

AN ABSTRACT OF THE THESIS OF

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CUSTOM-MADE PANTS

Abstract approved: *Redacted for Privacy*

Vera Wells

Pants have become a seemingly necessary part of the average American woman's wardrobe and may be worn for nearly every occasion. However, many women have indicated that when conventional methods of construction were used for pants-making, the pants did not conform to their expectation of good fit. Observation showed that pants made according to the conventional methods of construction did not comply with the standards of good fit that have been established for other garments. Therefore, the conventional methods of pants construction were modified in accordance with the principles and standards of clothing construction that have been used as a basis for achieving good fit.

The basic differences between the unmodified and modified methods of construction were: 1) the location of the lengthwise grain line on the patterns, 2) the addition of fitting allowances on the fitting seams of the modified pants patterns, 3) the techniques used to

facilitate the placement of the grain lines of the fabric on the balance lines of the body, and 4) the fabrics used to construct the pants. The participants were students at Oregon State University.

To determine the effect that a modified method of construction would have on the fit of women's custom-made pants, eight pants patterns were randomly selected from the commercial patterns purchased by the participants. Two pairs of pants were constructed from each of the selected patterns, one pair before the pattern was modified and another pair after pattern modifications. An additional 46 pairs of pants were also made by the modified method of construction. Each of the 62 pairs of pants was then modeled, and 12 characteristics of fit were rated by a panel of clothing construction authorities as well as by the other participants in a class.

There were statistically significant differences between the fit of the crosswise grain line, front crotch, back crotch, and lower back hip on the two sets of garments, while no significant differences were found between the other characteristics of fit on these garments. When the scores for the fit of the crosswise grain line, front crotch, back crotch, and lower back hip were compared among groups of modified pants, no significant differences were found. Subsequent analysis of the scores for the modified pants indicated that:

- 1) bonded wool-acetate fabrics were not suitable for the construction of closely fitted pants,
- 2) the size of the wearer apparently did not

affect the ratings of the fit of the modified pants, and 3) the comfort of the modified pants was considered to be above average. The results of a secondary investigation showed that the total crotch length method of measurement provided a better basis for determining the adequacy of the crotch length of a pattern than did either of the two crotch depth methods of measurement.

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Custom-Made Pants

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TABLE OF CONTENTS

	Page
INTRODUCTION	1
Statement of the Problem	2
The Hypotheses	4
Limitations and Assumptions	4
Definition of Terms	6
REVIEW OF LITERATURE	8
Standards of Fit	8
Physical Components	10
Body Measurements	11
Compositional Components	12
The Pattern	12
The Fabric	15
The Findings	16
Guides for Fitting	17
Measurement Comparisons	17
Pattern Alteration	19
Preparation for Fitting	20
Fitting Techniques	21
Guides for Sewing	23
PROCEDURE	26
Preliminary Observation	26
Procedural Variations	27
Methods of Measurement	28
Body Measurements	28
Pattern Measurement	29
Pattern Alteration	29
Preparation of Unmodified Pants	30
Preparation of Modified Pants	31
Pattern Preparation	31
Fabric Preparation	32
Preparation for Fitting	33
Method of Fitting	35
Method of Sewing	38
Method of Evaluation	40
Method of Analysis	41

TABLE OF CONTENTS (continued)

	Page
RESULTS AND DISCUSSION OF DATA	45
Description of the Sample	45
Comparison of Modified and Unmodified Pants	46
Comparison of the Fit of Selected Pants	51
Effect of the Fabric on the Fit of Modified Pants	51
Effect of Size on the Fit of Modified Pants	52
Crotch Length-Depth Measurements	54
Comfort Evaluation	55
CONCLUSIONS AND RECOMMENDATIONS	58
BIBLIOGRAPHY	64
APPENDIX I	66
APPENDIX II	68
APPENDIX III	69
APPENDIX IV	70

LIST OF TABLES

Table		Page
1	Location and recommended amount of ease for pants patterns.	30
2	Mean scores for each of the characteristics of fit on the modified and unmodified pants and the computed F-value for each characteristic.	48
3	Mean scores for the characteristics of fit of the modified pants made from bonded and unbonded fabrics.	53
4	The number of kinds of change in crotch measurement as indicated and made according to the method of measurement.	55
5	Percentage distribution of comfort scores for modified pants in relation to activity.	56

LIST OF ILLUSTRATIONS

Figures		Page
1	Basic pants patterns which illustrate differences in design.	14
2	Basic design for culottes.	15
3	A pants pattern with fitting allowances.	20
4	A modified pants pattern prepared for cutting.	32
5	The general outline of a corrected pants pattern.	38

ANALYSIS OF THE FIT OF WOMEN'S CUSTOM-MADE PANTS

INTRODUCTION

Women of many cultures have worn pants or a pants-type garment during various periods of history, but only recently have these garments become an accepted and seemingly necessary part of the average American woman's wardrobe. Today, pants or a pants-type garment may be worn for nearly every occasion. Although some of these garments are loosely fitted, many of the recent styles follow body contours very closely. Since the fit of any garment can influence the individual wearer physiologically and psychologically, as well as economically and sociologically, the fit of women's pants seems especially important when these garments provide a minimum amount of ease.

The achievement of good fit has been recognized as the most important step in clothing construction. Hillhouse and Mansfield (1948, p. 193) state that "perfection of fit goes far beyond mere comfort and wearability." They also consider the skillful concealment of figure irregularities and the addition of style as basic to good fit. Bane (1966) states that fitting is the most difficult step to accomplish and indicates that the difficulty may be caused by the many variable factors involved in garment construction. The figure, fabric, design,

and purpose of the garment must be blended to attain the desired effect.

A garment that provides separate coverings for the lower body extremities complicates the achievement of good fit not only because there are additional body areas to be fitted, but perhaps more importantly, a balanced relationship between each of the areas must be maintained. Thus, achieving a good fit in women's pants may be more exacting than obtaining a good fit in any other garment.

Statement of the Problem

Prior to the time of this study, the author was frequently asked about the fit of women's pants, or more specifically, why women's pants did not fit. Many of the questions indicated concern about the inadequacy of the garment-to-body size relationships that were used to construct women's pants. For example, when the size of the hip area was adequate, the circumference of the waist line might be either too large or too small; or, the length of the crotch was not proportionately adequate for the individual when other areas of the garment provided adequate size. Since all commercial patterns are drafted to fit a composite "average" figure, these questions about size seemed to indicate that if custom-made pants were to fit the wearer, a fundamental knowledge of pattern alteration and fitting technique was necessary.

The writer's search for a reliable source of information about pants construction revealed that little had been written about pants construction and that no prior study had been reported. Various discrepancies and omissions in the literature were apparent and probably had contributed to the problems which confronted the women who desired pants that were fitted to their specific figure needs. Thus, this research was designed to investigate the contemporary methods used for the construction of women's custom-made pants for the purpose of determining a modified method which could improve the fit of women's pants. The findings of this study should be useful to the home sewer as well as instructors of clothing construction, since the results could be applicable to all basic pants construction.

The objectives of this research were to: 1) determine the effect that a modified method of pants construction would have on the fit of women's custom-made pants as compared with the fit of women's custom-made pants constructed by conventional (unmodified) methods, 2) determine if the fabric used for the construction of pants made by the modified method affected the fit of the pants, 3) determine if the size of the wearer affected the fit of the pants constructed by the modified methods, and 4) determine which one of the methods used to take crotch measurements would provide an accurate indication of crotch length.

The Hypotheses

The hypotheses were:

1. Pants made by the modified method of construction will fit the wearer better than pants constructed by conventional methods.
2. The fit of the pants made by the modified method of construction will not be affected by the fabric used for their construction.
3. There is no association between the fit of the pants made by the modified method of construction and the size of the wearer.
4. Pants made by the modified method of construction will provide the wearer with a high level of comfort.
5. Total crotch length measurements will provide a more accurate indication of adequate crotch length than either of the two methods of crotch depth measurement.

Limitations and Assumptions

The participants in this study were limited to those students who enrolled winter term 1967 in the beginning clothing construction¹ classes at Oregon State University. The course was available to all women students, but only three 20-student sections were offered during this term. Although this fact tended to limit the participants to an "ideal figure" age group, the investigator's previous experience

¹ Clothing Construction CT 210.

indicated that the participants would have various figure irregularities and fitting problems.

The course outline introduced further limitations since certain fundamental construction procedures were incorporated in this classroom construction project:

1. The pants patterns purchased by the participants had the following features: a) a normal waistline position, b) outside leg seams, c) full length legs, and d) a hip size that corresponded with the individual's widest hip measurement.

2. The fiber content of the fabric used by the participants consisted of wool or a blend of fibers in which wool was predominant. The use of lining and/or underlining was optional.

3. The findings included silk and/or mercerized cotton thread, grosgrain ribbon, a metal or nylon coil zipper, a flat skirt hook and eye, and a small snap.

The investigator recognized that the participants' prior construction experiences would not be parallel, but assumed that the instruction and supervision given throughout the duration of the study would enable each participant to achieve an acceptable level of construction proficiency.

The scope of this study did not permit an investigation into the sociological, psychological, physiological, or economic factors associated with women's pants. No attempt was made to investigate

the fit of ready-to-wear pants or to compare the fit of custom-made pants to the fit of ready-to-wear pants. The value of anthropometric measurement technique was recognized by the investigator, but the orientation of this study indicated that the measuring equipment should closely resemble the equipment normally used by the home sewer.

Definition of Terms

In contemporary usage, pants is a generic term applied to any garment that covers the lower trunk and is divided into separate coverings for at least a portion of the lower body extremities. The present study includes only those pants that originate at the waist-line, are fitted through the hip area, and extend into separate ankle-length coverings for the legs.

The term fit has been defined as having the attributes and qualifications to meet a specific requirement, detail, or purpose. The fit of a garment is determined by the size and shape relationships which exist between the garment and the wearer. Closely fitted pants should conform to the structural lines of the human body, yet permit the wearer to participate in active body movement. Pants should be comfortable; free of constricting influences that may affect the physiological functions of the body.

The pants described in this study have been classified according

to the method of construction used for their preparation. The term unmodified refers to 1) the commercial pants patterns that have been used in the way in which the average home sewer would use the pattern, and 2) the pants cut from these patterns. The unmodified pants patterns may have had proportional length and/or width alterations (basic size), but the patterns and the garments cut from these patterns were not changed in any other way. The pants made according to the writer's experimental construction procedure, and the patterns from which these pants were cut, have been designated as modified.

REVIEW OF LITERATURE

A fundamental understanding of the various aspects of each factor involved in the construction of a garment has been considered prerequisite to the achievement of clothing that fits the wearer and enhances the wearer's appearance and comfort. The factors that contribute to and affect the fit of a garment have been referred to as: fabric, figure, design (pattern), and purpose of the garment (Bane, 1966), but most clothing construction authorities also emphasize the importance of accurate construction techniques. Pants, which Tyroler (1963, p. 12) considers ". . . the perennial stepchildren of the pattern instruction sheets," should not be an exception to good fit.

The writer has discussed the pertinent information in the current literature concerning the fit of women's custom-made pants and the contemporary methods used to combine and manipulate the factors that contribute to the fit of these pants.

Standards of Fit

Generalized information describing the fit of women's pants indicated that well-fitted pants were ". . . smooth, but not tight, along the curve of the body" (Mauck, 1947, p. 164) and that the crotch seam line should follow the curve of the body without being so long as to sag. To achieve good fit when constructing any garment, Latzke

and Quinlan (1940, p. 101, 102) indicated the following principles of fitting:

1. The garment should conform to the body when various positions are taken.
2. . . . Basic seams or design lines of a garment should be placed either on contour lines of the body or related to points of articulation.
3. . . . The fabric must be so handled that the filling yarns of the fabric are held parallel at one or more of the following places: the chest, scye, bust, and hip lines; and wherever they are held parallel the warp yarns are perpendicular to them as well as parallel to the center front.

The purpose a garment is to serve determines the pattern design, the fabric or fabrics, and the findings that can be used for construction. In general, pants have been considered activity or sport garments, with a basic design that was functional and simple. According to Bane (1966), sport clothes and those garments that will frequently be worn for several hours at a time must be fitted with more freedom than evening garments or those garments worn infrequently for short periods of time. Clothing construction authorities agreed that the amount of freedom or allowance for ease could be varied from style to style and with the wearer's personal preference, but that the ease should provide adequate fabric for movement, comfort, and a becoming fit.

Physical Components

Garment-making procedures have been based on a knowledge of the physical characteristics of the human body. The structural formation of each human body is similar, but heredity and environment influence the individual combination of bone, muscle, tissue, fat, and skin to the extent that each figure becomes unique. Deviations in the proportional length and width size relationships of the body and the segments may occur between any two or more body segments, between the same segments as they appear on opposite sides of the body, or between the two sides of the body itself (Latzke and Quinlan, 1940).

Posture, the position or alignment of the body segments also affects the structural outline. The criteria for ideal posture are based on a balanced or centered alignment of the head, trunk, pelvis, legs, and feet. The center of gravity or weight center of the body should be centered over the feet. An ideal silhouette view illustrated that the head was erect with the chin level, the chest high but relaxed, the abdomen flat, the curves of the vertebra rounded but not exaggerated, and the knees slightly flexed. A back silhouette view indicated a symmetrical outline with the shoulders and hips level, the spine and legs straight, and the feet pointed forward (Latzke and Quinlan, 1940).

Seven waistline-to-base variations in body structure and posture that could affect the fit of pants have been listed by Mansfield (1953) as: 1) prominent pelvic bone, 2) large abdomen, 3) back hip (flat or prominent), 4) sway back, 5) hips broad from side to side, 6) high hip, and 7) heavy thighs.

Body Measurements

Most clothing construction authorities agreed that accurate body measurements were prerequisite to good fit and that the measurements should be taken: 1) with an accurate tape, 2) over the undergarments that would be worn with the garment to be constructed, 3) with the tape held snugly but not tightly against the body, 4) with a cord or tape fastened around the waist to insure accuracy of vertical measurements, and 5) with the aid of another person; while the number of measurements that were considered necessary seemed to be dependent upon the style of the pants.² However, the authors were not in complete accord concerning the method of measurement to be used to determine the length of the crotch. Most authors suggested a crotch depth method of measurement, but some authors used a tape measure, while other authors used a ruler to determine the distance

² A compiled listing of the body measurements that were suggested for ankle length, fitted pants has been placed in Appendix I.

between the waistline and the top of a flat surface on which the person being measured was seated. A few authors described the use of total crotch length measurement for women who had a protruding abdomen. For this method, the end of the tape was held on the center front waistline while the length of the tape was carried between the legs and up to the center back waistline.

Compositional Components

The Pattern

Patterns provided the design and plan for shaping fabric to the body. The basic contour of the pattern sections formed the primary shape of the garment while the darts within the sections aided in adjusting the difference between circumference measurements. Most commercial patterns have been drafted from a composite representation of the stature, proportion, and circumference measurements of many people, as compiled by the United States Bureau of Standards. Thus, the basic size of a commercial pattern is standardized, although the amount of ease and design fullness may vary between pattern styles as presented by a single designer and/or between the various pattern designers (Bane, 1966).

The basic pants patterns described in the literature seemed representative of the commercial patterns on the current market (Figure 1). These patterns illustrated the differences which occur between the designer's interpretation for the distribution of fabric to cover the contours of the lower body. Aside from the contour of the legs (style feature), the differences that were noted were: 1) location of the lengthwise grain line, 2) shape of the crotch, 3) length of the back crotch, and 4) location of the darts.

The basic design for a pants-type garment (culottes) is shown in Figure 2. The shape of the crotch of this pattern seemed to correspond with Waisman's (1950, p. 32) statement that "the curve of the crotch should look like a U, with the bottom of the U at the central, lowest part of the crotch" on men's pants.

Tyroler's (1963) prerequisites for a well-designed pattern indicated that there should be a small amount of bias on the front and back crotch seams, but that too much bias would cause the pants to pull down in back when the wearer was seated. Tyroler (1963) also indicated that women's pants patterns should have outside leg seams to provide an opportunity to fit the pants.

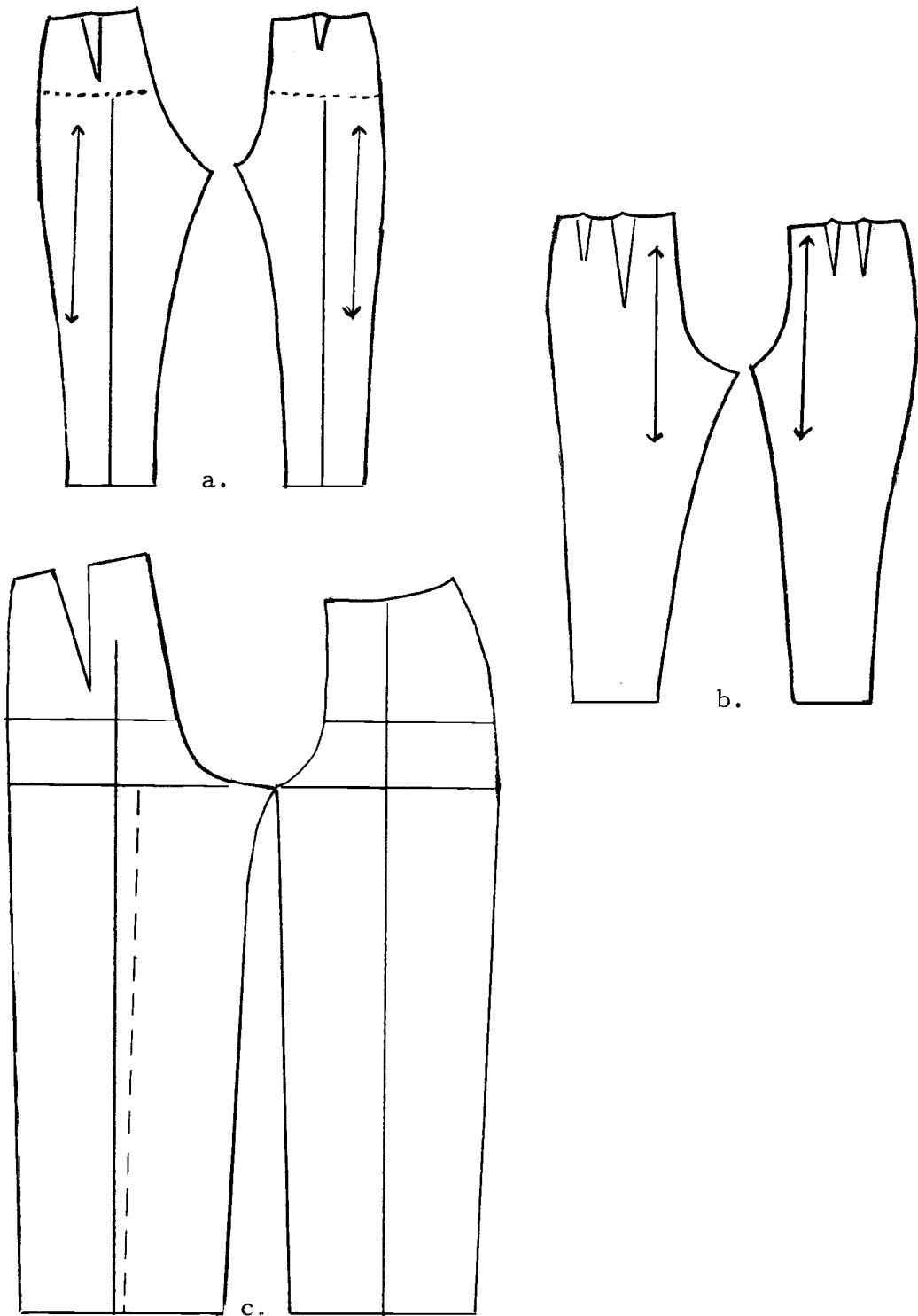


Figure 1. Basic pants patterns which illustrate differences in design. [Adapted from: a) Rohr (1961, p. 62), b) Tyroler (1963, p. 49), and c) Pepin (1942, p. 208).]

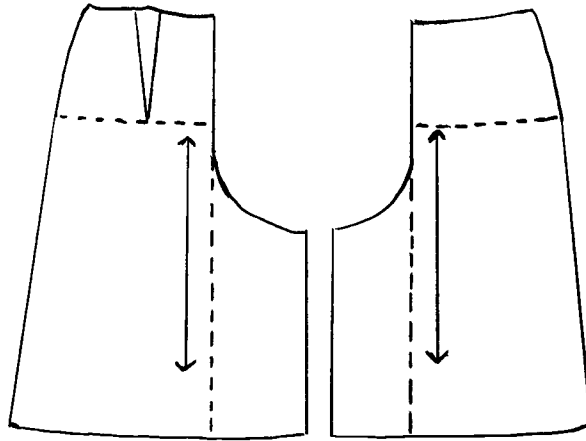


Figure 2. Basic design for culottes. [Adapted from Rohr (1961, p. 61).]

The Fabric

There was agreement among the authors who described the characteristics of fabric, that an understanding of textiles was essential to the selection of fabric for any garment. The properties and characteristics of the fibers and yarns, the method used to form the fabric, and the subsequent processing or tentering the fabric received affect the way a fabric will adapt to the design of a garment. Loosely structured fabrics tend to stretch, while very firmly woven fabrics will hold a sharp line but may be difficult to mold to body contour lines. Mansfield (1953) directs attention to the resiliency

of the lengthwise grain which helps the fabric recover its original shape after body movements have forced it into wrinkles. According to Bane (1966), bonded fabrics are suitable for slacks and shorts, but she cautioned that the bulk in the seams and hems would be increased.

The writer found little information concerning methods of lining or underlining pants, although the literature pertaining to these supportive fabrics indicated that these fabrics would help to prevent distortion of the garment fabric. In general, lining fabrics are lighter in weight and should respond to the care and treatment given to the completed garment.

To prepare fabric for cutting, most clothing construction authorities suggested that woolen fabrics should be processed to control shrinkage before the fabric was cut.

The Findings

The thread used to hold a garment together should resemble the fabric in color, luster, and elasticity. Mercerized cotton thread, available in a wide range of colors, was suggested for most fabrics, but silk thread was suggested when elasticity and strength were important (Mansfield, 1953).

Zippers are generally used as the placket closure in a fitted garment. The zipper should be an appropriate weight for the garment fabric and have enough length that the garment will slip on and off easily.

Mansfield (1953) stated that the selection of a fastener was dependent upon the suitability for a specific purpose. Snaps are used for holding edges that will receive little strain, while hooks and eyes are used on edges that are subjected to greater strain.

Grosgrain ribbon may be used to finish the back of a waistband, but it should be processed for shrinkage control before being applied.

Guides for Fitting

Measurement Comparisons

Most clothing construction authorities agreed that the measurement chart provided the basic step for garment construction. The comparison of the various body measurements to the corresponding pattern measurements showed the need for and location of adjustment in the length and/or width. Hutton (1966) advised that the lengthwise grain-lines should be extended the full length of the pattern sections, while Tyroler (1963) indicated that the crotch, hip, knee, and crease lines were also drawn on the pattern. The hip line was determined

from the individual's vertical waist-to-fullest-hip measurement.

The crotch line was drawn at right angles to the grain line on the front section, the knee line was drawn about half-way between the crotch and the hem, and the crease line should pass through the center of the knee and hem lines as it was extended from the hem line to the hip line on both the front and the back.

The location of the pattern measurements that the clothing construction authorities considered necessary corresponded with the body measurements suggested by the authors. The pattern measurements that were suggested and the measuring techniques used to take them have been placed in Appendix II.

In the literature there were various opinions concerning the amount of ease that should be added to the body measurements before a comparison was made. Most of the authors suggested both minimum and maximum amounts of ease for the various locations and indicated that the larger pattern sizes would require more ease than the smaller sizes.

The differences that occurred between the body measurements and pattern measurements were used to indicate the need for and amount of pattern alteration that would provide adequate size for the body.

Pattern Alteration

The methods used to make basic length and width alterations on garment patterns were somewhat standardized. Uncomplicated adjustments were made by folding out the excess length or width to decrease size or by inserting a strip of paper to increase size. Pattern edges which became distorted during alteration were re-aligned. When an alteration lengthened or shortened an edge, the edge it joined was altered a corresponding amount.

According to Bane (1966), alterations which changed the shape as well as the size of a pattern were more complicated than size alterations. The wedge-shaped adjustments that were used to adapt the shape of the pattern were usually used to correct the pattern after garment fitting because the exact size of the alteration was difficult to calculate before fitting.

Hutton (1966) suggested that certain wedge-shaped additions should be included on all patterns so that extra fabric would be available for fitting purposes. These suggested additions were located as shown in Figure 3.

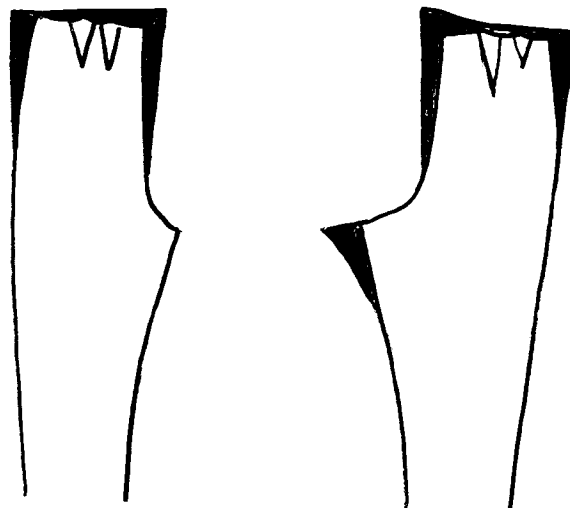


Figure 3. A pants pattern with fitting allowances. [Adapted Hutton (1966, p. 99)]

Preparation for Fitting

Strickland (1956) discussed the layout and cutting techniques used for pants, noting that the fabric should be squared to the table and that special care should be used to match both the lengthwise and crosswise grain lines of the fabric. She also advised that the lengthwise grain line markings on the pattern sections were placed parallel to the selvage. When plaid fabric was used, the pattern sections were matched on the crosswise grain line. Accurate cutting and marking of the garment sections was stressed by most authors.

When the garment fabric was underlined, Bishop and Arch (1962) advised stay stitching the outer fabric and underlining separately. Stay stitching was done with the grain on both the front

and back sections between the 7-inch hip-line and the waistline on the outside leg seams and along the waistline.

According to Mauck (1947), the front and back sections of the pants should be hand basted for fitting. Then a cloth band or tape which has been marked to correspond with the waistline measurement, should be attached to the waistline edge to support the pants during fitting.

Fitting Techniques

Most of the information that pertained to fitting pants was directed toward solving specific fitting problems rather than to the fundamental steps that could be used for fitting. However, Erwin and Kinchen (1964) presented a comprehensive description of a method used for fitting dresses that complimented the principles of fitting defined by Latzke and Quinlan (1940) and could be adapted for fitting other garments.

Five interrelated aspects of fitting formed the basis of Erwin and Kinchen's (1964) guide for achieving good fit. These aspects included the ease, line, grain, set, and balance of a garment and were controlled by the manipulation of the seams and darts of the garment. When these terms were defined, these authors indicated that ease was adequate garment size, while the line of a garment included straight vertical or silhouette seam lines, smoothly curved

horizontal or circumference seam lines, and graceful, direct design lines within the outlined shape of the garment. A garment has balance when the fabric does not flare out or hug the body more closely on one side than on the other. When a garment had smooth set, there were no wrinkles or slanting triangles of fabric to disturb the appearance. The grain of the fabric should be balanced on the body with the lengthwise grain line perpendicular to the floor and the crosswise grain line held parallel to the floor at the hip line.

Attention was directed to the importance of the purpose and function of darts in garment fitting. Bane (1964, p. 178) stated that:

There is no one principle in the whole field of clothing construction that is of more consequence than the 'principle of the dart': A dart creates shape in the area surrounding the tip of the dart. The wider the base of the dart, the greater the shape created; the narrower the base of the dart, the smaller the shape created.

Tyroler (1963) indicated that darts can be: 1) transferred to where they are needed, 2) eliminated if not needed, 3) used to control the circumference of the waistline, and 4) redirected to provide style variation.

Most clothing construction authors suggested that garments should be fitted to the right side of the body and that the changes are transferred to the left side of the garment. The seam lines that were changed during fitting should be slip-basted on the outside of the garment and then rebasted on the inside to smooth the basted lines.

Guides for Sewing

Although pants usually have only a few primary seams, the sewing procedure used for pants showed that several variations in the procedure were suggested for use. In general, plain seams were used for most pants styles, and the seams were pressed open. The waistline edge could be finished with an inside facing, but most styles were finished with a waistband. The placket opening was usually placed in the side hip position, but could be located in the upper part of the back crotch seam. A zipper was usually used to close the placket area.

Several variations in the directions given for stitching the garment sections together were noted, especially the order of the procedure suggested for stitching the crotch seam-inside leg seam area. Some authors suggested sewing the crotch seams first, then sewing the inside leg seam in a continuous process from one hem edge to the other, while Tyroler (1963) stitched the upper part of the crotch seam first, then completed the lowest part of the crotch after the other seams were stitched. Tyroler's (1963) method also included stretching the curve of the back crotch seam about 1/2 inch during stitching.

Although the literature indicated that pants may be lined, specific information about the application of a free-hanging lining was not found. When pants were underlined, the two layers of fabric

were cut separately, then handled as one layer during assembling and stitching.

Pants were hemmed in any one of several ways. When the length had been determined, the hem edge was turned to the inside and basted along the fold. The width of the hem, usually not more than 1-1/2 inches when finished, was trimmed to an even width and hand stitched according to the type of fabric and the style or shape of the lower leg area.

The literature indicated that the general pressing technique used for other garments was also suitable for pants construction. Mauck (1947, p. 163) has written that "if pressing is done after each step in each process, the finished slacks need only a light, final pressing." Two innovations concerning the pressing of pants were suggested by Tyroler (1963). The first was that the front crease should be set before any seams are sewn and indicated that the creases are centered on the knee-line, extending from the hem edge to the waistline. The second was suggested for use on the legs of fitted pants which sometimes have a tendency to cling to the shin as the shape of the calf of the leg pulls the fabric toward the back. The directions specified pressing a convex curve into the inside and outside leg seam on the front section only. As the seams were stretched 1/4 to 1/2 inch, a concave curve was formed on the front crease line

thus creating a shape similar to the contour of the lower leg. The increased length (amount of stretch) was trimmed off across the width of the front hem edge.

PROCEDURE

Preliminary Observation

To become familiar with the routine and procedures used for the construction of pants in a classroom situation, the investigator arranged to observe a class of beginning clothing construction students during fall term, 1966.

The observation period provided an opportunity for the investigator to examine and evaluate several pairs of custom-made pants. One pair of pants drew particular attention because the plaid fabric used for construction emphasized certain features of the garment. It was noted that the fabric fitted the wearer's body contours smoothly; however, the grain-line position did not conform to fundamental garment construction criteria. The lengthwise grain-line radiated outward from the center of the body, and the crosswise grain-line was held in a diagonal position which resembled a broad, somewhat flattened "V". The front crease-line (center of the leg) was not parallel to the lengthwise grain, but extended across the lengthwise grain.

Investigation showed that the student had accurately followed the layout and cutting guides printed on the pattern and had explicitly followed all classroom instructions. Construction details had been

performed with care, and the fitter had smoothed the flat fabric to the 3-dimensional body satisfactorily.

Procedural Variations

Several generally accepted clothing construction techniques were used to prepare the pants made by the conventional or unmodified method of construction as well as those pants made according to the experimental or modified method of construction.

Commercial pants patterns, selected to correspond with the hip measurement of the individual participant, were used as the basis for construction. The procedures that were common to both methods of construction were: 1) recording the body and pattern measurements for each participant, 2) alteration of the commercial patterns to provide adequate size, and 3) the techniques used to assemble and stitch each of the garments made for the study.

The details of the techniques that introduced variation between the two methods of construction have been described in the following text, but in general, the differences consisted of: 1) the adjustments that were made to facilitate the placement of the grain lines of the fabric on the balance lines of the body, which included the placement of the lengthwise grain line on the pattern and the addition of fitting allowances; 2) the techniques used to fit the garments; and 3) the kinds of fabric used to construct the pants.

Since more than one method could be used to determine the adequacy of the length of the crotch of a pants pattern, a secondary investigation was conducted.

Methods of Measurement

The difference between the size of the body and the size of the pattern was used to determine the adequacy of the size of the pattern for each participant. Body measurements were recorded on charts designed for this purpose (Appendix III). The patterns were also measured, and the measurements were recorded on the chart.

Body Measurements

Each student was instructed to wear the undergarment that she would normally wear with pants. Usually this consisted of briefs, but a few young women specified that they always wore a light-weight girdle with pants.

All measurements, except instep and crotch depth, were taken while the student participant stood facing a three-way full-length mirror. The waist measurement was taken first, then a muslin fitting band was fastened in place at the waistline. A guide for measuring the 7-inch hip line was established by placing pins parallel to and 7 inches below the waistline at the center front, center back, right and left side seam positions. Thigh, knee, calf, and instep

measurements were made on the right side of the body. The detailed procedure used for taking body measurements has been placed in Appendix I.

Pattern Measurement

The patterns were smoothed on a large table with the front and back leg sections lapped, seam-line on seam-line, at the lowest point of the crotch. Pins were used to hold the pattern in this position. A cloth tape, held on edge when measuring curved lines, was used to determine the finished size of the pattern. The procedure used for taking each pattern measurement has been placed in Appendix II.

Pattern Alteration

The difference between body size-plus-ease and the pattern measurements recorded for each individual was used to indicate the need for and location of pattern alteration. Table 1 shows the minimum and maximum amount of ease that was allowed for the various areas on the pattern.

Standard alteration procedures were used, with tissue paper inserted to increase size, or the pattern tissue lapped to decrease size. Crotch length alterations were made 7 inches below the side waistline position. One-half of the total amount of alteration was

Table 1. Location and recommended amount of ease for pants patterns.

Location of Ease	Measurement (inches)	
	Minimum	Maximum
Waistline	1/2	1
Hip (widest)	1	2
Thigh, knee, calf, and instep	1	---
Crotch length	1/2	1
Crotch depth	3/4	---

made on the front section with a corresponding alteration made on the back. The length of the leg was altered mid-way between the crotch-line and knee-line and/or knee-line and hem-line. Width alterations were made by redrawing the side seam when a small increase was needed. Other width alterations were made parallel to the lengthwise grain-line between the outer dart and the side edge.

Preparation of Unmodified Pants

To establish a basis for comparison, eight pants patterns were randomly selected from those patterns used by the participants. When necessary, the patterns were altered for length and/or width by using standard alteration procedures, before the patterns were cut in heavy weight muslin according to the information provided on the pattern layout guide. These garments were constructed by an upper division student who had a high level of competence in the techniques of clothing construction.

The method used for sewing these pants was basically the same as the method subsequently used for the modified pants, but the following exceptions were made: 1) the back crotch seam placket opening did not have a zipper closure, 2) the waistband was cut (double width) on the lengthwise grain of the muslin and did not have a cross-grain backing, 3) the hems were turned on the fold line, pressed, and held with basting. The crease lines of the front and back sections were aligned and pressed on the lines indicated by the pattern. Colored ink was used to indicate the crosswise and lengthwise grain-lines on the muslin garments.

These pants were not fitted on the individual, however, the waistline circumference was adjusted by manipulating the depth of the dart to correspond with the waist measurement of the participant.

Preparation of Modified Pants

Pattern Preparation

The lengthwise grain-line position was established by folding the leg area between the knee and hem edge on the front section so that the seam lines were exactly matched between these points. The tissue pattern was then firmly creased along the fold. Using this area as a base, the fold was extended through the upper pattern section to the waistline. The pattern was unfolded, and a line was drawn

the length of the crease mark. The back section was handled in the same way.

An allowance for fitting was provided on each seam edge. The cutting line for the crotch seam was drawn parallel to the established grain line from the upper end of the greatest curve of the crotch to the waistline on both the front and the back. The width of the seam allowance was increased to 1 inch on the inside and outside leg seams and along the waistline seam. A pants pattern, prepared according to these directions, is shown in Figure 4.

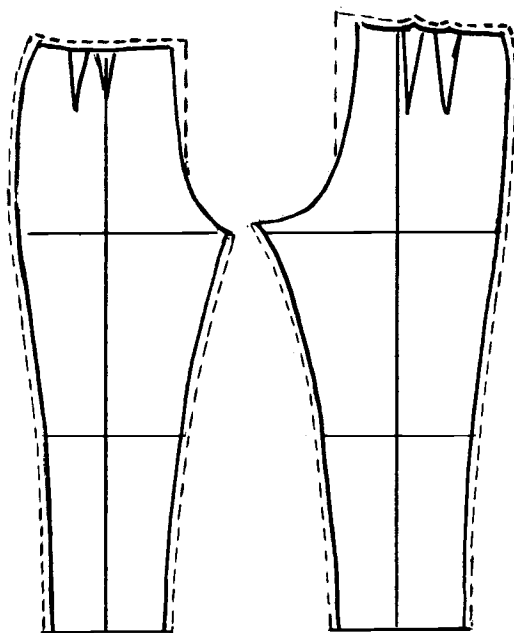


Figure 4. A modified pants pattern prepared for cutting.

Fabric Preparation

The fabrics were processed for shrinkage control by the method that was suitable for the specific fabric. Some of the fabrics were

steam-pressed at a commercial establishment, while other fabrics were processed by the dampened sheet method. The grosgrain ribbon was preshrunk, and all stretch was removed by pulling on the slightly dampened ribbon as it was pressed.

Preparation for Fitting

When the pattern and fabric preparations were completed, the front and back pattern sections were placed with the established grain-line marking of the pattern on the lengthwise grain of the fabric. The waistband was placed on either the crosswise or lengthwise grain. When a plaid or checked fabric was used, the grain line of the pattern was placed on the center of a unit or between two units as determined by the width of the fabric. Special attention was given to the effect that appeared in the widest hip area. The notch on the outside leg seam (hip level) was used as the point of matching for the crosswise grain.

The fabric was cut with the grain, using long, even strokes of the shears with the notches cut outward.

The same layout and cutting procedures were used for the lining and underlining fabrics.

Tailor tacks were used to mark the position of the darts and crotch seam line. Hand basted lines were used to mark the lengthwise grain in the center of each leg section, the crosswise grain at

the 7-inch level, and the placket opening which could be located on the side hip or in the crotch seam.

When the pants were underlined, the underlining was cut to correspond with the modified pattern sections, then the fabric sections were placed together and held with several rows of diagonal basting.

Stay stitching was done with the grain, 1/8 inch outside of the stitching line on the waistline and waistline-to-hip portion of the side seams. Machine basting was used to mark and stay the placket opening.

The marked grain line of the front section was pressed to form the permanent crease line before the sections were basted. Some of the participants used an optional method of pressing which consisted of stretching the seam allowances of the front section and trimming off a small amount of fabric across the width of the hem edge. Stretching the seam allowances caused the crease line to curve slightly between the knee and the hem.

The pants were either basted by hand or with machine stitching. First, darts were basted, then the outside and inside leg seams were basted. The crotch seam lines were placed together, pinned, and basted on the stitching line from the lowest crotch to the waistline. The seam allowance of the inside leg seam was not caught into the crotch seam stitching, but was left free.

Method of Fitting

The procedure used for fitting was based on Latzke and Quinlan's (1940) principles of fitting and supplemented with the manipulative procedures suggested by other clothing construction authorities.

A muslin fitting band, marked for the participant's waist-plus-ease measurement was pinned to the waistline edge of the pants with the lower edge of the band placed on the stitching line of the waistline seam. The pants were put on right-side out with the leg seam allowances turned toward the front. The placket opening was carefully lapped, seam line-on-seam line, and pinned securely.

The wearer stood in front of a mirror, with her feet about 4 to 6 inches apart, for fitting. The fitting band was checked for adequate size--snug enough to support the garment but loose enough for comfort. The general appearance of the pants was assessed, then the grain, ease, line, set, and balance of the garment were adjusted on the right side of the body.

The lengthwise and crosswise grain lines were checked and adjusted to coincide with the balance line of the lower body (hip). The crosswise grain was held parallel to the floor at the 7-inch hip level, while the lengthwise grain was held perpendicular to the floor through the center of the lower leg and then extended to the waistline. To adjust the grain lines, the bastings and/or pins that held the crotch

seam were removed, and a part of the fitting allowance was incorporated into the center area of the front and/or back. The darts were then placed in the position(s) that provided fullness where fullness was needed. The grain line was used as a further indication of the location and amount of darting. The outside leg seams also provided a darting function, hence, the seam allowance in the hip-to-waistline area was adjusted as necessary.

The amount of ease that was included on each garment was determined by appearance (grain line maintained) and the wearer's expression of comfort. When the crotch seam dropped too far below the curve of the body, the excess length was pinned out in a horizontal tuck around the body at the hip level. When just the front or the back crotch area was shortened, a wedge-shaped tuck was taken across that section with the greatest depth located at the center, and tapered to nothing at the side seam. When either adjustment was necessary, the pattern was altered the indicated amount, and the seam lines and grain line were revised before the upper area of the section was recut, rebasted, and refitted.

The length of the crotch seam was increased by releasing the fitting allowance that had been provided on the waistline seam.

The occurrence of drag-lines in the crotch area indicated the need to increase the width of the leg at the crotch level. This adjustment was made on the inside leg seam and/or the lower part of the

curve of the crotch. A change in the seam allowance of the inside leg seam was carried far enough to blend into the original seam line.

Fabric or extra width to cover a prominent side hip or larger-than-average thigh or back hip was released from the outside leg seam allowance. A plumb-line was used to assure a straight outside leg seam line.

The legs of the pants were tapered to suit the taste of the wearer. The level at which the taper started was slightly higher on the outside seam than on the inside seam. Equal amounts were taken off each seam at the hem line, but the amount varied in the knee to thigh area.

The balance of the garment was controlled primarily by the correct placement of the grain lines.

When the fitting adjustments were completed, the new stitching positions were slip-basted before the changes were transferred to the left side of the garment. The accuracy of the fitting adjustments was checked after the garments were rebasted, then the patterns were corrected according to the fitting adjustments that were made.

The lining was cut from the corrected pattern.

In Figure 5, the general outline of a corrected pants pattern is shown.

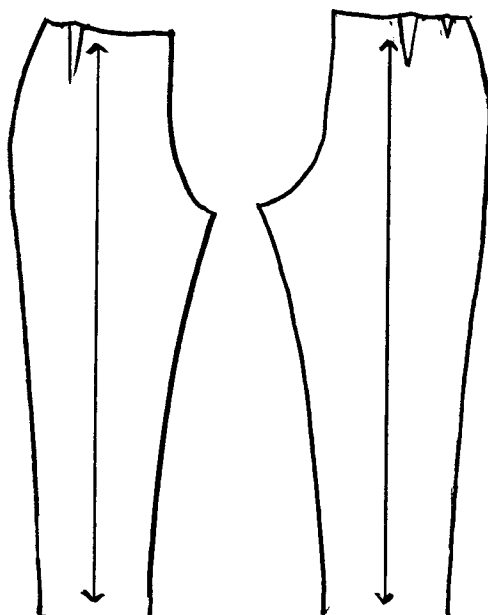


Figure 5. The general outline of a corrected pants pattern.

Method of Sewing

After the darts were stitched and pressed, the outside leg seams were stitched and pressed open. Next, the inside leg seams were stitched and pressed open, then the back crease line was pressed from a point parallel with the lowest crotch to the fold line of the hem.

The crotch seam line was rebasted before stitching. Then, beginning at a point 1 inch in front of the inside leg seam, the back crotch seam was stitched across the inside leg seam to the waistline edge or the lower end of a center back placket opening. The fabric in the deepest curve of the crotch was stretched about 1/2-inch during stitching. The front crotch stitching also extended from the lowest

crotch to the waistline, overlapping the back crotch stitching for about 2 inches. The curve of the front and back crotch seam were restitched exactly on the first line of stitching.

When the stitching was completed, the seam allowances were trimmed to a uniform width (about 1 inch) in the upper front and back area and gradually tapered to 3/8 inch below the 7-inch hip level. The seam was pressed open above the hip line.

A lapped seam method of zipper application was used to complete either a center back or side hip placket opening.

The above stitching procedure was also used to assemble the lining. Special handling techniques, applicable for the specific fabric, were adhered to. When the lining had been stitched and pressed, the seam allowance side of the two fabrics were placed together, and the sections were held with basting at the waistline. The seam allowance along the placket was turned under and hand stitched to the zipper tape.

The wool-grosgrain waistband was prepared and applied according to directions given in the clothing construction classes at Oregon State University.

Standard hemming procedures were used to finish the lower edge of the legs.

Method of Evaluation

During the last week of the term, the members of each class section met with a selected panel of judges for a 2-hour modeling and evaluation period. The modeling procedure and criteria used for rating the pants was explained. The recording form that was used is shown in Appendix IV.

Each participant modeled in front of a three-way mirror. The model faced the group, then turned slowly so that each aspect of the pants was viewed.

The rating scale used to rank each of the 12 characteristics of fit was:

- 5--Excellent; best of kind.
- 4--Superior; above average.
- 3--Fair; average.
- 2--Acceptable; satisfactory.
- 1--Poor.

The 12 characteristics of fit were:

1. General appearance: over-all appraisal of fit.
2. Silhouette: smooth line; follows body contour.
3. Crease line: vertical (lengthwise) grain should be in the center of the pants leg.
4. Crosswise grain line: horizontal (crosswise) grain should be parallel to the floor about the 7-inch hip.
5. Dart placement: point directed toward the fullest part of the body.
6. Front crotch: smooth; free from wrinkles and/or excess fabric.
7. Back crotch: slight indentation of the body.
8. Lower back hip: free from drag-lines and excess fabric.
9. Thigh: smooth; easy.

10. Knee: smooth; free from baggy, excess fabric.
11. Outside leg seam: straight; location pleasing to the eye.
12. Legs: (primarily a style feature) very slim; should not bind.

The panel of judges rated the fit of each of the garments, while each participant evaluated the fit of: 1) the modified pants made by the members of her class section, 2) the unmodified pants made for participants in the class section, and 3) the comfort of her own pants.

The same rating scale was also used to indicate the participant's estimation of comfort while wearing her modified pants for various physical activities. The activities for which the pants were rated were: 1) seated on a chair, 2) walking, normal step, 3) crouching, and 4) knee raised to a 45-degree angle.

Method of Analysis

The information recorded by each evaluator during the three evaluation periods was compiled on score sheets for processing. Statistical methods were used to analyze the data obtained from the evaluation of the fit of the modified and unmodified pants.

The total mean score used to determine if there was a significant difference between the fit of the unmodified pants and that of the modified pants was obtained by summing all of the scores for each of the 12 characteristics of fit for each garment in the two groups of garments cut from the eight randomly selected patterns. Because

the investigator felt that there was an imbalance in the ratio of inexperienced (participant) evaluators to the experienced (panel) evaluators, the means of the raw scores were weighted. The experienced evaluator mean score was given a weight of 0.7, while the inexperienced evaluator score was given a weight of 0.3. Analysis of variance, using an F-test with acceptance set at the 0.05 level of significance, was used to test the mean score.

The weighted mean scores for each of the 12 characteristics were then analyzed independently with an F-test to determine if there was a significant difference in the fit of any one or more of the characteristics on the eight pairs of modified pants as compared with the corresponding eight pairs of unmodified pants.

All of the modified pants (N = 54) were then classified according to the name of the pattern maker to determine if there was a significant difference in the fit of the crosswise grain line, front crotch, back crotch, and/or lower back hip among the groups so classified. An F-test was used to test each characteristic independently. The scores were first tested using a weighted mean score (0.7 and 0.3) and then with an unweighted mean score.

The results of this testing indicated that weighting the mean scores did not alter the results; thus, a non-parametric sign test was used to determine if there was a difference between the panel evaluation scores as compared with the student evaluation scores.

On the basis of this test, in which no significant difference was found between the two sets of scores, the investigator used only the panel evaluation scores for the subsequent statistical testing.

Each of the 54 modified garments was classified as to the basic type of fabric used for the construction of the garment before a Chi-square test was used to determine if there was a significant difference in the fit of pants made from unbonded, wool or wool-blend fabric as compared to pants made from bonded, wool-acetate fabrics. The total score for each garment in the two categories was obtained by summing the panel evaluation scores for the 12 characteristics.

Using Tyroler's (1963) small (less than 35 inches), medium (35 to 38 inches), and large (over 38 inches) hip size classifications as a guide, each of the 54 pairs of modified pants was placed into one of three size groups. A total score was obtained by summing the panel evaluation scores for the 12 characteristics of the garments within each size group. A Chi-square test was used to determine if there was an association between the size of the wearer and the fit of the modified pants.

Each of the three methods used to calculate the adequacy of the length or depth of the crotch was independently compared with the recorded total amount of change that was made on the individual garments. The score for the crotch length method of measurement consisted of the recorded body measurement plus 1/2 inch ease,

while the scores for the crotch depth methods of measurement were obtained by adding $3/4$ inch ease to the recorded body measurement when either method of depth measurement was used. A sign test was used to determine if there was a significant difference between the measurements obtained by any one of the three methods as compared to the recorded amount of change made on the individual garment.

Arithmetic methods were used to assess the comfort evaluation scores. The scores were summed for each activity to determine the effect of closely fitted pants on the comfort of the wearer.

RESULTS AND DISCUSSION OF DATA

The data were considered in the following order: 1) description of the sample, 2) comparison of modified and unmodified pants, 3) comparison of groups of modified pants, 4) effect of fabric on the fit of the modified pants, 5) effect of size on the fit of the modified pants, 6) crotch length-depth measurements, and 7) comfort evaluation.

Description of the Sample

The height of the 54 participants who completed all phases of the study ranged from 59 inches to 70 inches with an average height of 64.8 inches. Their weights ranged from 99 pounds to 180 pounds with the average weight being 122 pounds. The participant's pattern sizes (hip measurement) ranged from size 32 to Size 42.

The commercial patterns used by the participants were produced by the following pattern companies: Else', Incorporated, McCall's Corporation, Simplicity Pattern Company, The Butterick Company, Stewart Form, and Advance Pattern Company.

Of the two basic types of fabric used for pants constructed by the modified method of construction, 19 pairs of pants were constructed from bonded wool-acetate fabrics, and 35 pairs of pants were constructed from woven, unbonded wool or wool-blend fabrics.

Comparison of Modified and Unmodified Pants

A comparison of the total scores for the 12 characteristics of fit on the eight pairs of modified pants and the corresponding scores for the eight pairs of unmodified pants showed that the scores for the modified pants were significantly higher than the scores for the unmodified pants at the 0.025 level of significance. Thus, the null hypothesis, stating that there was no difference between the fit of the modified and unmodified pants, was rejected, and the alternate hypothesis, stating that the fit of the modified pants was better, was accepted. The significant difference did not mean that each of the characteristics of fit had been affected by the modified procedure, but it implied that one or more of the individual characteristics had been affected.

When the scores for the 12 characteristics of fit were tested independently, the scores for the fit of the crosswise grain line, front crotch, back crotch, and lower back hip on the modified pants were significantly higher than the scores for the fit of the unmodified pants. No significant difference between the scores for the two sets of pants with respect to the general appearance, silhouette, crease line, dart placement, thigh, knee, side seam, or legs was found.

A comparison of the scores for each of the 12 characteristics

of fit showed that the modified pants received higher scores for nine of the characteristics (including the four sets of scores for which a significant difference was found) and that the unmodified pants received higher scores for the knee, outside leg seam, and legs. A summary of the data is given in Table 2.

Modification of the pants construction method had the greatest effect in the waistline-to-crotch area of the pants. One or more of the procedural variations used for the construction of the modified pants may have contributed to the improved fit of the characteristics in this area. First, the changed grain line position on the modified pattern may have affected the location of the grain line on the completed garment. Secondly, the primary step in fitting frequently consisted of introducing at least a portion of the fitting allowance provided on the center front and center back crotch seam into this crotch area as the lengthwise and crosswise grain lines were arranged to conform with standards of clothing construction.

When the crosswise grain line was held parallel to the floor at the 7-inch hip line, the darting effect created by the original slope of the front and back crotch seam was eliminated, and the fabric provided for this purpose was introduced into the pants at the center front and center back. Information concerning the optimum amount of slope for the front and back crotch seam was not available for all of the participants, but there were indications that the amount of

Table 2. Mean scores for each of the characteristics of fit on the modified and unmodified pants and the computed F-value for each characteristic.

Characteristics of Fit	Modified Pants			Unmodified Pants			Computed F
	Mean Student Score	Mean Panel Score	Combined Weighted Mean	Mean Student Score	Mean Panel Score	Combined Weighted Mean	
1. General Appearance	3.531	3.912	3.792	3.059	3.742	3.533	1.836
2. Silhouette	3.547	4.096	3.945	3.157	3.911	3.594	3.500
3. Crease Line	3.766	4.371	4.186	3.268	4.163	3.891	3.528
4. Crosswise Grain Line	3.738	4.081	4.052	3.078	3.422	3.302	11.200*
5. Dart Placement	3.708	4.330	4.167	3.169	4.078	3.801	2.336
6. Front Crotch	3.737	4.413	4.125	2.825	3.122	3.028	14.061*
7. Back Crotch	3.561	4.288	4.061	2.806	3.497	3.160	14.003*
8. Lower Back Hip	3.198	3.663	3.548	2.684	2.788	2.751	6.902**
9. Thigh	3.379	4.162	3.891	2.860	2.787	3.503	4.166
10. Knee	3.382	4.080	3.865	2.970	4.330	3.908	.052
11. Outside Leg Seam	3.637	4.081	3.943	3.324	4.580	4.031	2.500
12. Legs	3.391	3.743	3.633	2.888	4.247	3.835	.548

* Significant at the 0.01 level of significance.

** Significant at the 0.05 level of significance.

seam darting (slope) should not exceed 1/4 inch. Frequently, the front crotch seam was on the straight-of-grain between the upper end of the curve of the lower crotch and the waistline..

The lower back hip area may have been affected by changing the position of the crosswise grain line. As the crosswise grain line was raised (straightened) at the center back, the characteristic sag or "baggy pants" look seemed to be decreased. Only a small amount of excess fabric was left below the outward curve of the buttocks to permit body movement such as bending and sitting.

The investigator was surprised to find that there was no significant difference between the crease line characteristic on the two sets of garments when a significant difference in the crosswise grain line position was found. The creaseline and lengthwise grain line position became synonymous on both the front and back of the pants legs when the modified method of construction was used.

One possible explanation for this seemingly inconsistent result could have been associated with the apparent amount and location of the change that took place when the grain lines were balanced on the body. The change in the lengthwise grain line position was relatively small as compared with the visibly greater change that occurred on the crosswise grain line. A second explanation could be that the terminology used to designate this characteristic influenced the opinion of the evaluators. The crease line could have been sharp

(well-pressed) and centered on the leg without coinciding with the lengthwise grain line. If this was true, the evaluations could have been based on this aspect of the creaseline rather than the intended grain line position.

Although there was not a significant difference, the slightly higher scores assigned to the unmodified pants for the knee, side seam, and legs seemed to indicate that the fit of the leg area was better than on the modified pants. Since the legs of the modified pants were tapered to suit the taste of the individual wearer, it was possible that the amount of tapering that was done was not acceptable to the evaluators as good fit. A second technique that may have adversely affected the fit of the legs was the pressing used to shape the legs of the modified pants. If the curve in the knee-to-hem of the front crease line was too great, the hem edge tended to stand away from the lower leg.

Adequate size apparently was a primary factor involved in the fit of the thigh area of the garments. No significant difference was found in the fit of this area of the two sets of garments. A further indication that the size was adequate was also implied by the acceptance of the null hypothesis stating that there was no difference between the fit of the crease line of the two sets of garments. If the size was not adequate, the grain line (crease line) would pull toward the area where additional fabric or width was needed.

Acceptance of the null hypothesis used to test for differences in the general appearance and silhouette characteristics may indicate that generalized terminology did not provide a discriminating basis for the evaluation of fit. The possibility of achieving a smooth appearance without meeting the standards of clothing construction was also noted during the writer's observation period. The general outlines of the pants apparently followed body contours without revealing deviations in other characteristics of fit.

Comparison of the Fit of Selected Pants

When the modified pants were classified according to the name of the pattern maker, there were three groups which were large enough to constitute an adequate sample size. Forty-eight pairs of modified pants were included in the three groups. Independent testing of the mean scores for the crosswise grain line, front crotch, back crotch, and lower back hip among these groups of garments showed that there was no significant difference in the fit of the modified pants when either weighted or unweighted mean scores were used. The experimental procedure apparently had created a similar effect on each of the garments for which it was used.

Effect of the Fabric on the Fit of Modified Pants

The total scores for the 35 pairs of modified pants constructed

from woven, unbonded wool or wool-blend fabrics were significantly higher than the scores for the 19 pairs of modified pants constructed from bonded wool-acetate fabrics. The null hypothesis was rejected at the 0.05 level of significance, and the alternate hypothesis, stating that the type of fabric used for the construction of pants does affect the fit of the pants, was accepted.

When the mean scores for the 12 characteristics of fit on the eight randomly selected pairs of modified pants were examined, the three pairs of pants constructed from woven, unbonded wool or wool-blend fabrics received higher scores for 10 of the 12 characteristics than did the five pairs of pants constructed from bonded fabrics. The greatest differences were found in the fit of the silhouette, knee, side seam, and legs of these garments. Since the legs of the modified pants were tapered, this information seems to indicate that bonded wool-acetate fabrics may not be the best choice for pants with closely fitted legs. A summary of the scores for each of the characteristics of fit for garments constructed from the two types of fabric is given in Table 3.

Effect of Size on the Fit of Modified Pants

The results of the Chi-square test showed that the null hypothesis stating that there was no association between the fit of the modified pants and the size of the wearer could be accepted at the 0.01

Table 3. Mean scores for the characteristics of fit of the modified pants made from bonded and unbonded fabrics.

Characteristics of Fit	Mean Scores	
	Unbonded Fabric	Bonded Fabric
General Appearance	3.99	3.86
Silhouette	4.33	3.99
Crease Line	4.21	4.46
Crosswise Grain Line	4.13	4.25
Dart Placement	3.99	3.73
Front Crotch	4.55	4.31
Back Crotch	4.33	4.26
Lower Back Hip	3.77	3.56
Thigh	4.33	4.06
Knee	4.33	3.93
Outside Leg Seam	4.33	3.93
Legs	4.10	3.53

level of significance. Although a few more garments in the small size range received high scores than did garments in the large size range, there was no significant difference between the two sets of scores. The garment that received the lowest score was in the small size range. Apparently, the fit of the modified pants for those participants who required a larger-than-average pattern size was as good as the fit of the modified pants for those participants who used a smaller pattern size. This observation seems to agree with Hutton's (1966, p. 27) statement that "with pants, size seems to have less to do with good fit than cut and proportion."

Crotch Length-Depth Measurements

Although accurate body and pattern measurements were recorded for each of the participants (N = 54), only 66 percent (N = 36) of the participants completed the final measurement detail.

A non-parametric sign test indicated that there was no significant difference between the recorded amount of crotch length alteration and the amount of alteration indicated by the total crotch length method of measurement. When the two crotch depth methods of measurement, made by using a tape measure or tailor's square, were compared with the recorded amount of crotch length alteration, the difference was significant.

Total crotch length measurements were accurate within plus-or-minus 1/4 inch of the total adjustment made on 36.1 percent of the garments. Crotch depth measurements made with a tape measure were accurate for the same percentage of garments, but the amount of variation for the other 63.9 percent of the garments apparently was greater than the amount of variation that was present when the total crotch length measurements were compared to the amount of change. Crotch depth measurements made with a tailor's square were accurate for only 22.2 percent of the garments.

Table 4 shows the number of each kind of crotch length change that was indicated by the three methods of measurement and the

Table 4. The number of kinds of change in crotch measurement as indicated and made according to the method of measurement.

Method of Measurement	Kind of Change Indicated by Measurement			Kind of Change Made on Modified Pants		
	In-crease	De-crease	No Change	In-crease	De-crease	No Change
Total Crotch Length	9	26	1	4	30	2
Crotch Depth (Tape measure)	1	35	--	4	32	--
Crotch Depth (Tailor's square)	1	35	--	4	32	--

number of each kind of change that was made on the 36 pairs of modified pants. The total crotch length method of measurement apparently provided a better basis for determining adequate crotch length than did either of the crotch depth methods of measurement. Since there is little, if any, opportunity to increase crotch length after the fabric has been cut, provision for adequate crotch length on the pattern is especially important.

Comfort Evaluation

Fifty-two participants submitted complete comfort evaluation data for the modified pants. The mean of the scores for each of the four test activities showed that these participants felt that the

modified pants were most comfortable when the wearer was walking, and least comfortable when the wearer was kneeling. The mean scores for each activity were: 1) walking--4.30, 2) crouching--3.63, 3) knee raised--3.63, and 4) seated--4.09.

Fifteen percent of the participants rated the comfort of their pants as "Excellent" (5) for each of the four test activities. Fewer than 6 percent of the participants experienced "Poor" (1) comfort during the evaluation of the comfort of their pants. The "Poor" rating was given when the wearer was crouching and/or when the wearer's knee was raised to a 45-degree angle.

When the scores for each of the four activities were combined, 50 percent of the modified pants were considered "Superior, above average" (4) or "Excellent, best of kind" (5), while only 7.7 percent of the pants were rated less than "Fair, average" (3). The percentage distribution of the modified pants by mean comfort evaluation score is shown in Table 5.

Table 5. Percentage distribution of comfort scores for modified pants in relation to activity.

Activity	Comfort Rating				
	1	2	3	4	5
Seated	--	--	23.07	44.22	32.69
Walking	--	--	13.45	42.30	44.22
Crouching	1.92	7.69	38.46	28.84	23.07
Knee Raised	3.84	3.84	36.53	34.61	21.53

The comfort evaluation data seem to agree with and substantiate the previous findings concerning the leg area of the modified pants. The comfort, as well as the fit of the legs, apparently was adversely affected by the techniques used for the construction of this part of the modified pants.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this research was to determine if the fit of women's custom-made pants could be improved by modifying the conventional methods of construction. The modified method was also intended to provide a basic method of pants construction suitable for use by home sewers and teachers of clothing construction. The results are limited to the garments discussed in the study, but the findings imply that the use of the modified method of construction would improve the fit of other custom-made pants.

On the basis of the statistical analysis, the first hypothesis, which stated that the pants constructed by the modified method would fit the wearer better than pants constructed by conventional methods, was accepted. The results of the analysis of the individual characteristics of fit showed that the hip line and back crotch areas of the modified pants were improved, while no significant differences were found between the modified and unmodified pants for other areas of the garments. The seven waist line-to-base figure variations³ described by Mansfield (1953) occurred within or could have affected the fit of the hip line and back crotch areas of the pants. Thus, improving the fit of these areas was especially important.

³ Prominent pelvic bone, large abdomen, back hip, sway back, broad hips, high hip, and heavy thighs.

Apparently a combination of construction details similar to those used for the modified method of construction would be necessary to achieve this desired effect. Introducing a singular change such as re-aligning the lengthwise grain line position on the pattern sections would not have been sufficient. Additional width was also needed above the crotch line on both the front and the back crotch seam to permit the continuation of the vertical grain line position into this area. Adding width to the front and back crotch seam areas tended to reduce the amount of slope on this seam and resulted in the U-shaped crotch that Waisman (1950) specified for use on men's pants patterns. The addition of width along the upper part of the center front and center back crotch seam lines introduced excess size which was manipulated toward the side hip area, with ease and darts used to control the grain line position on the waist line edge. The excess size was then removed by increasing the amount of curve in the hip area of the outside leg seam line.

Thus, the writer has concluded that the design of women's pants patterns should not confine a major part of the shape-creating function of the pattern to the crotch seam, since the convex curves of the body are not located in this area. Instead, the writer recommends that the plan or design of the pattern should divide and distribute the shape-producing aspects of the design among the several areas that are directly affected by the convex curves of the body.

Custom-fitting techniques have been recognized as the way in which women with special figure problems could have clothing which fit, but the scant amount of literature concerning the fit of women's pants must have been a disappointment to the novice who looked for guidelines for fitting pants. The fitting procedures that were used to fit the pants made by the modified method of construction seemed to provide a satisfactory basis for fitting women's pants.

Although most pants construction authorities have suggested that muslin or another inexpensive fabric should be used to test and perfect the fit of a pants pattern before cutting the pattern from woolens or expensive fabrics, the writer suggests that, if the modified method of construction is used, the first pair of pants could be cut from any suitable fabric. Only a small amount of fabric is ultimately trimmed away on the hip area of the outside leg seam.

When the fitting of pants has been completed, the pattern can be altered to correspond with and reflect the adjustments that were made during fittings, thus a basic pants pattern would be ready for further use. The writer feels that the garments cut from the corrected pattern probably would not need fitting if similar fabrics were used. Further research designed to study the usefulness of a basic pants pattern would be helpful to most of the women who are interested in clothing construction.

Some statements in the literature indicated that bonded fabrics

were suitable for women's pants; however, the bonded wool-acetate fabrics that were used for the construction of some of the modified pants apparently affected the fit of these pants. The writer feels that the shape retention qualities of the fabrics used for the modified pants probably contributed to the difference in the fit of the pants. Unbonded wool fabrics tend to regain their shape more rapidly after stretching than do bonded wool-acetate fabrics. Since more than one-third of the participants selected bonded wool-acetate fabrics for the construction of their pants, further study concerning the use of these fabrics for various types of garments would seem appropriate.

Although the muslin fabric used for the construction of the unmodified pants could have affected the evaluators' judgment of these pants, the writer feels that the quality of the muslin used for their construction and the well-pressed appearance of the garments during the modeling-evaluation period probably created as favorable an attitude toward these garments as possible. Evidence to support the writer's belief may be found in the evaluation of the fit of the leg area of the two sets of pants. No significant differences were found, but the scores for the leg area of the unmodified pants were higher than the scores for the same area of the modified pants.

By definition, the fit of a garment is determined by the size and shape relationships which exist between the garment and the

wearer. Since there was no indication that the size of the wearer affected the fit of the modified pants, the writer accepted the third hypothesis and assumed that the modified method of construction could be used successfully by the majority of women.

Because determining the adequacy of the size of a pants pattern cannot be satisfactorily accomplished by pattern fitting, the usual method of ascertaining the relationship between the size of the pattern and the size of the body has been the comparison of these measurements. Although the total crotch length method of measurement has been used primarily for determining the length of the crotch for those women who had a protruding abdomen, the results of this research indicated that this method of measurement could be used by other women regardless of their body structure or postural variations. The null hypothesis stating that the method of measurement used to determine the adequacy of the length of the crotch will not affect the accuracy of the measurement was rejected, and the alternate hypothesis stating that total crotch length measurements would provide a better basis for determining the adequacy of the crotch length was accepted. The total crotch length method of measurement also provided the opportunity to test the amount of ease that was needed on the crotch seam. A study designed to test the methods used to determine body and pattern measurement relationships would be desirable, since the data compiled for this section of the present

study does not provide a sufficient depth of information to justify making judgments.

The majority of the participants indicated that the comfort of their modified pants was above average when they compared these pants to other garments within their frame of reference. A few participants indicated that the comfort of their modified pants was not as high as would be desirable, but a survey of the scores for the garments constructed by these participants showed that the fit of the garments was also considered to be lower than average. Thus the factors that affected the fit of the garments probably affected the comfort of the wearer. The relationship between the fit of pants and the comfort of the wearer could be studied with respect for the physiological, psychological, sociological, and/or economic implications that might be associated with these relationships.

The results of this initial investigation concerning the fit of women's custom-made pants have been interpreted and presented by the writer as evidence that the fit of women's pants could be improved. However, the design of the research should be refined before further investigation is conducted. The size of the sample and the scope of a future study could be decreased in favor of greater depth and concentration on the details of the investigation.

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APPENDIX I

Guide for Body Measurements

1. Waist--tape held snugly but not tightly around the waist.
2. Hip (7-inch level)--tape held parallel to the waistline.
3. Widest hip--tape allowed to slip down the body to the area of greatest circumference. (Both girth and distance from the waistline recorded.)
4. Thigh--tape held firmly around the fullest part of the upper leg.
5. Knee--tape held parallel to the floor, around the cap and back crease.
6. Calf--tape held firmly around the fullest part of the lower leg.
7. Instep--tape held around the heel and across the front crease of the ankle.
8. Waistline to floor measurements--end of tape held on waistline at the center front; length of tape held smoothly over contour of body, then dropped vertically to the floor. Procedure repeated at center back and both sides of the body.
9. Finished length--tape held on right side seam position between waistline and desired style length. For full-length pants the measurement terminates at the most prominent part of the ankle bone.
10. Knee length--tape held at waistline on the right side seam position. Length of tape held smoothly over the contour of the side hip; extending to a position parallel with the back crease of the knee.
11. Total crotch length (standing)--end of tape held at center front waistline; length of tape passed between the legs and carried upward to the center back waistline. Tape held snugly but not tightly against the body. (Test for crotch seam ease.)

12. Crotch depth (seated on a flat surface)--
 - a. with a tape measure held on the right side seam position over the curve of the hip between waistline and surface.
 - b. with a tailor's square held with one side on the flat surface, the other upright. A ruler was held parallel to the surface at the waistline.

APPENDICES

APPENDIX II

Guide for Pattern Measurements

1. Waistline--tape held on edge along the seam line on both the front and back sections.
2. Hip (7-inch level)--hip level marked at intervals across the front and back sections. Tape held on marked line between side seam and center on both sections. Add front and back totals. Multiply by 2.
3. Widest hip--corresponding body measurement level used to locate the distance from the waistline. Above procedure (2) used to mark, measure, and compile.
4. Thigh--tape held parallel to and one inch below the crotch line on both front and back pattern sections.
5. Knee--tape held on knee line on front and back sections.
6. Calf--tape placed three to four inches below and parallel to the knee line on the front and back sections.
7. Hem edge--tape held on the fold line of hem on front and back sections.
8. Finished length--tape held on the outside leg seam line between waistline and fold line of hem.
9. Knee length--tape held on edge along the outside leg seam line between waistline and knee line.
10. Total crotch length--end of tape held at center front; length of tape held on edge along the crotch seam line to center back.
11. Crotch depth measurements--
 - a. Tape held on edge on the side seam line between the crotch line and waistline.
 - b. Distance between crotch line and waistline at the side edge (measured with a ruler).

APPENDIX III

Body Measurements Chart

NAME _____ HEIGHT _____ WEIGHT _____

DATE _____

SECTION NO. _____

PATTERN _____ NO. _____

PATTERN SIZE _____

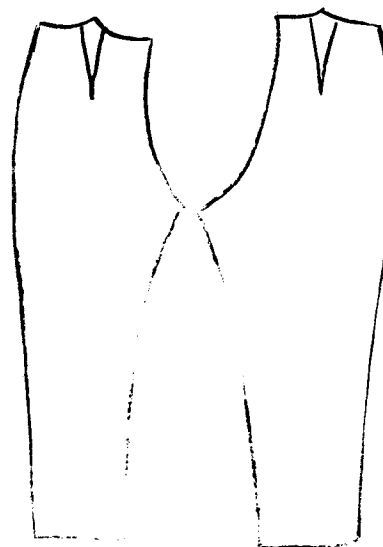
ALTERATIONS

Indicate the location and amount of alterations to be made. Use pencil.

	Body	Ease	Total	Patt.
GIRTH MEASUREMENTS				
Waist				
Hip (7")				
Widest hip				
Thigh				
Knee				
Calf				
Instep				
LENGTH MEASUREMENTS				
Center front				
Right side				
Center back				
Left side				
Finished				
Knee length				
Crotch length				
Crotch depth, T				
Crotch depth, L				

FRONT

BACK



NOTES

APPENDIX IV

Garment Evaluation Recording Form

NAME _____

SECTION NUMBER _____

DEFINITION OF EVALUATION TERMS

- GENERAL APPEARANCE: over-all appraisal of fit.
SILHOUETTE: smooth line; follows body contour.
CREASE LINE: on vertical (lengthwise) grain; should be in the center of the pants leg.
CROSSWISE GRAIN LINE: horizontal (crosswise) grain; should be parallel to the floor about the 7" hip.
DART PLACEMENT: point directed to the fullest part of the body.
FRONT CROTCH: smooth; free from wrinkles and/or excess fabric.
BACK CROTCH: slight indentation on the body.
LOWER BACK HIP: free from drag-lines and excess fabric.
THIGH: smooth; easy.
KNEE: smooth; free from baggy, excess fabric.
OUTSIDE LEGS SEAM: straight; location pleasing to the eye.
LEGS: (primarily a style feature) very slim; should not bind.

RATING SCALE

- 5 Excellent, best of kind.
4 Superior, above average.
3 Fair, average.
2 Acceptable, satisfactory.
1 Poor

INSTRUCTIONS FOR FITTING
EVALUATION:

Select the number from the rating scale which best describes your opinion of each garment in relation to the statements in the left hand column of the fitting evaluation chart.

FITTING EVALUATION CHART

GENERAL APPEARANCE																				
SILHOUETTE																				
CREASE LINE																				
CROSSWISE GRAIN LINE																				
DART PLACEMENT																				
FRONT CROTCH																				
BACK CROTCH																				
LOWER BACK HIP																				
THIGH																				
KNEE																				
OUTSIDE LEG SEAM																				
LEGS																				

COMFORT EVALUATION

Each student should evaluate her own garment using the rating scale found on the facing page.

COMFORT EVALUATION CHART

Seated on chair	
Walking, normal step	
Crouching	
Knee raised to 45° angle	