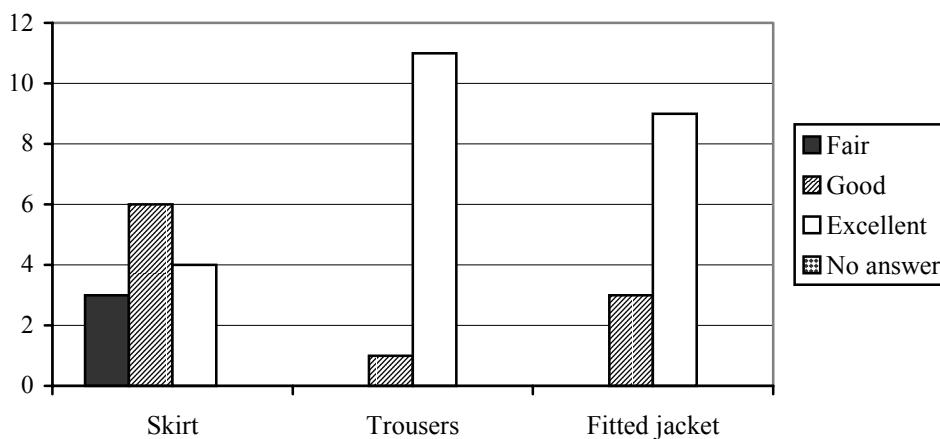


Figure 60: Follow-up evaluation of the overall comfort, skirt(N=23), trousers (N=12), fitted jacket (N=12)

Reflections

Clothes are an important part of our everyday and social life. Everyone wants to feel a part of a group and be able to find clothes that are significant for that group. Clothing is important for personal development and the first impressions are greatly affected by the clothes. This has been established by previous research with various perspectives. The perspective of this study has been technological but also esthetical. In order for individuals with large disfigurements to get well-fitting and esthetical garments it is necessary to continuously develop the pattern construction methods.

Finding suitable clothes

Unfortunately there are individuals that can not select their clothes according to their desire. Impaired, disabled and elderly have largest difficulties with finding suitable garments include. They have to select garments that they can fit into or that are possible to alter. It is most important for them to be able to select the garments according to their desires, the function of the garment comes in second place. Agility and social integration are improved for the disabled/impaired when they have adapted/suitable garments, they became less handicaped/disadvantaged.

The problem of finding suitable garments for the disabled/impaired is first of all affected by the disfigurement and secondly by the lack of technical solutions e.g. Velcro instead of zipper or buttons¹⁷². The companies offering garments for a specific target group e.g. wheelchair users, offer garments for a sitting position in combination with technical solutions. They seem to focus too much on the technical solution. Among the test persons who participated in this study there were only a few that would need special technical solutions. There are many individuals who are in need of made-to-measure garments but do not necessarily need other technical solutions than those offered on standard clothes. The garment fit and the technical solutions should be available separately or in combination if necessary.

The latest sizing system for women in Sweden was compiled during the 1970's. The new system was intended to facilitate the situation for the industry, the retail store, the consumer, and for education in the trade. Better fit, fewer sizes, and making it easier to find the right size were among the things that would be improved by a new sizing system¹⁷³. I think it is a contradiction to suggest that fewer sizes would improve garment fit and make it easier for the consumer to find the right size. It is an improvement when all manufacturers use the same sizing system and labelling. But I do not understand how fewer sizes could offer a better garment fit. The more variation in sizes that garments are produced the more people with figure variations can find suitable garments.

¹⁷² (Thorén, 1992)

¹⁷³ (Cednäs and Kjellnäs 1977)

Producing suitable garments

There are different ways of producing suitable garments, for example by a tailors shop or by a manufacturer. When a garment is made-up at a tailors shop it is usually necessary for the customer to be close to or at least physically visit the production sight. It is an advantage to meet the customer personally, see the body figure and discuss the garment. Production within the industry is usually at a factory separate from where the order is placed and contact with the customer established. Manufacturers can reach more individuals even if they are not close to the production sight. This makes it possible for the manufacturer to move the production to another area of the world without deteriorate for the customer. Especially now when the order/production information can be sent electronically. It is however important for manufacturers have a reliable system to pass on all the necessary information from the customer, through the shop assistant, to the pattern constructor or the cutter.

Figure 10, page 40, illustrates the process of creating an individual garment. The EASYTEX project has dealt with all steps without the *making – up*¹⁷⁴ and the *delivery*¹⁷⁵ of the final garments. Within **this** study the focus is on the individual patterns and the associated figure registration. However, there are quite a few steps within the whole process that could be studied, explored and improved as well.

Today there are some manufacturers that produce made-to-measure garments. Most of them produce garments for uniforms. Of all the garments 20 percent are returned, which is a pretty large percentage especially when considering that people in uniform probably do not have that many large disfigurements. It would be interesting to know why the return rate is so high. Is it the figure registration that is made incorrectly or is it the adaptations? Or maybe the customers have high demands?

Different measurement charts have been developed for specific groups, such as Down's syndrome, and for individuals with a short stature. Clothes could be mass-produced in "standard" sizes according to these special charts. This would help the individuals that come within the sizes in these specific charts. However the problem in producing garments for such a small target group would be the small potential market. There might be a large number of such people in the whole world, but it would be difficult and costly to reach them all. Within the small target group the way of dressing and the styles preferred, probably varies as much as it would between individuals with a standard figure. Studies have shown that the impaired and disabled want to select their clothes from the regular supply in the retail stores.

With the perspective of the whole clothing market the target group with large disfigurements is rather small. If this target group could be included in the regular market it would be more attractive for the manufacturers. If the clothing industries offered mass customisation the variety of supplies would increase. Garment fit could also be improved by modifying the garment according to the individual figure. This would make it possible for the customer to maximise the purchase instead of just satisfying it. The mass customisation would benefit not only the individuals with disfigurements but also the customers with high demands on the different aspects of the garment. The retail stores and the manufacturers should offer what the customer wants to buy. The customer should be able to buy what they really wants instead of just buying what the retail stores offer. The factor that might stop individuals from buying

¹⁷⁴ Companies commissioned to make – up the garments did this.

¹⁷⁵ The garments were not delivered. The test persons came to the university in order to evaluate them and pick up the garments.

customised garments is the price¹⁷⁶. It might also be a disadvantage for some that the garment has to be produced after the order is placed. It would not be possible to take the garment home right away.

Possibilities with newly developed solutions

Today, the hardware and software are available for the industry to offer mass customisation. They must put these new technical solutions into use in order to give better service to their customers. Other mass production means such as the car industry, have changed in order to give their customers the possibility to compose the product according to their individual desires. According to Hoffman (1979) there are six factors that the customer would like to have satisfied in a garment. By using the available software it is possible to offer customers to maximise their purchase within these areas. (1) *Fashion* – selection of a fashionable garment in the retail store, available for mass customisation. (2) *Design* – possibility to select desired details in the garment. (3) *Colour* – selection of fabric and along with that the selection of colour. (4&5) *Comfort & Fit* – the garment is modified according to the individual measurements and body figure. (6) *Cost* – with the software and automated equipment the cost for the customised garment is kept down. The clothing industry has to choose the direction; standard sizes only, made-to-measure, mass customisation, or a combination of these. Mass customisation not only benefits the customer. The manufacturer does not have to decide how many garments of each design/colour/style should be produced. Overproduction should be limited. The store does not have to keep as many sizes and variations in stock. This decreases the needed area in the stores, which affects the costs. But all this is another study!

Today most made-to-measure garments are produced for high quality men's wear. This is probably because the type of garments, e.g. jackets, trousers, and shirts do not change that much from season to season. Fashions in women's clothing change often. More preparations are needed in order to offer made-to-measure garments when the designs are replaced quickly.

It is interesting how clothing production has changed over the decades. Clothes used to be made-up at a tailors shop or at home, and were automatically customised. The standard sizes came into the picture when the customer could not wait for the garment to be made-up. When the standard sizes garment were accepted and the sewing machine entered the market the manufacturers took over most of the clothing production. However, there were some customers that still wanted customised garments. The technical development has continued and it is now possible to get customised garments from the manufacturers.

The tailors should take advantage of the new techniques and apply it to their traditional businesses. They could build up the system with the knowledge they have in producing the tailored garments and save some time.

The necessary know-how

It is great that the technique is developed in order to be able to offer better service and products to the customers. However, one has to remember that the technique is only an aid, to

¹⁷⁶ A study made within the EASYTEX project showed that only about one third of the test persons were willing to pay the calculated price for the made-to-measure garments: fitted jacket 2500skr/300€, trousers 1450skr/168€, and skirt 1350skr/162€.

perform what the human being wants it to do. The knowledge about figure analysis and pattern construction is still essential. The larger disfigurement the system is programmed to handle, the more knowledge is needed to build it up and run it. The main reason for this study is, therefore to document the adaptations necessary for certain large disfigurements.

Method

The unique figures within this study are short/tall, warped figure, prominent figure, and wheelchair user. These were created according to how the pattern is adapted, Table 1, page 34. This can be taken one step further. The disfigurements can be divided into three categories instead. The *warped figure* and the *wheelchair user* can be put in the same category. The pattern is adapted in order to adjust the **balance** of the garment. For the *warped figure* the balance of the garment needs to be adjusted according to the left and the right side of the body. The pattern adaptation for the *wheelchair user* adjusts the balance between the front and the back of the garment.

The uneven distribution between the upper and lower parts of the body, Figure 7, page 34, within each category has its explanation. When an individual has a warped lower part of the body it seems as though the body usually tries to compensate it, the upper part of the body e.g. the shoulders are not necessarily warped.

The largest projections seem to be around the shoulder blade/scapula and around the ribs. There are some projections to the lower part of the body but usually they are much smaller. Wheelchair users all need the garment adjustments according to the sitting position, but the upper part of the body may have other disfigurements, which fit into the other categories, **or** no disfigurement at all.

The methods used for the different steps will be discussed, along with the discussion of the result.

Figure registration

Figure registration was done by taking measurements and by photos. These are then used for the figure analysis, which is important in order to create an individual pattern. As said previously, the measurements were modified as the study proceeded. The experience gained while working with various body figures, led to another way of measuring and analysing the information in certain areas. Now, when analysing the data once more another connection between the measurements and the pattern construction has been discovered. Some of the measurements would have been easier to obtain with an anthropometer, for example the *inside leg length*. It would have been better to obtain certain measurements with an anthropometer because it measures distances without including any outward projections of the body, for example the *height of neck point* and the *height of shoulder point*. Some measurements would have been better measured both with an anthropometer and with a tape measure, for example *outside leg length*. For the study this measurement was taken with a tape measure. This measurement determines if the subject has a warped waist **and** if there is a projection on either side of the body. To determine if the waist is warped the *outside leg length* should be measured with an anthropometer in order to exclude any outline projections of this part of the body. Ideal measurements only indicate one thing per measurement.

During the measuring, the subject moves when the different measurements are taken or in order to sit down and take a rest. The skeleton and the body mass might shift around and

could give illogical measurements. If the measurements are taken with a body scanner the procedure takes only a couple of minutes and the subject moves just once¹⁷⁷. The measurements are obtained when the subject is standing in only two positions. It is important to instruct the subject not to move the body in unusual ways, such as pulling in the stomach or moving the shoulders upward or forward etc. When measuring manually the subject is reminded not to move if doing something unusual which changes the position in different ways.

One of the advantages of automatic measurement is that it is possible to go back and check how the landmarks are placed and how the measurements are obtained. This would have been useful in the case of *test person A* in order to control how the actual *neck circumference* is taken. The measurement seemed to be too large when analysing the figure illustration. The neck circumference was not adapted even if the measurements indicated that the circumference should be increased. This could be done because a test garment was sewn and there was a chance to modify the circumference if necessary. It might not be wise to “ignore” an adaptation like this if the order goes directly into production, without any test garment. This example illustrates once more that the measuring procedure is extremely important in order to make the right decisions when later doing the pattern construction.

The garment measurements are sometimes useful, for example to obtain the length of the skirt. The main reason to take this measurement is, of course, to make the length of the skirt according to the individual’s desire. It is better to have an actual measured value of the length instead of talking about short or long skirt. The length of a “short” skirt might vary quite a bit from person to person. The same could be said for the sleeve length. In addition to the arm length it might be a good idea to register what sleeve length the individual feels comfortable with. Note that the length of the actual sleeve on a fitted jacket with shoulder pads should always be longer than the sleeve length measured on the body, due to the thickness of the shoulder pads.

The photos would have been easier to analyse if they had been taken with the individual standing in front of a large grid. This would have made it easier to analyse the figure in relation to the horizontal and vertical lines. Sometimes it was awkward to take the photos, especially when the individual did not wear a bra or because of their personality/shyness. Not all the photos were taken with the subject just in underwear. This is not desirable because disfigurements do not usually show clearly with clothes on. When arranging the appointment with each subject an information letter should have been sent out in order to inform them what was going to happen. This would have made them more prepared and the situation would not have been as awkward.

It is important to analyse the measurements and the figure illustration in order to decide which adaptations should be applied to the garment. This applies when the measurements are taken as presented in this report. It would be interesting to see if it is possible to get a stronger connection between measurements and the pattern adaptations. The measurements probably need to be of another character than the measurements obtained in this study. The vertical and horizontal measurements should be combined with outline measurements. Because of the complexity of the measurements they should be obtained with some type of reliable body. New connection between the measurements and the pattern adaptation could probably be

¹⁷⁷ Telmat’s body scanner Symcad needs two photos from the front/back and from the profile.

explored by an extensive statistic survey. However, this should probably not include larger disfigurements such as those exemplified in this study.

Made-to-Measure garments

The process of making the individual patterns has followed almost the same routine throughout the study. However, there has been some differences between the phases, Figure 9, page 39. In phase C there were almost no test garments sewn. However in some cases when the disfigurements are extensive it is better to sew a test garment in order to control if the correct adaptations are applied. The same process can be followed when making an individual garment, but depending on the disfigurements it might be suitable to sew a test garment and sometimes it is possible to go directly to the making-up.

When the individual garment is created there are many factors affecting the outcome of the garment. One of the aspects is to make the garment comfortable for the wearer. This is quite difficult to incorporate in the individual garment, especially if the individual has not been able to try at least a standard size of the designed garment. This is usually not possible for individuals who diverge greatly from the standard figure. The tolerance over for example the bust varies between individuals. Individuals with large disfigurements might also need larger tolerance in their garments in order to allow freedom of movement. For example an extremely short individual climbs stairs in a different way to a taller person. The legs of the short individual have to be able to swing to the sides and then forward instead of just being lifted up and forward. It is difficult for the subject to know or imagine exactly how the finished garment will feel. This risk is always present when producing an individual garment, whatever method is used. The risk might be a little less when the garment is tried out during the making up process; then it is possible to do small modifications. It is important that the individual gets correct guidance when selecting the garment type and design. It should be according to the individuals style, but also according to the body figure – it has to be possible to adapt the pattern for this figure.

In this study the garments have always been according to the 40-series. The test persons have usually been shorter than 168cm in height, which is the average for the 40-series. The reason for not using 20-series (160cm +-4cm) for example was simply because well-developed patterns for the 40-series were available. However, by using the 20-series it would not have decreased the number of adaptations, only the applied value¹⁷⁸. Of course it is better to adapt a pattern with as small values as possible¹⁷⁹ but the length difference between the 40-series and 20-series is so small that it would probably not matter so much when adapting patterns for large disfigurements, which is done in this study.

The smallest size of garment used in the study was C32. In a couple of cases it would have been better to use one size smaller as a starting point. The smallest size in the chart is C32, so C30 is officially not available. However, it would have been suitable because it would have decreased the number of alterations.

¹⁷⁸ (Nyman, 1999)

¹⁷⁹ It is always preferable to alter the tried-out, standard garment as little as possible. Small alterations give a more reliable individual garment pattern.

Measurements and adaptations

The methods to measure and adapt patterns have been modified and improved along the way. Some small adaptations applied to the patterns in the beginning would not have been applied if the patterns had been made later on in the study.

It is very important to place the landmarks on the correct locations of the body. If the anatomical waist is difficult to find the subject is asked to place the cotton band where the waistband should be placed, which usually is lower than the anatomical waist. When measuring, for example, the *body rise – centre front* it should be noted that the waist is not placed at the anatomical waist. This measurement can not be compared with the standard body measurement, it has to be compared with the garment measurement of the centre front. If the measurement is compared with the standard body measurement it will indicate that this distance should be lowered on the trousers, which would lead to the waistband being placed too low on the garment. Another important aspect is where the individual would like to have the waistband. It can vary quite a lot between individuals.

The goal was to obtain only the measurements necessary to determine how the garments should be altered. The right and left sides of the body were only measured when judged as necessary by the experts. In order to control exactly whether there is a difference between the right side and left side of the body the body halves should *always* be measured. However, if there is a small difference between the halves, not noticed by the eye, it does not matter for the outcome of the garment fit. In the beginning of the project there were subjects whose right and left sides of the body were not obtained separately. The adjustments according to the left and right sides of the waist for example had to be adjusted after the first test garment. This is exemplified on the trousers for *test person A*. Consequently, the measurer has to decide if the specific measurements should be obtained or not. If not certain, it might be better to register the left and right sides of the body, especially if no test garment will be sewn. One of the advantages of automatic measurement is that all such measurements can be taken without extending the time required for the measurer or the “customer”.

The *height* measurement was not always taken; the test person was instead informed about the value. Now, when analysing all measurements once more, this measurement should have been obtained as well, in order to be sure of the correct value. Using an anthropometer would have been suitable. Having this measurement did not affect the outcome of the garment fit but it is confusing when studying the height in relation to other length measurements. When studying the *short stature*, page 58, the height difference does not correspond with the other length differences. The length adaptations, related to the total height, are *inside leg length* -27.5cm, *body rise* -3cm, and the *nape to waist back* -5.5cm. All these negative values add up to -36cm, in comparison with the total *height*, which indicates a total shortening of only -31cm. Before starting to analyse the reason for the different values it should be said that the final garments, skirts, trousers, and fitted jacket, had an excellent fit. This indicates that the *inside leg length*, the *body rise*, and the *nape to waist back* have the correct values. Three explanations could be possible. (1) If the *height* is correct the distance from the nape to the top of the head must be 5cm longer than that of a standard individual with a height of about 168cm. This does not seem reasonable when analysing the figure illustration. (2) There might be small errors in the individual measurements obtained, they must, however, be small errors that did not affect the outcome of the excellent garment fit. (3) The last possible error is that the *height* of the individual is incorrect. The true explanation might be a combination of all three suggested.

The *nape to waist back* should maybe be measured as a vertical distance measurement as well as an outline measurement, particularly if the back has a large disfigurement. The distance measurement would give the vertical measurement without the disfigurement. It would be easier to know what has to be adapted on the pattern according to the distance value and what needs to be adapted in relation to the disfigurement.

The *nape to waist back* and the *nape to waist front* can indicate the balance between the front and back. When adapting the pattern according to these measurements, for example *arched back* page 68, the adaptations are placed from the waist and up and not *along* the waistline. When analysing how this measurement is taken and how it is used in the pattern it might be better to taken these measurements on a horizontal line. Sometimes the waistline is not at the same level in the front and in the back. The waist on a fitted jacket should however always be horizontal in order to look the best. An example: If the waist is not horizontal, it might be lower in the back in relation to the front. The *nape to waist front* will be measured to a higher level than the *nape to waist back* and therefor the balance between the front and the back is not clearly indicated. The measurements include both the balance difference and the sloping waistline, which makes it more difficult to analyse the measurements.

The *shoulder width* is always taken on both the left and the right sides of the body. If the shoulders are of different widths the aim is to make the garment's shoulders to harmonise with the individual shoulders but at the same time the garment should look as symmetrical as possible. The whole difference between the right shoulder and left shoulder might not be considered when adapting the pattern. The shorter shoulder might not be shortened as much as the measurement indicates. In this case it is important to make sure that this shoulder has support so it does not sag and gives a poor garment fit in this area. The support does not have to be a thick shoulder pad, it can be a flat shoulder pad with good stiffness¹⁸⁰.

By using the *inside leg length* and the *outside leg length* the body rise can be controlled. It might not be necessary to measure the *body rise* measurement, at least not when measuring a standing person. When studying the measurements used when adapting the *skirt* for *test person B*, page 85, a difference of 10cm was indicated between the left and right sides of the *outside leg length*. Comparing the left side to the right side of the *body rise* the difference is only 7cm. The reason for the different values are not studied here but it might be because the measurements are obtained when the subject is in two totally different positions, standing up and sitting down. This might change the position of the skeleton and shift the body mass around, which could explained the different values. In the case of *test person B* the explanation could also be different leg lengths, which makes the pelvis more warped when standing up then when sitting down. In another case the largest difference was obtained by the *body rise*. So in these cases the difference can not be explained by difference in leg length. In the last case something must have happened when the position was changed. This should be studied further before excluding the *body rise* measurement.

Test garment

The goal of the EASYTEX project was to make the process of made-to-measure as similar as possible to real manufacturing. This meant that the test garments had to be eliminated in the

¹⁸⁰ A shoulder pad with good stiffness but without thickness is easy to create with a piece of fabric and some layers of interlining.

final part of the study. When working with large disfigurements in many combinations it is advisable to sew a test garment and/or to try out the garment during the making up. When testing the garment, small modifications can be noticed which are impossible to discover when making only a figure analysis. The work method, depends on how extensive the disfigurements is, what kind of garment it is, and the experience of the pattern constructor.

Making-up

The making-up process has not been followed in this study. It would however be interesting to study the whole process of producing mass customisation of garments within the industry. There are many aspects to think about. The manufacturer has to have a stock of fabric in order to be able to produce the garments quickly. The colour of the thread needs to correspond to the fabric, which can be difficult if there are made-to-measure garments of different colours. The single garment has to be held together all though the making up process. There has to be a larger amount of garments produced before this kind of study can be made.

Evaluation of made-up garments

More than half of the women in a survey could not find suitable trousers¹⁸¹. This can be because many areas of the body affect the fit of the trousers as another study shows; *hips, buttocks, thighs, crotch, and length of trousers* are noted as giving the least satisfaction¹⁸². These quoted studies underline the fact that the evaluation results for trousers are *excellent* in this study, Figure 58 and 60, page 90.

The evaluation was not anonymous and that could affect the answers given by the test persons in their two evaluations. However, it was important to be able to study some of the answers in relation to the figure analysis, style of the garment, size and used adaptations. As said before it was not practical to have the study done anonymously due primarily to the many face-to-face meetings between the experts and the test persons.

The overall impression and the comfort and fit of the garment are evaluated by the test persons. This might indirectly include an evaluation of the type and design of the garment and also the type of fabric and the colour. Because the test person did not have so many designs to select from, especially in phase B, they could not avoid a design or detail that they did not like. This might affect the evaluation in a negative direction. When mass customisation is available on the market the assortment will be larger and the customer will have more to choose from.

The evaluation done by the test persons concerning the comfort of the garments were quite positive. When evaluating the comfort of these garments they could compare them with the comfort of other garments they use. The garments they usually wear might not be adapted so much, which leads to a poorer fit. On the other hand they might never have used a fitted jacket before and therefore they are not used to the feeling and restriction of movement this type of garment gives. They might indirectly compare the comfort of a fitted jacket with a cardigan, which is not comparable.

¹⁸¹ (Cednäs, 1973)

¹⁸² (LaBat & DeLong, 1990)

The first evaluation, Figure 58, page 90, done by the test persons is quite positive. They answered the questions while they had the garment on. It might be difficult to fully evaluate the comfort without using the garment a couple of times.

All the garments in phase C were not all evaluated when this report was completed. The ten garments that were evaluated so far indicate that it is possible to make made-to-measure garments without a test garment sewn before making-up. However, the conclusion concerning this matter should not be made until more garments are evaluated.

The *follow-up* evaluation was interesting to make, the idea was to find out what the test persons thought about the garments and, primarily for this study, what they thought about the comfort when they had used the garments for a while. It might have been better to do this follow-up evaluation after a year. Some garments are used in certain seasons depending on the design and on the type of fabric and the colour. If the evaluation had been done after a year the individuals would have had the chance to use the garments in the correct season. The amount of times the garments have been used depends on many factors, for example the season, style, design, details, fabric, colour, comfort, fit etc.

It is interesting to see that the evaluation of the comfort of the trousers and the fitted jacket is quite good. The skirt evaluation on the other hand shows more of a spread regarding the comfort. It is much easier to get a good comfort and fit in a skirt than to get it in a pair of trousers or a fitted jacket.

Conclusion

The process of how an individual garment is created has been explored in this study. The main focus has been on the *individual pattern* and, in relation to that, the *figure registration*.

The same procedure for making individual patterns can be used for different kinds of disfigurement. However, if the disfigurement is large and/or in many combinations it is best to sew a test garment.

The most important conclusion drawn from this study is that it is possible to create individual garments to fit individuals with large disfigurements. The measurement and adaptation methods presented in this study should be further improved in order to contribute to continuous development of the knowledge within these areas.

I look forward to continuously expanding my knowledge within the field of pattern construction and other related areas in the future.

Sammanfattning

Det kan vara svårt för vissa människor att få tag på kläder i detaljhandeln. Problemet är mer eller mindre omfattande och kan drabba vem som helst, allt beroende på figurtyp, affärernas utbud samt den enskildes krav på till exempel passformen. Det är många bland äldre och funktionshindrade som har stora problem med att finna passande kläder. Det är inte ovanligt att finna personer bland dessa som har en unik kroppsform vilken inte alltid passar inom ramen för de standard-storlekar som erbjuds i affärerna. Det verkar vara ett glapp mellan affärernas utbud och kundernas behov. Ju mer kroppsformen avviker från standard desto svårare är det att hitta passande kläder.

Vissa affärer erbjuder, mot en avgift, att utföra mindre ändringar på plaggen, som till exempel förkortning av längden eller minskning/ökning av midjevidden. Idag finns det också några få företag som säljer kläder för vissa målgrupper som till exempel för rullstolsburna. Plaggen är dock inte individanpassade och därför kan inte alla rullstolsburna hitta välsittande plagg från dessa företag heller. Produktutveckling av passform och funktion har skett för vissa målgrupper som för äldre och för kvinnor med osteoporos. Speciella storlekssystem har också tagits fram för vissa figurtyper, till exempel för kortvuxna och för individer med Downs syndrom.

Tidigare forskning visar att det finns framför allt tre områden som måste förbättras för att det skall bli möjligt att tillverka kläder till dem med avvikande figurer. För det första måste metoderna för hur man kan erhålla nödvändiga kroppsmaat genom fotoanalys utforskas vidare. Dessutom måste rationellare metoder för att individanpassa mönster tas fram och i anslutning till detta måste programvaror för måttbeställning utvecklas samt även specialistkunskap inom området.

EASYTEX är ett projekt med målet att förbättra levnadsstandarden för äldre och funktionshindrade vad beträffar kläder och textilier. Projektet är finansierat av Europeiska Unionen (EU) och startade januari 1997 och kommer att avslutas i juni 2000. Fem länder deltar i EASYTEX: Storbritannien¹⁸³, Grekland¹⁸⁴, Finland¹⁸⁵, Frankrike¹⁸⁶ och Sverige¹⁸⁷. Resultaten av projektet är en databas, utrustning och mjukvara för automatisk måtttagning, mjukvara för automatisk måttanpassning av mönster. Uppgiften för Institutionen för Hushållsvetenskap vid Göteborgs universitet (GU) inom projektet EASYTEX har varit att tillsammans med Lectra Systèmes utveckla programvaran FitNet. Detta program används för att effektivisera tillverkningen av individanpassade kläder¹⁸⁸. Programvaran har utvärderats för att se om den kunde klara av så stora avvikelser som var representerade bland äldre och

¹⁸³ De Montfort University, Leicester: databas

¹⁸⁴ Clotefi, Aten: materialegenskaper

¹⁸⁵ VTT, Tamerfors: Koordinator och materialegenskaper

¹⁸⁶ Lectra Systèm, Bordeaux: Utveckling av mjukvara för mönsterkonstruktion och måttanpassning.

Telmat, Strasbourg: Automatiska 3D mått.

¹⁸⁷ Chalmers, Göteborg : Samarbete med Telmat.

Göteborgs universitet: Samarbete med Lectra Systèmes

¹⁸⁸ Ett användarvänligt formulär hjälper användaren att fatta de beslut som måste tas för att skapa det unika plagget. Modell, material och detaljer kan väljas efter kundens önskemål. Slutligen kan passformen anpassas till den individuella figuren. Beställningen skickas sedan för produktion någonstans i världen.

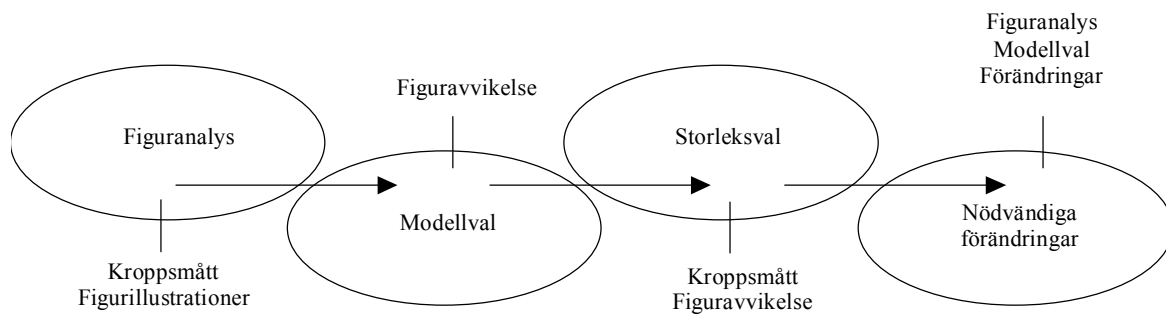
funktionshindrade. Under projektets gång har programvarorna förbättrats på många sätt genom samarbetet mellan Lectra Systèmes och GU.

De tekniska hjälpmedel som finns tillgängliga idag gör det möjligt för industrin att erbjuda kunderna ett individanpassat estetiskt tilltalande och välsittande plagg. Men det måste också finnas en kunskap om hur man förändrar ett standardmönster för att uppnå samma mål. Denna studie syftar till att utforska och utveckla metoder för hur mönster skall förändras när den enskilda figuren har stora avvikelser från standard. Metoder och erfarenheter diskuteras med två områden i fokus:

- **DET INDIVIDANPASSADE PLAGGET – PROCESSEN**
Vilka steg ingår i framtagandet av det individanpassade plagget?
- **MÖNSTERKONSTRUKTIONEN**
På vilket sätt måste ett mönster förändras för att ge ett välsittande plagg för individer med stora figuravvikelser?

Det empiriska materialet till denna studie har samlats in inom projektet EASYTEX. Totalt valdes 29 kvinnliga provpersoner ut att delta i projektet. De delades in i fyra kategorier: *kort/lång, sned, puckel eller liknande samt rullstolsburen.*

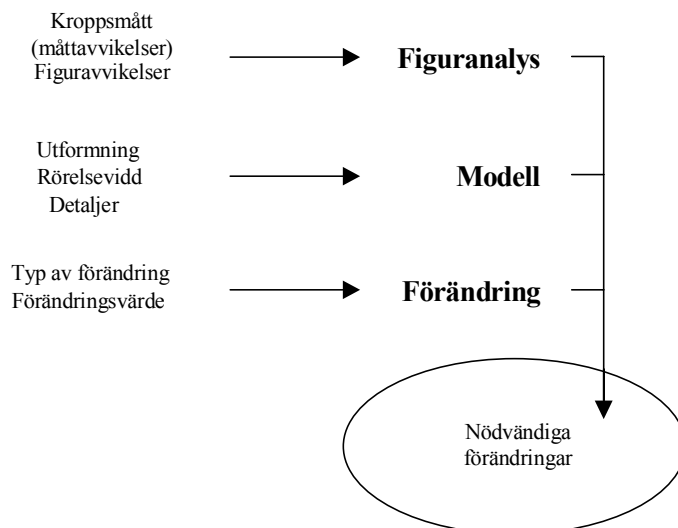
För att skapa ett individanpassat mönster har tidigare undersökningar visat att det är mest rationellt att utgå från ett mönster i en standardstorlek som sedan anpassas till den individuella figuren. Fördelen med att använda ett standardmönster är att proportioner och detaljer redan är utvärderade. De individuella proportionerna måste givetvis läggas till men de bör endast förändra plagget så att det harmonierar med den individuella figuren och inte förändrar modellutformningen. Med standardstorleken som utgångspunkt skapas det *individanpassade mönstret* genom figuranalys, modellval, storleksval och nödvändiga förändringar, Figur A.



Figur A : Tillvägagångssättet för att skapa ett individanpassat mönster

Figuranalysen görs genom studien av såväl kroppsmått som figurillustrationer. För att kunna ta så korrekta kroppsmått som möjligt bör vissa mätpunkter [landmarks] markeras på kroppen. När det är möjligt bör mätten tas i en följd, till exempel bör ärmlängden mätas i följd med axelbredden för att minimera felmätningarna. Alla kroppsmått inom studien är mätta med tanke på den kommande mönsterkonstruktionen. Figurillustrationerna har gjorts med hjälp av några fotografier.

När ett individanpassat mönster skapas behövs ofta många kombinationer av förändringar göras. Hur och med vilka värden dessa förändringar skall ske är relaterat till *figuranalysen*, *modellvalet* samt *andra gjorda förändringar*. Beslutet inom vart och ett av dessa tre områden är i sin tur påverkat av olika faktorer, Figur B. Förändringarna och dess värden måste användas på ett sådant sätt att de inte drar uppmärksamhet till avvikelser. Det är viktigt att hitta en balans mellan att dölja figuravvikelsen och att skapa ett plagg i harmoni med den individuella figuren.



Figur B: Faktorer som påverkar vilka förändringar som behövs

De förändringar som behövs för olika figuravvikelser är i denna studie indelade i två delar. Först kommer en generell presentation av förändringar bestående av **enskilda förändringar** kopplade till specifika figuravvikelser. *Kroppsmåtten* som är relaterade till förändringarna presenteras och diskuteras. Var förändringarna har placerats på mönstret och vilka värden som använts illustreras sedan i en *förändringsplan*. Mönstret är därefter justerat enligt förändringsplanen. Det *förändrade mönstret* presenteras i jämförelse med standardmönstret för att illustrera vad som skett. I den andra delen presenteras **individanpassade mönster**, där olika förändringar kombineras. Dessa mönster presenteras med *kroppsmått*, *förändringsplan* och ett *slutgiltigt mönster*. Plaggen har utvärderats beträffande val av mönsterförändringar i syfte att ge ett plagg med en bra passform och bekvämlighet.

Genom teknisk utveckling kan industrin erbjuda bättre service åt sina kunder. Dock måste man komma ihåg att tekniken endast är ett hjälpmedel för att utföra vad operatören/människan ber den att göra. Det är fortfarande mycket viktigt att besitta kunskap och erfarenhet beträffande figuranalys och mönsterkonstruktion. Ju större figuravvikelser tekniken skall hantera desto mer kunskap krävs för att bygga upp och använda systemtet på ett riktigt sätt.

Den främsta slutsatsen av denna studie är att det är möjligt att utforma metoder för att individanpassa mönster även för individer med stora figuravvikelser.

References

- Aldrich, W. (1980). *Metric pattern cutting for menswear*. London: Granada technical books.
- Aldrich, W. (1982). *Metric pattern cutting: A unique, completely metric method for designing beautiful clothes*. (3rd ed.). London: Bell & Hyman LTD.
- Anttila, P. (1995). How to investigate textiles and clothing - some methodological viewpoints. In U. Soujanen (Ed.), *Clothing and its social, psychological, cultural and environmental aspects* (pp. 49-63). Helsingfors: Department of Teacher Education.
- Benktzon, M. (1980). *Kläder och handikapp: Funktionsnedsättningar och deras betydelse för beklädnad [Clothing and handicap: The disabilities and their importance for clothing]*. Stockholm: Styrelsen för Teknisk Utveckling (STU).
- Benktzon, M. (1993). Designing for our future selves, the Swedish experience. *Applied ergonomics*, 24(1), 19-27.
- Bergenheim, E. (1986). *Måttömnad och individuell anpassning av kläder för handikappade: Utvecklingsbart nordiskt samarbetsprojekt [Made-to-measure and individually adapted clothes for disabled: Nordic collaboration project possible for development]*. Helsingfors: Textilkonstinstitutionen [Institution of Textile Arts].
- Berglin, H., & Hernández, N. (1997a). *Datoriserad mönsterkonstruktion: En beskrivning av Modaris version 2.1 [Computerised pattern construction: A description of Modaris version 2.1]* (Project report). Göteborg, Sweden: Department of Home Economics.
- Berglin, H., & Hernández, N. (1997b). *Deviations in body constitution and adaptation of patterns* (Project report). Göteborg, Sweden: Department of Home Economics.
- Berglin, H., & Hernández, N. (1997c). *Special adaptations to clothing needed to be done for the disabled user* (Deliverable 3.1). Göteborg, Sweden: Department of Home Economics.
- Berglin, H., & Hernández, N. (1998). *Definition of automatized [automated] pattern adaptations not available in software products for clothing: Primary report* (Deliverable 3.2). Göteborg, Sweden: Department of Home Economics.
- Berglin, H., & Hernández, N. (1999). *Special automatized [automated] pattern adaptations not available in software products for clothing* (Deliverable 3.3). Göteborg, Sweden: Department of Home Economics.
- Blom, A. C. (1998). *Avvikande figur: Hinder och möjligheter för den kvinnliga klädkonsumenten [The deviating figure: An obstacle and a possibility for the female clothing consumer]* (Examination work). Göteborg, Sweden: Department of Home Economics.
- Broby-Johansen, R. (1953). *Kropp och kläder: Klädedräktens konsthistoria [Body and clothing: History of the art for costume]*. Forsa, Sweden: Rabén och Sjögren.
- Caldwell, L. F., & Workman, J. E. (1991). Retailers' perceptions of the effects of garment complexity on interest in customized patterns. *Clothing and Textiles Research Journal*, 9(3), 1-6.
- Cednäs, M. (1973). *Storlek och passform hos konfektionerade plagg: Svårighet att få tillfredsställande storlek och passform vid köp av damkläder - Intervjuundersökning i samband med kroppsmätning av kvinnor [The size and fit of manufactured garments: Difficulties in finding satisfactory size and fit when buying women's wear - field investigation in connection to body measuring of women]* (Research report FR 19-1973). Göteborg, Sweden: Svenska Textilforskningsinstitutet (TEFO).

- Cednäs, M., & Kjellnäs, F. (1977). *Storlekssystem för damkläder: Måttlistor och markandsandelstabeller [Sizing systems for women's clothing: measurement charts and tables of the market share]* (STU-investigation 70-1977). Stockholm/Göteborg: Svenska Textilforskningsinstitutet (TEFO) Konfektionsindustriföreningen (KIF).
- Centergran. (1996). *Bygdedräkter bruk och brukare [Provincial costumes, usage and users]*. Unpublished Dissertation, Göteborg University, Göteborg, Sweden.
- Commission of the European communities directorate general XIII. (1998). *EASYTEX: Aesthetical, adjustable, serviceable and mainstay textiles for disabled and elderly*. (Project programme DE 3002, TIDE): Telecommunications, information market and exploitation of research.
- Corke, A. (1996). Fitting sleeves. In M. G. Barnes (Ed.), *Fitting solutions: Pattern-altering tips for garments that fit*. Newtown, CT: The Taunton Press.
- DeCosse, C. (Ed.). (1998a). *Sy Själv: Grundboken [Sew by yourself: The basics]*. (Vol. 1). Höganäs, Sweden: Svenska Bokklubbsförlaget.
- DeCosse, C. (Ed.). (1998b). *Sy Själv: Perfekt passform [Sew by yourself: Perfect fit]*. (Vol. 7). Höganäs, Sweden: Svenska Bokklubbsförlaget.
- DeMont, D. (1994). Making paper patterns fit non-paper people : Careful measurements make your garments measure up. In A. T. Yanagi (Ed.), *Fitting Your Figure*. Newton, CT, USA: Taunton.
- Elliott, J. (Ed.). (1997). *The Oxford paperback dictionary & thesaurus*. New York, NY, USA: Oxford.
- Eriksson, A. (1999). *Individanpassing, CAD-program & antropometriska metoder [Made-to-measure, CAD-software & anthropometric methods]* (Examination work). Borås, Sweden: School of textile.
- European Committee for Standardization. (1998). *Size designation of clothes - Definitions and body measurement procedure* (Draft ISO 3635:1981 modified). Brussels: European Standard.
- Farrel-Beck, J. A., & Pouliot, C. J. (1983). Pants alteration by graphic somatometry techniques. *Home economics research journal*, 12(1), 95-105.
- Feather, B. (1993). *Menswear: Body dimensions and wardrobe coordination* (Publication GH0711). Columbia, MO, USA: Department of Textile and Apparel Management.
- Feinberg, R. A., Mataro, L., & Burroughs, W. J. (1992). Clothing and social identity. *Clothing and Textiles Research Journal*, 11(1), 18-23.
- Frost, E. (1987). *Grunnrisskonstruksjon: Klæer for funksjonshemmede [Construction of basic patterns: Clothes for the handicapped]*. (2nd ed.). Oslo: Yrkesopplæring.
- Gaarder, K. (1995). *Mönsterforming [Pattern construction]*. (2nd ed.). Oslo: Yrkesopplæring.
- Gamwell, A. M. (1966). *A survey of problems of clothing for the sick and disabled*. London: The disabled living activities group.
- Gazzuolo, E., DeLong, M., Lohr, S., LaBat, K., & Bye, E. (1992). Predicting garment pattern dimensions from photographic and anthropometric data. *Applied Ergonomics*, 23(3), 161-171.
- Hallberg, L. R.-M. (1992). *Hearing impairments, coping and perceived handicap*. Unpublished Dissertation, Göteborg University, Göteborg, Sweden.
- Hallenbeck, P. N. (1966). Special clothing for the handicapped. *Rehabilitation Literature*, 27(2), 34-40.
- Hasvén, G. (1992). *Den grå kostymen [The grey suit]*. Malmö, Sweden: Gleerup.
- Heisey, F. L., Brown, P., & Johnson, R. F. (1988). Three-dimensional pattern drafting: A theoretical framework. *Clothing and Textiles Research Journal*, 6(3), 1-9.
- Hey, J. (1998, May). As you like it. *High Points*, 5, 10.

- Hoffman, A. M. (1979). *Clothing for the handicapped, the aged, and other people with special needs*. Springfield, IL, USA: Charles C Thomas.
- Hogge, V. E., Baer, M., & Kang-Park, J. (1988). Clothing for elderly and non-elderly men: A comparison of preferences, perceived availability and fitting problems. *Clothing and Textiles Research Journal*, 6(4), 47-53.
- Hulme, W. H. (1946). *The theory of garment-pattern making*. (2nd ed.). London: The national trade press, LTD.
- Huxley, S. (Ed.). (1996). *Sewing secrets from the fashion industry: Proven methods to help you sew like the pros*. New York, NY, USA: Rodale Press.
- Ilmola, A. (1996, December). *Research on personal body and pattern solutions*. Paper presented at the Changing body, changing pattern: Pattern symposium, Koupio, Finland.
- Jacobson, M. (1994). *Kläder som språk och handling [Dress as a language and in action]*. Stockholm: Carlsson Bokförlag.
- Johansson, S. (1987). *Konstruktions- och plaggmåttlistor för damkläder [Construction and garment measurement charts for women's clothing]*. Stockholm: Styrelsen för Teknisk Utveckling (STU).
- Kaiser, S. (1997). *The social psychology of clothing: Symbolic appearances in context*. (2nd ed.). New York, NY, USA: Fairchild Publications.
- Kernaleguen, A. (1978). *Clothing design for the handicapped*. Edmonton, Canada: University of Alberta Press.
- Kindwell, C. B. (1979). *Cutting a fashionable fit: Dressmakers' drafting systems in the United States*. Washington, DC: Smithsonian Institution Press.
- Kohlström, G. (1996). *Identitetsförändringar vid anpassning till funktionshinder/handikapp [Changes in the identity when adjusting to a disability/handicap]*. Unpublished Dissertation, Göteborg University, Göteborg, Sweden.
- Kohvakka, M. (1996, December 12-14). *Changing body changing pattern*. Paper presented at the Changing body, changing pattern: Pattern symposium, Kuopio, Finland.
- Koskennurmi-Sivonen, R. (1998). *Creating a unique dress: A study of Riita Immonen's creations in the Finnish fashion house tradition*. Helsingfors: Akatiimi.
- Kratz, G. (1996). *Adapted clothes for disabled people: Rehabilitation and educational perspectives* (Licentiat treatise). Stockholm: Department of surgical sciences.
- Kärholm, M. (1976). *Bättre kläder för äldre människor, vuxna handikapp och handikappade barn [Better clothes for the elderly, and handicapped adults and children]* (STU-Investigation 61-1977). Göteborg, Sweden: Styrelsen för Tekniks Utveckling (STU).
- Kärholm, M., Dahlman, S., & Wallin, E. R.-M. . (1977). Hygiene and clothing problems for elderly people - areas in need for technological development. *Journal of Consumer Studies and Home Economics*, 1, 73-85.
- LaBat, K. L., & DeLong, M. R. (1990). Body cathexis and satisfaction with fit of apparel. *Clothing and Textiles Research Journal*, 8, 43-48.
- Lamb, j. M., & Kallal, M. J. (1992). A conceptual framework for apparel design. *Clothing and Textiles Research Journal*, 10(2), 42-47.
- Landroy, L. d. (1949). *Klipp och sy själv [Cut and sew by yourself]*. Stockholm: Wennerbergs förlag AB.
- Lejring, L. (1996). *Klädverkstan: Ett utbildningsprojekt för handikappade med krav på figuranpassade kläder [The clothing workshop: A educational project for disabled with demands on individually adapted garments]* (Project description). Göteborg, Sweden: Folkuniversitetet.
- Lewin, T., & Svensson, B. (1975). *Kroppsmått hos män och kvinnor: III Ordförklaringar, måttdefinitioner, tabell- och diagramindex och appendix in English [Male and female body measurements: III Explanation of words, definitions of measurements, table and*

- diagram index and appendix in English*] (Stencil 45). Göteborg, Sweden: Institutionen för anatomi & Avdelningen för handikappforskning [Department of anatomy & Department of handicap research].
- Liechty, E. G., Pottberg, D. N., & Rasband, J. A. (1994). *Fitting & pattern alteration: A multi-method approach*. New York, NY, USA: Fairchild.
- Liskey-Fitzwater, N., Moore, C. L., & Gurel, L. M. (1993). Clothing importance and self-perception of female adolescents with and without scoliosis. *Clothing and Textiles Research Journal*, 11(3), 16-22.
- Lodge, M. M. (1989). *Clothing and dressing: Equipment for disabled people*. Oxford, Great Britain: Oxfordshire health authority.
- Lundgren, J. (1999, April 19). Jakten på den perfekta storleken [The hunt for the perfect size]. *Göteborgs-Posten*, pp. 42.
- Melliar, M. (1968). *Pattern cutting*. London: B.T. Batsford LTD.
- Molloy, J. T. (1988). *Nya dress för success: Så påverkar du dig själv och andra genom din klädsel* [The new dress for success: the way you influence yourself and others by your dress]. Göteborg, Sweden: ISL.
- Morris, M., & McCann, S. (1997). *Every sewer's guide to the perfect fit: Costomizing your patterns for a sensational look*. Ashville, NE, USA: Lark Books.
- Nagasawa, R. H., Hutton, S. S., & Kaiser, S. B. (1991). A paradigm for the study of the social meaning of clothes: Complementarity of social-psychological theories. *Clothing and textiles research journal*, 10(1), 53-62.
- Nyman, A. (1999). *Kläder för korta kvinnor: En undersökning om utbud, storlekssystem och konstruktion* [Clothing for the short woman: a survey concerning its supply, sizing system, and construction] (Examination work). Göteborg, Sweden: Department of Home Economics.
- Roach-Higgins, M. E., & Eicher, J. B. (1992). Dress and identity. *Clothing and Textiles Research Journal*, 10(4), 1-8.
- Roebuck, J. A. (1995). *Anthropometric methods; Designing to fit the human body*. Santa Monica, CA, USA: Human factorts and ergonomics society.
- Rosenblad-Wallin, E. (1977). *Kläder för äldre* [Clothing for the elderly] (STU-investigation 72-1977). Göteborg, Sweden: Styrelsen för Teknisk Utveckling (STU).
- Rosenblad-Wallin, E. (1983). *Människa, beklädnad och miljö: Metod för utveckling av funktinell beklädnad* [Mankind, clothing, and environment: A method for development of functional clothing]. Unpublished Dissertation, Chalmers Univeristy of Technology, Göteborg, Sweden.
- Ryan, M. S. (1966). *Clothing: A study in human behavior*. New York, NY, USA: Holt, Rienhart and Winston, Inc.
- Sheldon, W. H. (1940). *The varieties of human physique: An introduction to constitutional psychology*. New York, NY, USA: Harper & Brothers.
- Shoben, M. M., & Ward, J. P. (1987). *Pattern cutting and making up: The professional approach*. London: Heinemann.
- Stenström, C. (1997). *Handikappkläder: Problemorientering omkring äldre personers krav beträffande kläder* [Clothing for the disabled: A survey of problems concerning elderly persons' demands on clothing] (Examination work). Gothenbug: Departaemt of Home Economics.
- Tam, H., & Harwood, R. J. (1993). *Size chart development for females with Down's syndrome*. Paper presented at the 2nd Asian Textile Conference.
- Taylor, P. J., & Shoben, M. M. (1984). *Grading for the fashion industry*. London: Hutchinson & Co. Ltd.

- Telmat Industrie. (1998). *Definition of the measurements taken by SYMCAD* (Manual Version 1.1). Strasbourg, France.
- The Disabled Living Foundation (Ed.). (1994). *All Dressed up: A guide to choosing clothes and useful dressing techniques for elderly people and people with disabilities*. London: Disabled Living Foundation.
- Thorén, M. (1992). *Individanpassad konfektion: för personer med fysiska handikapp och avvikande krippsproportioner [Made-to-measure for individuals with physical handicaps and diverging body proportions]* (CTH/KT/R-92/0004). Göteborg, Sweden: Department of Consumer Technology.
- Thorén, M. (1994). *Individanpassad plaggtillverkning för personer med fysiska handikapp och avvikande kroppsproportioner [Production of Made-to-Measure garments for individuals with physical handicaps and diverging body proportions]*. Göteborg, Sweden: Department of Consumer Technology.
- Watkins, S. M. (1984). *Clothing: The portable environment*. Ames, IA: Iowa State University Press.
- WHO, World Health Organization (1980). *International classification of impairments, disabilities, and handicaps: A manual of classification relating to the consequences of disease*. Geneva, Switzerland: World Health Organization.
- WHO, World Health Organization (1999). *International classification of functioning and disability: Beta-2 draft short version (WHO/HSC/ACE/99.2)*. Geneva, Switzerland: World Health Organization.
- Vigede, T. (1988). *Antropometriska hjälpmedel för tillverkning av kläder: Måttagning - mönster 1810-1987 [Anthropometric equipment for manufacturing clothes: Measurements - patterns 1810-1987]*. Unpublished Licentiate treatise, Chalmers University of Technology, Göteborg, Sweden.
- Yoon, J. C. (1994). The Accuracy of Consumer-Made Body Measurements for Women's Mail-Order Clothing. *Human Factors*, 36(3), 557-568.
- Zieman, N. (1994). *Fitting finesse*. Birmingham, AL, USA: Oxmoor House.
- Öberg, I., & Ersman, H. (1989). *Mönsterkonstruktion herrkläder [Pattern construction for men's wear]*. Stockholm: LTs förlag.
- Öberg, I., & Ersman, H. (1992). *Mönsterkonstruktion damkläder [Pattern construction for women's wear]*. (3rd ed.). Stockholm: Natur och Kultur.
- Öberg, I., & Ersman, H. (1999). *Mönster och konstruktioner för damkläder [Pattern and constructions for women's garments]*. Stockholm: Natur & Kultur/ LTs förlag.

List of illustrations

List of Figures

1:	The share of the market for the different sizes	15
2:	Studies within the areas of designing and making up	19
3:	The communication between the manufacturer and the customer via Internet	27
4:	The process of creating an individual basic pattern with Frost's method	30
5:	Timetable for gathering of empirical material	32
6:	Test persons' participation in the different phases	33
7:	The categorising of the test persons	34
8:	The process of the body figure registration	36
9:	Overview of the different proceedings included in the different phases	39
10:	The process for creating made-to-measure garments.....	40
11:	The process of creating individual patterns	41
12:	The locations of the landmarks	44
13:	Full-length body figure, front view	47
14:	Body figure, back view	49
15:	Full-length body figure, side view	51
16:	Body figure, sitting position	52
17:	Body figure, side view	53
18:	Body figure with hunch	53
19:	Factors affecting the decision of which alterations are needed	55
20:	Individual with short stature	58
21:	Individual with tall stature	58
22:	Fitting problems caused by the short stature	59
23:	A pair of trousers for the short individual	60
24:	Fitted jacket for the short individual	61
25:	Body figure with warped shoulders	62
26:	Body figure with warped waist A	62
27:	Body figure with warped waist B	62
28:	Fitting problems caused by the warped shoulders	63
29:	Inner circumference of scye	63
30:	Fitted jacket for the individual with warped shoulders	64
31:	Fitting problems caused by the warped waist	65
32:	A pair of trousers for the individual with a warped waist, alternative 1	65
33:	A pair of trousers for the individual with a warped waist, alternative 2	66
34:	Body figure with arched back	67
35:	Body figure with prominent buttocks	67
36:	Body figure with hunchback	67
37:	Fitted jacket for an individual with arched back	68
38:	Skirt for the individual with prominent stomach	70
39:	Fitting problems caused by the prominent buttocks.....	71
40:	A pair of trousers for the individual with prominent buttocks	72
41:	Fitting problems caused by the hunchback	73
42:	Fitted jacket for the individual with a hunchback	74

43: Individual confined to a wheelchair	75
44: Fitting problems caused by the sitting position	76
45: A pair of trousers for the individual confined to a wheelchair	76
46: Figure illustration of test person A	78
47: Adaptation plan for test person A's trousers	80
48: Test person A's adapted trousers	80
49: Adaptation plan for test person A's fitted jacket	82
50: Test person A's adapted fitted jacket	82
51: Test person A's final garments	83
52: Figure illustration of test person B	84
53: Adaptation plan for test person B's skirt	86
54: Test person B's adapted skirt	86
55: Adaptation plan for test person B's fitted jacket	88
56: Test person B's adapted fitted jacket	89
57: Test person B's final garments	89
58: Evaluation of the overall comfort, phase B	90
59: The use of the final garments, phase B	91
60: Follow-up evaluation of the overall comfort	91

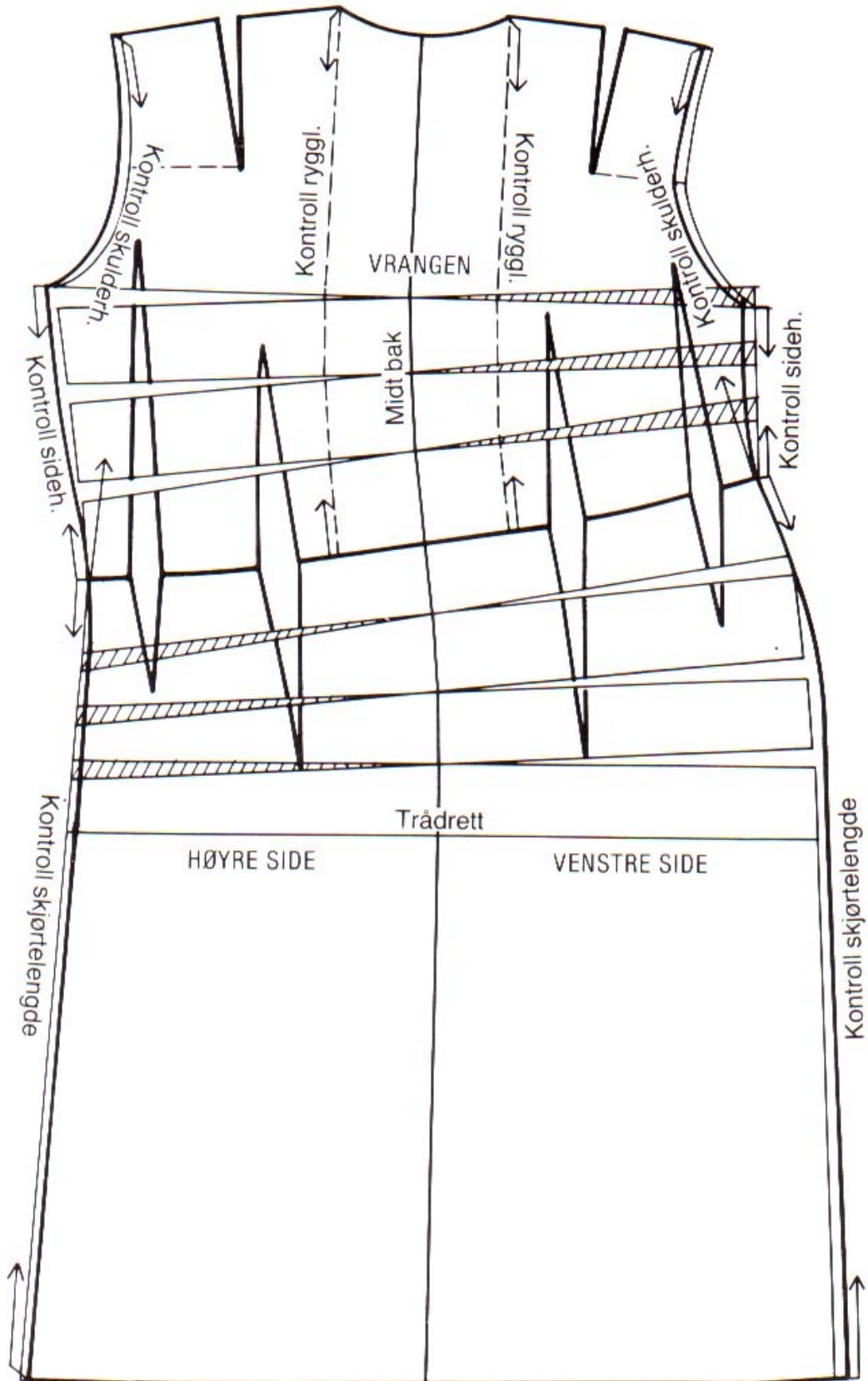
List of Tables

1: Categories of disfigurements	34
2: Criteria used when evaluating the final garment	38
3: The tolerances of the plain basic garments	56
4: Measurements that indicate the short stature	59
5: Measurements that indicate the warped shoulders	63
6: Measurements for indicating a warped waist	65
7: Measurements indicating the arched back	68
8: Measurements that can be used a guideline for the prominent stomach	70
9: Measurements indicating the prominent buttocks	71
10: The measurements indicating the hunchback	73
11: The needed measurements for test person A's trousers	79
12: Needed measurements for test person A's fitted jacket	81
13: Needed measurements for test person B's skirt	85
14: Needed measurements for test person B's fitted jacket	87

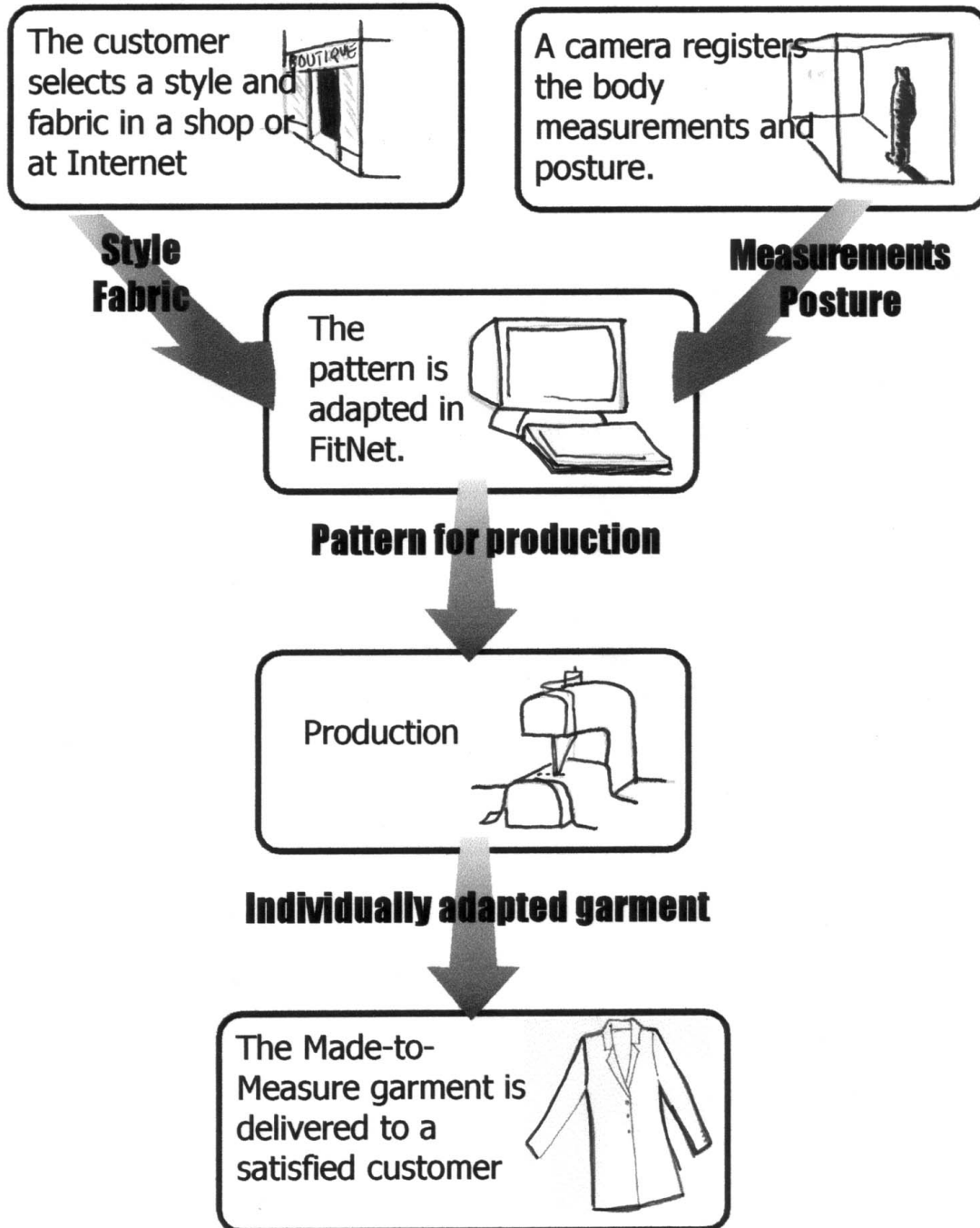
Appendices

A: Pattern adapted according to Frost's method	113
B: From order to complete garment	114
C: Evaluation of test garments.....	115
D: Test person's valuation of final garments, phase B.....	116
E: Expert's evaluation of final garments, phase B	120
F: Test person's evaluation of final garments, phase C.....	123
G: Expert's evaluation of final garments, phase C.....	126
H: Test person's follow up evaluation of final garments, phase B.....	130
I: Covering letter attached to the follow up evaluation	132
J: Registration of individual measurements.....	134
K: Illustration for registration of larger disfigurements	135
L: Standard garments.....	136
M: Garments used in phase B & C.....	137

Appendix A: Pattern adapted according to Frost's method (1987, p.30)



Appendix B: From order to complete garment Illustration Helene Berglin



*Appendix C: Evaluation of test garments***Aprovning av plagg [Testing of garment]**

Kundnummer: _____ Datum: _____
 [Customer number] _____ [Date] _____
 Namn: _____
 [Name] _____
 Typ av plagg: _____
 [Type of garment] _____

Helhetsintryck [Overall impression]: _____

- Ändringar som gjorts [Applied adaptations]

Ändring [Adaptation]	Kommentar [Comment]

Kundnummer [Customer number]: _____

• **Ändringar som ej gjorts [Adaptations not applied]**

Ändringar som ej tagits med [Adaptations not applied]	Kommentar [Comment]

• **Kontrollmått [Control measurement]**

Typ av mått [Type of measurement]							
Mått [Measurement]							

Om något ej är bra – vad beror det på ? [If something is not good – what is the cause?]

Felaktiga ändringar [Wrong adaptations]

Mätfel [Measurement errors]

Modellen ej bra [The style not suitable]

• **Övriga åsikter [Other opinions]**

Modellförslag [Style suggestions]

Diverse [Other]

TEST PERSONENS ÅSIKTER [TEST PERSON'S OPINION]

Namn:

[Name]

Vilka plagg använder du helst? [Which type of garments do you prefer?]	Byxa [Trousers]	<input type="checkbox"/>	Kjol [Skirt]	<input type="checkbox"/>	Skjorta/Blus [Shirt/Brous]	<input type="checkbox"/>
	Klänning [Dress]	<input type="checkbox"/>	Jacka [Jacket]	<input type="checkbox"/>	Kavaj [Fitted jacket]	<input type="checkbox"/>
	(annat[other]) _____					<input type="checkbox"/>
Hur får du vanligtvis bra passform på kläder i dag? [How do you get clothes with a good fit today?]	Skräddare [Tailor]	<input type="checkbox"/>	Konfektion [Ready-made]	<input type="checkbox"/>	Ändrar konf. [Alter ready-made]	<input type="checkbox"/>
	Syr själv [Sew myself]	<input type="checkbox"/>	(annat [other]) _____			<input type="checkbox"/>

BEKVÄMLIGHET [COMFORT]

Hur bekvämt är plagget? Detta måste bedömas i förhållande till vilket plagg det är, en storskjorta kan inte kännas på samma sätt som en figursydd kavaj. [How comfortable is the garment? This has to be judged in relation to what type of garment it is, a shirt can not have the same feeling as a fitted jacket.]

Kryssa i nedan vad du tycker om bekvämligheten. [Mark what you think about the comfort.]

KJOL [SKIRT]	Allmän känsla [Overall comfort]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
BYXA [TROUSERS]	Allmän känsla [Overall comfort]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Gren [Crutch]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>

fortsättning BEKVÄMLIGHET [continuation COMFORT]

KAVAJ [FITTED JACKET]	Allmän känsla [Overall comfort]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Axlar/Ärmhål/Hals [Shoulders/Scye/Neck]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Övervidd [Bust]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Ärmar [Sleeves]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Midja/Stuss [Waist/Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>

Om Du svarade *Mindre bra* på någon fråga under BEKVÄMLIGHET vad var det som ej var bra? [If you have answered *Fair* on any of the questions under the headline COMFORT what was it that was not good?]

HELHETSINTRYCK [OVERALL IMPRESSION]

Helhetsintrycket är viktigt när vi klär oss. Kryssa i nedan vad du tycker om helhetsintrycket för de olika kombinationerna. [The overall impression is important when we dress. Mark what you think about the overall impression for the different combinations.]

Kavaj och byxa [Fitted jacket and trousers]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
Kavaj och kjol [Fitted jacket and skirt]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>

Om Du svarade *Mindre bra* på någon fråga vad var det som ej var bra? [If you answered *Fair* on any of the questions, what was it that was not good?]

ÖVRIGT [VARIOUS]

Vi har alla olika stil och trivs i olika sorters kläder. Hur tycker du att dessa kläder stämmer överens med din klädstil?

[We all have different styles and feel comfortable with different sorts of garments. How do think these garments agree with your clothing style?]

Är det något du vill kommentera angående till exempel material, detaljer?

[Is there something you would like to comment on, for example the fabric, details?]

Hur upplever du dessa plagg, med tanke på passformen, jämfört med dina nuvarande plagg?

[How do you feel about these garments, in the matter of fit in comparison with the garments you usually have?]

Övriga kommentarer från Dig som provperson.

[Other comments from you as a test person.]

Vi tackar för Din medverkan och Ditt engagemang!!
[Thanks for you participation and you committment!!]

Appendix E: Expert's evaluation of final garments, phase B

VÅR OBJEKTIVA BEDÖMNING [OUR OBJECTIVE EVALUATION]

Provperson: _____ Kategori: _____
 [Test person] [Category]

PASSFORM KAVAJ [FIT OF THE FITTED JACKET]

Bedöm plaggets passform främst utifrån dess helhet. Följande tre kategorier bedöms; rörelsevidd, form i harmoni med kroppen samt sömmer/skärningar/detaljer. [Evaluate the garment fit primarily from its total fit. Following categories are evaluated; tolerance, shape in harmony with the body figure and seams/style lines/details.]

RÖRELSEVIDD [TOLERANCE]	Byst [Bust]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Midja [Waist]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Stuss [Hip]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Ärm [Sleeve]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
HARMONI [HARMONY]	Axlar [Shoulders]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Ärmhål [Scye]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Ärmar [Sleeves]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Stuss	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
SÖM & DETALJ [SEAM & DETAIL]	Längsgående söm fram/bak [Longitudinal seam front/back]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Axelsöm [Shoulder seam]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Fickor [Pockets]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Krage [Collar]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>

PASSFORM KJOL [FIT OF THE SKIRT]

Bedöm plaggets passform främst utifrån dess helhet. Följande tre kategorier bedöms; rörelsevidd, form i harmoni med kroppen samt sömmer/skärningar/detaljer. [Evaluate the garment fit primarily from its total fit. Following categories are evaluated; tolerance, shape in harmony with the body figure and seams/style lines/details.]

RÖRELSEVIDD [TOLERANCE]	Midja [Waist]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Stuss [Hip]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
HARMONI [HARMONY]	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
SÖM - DETALJ [SEAM&DETAIL]	Längsgående söm fram/bak [Longitudinal seam front/back]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Sprund [Slit]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>

PASSFORM BYXA [FIT OF THE TROUSERS]

Bedöm plaggets passform främst utifrån dess helhet. Följande tre kategorier bedöms; rörelsevidd, form i harmoni med kroppen samt sömmer/skärningar/detaljer. [Evaluate the garment fit primarily from its total fit. Following categories are evaluated; tolerance, shape in harmony with the body figure and seams/style lines/details.]

RÖRELSEVIDD [TOLERANCE]	Midja [Waist]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Stuss [Hip]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
HARMONI [HARMONY]	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
DETALJ [DETAIL]	Resår [Elastic]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Fickor [Pockets]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>

Är det något du vill kommentera? [Is there something that you would like to comment?]

AVVIKELSE [DISFIGUREMENT]

Har vi lyckats anpassa plagget till avvikelserna? [Have we succeeded with adapting the garment according to the disfigurements?]

Vilken är den största avvikelserna?
[Which is the largest disfigurement?]

Är plagget korrekt ändrat/sytt i anslutning till avvikelserna?
Om inte vad beskriv vad.
[Is the garment correctly adapted/sewn in relation to the disfigurements? If not describe what.]

Övriga kommentarer.
[Other comments.]

Appendix F: Test person's evaluation of final garments, phase C

TEST PERSONENS ÅSIKTER [TEST PERSON'S OPINION]

Namn:

[Name]

Vilka plagg använder du helst? [Which type of garments do you prefer?]	Byxa [Trousers]	<input type="checkbox"/>	Kjol [Skirt]	<input type="checkbox"/>	Skjorta/Blus [Shirt/Brous]	<input type="checkbox"/>
	Klänning [Dress]	<input type="checkbox"/>	Jacka [Jacket]	<input type="checkbox"/>	Kavaj [Fitted jacket]	<input type="checkbox"/>
	(annat[other]) _____					<input type="checkbox"/>
Hur får du vanligtvis bra passform på kläder i dag? [How do you get clothes with a good fit today?]	Skräddare [Tailor]	<input type="checkbox"/>	Konfektion [Ready-made]	<input type="checkbox"/>	Ändrar konf. [Alter ready-made]	<input type="checkbox"/>
	Syr själv [Sew myself]	<input type="checkbox"/>	(annat [other]) _____			<input type="checkbox"/>

BEKVÄMLIGHET [COMFORT]

Hur bekvämt är plagget? Detta måste bedömas i förhållande till vilket plagg det är, en storskjorta kan inte kännas på samma sätt som en figursydd kavaj. [How comfortable is the garment? This has to be judged in relation to what type of garment it is, a shirt can not have the same feeling as a fitted jacket.]

Kryssa i nedan vad du tycker om bekvämligheten. [Mark what you think about the comfort.]

KJOL [SKIRT]	Allmän känsla [Overall comfort]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
BYXA [TROUSERS]	Allmän känsla [Overall comfort]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Gren [Crutch]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>

fortsättning BEKVÄMLIGHET [continuation COMFORT]

KLÄNNING [DRESS]	Allmän känsla [Overall comfort]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Byst [Bust]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
KAVAJ / ROCK [FITTED JACKET / COAT]	Allmän känsla [Overall comfort]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Axlar/Ärmhåll/Hals [Shoulders/Scye/Neck]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Övervidd [Bust]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Ärmar [Sleeves]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
	Midja/Stuss [Waist/Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>

Om Du svarade *Mindre bra* på någon fråga under BEKVÄMLIGHET vad var det som ej var bra? [If you have answered *Fair* on any of the questions under the headline COMFORT what was it that was not good?]

HELHETSINTRYCK [OVERALL IMPRESSION]

Helhetsintrycket är viktigt när vi klär oss. Kryssa i nedan vad du tycker om helhetsintrycket för de olika kombinationerna. [The overall impression is important when we dress. Mark what you think about the overall impression for the different combinations.]

Plaggen tillsammans [The garments in combination]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	Mycket bra [Excellent]	<input type="checkbox"/>
--	----------------------	--------------------------	---------------	--------------------------	---------------------------	--------------------------

Om Du svarade *Mindre bra* på någon fråga vad var det som ej var bra? [If you answered *Fair* on any of the questions, what was it that was not good?]

ÖVRIGT [VARIOUS]

Vi har alla olika stil och trivs i olika sorters kläder. Hur tycker du att dessa kläder stämmer överens med din klädstil?

[We all have different styles and feel comfortable with different sorts of garments. How do think these garments agree with your clothing style?]

Är det något du vill kommentera angående till exempel material, detaljer?

[Is there something you would like to comment, for example the fabric, details?]

Hur upplever du dessa plagg, med tanke på passformen, jämfört med dina nuvarande plagg?

[How do you feel about these garments, in the matter of fit in comparison with the garments you usually have?]

Övriga kommentarer från Dig som provperson.

[Other comments from you as a test person.]

*Vi tackar för Din medverkan och Ditt engagemang!!
[Thanks for you participation and you committment!!]*

Appendix G: Expert's evaluation of final garments, phase C

VÅR OBJEKTIVA BEDÖMNING [OUR OBJECTIVE EVALUATION]

Provperson:
[Test person]

Kategori:
[Category]

PASSFORM KAVAJ [FIT OF THE FITTED JACKET]

Bedöm plaggets passform främst utifrån dess helhet. Följande tre kategorier bedöms; rörelsevidd, form i harmoni med kroppen samt sömmar/skärningar/detaljer. [Evaluate the garment fit primarily from its total fit. Following categories are evaluated; tolerance, shape in harmony with the body figure and seams/style lines/details.]

RÖRELSEVIDD [TOLERANCE]	Byst [Bust]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Midja [Waist]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Stuss [Hip]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Ärm [Sleeve]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
HARMONI [HARMONY]	Axlar [Shoulders]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Ärmhål [Scye]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Ärmar [Sleeves]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
SÖM & DETALJ [SEAM & DETAIL]	Längsgående söm fram/bak [Longitudinal seam from/back]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Axelsöm [Shoulder seam]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Fickor [Pockets]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Krage [Collar]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>

PASSFORM KJOL [FIT OF THE SKIRT]

Bedöm plaggets passform främst utifrån dess helhet. Följande tre kategorier bedöms; rörelsevidd, form i harmoni med kroppen samt sömmar/skärningar/detaljer. [Evaluate the garment fit primarily from its total fit. Following categories are evaluated; tolerance, shape in harmony with the body figure and seams/style lines/details.]

RÖRELSEVIDD [TOLERANCE]	Midja [Waist]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Stuss [Hip]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
HARMONI [HARMONY]	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
SÖM - DETALJ [SEAM&DETAIL]	Resår [Elastics]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Fickor [Pockets]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>

PASSFORM BYXA [FIT OF THE TROUSERS]

Bedöm plaggets passform främst utifrån dess helhet. Följande tre kategorier bedöms; rörelsevidd, form i harmoni med kroppen samt sömmar/skärningar/detaljer. [Evaluate the garment fit primarily from its total fit. Following categories are evaluated; tolerance, shape in harmony with the body figure and seams/style lines/details.]

RÖRELSEVIDD [TOLERANCE]	Midja [Waist]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Stuss [Hip]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
HARMONI [HARMONY]	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
DETALJ [DETAIL]	Resår [Elastic]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Fickor [Pockets]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>

PASSFORM KLÄNNING [FIT OF THE DRESS]

Bedöm plaggets passform främst utifrån dess helhet. Följande tre kategorier bedöms; rörelsevidd, form i harmoni med kroppen samt sömmar/skärningar/detaljer. [Evaluate the garment fit primarily from its total fit. Following categories are evaluated; tolerance, shape in harmony with the body figure and seams/style lines/details.]

RÖRELSEVIDD [TOLERANCE]	Byst [Bust]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Midja [Waist]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
	Stuss [Hip]	För liten [Too small]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>	För stor [Too large]	<input type="checkbox"/>
HARMONI [HARMONY]	Byst [Bust]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Midja [Waist]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>
	Stuss [Hip]	Mindre bra [Fair]	<input type="checkbox"/>	Bra [Good]	<input type="checkbox"/>		<input type="checkbox"/>

fortsättning BEKVÄMLIGHET [continuation COMFORT]

SKRIV VARFÖR! [WRITE WHY!]	Byxa [Trousers]	_____
	Kjol [Skirt]	_____
	Kavaj [Fitted jacket]	_____

PRISSÄTTNING [PRICING]

Westerlind AB, de som sydde upp Dina plagg, har gjort en uppskattning av vad dessa individanpassade plagg skulle kosta ute i handeln. Skulle Du vara villig att betala det angivna priset för ett individanpassat plagg. Svara genom att sätt kryss för vart och ett av plaggen. [Westerlind AB, the company making-up your garments, has estimated what these made-to-measure garments would cost in the retail store. Would you be willing to pay the set price for the individualised garments?. Mark for each of the garments.]

PRIS [PRICE]	Byxa [Trousers]	1450:-	Ja [Yes]	<input type="checkbox"/>	Nej [No]	<input type="checkbox"/>
	Kjol [Skirt]	1350:-	Ja [Yes]	<input type="checkbox"/>	Nej [No]	<input type="checkbox"/>
	Kavaj [Fitted jacket]	2500:-	Ja [Yes]	<input type="checkbox"/>	Nej [No]	<input type="checkbox"/>

Om Du svarade att Du ej var villig att betala det angivna priset - var vänlig skriv vilket pris Du skulle kunna acceptera. [If you have answered that you were not willing to pay the price – please write down the price you could accept.]

PRISSÄTTNING [SET PRICE]	Byxa [Trousers]	_____ kr
	Kjol [Skirt]	_____ kr
	Kavaj [Fitted jacket]	_____ kr

ALLMÄNT [OTHER]

Vi värdesätter Dina åsikter och undrar om Du har ytterligare några kommentarer angående något av plaggen (tex. lättskötta, skrynklar inte, lagom varmt, bra färg osv.). [Your opinion is important to us. Do you have any further comments about any of the garments (for example, easy care, wrinkles easily, gives a comfortable temperature, nice colour etc.)]

Tack än en gång «Förnamn» för att Du har ställt upp för oss och projektet EASYTEX!!
[Thanks once more «First name» for your participation in the EASYTEX project!!]

Appendix I: Covering letter attached to the follow up evaluation



GÖTEBORGS UNIVERSITET

Institutionen för hushållsvetenskap

GÖTEBORG UNIVERSITY
 Department of Home Economics
 Niina Hernández, Doktorand

25 October 2000

«Förnamn» «Efternamn»
 «Gatuadress»
 «Postnummer» «Postadress»

Hej «Förnamn»

Hoppas att allt är väl med Dig, «Förnamn»!

EASYTEX- projektet fortskrider men med mindre personalstyrka än tidigare. Helene Berglin och Camilla Svensson slutade vid millennieskiftet. Jag, Niina Hernández är kvar och skriver på min licentiatavhandling som är planerad att vara färdig i slutet på maj.

Det är nu viktigt att individanpassade kläder blir tillgängliga på marknaden och att Du då kan få möjlighet att få kläder som passar Din kropp direkt från industrin. Det skulle väl vara något det?!?! ☺ För att fortsätta undersökningen vad beträffar individanpassade kläder är det viktigt att höra vad Du anser. Jag gör en enkätundersökning för att samla in ytterligare viktig information för framtida arbete.

Genom att fylla i enkäten och skicka in den till mig bidrar Du till att föra individanpassade kläder ut på marknaden. Vänligen skicka in den ifyllda enkäten senast den **10 mars 2000**.

Hälsningar genom

Niina Hernández
 Doktorand

<i>Postadress / Postal address</i>	<i>Besöksadress / Visiting address</i>	<i>Telefon / Telephone</i>	<i>E-post / E-mail Internet</i>
Box 12204	Birger Jarlsgatan 3	+46 (0)31 773 4247 dir	Niina.Hernandez@ped.gu.se
S-402 42 GÖTEBORG	Göteborg	+46 (0)31 773 1000 vx	
Sweden		+46 (0)31 773 4209 fax	

<http://www.ped.gu.se/ihu/hushome.html>



GÖTEBORGS UNIVERSITET

Institutionen för hushållsvetenskap

GÖTEBORG UNIVERSITY

*Department of Home Economics**Niina Hernández, PhD Student*

25 October 2000

«First name» «Surname»
 «Street address»
 «Postcode» «Postal address»

Hello «First name»

We hope that everything is fine with you, «First name»!

The EASYTEX- project proceeds but with less staff than before. The employment for Helene Berglin and Camilla Svensson ended at the turn of the millennium. I, Niina Hernández am still working with the project and writing my licentiate treatise that is planned to be completed in the end of May.

It is important that the made-to-measure garments become available on the market so you can get clothes from the manufacturer that fit your figure. That would be something, wouldn't it?!!! ☺ In order to continue the research concerning made-to-measure garments is it important to know what you think. I am doing an opinion pull in order to gather important information for future work.

You can contribute by filling in the form and sending it in to me. By doing this you will help to make made-to-measure garments available on the market. Please mail the filled in form at the latest March 10 2000.

Sincerely

Niina Hernández
 PhD student

Postadress / Postal address

Box 12204
 S-402 42 GÖTEBORG
 Sweden

Besöksadress / Visiting address

Birger Jarlsgatan 3
 Göteborg

Telefon / Telephone

+46 (0)31 773 4247 dir
 +46 (0)31 773 1000 vx
 +46 (0)31 773 4209 fax

E-post / E-mail Internet

Niina.Hernandez@ped.gu.se

<http://www.ped.gu.se/ihu/hushome.html>

Appendix J: Registration of individual measurements

INDIVIDUELLA MÅTT
[Individual measurements]

Namn [Name]: _____

Datum [Date]: _____

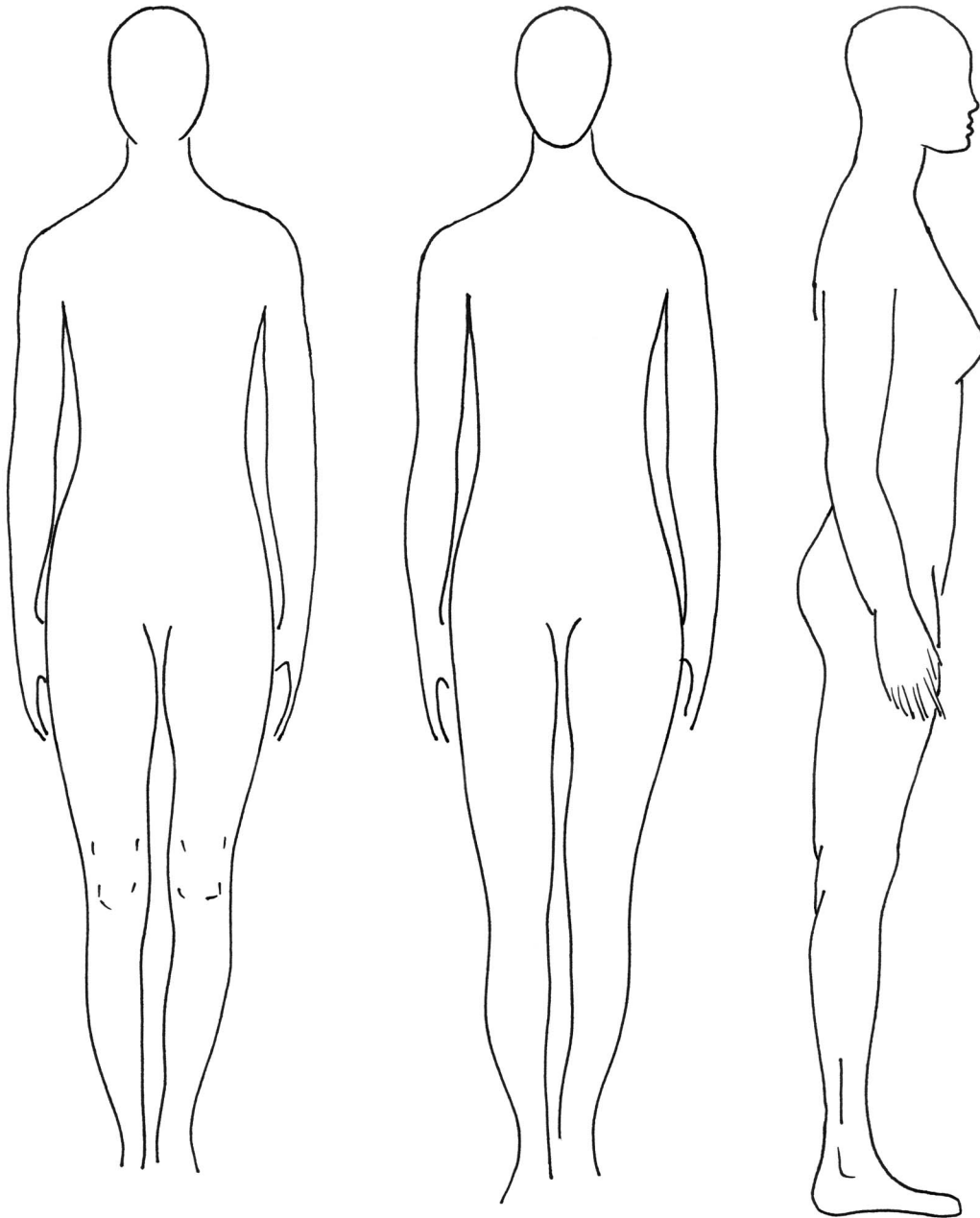
Kroppsmått [Body measurements]	hela måttet [total measurement]	höger [right]	vänster [left]
Kroppslängd [Height]			
Bystvidd [Bust circumference]			
Midjevidd [Waist circumference]			
Höftvidd [High hip circumference]			
Stussvidd [Hip circumference]			
Halsvidd [Neck circumference]			
Livlängd bak [Nape to waist back]			
Ryggbredd [Back width]			
Yttre axelspets – Yttre axelspets [Shoulder point – Shoulder point]			
Bysthöjd (mb-byst) [Nape to bust point]			
Livlängd fram (mb-midjan) [Nape to waist front]			
Axelbredd [Shoulder width]			
Ärmlängd [Arm length]			
Överarmsvidd [Upper arm circumference]			
Handledsvidd [Wrist circumference]			
Hellängd bak (midja-golv)* [Waist to floor – back]			
Hellängd fram (midja-golv)* [Waist to floor – front]			
Kjollängd/Klänning [Skirt length]			
Sidlängd (midja-golv)* [Outside leg length]			
Byxhöjd, mitt fram [Body rise – centre front]			
Innerbenlängd* [Inside leg length]			
Sitthöjd [Body rise]			
Lårvidd [Thigh circumference]			
Ev. lägsta klacken [Lowest heel]			

Specialmått för vissa kategorier [Special measurements for certain categories]

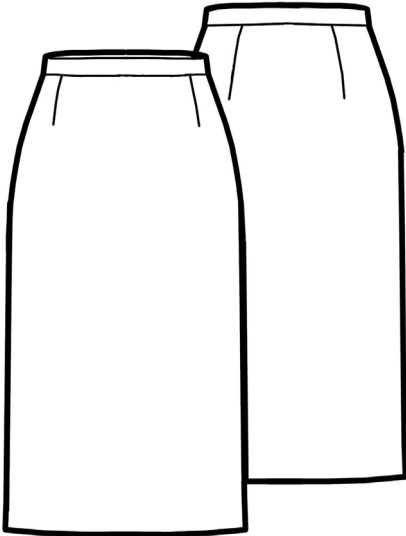
Stussvidd-inre axelspets bak [Height of neck point – back]			
Inre axelspets-stussvidd fram [Height of neck point – front]			
Stussvidd-yttre axelspets bak [Height of shoulder point – back]			
Yttre axelspets-stussvidd fram [Height of shoulder point – front]			
Sidhöjd (midja-armhåla) [Side (waist- arm pit)]			
Midja fram/bak [Waist front/back]		fram [front]	bak [back]
Stuss fram/bak [Hip front/back]		fram [front]	bak [back]
Stuss inkl. lår [Hip including thighs]			

* Drag ev. av klackens höjd [Subtract any height of heel]

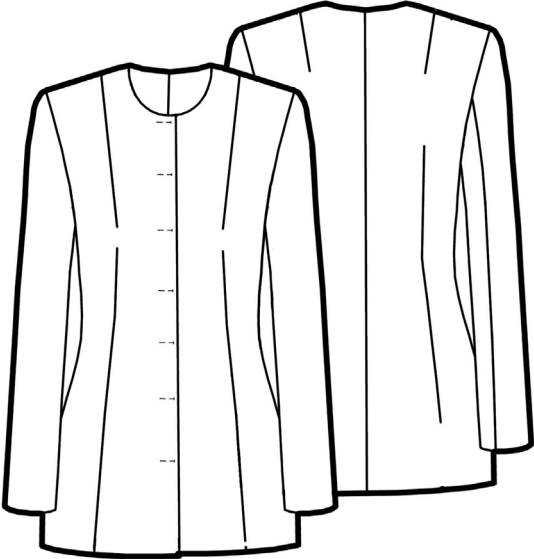
Appendix K: Illustration for registration of larger disfigurements



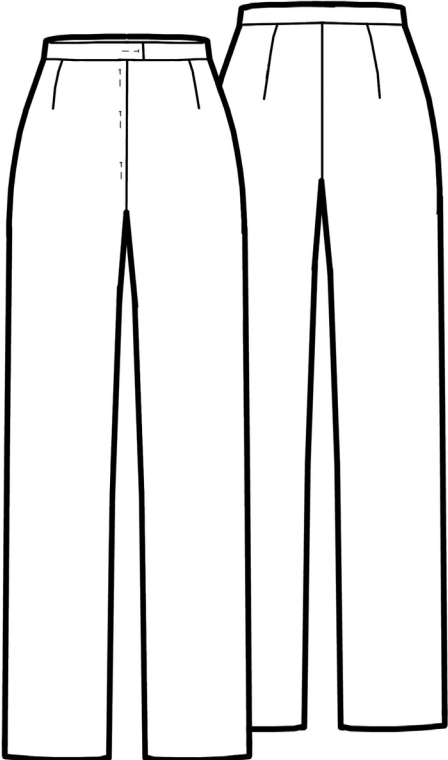
Appendix L: Standard garments



Skirt with darts both on the front and on the back piece of the garment.



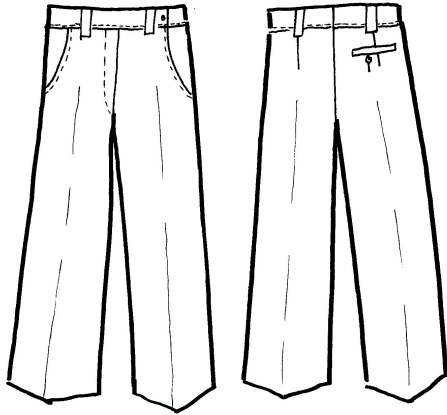
Fitted jacket with darts forming the garment to the body figure.



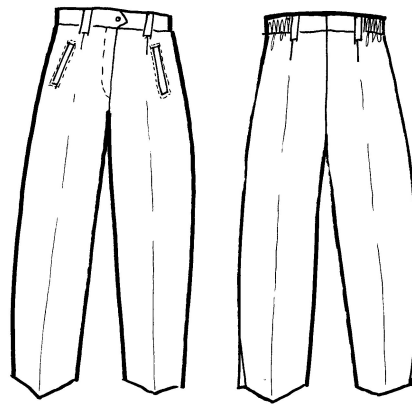
Trousers with darts both on the front and on the back piece of the garment.

Appendix M: Garments used in phase B & C

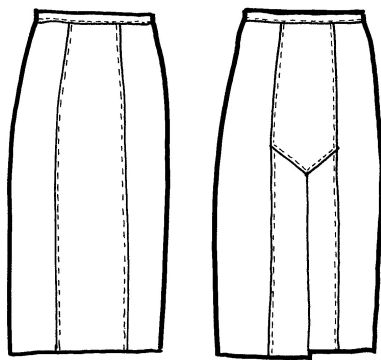
Phase B



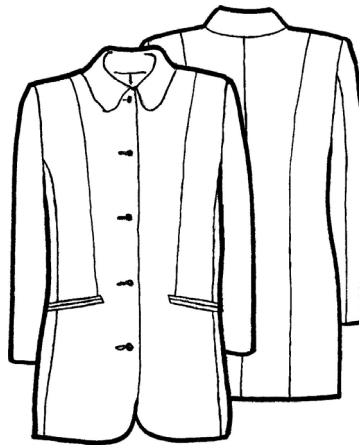
Classic trousers
Illustration Helene Berglin



Classic trousers with a elastic section on the waistband
Illustration Helene Berglin



Skirt with a slit in the back. The skirt comes in a short and a long variant.
Illustration Helene Berglin

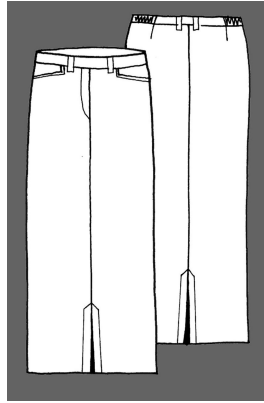


Fitted jacket with cuts from the shoulders both in front and in back.
Illustration Niina Hernández

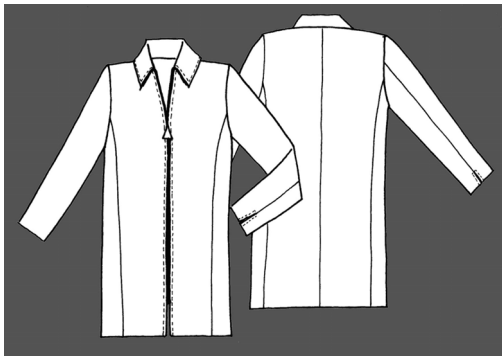
Phace C



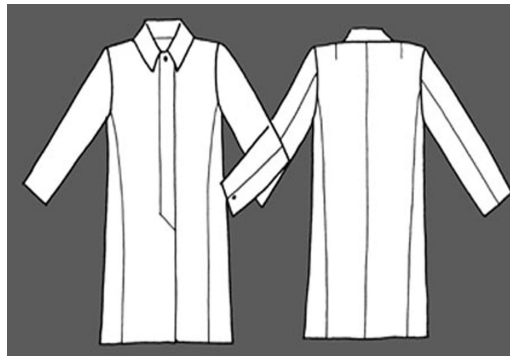
Trouser with straight pocket and an elastic section on the waistband.
Illustration Helene Berglin



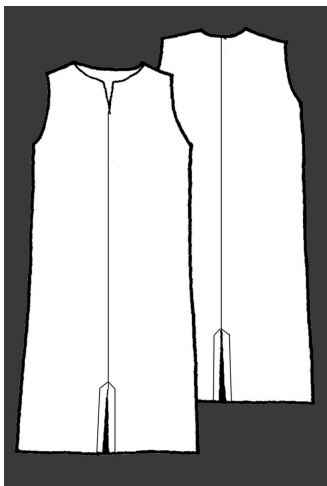
Skirt with a slit front and back, straight pockets and an elastic section on the waistband.
Illustration Helene Berglin



Fitted jacket with a zipper along the centre front. Pockets in the seam.
Illustration Helene Berglin



Coat with hidden buttoning along the front. Pockets in the seam.
Illustration Helene Berglin



Short and long sleeveless dress with slit in front and back.
Illustration Helene Berglin

To find clothes in a retail store is a problem for quite a lot of individuals, especially for those with extensive body disfigurements. Today, information technology brings the industry the aids to produce and offer mass customised garments to a greater variety of customers. Thus, part of the problem is solved. Consequently, the knowledge of how to adapt garment design and patterns in order to obtain esthetical and well-fitting garments becomes fundamental. This thesis reports and discusses the methodology and experiences in research work, with two main areas of focus; *the work process* and *pattern construction* in the development of individual garments for persons with large disfigurements.

The thesis describes how an innovative figure registration can be carried out, including the measuring procedure and the figure illustrations, both necessary for the *figure analysis* which is essential for the creation of the individual pattern. The different adaptations needed for various large disfigurements are presented in two sections; first a general presentation of single adaptations according to specific disfigurements, followed by, adaptations in complex combinations creating individual patterns.

This study has been undertaken within the framework of the EASYTEX project, the overall aim of which is to improve living conditions for the elderly, the disabled, and impaired individuals. The EASYTEX project, which is financed by the European Commission started January 1997 and runs through to June 2000.

Keywords:

pattern construction, pattern adaptation, figure registration, body measurement, disfigurement, clothes, garment, made-to-measure, mass customisation

Research report 30, 2000
ISSN 1403-7033

Department of Home Economics
Göteborg University
2000