ABSTRACT

MCLENDON, DEBRA, LEE. An Investigation of the Sizing, Grading, and Fit of Commercial Sewing Patterns. (Under the direction of Dr. Cynthia Istook, Committee Chair, Dr. Katherine Carroll, Committee Member, and Dr. Marguerite Moore, Committee Member).

Fit is the most critical component that ensures consumer satisfaction with garments constructed from commercial sewing patterns. The purpose of this study was to evaluate current commercial sewing pattern industry sizing, grading, and fit practices and propose ways to improve sizing and fit. Sizing standards for U.S. commercial sewing patterns in the Missy 6 – 22 size range are based on outdated anthropometric studies conducted over 71 years ago. U.S. pattern companies have not changed their sizing standards since 1972. Data from more recent sizing surveys, such as SizeUSA (2004), shows the body shapes and measurements of the population of U.S. women have changed. U.S. pattern sizing is based on the hourglass figure, which represents only 8% of the U.S. population of women. Much confusion surrounds pattern size selection, since consumers typically need to purchase a pattern several sizes larger than their average ready-made clothing size. Basic fit patterns (fitting shells) and semi-fitted sheath dress patterns were purchased from five major brands under study (Burda, Butterick, McCall's, New Look, Vogue). Sizes 10 and 18 were selected to cut and construct sample garments for fit-testing on fitting mannequins. Quantitative methods were used to measure key body areas of the bust, waist, and hip of tissue patterns and compare them to finished garment measurements provided by pattern companies. Amounts of ease and finished pattern measures were used to determine if these measures conformed to the ease specifications for each fit category and matched printed pattern

measures. The fit of five different brands of sample garments on fitting mannequins was compared using qualitative visual analysis. Fit was assessed to identify any fitting issues that might be related to the patterns. Patterns were measured to verify if the circumference grades for the bust, waist, and hip were in accordance with pattern companies' standardized body measurements. The results clearly indicated that current pattern sizing does not conform to the body profiles of today's consumers and that the fit needs of a significant part of the population are unmet with current pattern offerings. The study also found that current pattern sizing is not aligned with sizing indicated by the most recent sizing survey. Results showed that the majority of brands studied failed to contain the ideal amount of ease and that some of the printed measures on all brands were different from physical measures. Results indicated a significant difference in the fit of different brands. Findings also indicated the majority of brands were graded in accordance with pattern company measurements. This research provides useful information to the commercial sewing pattern industry on ways to improve patterns for the target consumer. Amateur and professional sewers could also benefit from the insight on pattern sizing and fit provided in this study.

An Investigation of the Sizing, Grading, and Fit of Commercial Sewing Patterns

by
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DEDICATION

This thesis is dedicated to

Dr. Cynthia L. Istook,

my teacher, mentor, and friend.

Without your encouragement and

support, this journey would not

have been possible. My deepest

gratitude for all you have given me.

BIOGRAPHY

The author, Debra Lee McLendon, is the eldest child born to Leona and Ernest Marmaras. As the daughter of a career military officer, she grew up in numerous states across the country, including Massachusetts, New Jersey, Virginia, Georgia, Kansas, Colorado, and Hawaii. As a young child, she lived in Germany for several years, where she became a big sister to her younger brother, Michael and sister, Kimberly. Upon graduating from Spencer High School in Columbus, Georgia, Debra entered Columbus State University. The following year, she transferred to the University of Georgia as a sophomore, and later graduated with a Bachelor of Science degree in Home Economics, majoring in Clothing and Textiles. Debra spent many years in a successful career working in both the apparel and soft home furnishings industries, holding such positions as Designer, Patternmaker, and Department Manager. Her lifelong desire to teach the subject of apparel development prompted her to attend Graduate School at North Carolina State University, College of Textiles, in the Department of Textile and Apparel, Technology and Management. She is currently pursuing her Master of Science degree and looks forward to sharing her passion for textiles and apparel with others in a teaching capacity upon graduating in December 2011.

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CHAPTER ONE: INTRODUCTION

The development and marketing of patterns for the home sewer in the United States is a highly concentrated market. A few large firms dominate the pattern-making industry today, which began more than 150 years ago. Prior to the availability of mass-produced ready-to-wear (RTW) apparel, commercial sewing patterns were first created as a way to assist people in sewing their own clothing at home. Currently, more than 35 million Americans participate in home sewing activities (Hamilton & Hylton, 2006). To service this vast market of sewing hobbyists, pattern companies offer over 20,000 designs for clothing, craft, and home décor items (Palmer & Alto, 2006).

Fit is the single most critical aspect of home sewn garments and is one of the main reasons why people sew their own clothing. Other reasons to engage in home sewing is as a means of relaxation, creative expression, and to achieve better proportions than can be found in RTW clothing (Ashdown, Lyman-Clarke, & Palmer, 2007).

Since pattern companies invest an average of $40,000 to create and market a single pattern, the industry could experience declining sales by failing to meet customer expectations if home sewers are dissatisfied with the fit of apparel made from patterns (LaBat, Salusso, & Rhee, 2007; Palmer & Alto, 2006).

In the U.S. for 2010, the estimated sales for the category of sewing machines and patterns combined were more than $500 million (IBISWorld, 2010). Sales of commercial sewing patterns were grouped with sales of sewing machines in a 2010 survey, so estimated annual revenues of only patterns are not available. Since the major companies are privately owned, it is difficult to obtain annual sales figures. With sales of fabric, craft, and sewing

merchandise projected to rise at an annual rate of nearly 2% over the next 5 years, pattern companies face challenges on many different levels (IBISWorld). According to N. Tapanes, Consumer Service Assistant at Simplicity Creative Group (personal communication, June 7, 2011), Simplicity and New Look pattern designs are introduced and maintained based on current fashion trends, ease of sewing, consumer demand, and sales. Commercial sewing pattern companies are well advised to find better fit methods and invest in available custom fit technologies, such as CAD applications and body scanning (LaBat et al., 2007). These improvements could be used to produce patterns that can "help introduce the next generation of sewers to the creative potential of home sewing, and to provide their current customers with the tools that they need to continue their dedication to the art and craft of making clothing" (Ashdown et al., 2007, p. 345).

Rationale

One area in which pattern companies should invest time and resources in research and development is the fit of commercially available commercial sewing patterns for the missy size market. Much research has been conducted in the area of consumer dissatisfaction with the fit of RTW apparel; however, few studies (LaBat et al., 2007; Palmer & Alto, 2006) have focused on the fit of commercial sewing patterns. Unlike RTW apparel, which can be tried on to select the size that fits best, patterns must first be made up into garments to ascertain fit (Ashdown et al., 2007).

The pattern making industry could benefit from increased awareness of its customer base in order to provide products and services that will enable home sewers to successfully

create well-fitting clothing (LaBat et al., 2007). Most major pattern companies produce commercial sewing patterns for the misses' market in standardized sizes ranging from size 6 to a size 22. The misses' sizes ranging from 10 to 16 account for the majority of pattern sales (Palmer & Alto, 2006). This research was primarily focused on sizes 10 and 18 in order to address the grading issues and subsequent fit of this popular segment of pattern sizes.

Previous studies (Bye, LaBat, McKinney & Kim, 2008; LaBat et al., 2007; Murphey, 1993) found a decreased level of satisfaction with the fit of larger sized garments resulting from grading practices, especially in the areas of the shoulder, bust, neck, and armhole areas. To extend what others have examined, this research will study pattern-grading practices to determine how fit in these areas is affected by grading, especially on larger, size 18 garments.

A common perception among home sewers is that there is a difference in the fit of patterns among the major brands and that one brand fits better than another does. According to Palmer and Alto (2006), the fit of size 10 basic bodices produced from 6 major brands of patterns was essentially the same. The Palmer and Alto study included four of the five major brands that will be explored in this case study. This research will study the fit of garments that comprise the entire torso area, excluding the arms, to gain insight into the fit at the hip area, as well as the previously researched bodice fit.

The results of this study will lead to a better understanding of how well current size recommendations used by the pattern-making industry meet the fit needs of today's U.S. population of home sewers. A new sizing system and improved grading methods more aligned with current RTW apparel sizing systems could be implemented to improve the fit of garments created from commercial sewing patterns, which might reduce confusion and

improve consumer satisfaction with finished products constructed from commercial sewing patterns.

Research Questions

The goal of this research was to conduct an analysis of the standardized sizing specifications and grading methods currently used by leading manufacturers of commercial sewing patterns and to determine how these variables affect the fit of finished garments. To guide the research, the following questions were developed related to the impact of sizing, pattern specifications, and grading on the fit of commercial sewing patterns. The commercial pattern industry faces challenges in meeting the target consumer's desire for well-fitting patterns. The answers to these questions are important because after investing considerable time, effort, and money cutting and sewing clothing from patterns, the least desired results are garments that do not fit. The four primary research questions guiding this study are:

1. *Does the fit profile used by the commercial sewing pattern industry conform to the body profiles of today's U.S. consumers?*
2. *Do finished garment measurements in key areas printed on patterns conform to the company ease specifications for each fit category?*
3. *Is there a difference in the fit of finished basic dresses constructed from the five brands of commercial sewing patterns under study (Burda, Butterick, McCall's, New Look, and Vogue)?*
4. *Are the grade rules used by pattern companies at the bust, waist, and hip based on their standardized body measurements?*

Limitations

This study was limited in the following ways:

Commercial sewing pattern companies use dress forms and live fit models to assess fit. Although fit mannequins have fewer variables than the human body does, variations in fit may occur by trying sample garments on fit mannequins, as opposed to live models.

The fit mannequin, considered a reliable form to assess fit in an industry setting, may not be representative of the sizing of the current population of U.S. women.

The unavailability of fitting shell patterns from all five major brands limited the number of fitting shell patterns studied to two. Fitting shell patterns for the other three brands were improvised through dress patterns with similar fit and style.

Definition of Key Terms

Anthropometric: Measurements of specific areas of the human body used to develop clothing sizing systems. Also used for the ergonomic design of car seats and airplane cockpits. Anthropometric data is collected by manual measurement or by a body scanner and is usually obtained by a scientific method of conducting large scale sizing surveys.

Arc Measurement: Partial measurement of the circumference or girth of a body area, such as the front bust from side seam to side seam.

Armscye: Curved area that defines the armhole from the outer shoulder to the side seam.

Base size: The size a master pattern is drafted, or digitized in and then used to grade smaller or larger sizes.

Basic block: A set of pattern pieces that encompass a style category, such as the princess or torso block. The simplified pattern pieces in a basic block do not include facings, pockets, or other styling details. They are the foundation for drafting master patterns.

Basic sloper: A set of simple pattern pieces needed to make a close fitting garment, with minimum ease added and no seam allowances. Flat patternmaking design uses slopers to create basic blocks, or foundation patterns.

Body shape: A description of the basic three dimensional contour of different types of human figures based on key body measurements. Simmons (2002) identified nine predominant body shapes: hourglass, bottom hourglass, top hourglass, rectangle, diamond, oval, spoon, triangle, and inverted triangle.

Circumference measurement: Measurement that encircles the body at a specific location, such as the full bust, waist, or hip. Also known as girth measurements.

Fit Profile: Body shape and additional body measurements that help describe the fit needs of a specific consumer or population. Examples of predominant shapes are rectangle, bottom hourglass and spoon (Devarajan, 2003; Newcomb & Istook, 2006a & b; Simmons, Istook, & Devarajan, 2004 a & b).

Fitting Shell: A basic pattern, similar to a sloper, but with seam allowances. Sold by commercial sewing pattern companies to help sewers custom fit and alter patterns to their individualized shape. Also known as a fit pattern.

Grade (noun): 1. The amount of change (increase or decrease) in the circumference of the body within a given size range. **2.** The specific amount of change at each cardinal point on a pattern piece.

Grade (verb): To systematically increase or decrease a base-size pattern to create a complete range of sizes.

Grade rule: A permanent record of the amount of movement made at each cardinal point on patterns when creating a range of sizes.

Graded nest: Pattern pieces of all sizes within a size range being produced stacked on top of each other along a common origin line in order to observe the differences in the grade increments.

PDS: Acronym for Pattern Design System, such as Gerber or Lectra.

CHAPTER TWO: REVIEW OF LITERATURE

The Home Sewing Market

Revenues of $4.3 billion from the sales of fabric, craft, and sewing supplies stores were reported for 2010 (IBISWorld, 2010). Growing numbers of consumers are creating their own apparel and accessories to satisfy their requirements for unique, customized clothing and as a means to express individual style. The resurgence of craft and do-it-yourself (DIY) fashion is driven by lowered levels of disposable income, while Americans return to taking up traditional hobbies like sewing in lieu of shopping. The popularity of reality based television shows ranging from fashion design (Project Runway) to home décor (Trading Spaces) as well as online handmade boutiques (Etsy) are additional influences on the increasing popularity and return to sewing and crafting. Sales of fabric, craft, and sewing merchandise are predicted to increase by nearly 2% annually over the next five years, as the U.S. economy continues to recover and discretionary income levels rise. The continued interest in DIY fashion, along with the aging demographic of baby boomers will contribute to sales increases (IBISWorld, 2010).

The market for products and services within the fabric, craft, and sewing supplies industry is segmented by fabrics; sewing and craft supplies; other; seasonal decorations; and home décor fabric (see Figure 1). Clothing patterns and sewing machines are included in the sales of other products. This market segment accounts for 12% of the industry revenue. Although the demand for sewing machines has remained relatively flat for the period of 2005 to 2010, clothing pattern sales have increased because of the popularity of DIY projects

(IBISWorld, 2010). The size of this market makes the home sewing industry a significant part of our economy and an important market segment (LaBat et al., 2007).

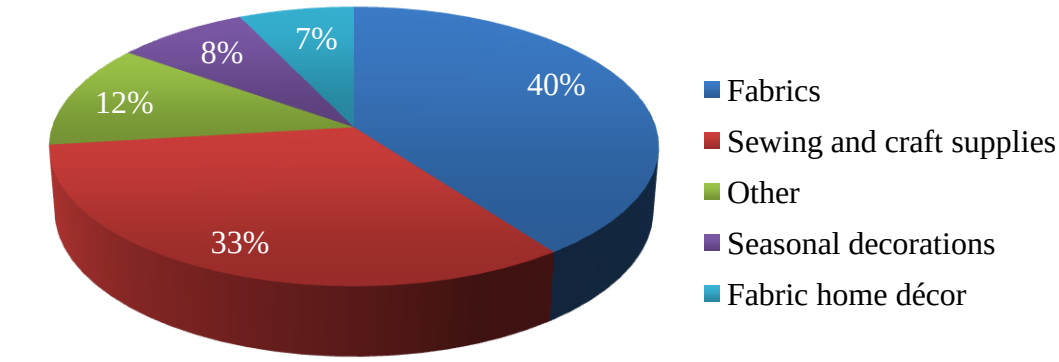

Figure 1. Products and services segmentation for fabric, craft, and sewing supply stores for 2010. Adapted from Fabric, Craft & Sewing Supplies Stores in the US, IBISWorld, 2010.

Fabric, craft, and sewing stores market directly to consumers. A 2009 consumer survey conducted by Michael's Stores found women accounted for 90% of the market, with the remaining 10% comprised of men. Traditionally, women are more likely to engage in sewing and crafting hobbies that utilize industry products (IBISWorld, 2010).

The majority of the fabric, craft, and sewing stores market segment is comprised of baby boomer women aged 45 to 64, due in part to the large amount of participants from this population that enjoy sewing and crafting pastimes. The next largest segment is comprised of women aged 25 to 44 years old (see Figure 2) (IBISWorld, 2010). In 2006, the Home Sewing Association estimated there were approximately 35 million sewing hobbyists in the

U.S. This was an increase of 5 million participants over the previous 6 years (Hamilton & Hylton, 2006).

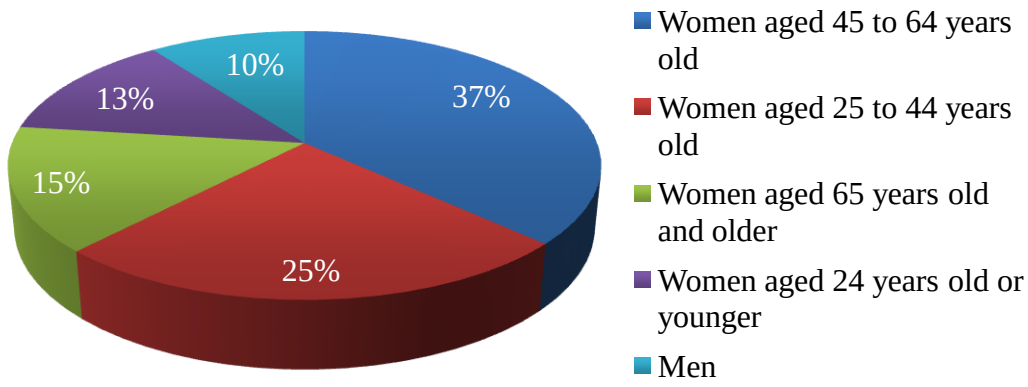

Figure 2. Major market segmentation for sewing hobbyists in the U.S. for 2010. Adapted from Fabric, Craft & Sewing Supplies Stores in the US, IBISWorld, 2010.

History of Commercial Sewing Patterns

The use of commercial sewing patterns is a common method of creating apparel and craft items. Patterns were initially created as a tool to aid sewers in constructing their own apparel at home. Today, the predominantly full-scale patterns, printed on tissue paper are available in a wide range of styles and sizes. Seven popular brands of sewing patterns dominate the commercial U.S. pattern market today–Burda, Butterick, Kwik Sew, McCall's, New Look, Simplicity, and Vogue (Knight, 2008). An assortment of over 20,000 different pattern designs can be found in the catalogs and on the websites of these major companies (Palmer & Alto, 2006). In addition, hundreds of small and medium-sized companies offer a wide variety of pattern brands, with new ones still in development (Ashdown et al., 2007).

Technological advances have provided new methods to purchase patterns. Today, patterns are distributed through numerous venues, including piece goods and sewing supplies stores, craft stores, mail order magazines and catalogs, and e-commerce websites. As the number of traditional brick and mortar piece goods and sewing supply stores decline, the widest assortment of patterns is available for purchase online (Ashdown et al., 2007).

Some websites offer downloadable patterns that sewers can print out on a home printer and tape together, or users can print patterns onto poster paper at copier stores. Home delivery of downloadable patterns is a convenience available by ordering online printing from a FedEx Office store, which prints and mails directly to the customer (Corcoran, 2007). Some websites sell downloadable patterns that normally retail for $9.99 for as little as $.99 (Sewing Patterns, 2009). Well-known brands such as Burda offer free downloadable patterns and sell others for one-half the regular retail price (BurdaStyle, Inc., 2009a). Retail prices for commercial sewing patterns range from $.99 to $30 (Hollahan, 2010).

One major pattern company, Burda, is using another emerging trend fueled by the open source philosophy, the sharing of intellectual property. They are allowing users to create new designs by remixing, refashioning and sampling. BurdaStyle removed the copyright from some of their pattern designs. The open source sewing patterns are free to use as a starting point for original designs. The company believes that by removing copyrights from their designs, they will inspire sewers' creativity in producing new fashion designs (BurdaStyle, Inc., 2009b).

The availability of pattern choices provide home sewers with many styling options and means to express their creativity through the selection of silhouette and size, coupled

with the desired fabric and findings. The vast array of today's fashion pattern choices include styles for men, women, and children and include categories of basics, haute couture, costumes, crafts, and home décor. Palmer and Alto (2006) maintained that Missy sized patterns are the category that generates the most revenue for the major companies The variety of styles offered is possible in part due to strides in numerous technical advances made over the nearly 150 years since the introduction of sewing patterns. A review of the development and evolution of the commercial sewing pattern market was beneficial in carrying out this research.

Early Efforts in Pattern Development

Few artifacts dated prior to the 1800s exist relating to the early beginnings of the commercial paper pattern industry. This is due in part because the first publications were pamphlets distributed only to the tailoring trade and were not considered significant enough to retain and include in archived collections. The earliest surviving American publication on the topic of cutting out men's clothing dates to 1809 (Seligman, 1996).

In the early 1800s, a plethora of pattern drafting systems was developed, with each new system claiming to be a vast improvement over an existing one. Coinciding with this same period, fashion magazines were in vogue and often contained scaled or full-sized pattern supplements. This set the stage for subsequent expansion in the offerings of fashion publications that developed during the progression of the 19th century (Seligman, 1996).

Early publications targeted two different markets. Educational guides were one type of publication aimed at girls and women for the purpose of instruction in needlework and domestic dressmaking. The second type, a drafting method based on proportional and/or

direct measurement tables was targeted to professional tailors and dressmakers (Seligman, 1996).

Dressmakers drafting systems involved the use of measuring devices, special rules, and curves specifically designed for use with a particular system. The invention of the inch tape measure and tailors-square by George Atkinson in 1799 gave rise to a system of direct measurement based on body dimensions (Seligman, 1996).

Prior to the Industrial Revolution, sewing was a laborious, time-consuming activity, as all stitching was done by hand. American women longed for Parisian-inspired fashions of their own, and women of means were willing to pay the high prices ornate garments commanded (Ketteler, 2010).

In the 1850s, prior to the availability of mass-produced patterns, the majority of American women had to sew their own clothing due to financial or geographic constraints. Without a pattern to guide them to cut out a garment, they often struggled to achieve acceptable styling, fit, and construction. For garments requiring proper fit, the only alternative available was to deconstruct an existing garment and use those pieces as a cutting guide (Walsh, 1979).

The invention of the lockstitch sewing machine, first by Elias Howe in 1846; followed by Isaac Singer's patent in 1851, revolutionized the way clothing was made both domestically and professionally, by providing the sewing industry with increased efficiencies (Cumming, 2010). The first Singer machines cost $100 to $125, a considerable sum of money in an era when the average annual household income was $500 (Gordon, 2007; Ketteler, 2010). Sewing machine prices began to fall and a more reasonably priced and

lighter-weight "family" model was sold in 1859 for $75 (Ketteler). More women acquired mechanical sewing machines during this time, but despite the advantages of speed provided by the machines, cutting out garments was still a considerable obstacle for the ordinary seamstress (Walsh, 1979).

Fashion diagrams, along with makeshift directions, were found in leading women's fashion magazines such as *Godey's, Peterson's*, and *Leslie's;* and skilled professional dressmakers were able to replicate these looks for their clients. However, most amateur seamstresses did not possess the high skill level needed to scale the diagrams to their correct size and to interpret the early designs. In addition, much improvement was needed in the area of more detailed sewing instructions (Walsh, 1979).

Mme. Demorest. In 1854, seamstress and designer Ellen Curtis Demorest sold the first branded commercial pattern in the U.S. Sold under the brand name Mme. Demorest, her original pattern was published in *Frank Leslie's Gazette of Fashions*. Later, Mme. Demorest patterns were sold in popular magazines like *Godey's Lady's Book* until 1860, when she and her husband began their own publishing company and *Mme. Demorest's Mirror of Fashions* was launched (Ketteler, 2010).

Full-scale, foldout printed tissue patterns were included as magazine supplements. Although this was an improvement over small-scale sketches and fashion plates, much work was still required to translate and transfer the numerous overlapping pattern-cutting lines onto plain paper or fabric (see Figure 3). However, since the patterns were sold in only one size, the biggest obstacle was having to size-scale the patterns, which remained a difficult task for all but the most accomplished professional seamstress (Walsh, 1979). Women either

had to have the skills necessary to adapt the patterns to their own size; hire a professional dressmaker to do it; or they could send their bust, waist, and sleeve length measurements to Mme. Demorest and special order a custom-fitted pattern for 20–25 cents (Ashdown et. al., 2007; Ketteler, 2010)

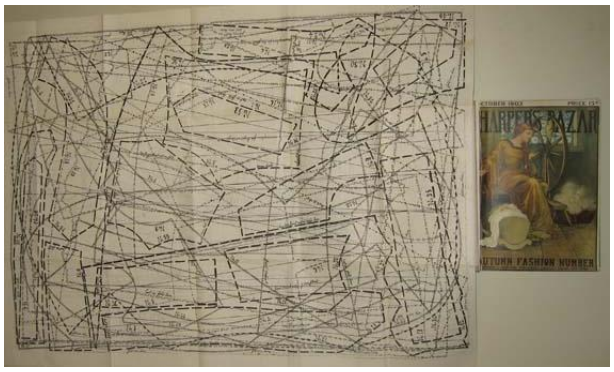

Figure 3. Pattern pieces with overlapping lines in foldout supplement from Harper's Bazar (1903). From "Make it Yourself": Home Sewing, Gender, and Culture, 1890-1930 (Ch. 4, p. 9), by S. Gordon, 2006, New York, NY: Gutenberg, Columbia University Press. Note spelling of 'Bazar' from early editions of magazine.

In 1876, 22 years after the introduction of Demorest's first pattern, the company distributed more than 3 million patterns. Their business ventures continued to experience tremendous success over the next 12 years, until the company was sold in 1888, after Ellen's retirement (Ketteler, 2010).

Butterick. Ebenezer Butterick, an experienced tailor from Massachusetts, published the first size-graded commercially available sewing patterns in 1863. Some accounts attribute Butterick's idea of making size graded patterns to his wife, who at the time was attempting to cut out a garment for their infant son and was frustrated by the absence of a sized pattern. Although patterns were available, they only came in a single size and it was up

to the sewer to resize, or grade the pattern up or down accordingly. Butterick seized the idea, and using his nephew's measurements, drafted the first sized commercial pattern for a boys' shirt (McCall Pattern Co., 2011; English, n.d.).

Butterick used stiff cardboard as a substrate for his very first patterns. He quickly realized that a more lightweight and supple paper was needed if he was to fold and ship the patterns across the country, and settled on the idea of using tissue paper (McCall Pattern Co., 2011). Prior to the 1950s, Butterick patterns were cut en masse using band saws. The plain, unprinted tissue paper pattern pieces contained perforations and cutouts to indicate the piece number, grain line, notches, and other construction details such as button placement. See Figure 4 for an example of Butterick's early tissue patterns.

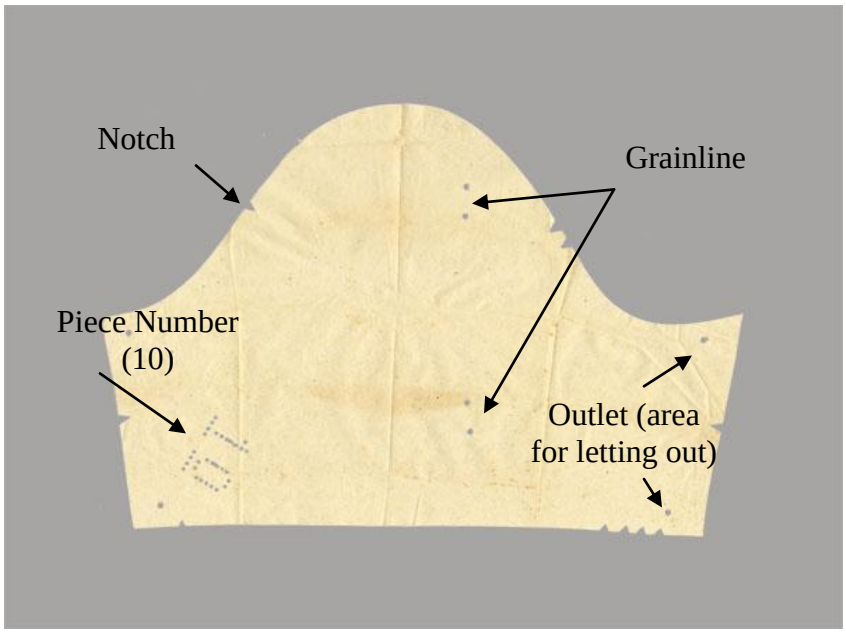

Figure 4. Butterick pattern piece for sleeve, circa 1930s. Debra McLendon photo**.**

Initially, the company operated successfully as a local home-based business, with family members helping to cut, fold, package, sell, and ship patterns from their Massachusetts residence. The company quickly outgrew the space and relocated to New York City by 1865 in order to expand (McCall Pattern Co., 2011). The business grew quickly over the next several years, starting with twelve employees to having 140 by 1870. The average daily production for his patterns in the next year was 23,000. This phenomenal growth is attributed to the fact that Butterick's patterns excelled in both style and fit. The company achieved sales of more than 4 million patterns in 1871, with an increase of an additional 2 million patterns the next year. By the early 1870s, Butterick was an established household brand with a nationwide following (Durack, 1997).

In the early years, patterns by E. Butterick and Company were produced for boys and men's apparel, with patterns for women's garments introduced several years later in 1866. The women's product offering consisted of 13 sizes of patterns for dresses, jackets, and capes, and 5 sizes of skirts. The target market for Butterick's sized, mass produced patterns was the home dressmaker (English, n.d.; McCall Pattern Co., 2011; Walsh, 1979).
To enter the vast untapped market in the 1860s, widely publicized size-graded and reasonably priced patterns (costing from 10 cents and up) were distributed through the Butterick store in New York City, sales agents, mail order catalogs, and dressmakers. With the extensive distribution network, women all over the country now had access to an abundance of patterns that facilitated sewing fashionable garments (Walsh, 1979).

According to Ashdown et al. (2007), commercial sewing patterns, especially ones that were sized, were a boon to the home sewing market since they were first introduced.

Butterick patterns were such a colossal winner; that many more pattern companies sprang up over the next several decades, including DuBarry (made by Simplicity for Woolworth's), Harper's, Marian Martin, Pictorial Review, Taylor's, and Vogue (see Figure 5).

Figure 5. DuBarry, Marian Martin, and Pictorial Review patterns. From the Author's collection.

In addition to producing patterns, Butterick simultaneously entered into the world of magazine publishing, in part to help promote sales of his patterns. He began with *The Ladies' Quarterly Review of Broadway Fashions* in 1864, followed by a second publication, *The Metropolitan Monthly* four years later. By this time, the country had an insatiable appetite for the latest news in fashion and the paper patterns to create them, shown in Figure 6. Butterick merged his two previous publications and introduced *The Delineator* as a monthly fashion magazine in 1873. From the late 1800s to the early 1900s, the magazine

rose to become one of the top six women's magazines and helped to establish the Butterick name as a leading provider of fashion news. The subscription price was $1.00 a year, or $.15 per issue for the 48-page publication (English, n.d.).

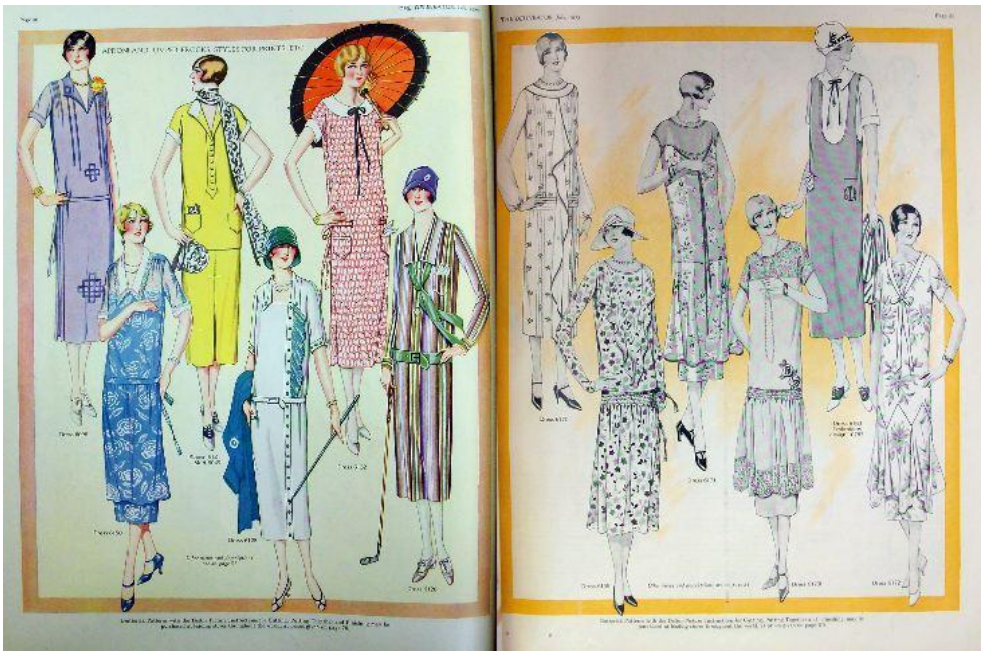

Figure 6. Butterick patterns featured in The Delineator, July 1925. Reprinted from English, n.d.

The Delineator, translated into 5 languages was continuously published over the next 64 years. The magazine was negatively affected by the economic downturn of the U.S. economy in the late 1920s. During the Depression, the publication experienced intense competition from other popular magazines such as *Vogue* and *McCall's*. The newfound availability of affordable RTW apparel that created a shift in the traditional method of clothing construction compounded the publications difficulties. After the magazines abrupt demise in 1937, Butterick focused his efforts on his more profitable pattern business (English, n.d.).

The earliest commercial sewing patterns were sold without much instruction on how to construct the garments. They were simply pre-cut pieces of tissue paper with no markings, and may have included an illustration of the garment along with a few paragraphs of written instructions. An assumption was made that the home sewer either already possessed the necessary skills, or would be able to figure out how to cut and sew the garment based on the minimal information provided. In the late 1860s, Butterick was the first to include a small 4 inch by 6 inch printed label with his patterns that contained a rendering of the finished garment along with an abbreviated set of instructions for assembly (Durack, 1997).

The Butterick Publishing Company found a method to help address one of the biggest challenges faced by pattern manufacturers: the most effective way to communicate the cutting and sewing procedures for garments that were cut from patterns. A guide sheet that contained illustrations to direct sewers in garment construction was the answer. Butterick was the assignee for a patent granted in 1919 for a "Dressmaker's Pattern Outfit" (see Figure 7). The series of perspective drawings was used to depict the construction sequence in the proprietary construction guide. He named the guide sheet the Deltor, whose name was coined by taking the first three and last two letters of *The Delineator*, his successful women's magazine. The guide sheet is now a standard component of all commercial sewing patterns today (Durack, 1997; English, n.d.).

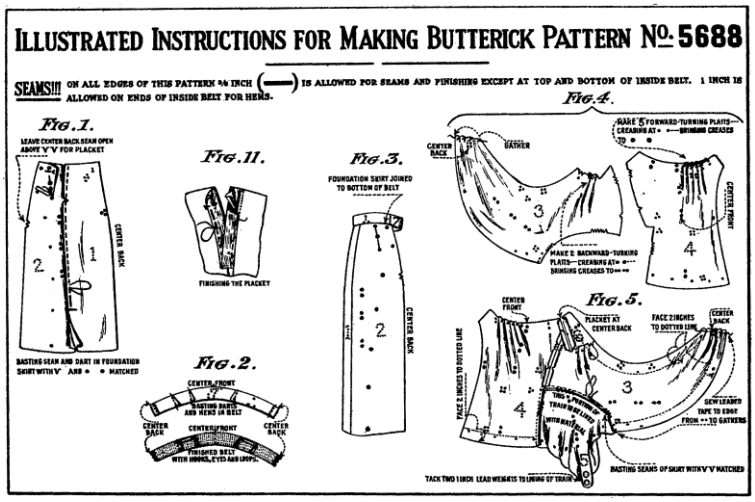

Figure 7. Guide sheet from Butterick (assignee) 1919 patent for Dressmaker's pattern outfit. From *http://upload.wikimedia.org/wikipedia/commons/3/39/Deltor_for_Butterick_5688_from_patent_US1313496.gif*

A second patent was assigned to the Butterick Publishing Company in 1923 for the invention of a cutting layout diagram. The diagram depicted various cutting layouts of pattern pieces based on the pattern, pattern size, and fabric width (see Figure 8). Cutting diagrams similar to the ones Butterick introduced are included in most patterns today (Durack, 1997).

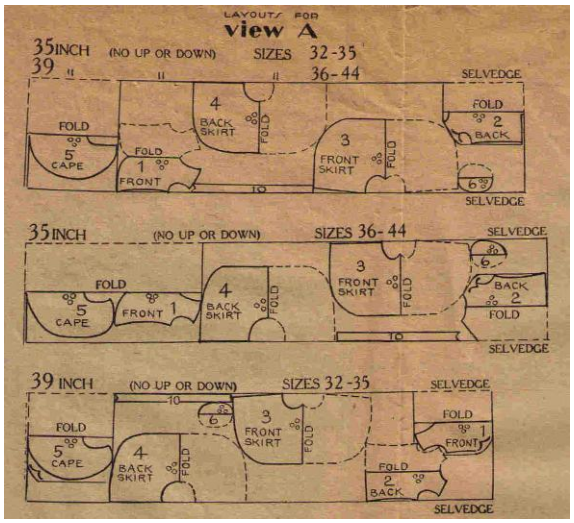

Figure 8. Excerpt from Butterick's patented cutting diagram, circa 1930, pattern #3004. From the author's collection.

Butterick used his two patents as a competitive advantage over other companies, who were barred from including such cutting and sewing guides with their patterns. He aggressively marketed these improvements on pattern envelopes, pattern pamphlets, and in *The Delineator* fashion publication (Durack, 1997). See Figure 9 for an example of a Butterick pattern featuring the Deltor instruction guide.

Figure 9. Butterick frock pattern #3004, circa 1930, featuring Deltor instruction guide. From the author's collection.

Butterick patterns, renowned for their quality and innovation remained an independent company for 138 years. Along with McCall's and Simplicity, they operated successfully throughout the 20th century as one of the top 3 U.S. pattern companies (Durack, 1997; English, n.d.). Today, Butterick continues to be a popular brand of fashionable commercial sewing patterns marketed by the McCall Pattern Company.

McCall's. James McCall was also an entrepreneur in the commercial sewing pattern industry. Originally from Scotland, McCall opened a tailoring shop in New York after arriving in the U.S. during the 1860s ("The Press", 1932). Then, he and his wife Belle founded a pattern company in 1870 (Clendenning, 2001; Holliday, 2001). A four-page

pamphlet, entitled *The Queen-The Illustrated Magazine of Fashion* was published in 1876 to market McCall's dress patterns (Holliday, 2001). McCall's was a fierce competitor of Butterick's, and offered more than 200 styles of moderately priced patterns in a range of sizes. They also advertised their products in *Harper's Bazaar* (Walsh, 1979).

James McCall died in 1884, just 14 years after launching his successful pattern company. After his death, the magazine formerly called *The Queen-The Illustrated Magazine of Fashion* was renamed *McCall's Magazine, the Queen of Fashion* in 1897. By 1910, the publication had attained a circulation of more than 1 million and enjoyed a successful run for 125 years (Holliday, 2001).

The McCall Company was assigned a patent in 1921 for paper patterns with printed shapes, markings, and text (Durack, 1997). They labeled their pattern envelopes as including a trademarked Printo Gravure, which included cutting and construction diagrams, and charts for finishing details (see Figure 10). In 1929, McCall's was the first to print their pattern envelopes in full color (see Figure 10) (Ashdown et al., 2007). McCall's primary competitor, Butterick, sought improvements in instructions for cutting and construction of patterns, whereas McCall's focused on improving the pattern pieces themselves. Prior to McCall's invention of "the pattern with the printed cutting line," all other brands of patterns were simply plain pieces of pre-cut tissue paper.

Figure 10. McCall pattern #6557, dated 1931. From the author's collection.

The new pattern pieces contained printed pattern details such as darts, tucks, notches, fold lines, grain lines, and seam allowances. As shown in Figure 11, these printed features greatly improved pattern usability, while still maintaining the structural integrity of the pattern pieces by eliminating the perforations found on other brands (Durack, 1997).

Early patterns featured silhouettes, proportions, and sizes that mostly correlated to the body measurements of home sewers in the 1880s. By this time, most companies were producing sized (proportionally graded) patterns. The benefits a pattern provided to the home sewer lowered the skill level required to create a garment, but issues pertaining to fit persisted and patterns frequently required alterations. Although an inconvenience, this was still considerably easier than drafting a pattern from scratch (Ashdown et al., 2007). The introduction of commercial sewing patterns as we know them today occurred during the

1890s, as companies began selling patterns in envelopes that included instructions (Ketteler, 2010).

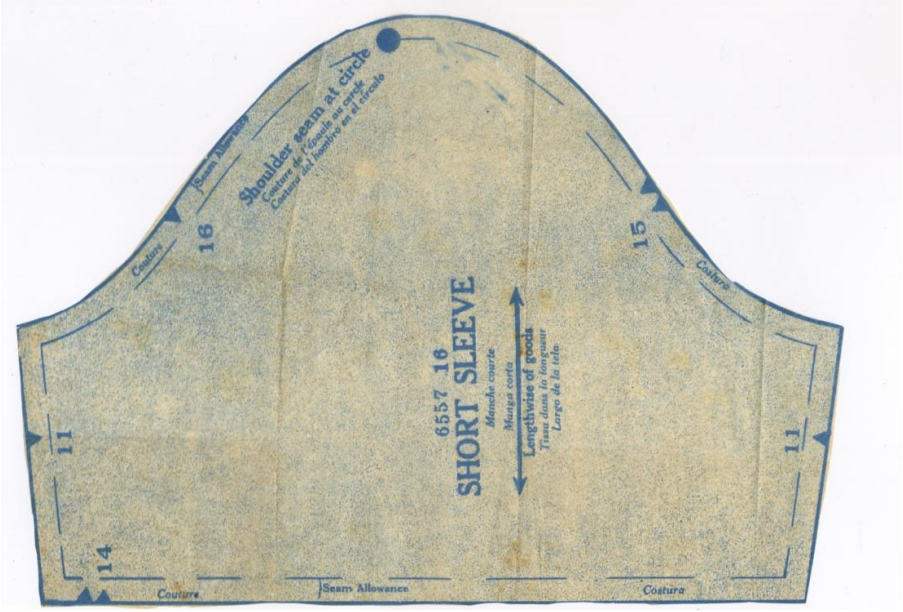

Figure 11. McCall printed pattern piece dated 1931. From the author's collection.

Vogue. The first Vogue pattern was sold through *Vogue* magazine in 1905. Rosa Payne is credited with designing the premier Vogue pattern. She convinced the editors of *Vogue* to include a pattern she had designed in their magazine. Payne's first pattern was only available in a single size, based on a 36-inch bust measurement. The early Vogue patterns were mail-ordered by readers, who clipped a coupon and mailed it in along with 50 cents. (McCall Pattern Co., 2011).

The stylish Vogue patterns were a hit and a separate business, Vogue Pattern Company, was formed in 1914 to keep up with the strong demand. The patterns were sold in department stores and showrooms across the country, as well as in London and Canada.

Vogue's operations continued to expand globally during the 1920s and 1930s, in conjunction with the growing trend of home sewing. Vogue patterns from as early as 1937 were marketed as "couturier" designs; however, they were not exact replicas of haute couture fashions. In 1949, Vogue was the first pattern company to introduce patterns that were duplicates of original creations by popular European fashion designers of the era. Today, Vogue Pattern Company continues to license the names of some of the world's premier designers, such as Donna Karen and Issey Miyake (McCall Pattern Co., 2011).

Simplicity. Joseph Shapiro and his son, James, started the Simplicity Pattern Company in 1927. By this time, the retail price of some patterns had gone up to as much as two dollars each. The founders of Simplicity entered the market by pricing their patterns well below their competitors, selling them for as little as 15 cents (American Sewing Guild, 2011). They were also the first company to offer 3 distinct looks contained within a single pattern and advertised "3 patterns for the price of 1" on the pattern envelope, a benefit in the depression years (see Figure 12) (Ashdown et al., 2007; Palmer & Alto, 2006).

Figure 12. Simplicity pattern, circa early 1930s, featuring 3 looks in 1 pattern, priced at 15 cents. From the author's collection. Envelope measures 4 inches wide by 7 inches long.

All the pieces for the first perforated, *not printed*, Simplicity patterns were contained on a large, single sheet of tissue paper, which was laid out in its entirety onto the fabric. The seamstress then cut along the perforations through both the pattern and fabric (American Sewing Guild, 2011).

Later, Simplicity pattern pieces were very similar to other major brands of pre-cut, unprinted patterns of the era. One feature that differentiated Simplicity patterns was the inclusion of a small (1inch) perforated letter on each pattern piece that indicated the various pieces such as "A" for front skirt and "B" for back skirt, etc. (see Figure 13).

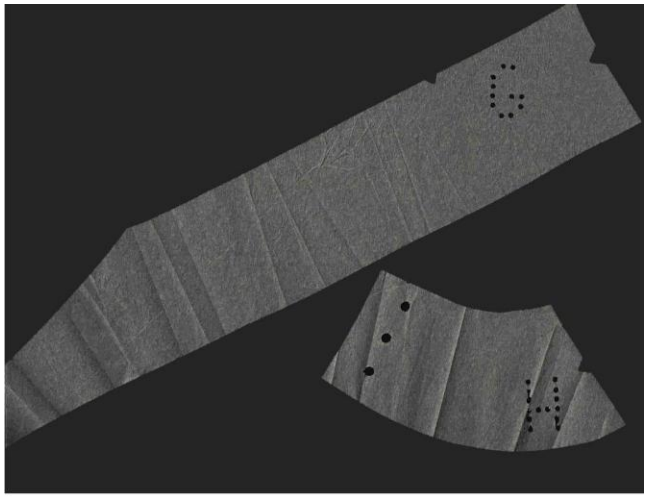

Figure 13. Simplicity pattern pieces with perforations circa early 1930s.
From the author's collection**.** Perforations indicate piece "G" (front neckband) and "H" (back neckband).

The guide sheets contained in early Simplicity patterns were small compared to today's standard size of 19 inches wide by 14 ½ inches long. All the cutting and sewing instructions on the "Simplicity Primer" were printed on a single sided sheet measuring 11 inches wide by 8 ½ inches long (see Figure 14).

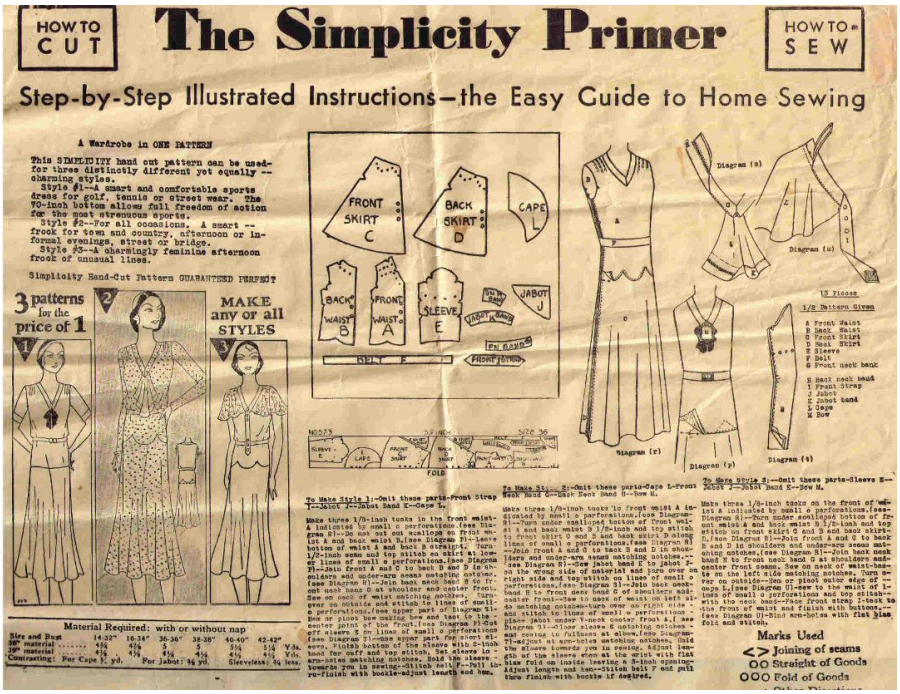

Figure 14. Simplicity guide sheet circa early 1930s. From the author's collection.

The first Simplicity pattern envelopes were small and measured only 4 inches by 7 inches, but by 1934 Simplicity began printing pattern envelopes similar in size to the envelopes of today. Five years later, they sold printed patterns for 25 cents each.

Early 20th Century

Many women of this era sewed their own clothing to economize, as they could not even afford inexpensive RTW dresses sold in stores. The economic hardships incurred from the First and Second World wars and the 1930s depression resulted in a boom in home sewing and a subsequent increase in the popularity of paper patterns (Ashdown et al., 2007). A shortage of RTW clothing occurred in the early 1940s because of imposed conservation of domestic resources due to World War II efforts. The U.S. commercial sewing pattern industry benefitted greatly from this scarcity of ready-made clothing as pattern sales soared.

A slimmer silhouette and shorter skirt and jacket lengths for women was born out of this necessity to conserve fabric and paper. The new patterns contained fewer pattern pieces and required less fabric to make (McCall Pattern Company, 2011).

Mid 20th Century

Pre-cut, unmarked, perforated patterns became obsolete, and by the 1950s, all major brands of patterns were printed (American Sewing Guild, 2011). The more user-friendly patterns had greatly improved since the 1930s and 1940s. The widespread availability of fabric and patterns in the post-war era sparked a newfound interest in homemaking and sewing. Patterns were sold at 25,000 stores across the country (Ketteler, 2010).

The 1950s saw a boom in the U.S. home sewing market, with industry sales of close to $1 billion in 1958. Sewing patterns accounted for $40 million of the total sales, with 90 million patterns sold (*Modern Living*, 1958). During this time, a consolidation of the market occurred as smaller pattern companies were acquired by larger ones (Ashdown et al., 2007).

Sewing was a top-ranked hobby in the 1950s, with sewers making an average of 21 to 27 garments (mostly dresses) each year (Ketteler, 2010). With the availability of designer patterns by McCall's (e.g. Givenchy, Pierre Cardin) and Vogue (e.g. Balmain, Schiaparelli, and Lanvin) among others, many women sewed European inspired high-fashion clothing for a fraction of the cost of similar RTW styles (Ketteler; McCall Pattern Co., 2011). During this era, the demographics of the home sewer changed significantly, with an average age of 27 in 1958, down from 45 in 1928 (*Modern Living,* 1958).

In 1958, McCall's patterns sold for .50 cents and annual sales had reached $11 million. Simplicity reigned as number one, selling patterns for as little as .35 cents each,

with sales of $20 million. In 1958, a typical Vogue pattern sold for $3 (*Modern Living*, 1958). A few years later, Butterick acquired Vogue's pattern division, in 1961. In order for the Vogue product line to remain separate and distinct from Butterick, the company retained a separate group of merchandisers, designers, artists, and editors (McCall Pattern Company, 2011).

Baby boomers coming of age in the 1960s sparked a sewing revolution. Home Economics was taught in schools, and many girls participated in scouting, adding to the popularity of sewing. A record $1 billion was spent on sewing and related supplies in 1963. The average cost for a yard of fabric in 1963 was $1. Between 1960 and 1968, the number of garments sewn at home increased by 50%. The amount of clothing sewn at home (300 million pieces) amounted to one-third the amount of all mass-produced garments (900 million pieces) in the U.S. By 1974, 44 million U.S. women and girls participated in sewing (Ketteler, 2010).

Despite a weak economy and high inflation during the 1970s, the sewing and crafting movement was used as a means of personal expression and style. Sewing, needlework and other crafts such as macrame´and rug-hooking remained popular alternatives to the inexpensive, mass-produced items sold in stores (Ketteler, 2010).

Burda. Aenne Burda in a town near Frankfurt, Germany founded the Burda pattern company. After her husband purchased a publishing business, Mrs. Burda employed several dressmakers and editors and the premier edition of the Burda fashion periodical was published in 1950. The initial issue, featuring the latest in Parisian fashions, had a circulation of 100,000 copies. The magazine contained pull-out patterns for children, teens,

grandmothers, and plus-sized individuals. The publication grew rapidly, and by 1967 had attained a circulation of 1.5 million, making it the largest European fashion magazine. By 1974, Burda was an international magazine translated into 14 different languages (Szeless, 2002).

As Corcoran (2007) proclaimed, "Burda patterns are well-known among older sewers, such as teacher and author Sandra Betzina, for their precise fit, particularly in jacket sleeves and pants" (p. 2). Burda fashion publications feature Burda patterns with a focus on designer fashion and current styles. *Burda Fashion* and *Burda Style* magazines are translated into17 languages and distributed globally to 90 countries. Today, Mrs. Burda's youngest son, Dr. Hubert Burda runs the company. To help develop a strong brand following, he wants to encourage sewers and creators of fashion to share their passions and talents to build networks of like-minded people (AME Info FZ LLC, 2011).

Late 20th Century

Debt-saddled Simplicity Pattern Company, along with other pattern companies, suffered financially during the early 1980s due to numerous leveraged buy-outs, changing consumer demographics, and tastes. Consumers were abandoning the practice of home sewing while traditional suppliers of patterns, fabrics, ands sewing notions such as Woolworth's, Sears, and JCPenney phased out these low-margin departments. Industry sources reported revenues for the home-sewing market were down by about 30%, with the number of pattern retailers dropping by more than one-third in less than a decade, down to 10,000 (Ettorre, 1993).

Despite a decline in the number of pattern offerings as companies streamlined in the early 1980s, the home sewing industry experienced an upswing by the late 1980s. Factors contributing to industry growth were "the aging of baby boomer women, the primary customers; a return to cocooning' and more attention to improving the home…; and advances in sewing machine technology" (Ettorre, 1993, p.26).

Simplicity, Butterick Company, and McCall Pattern Company dominated the pattern industry in the early 1990s. These "big three" companies combined made up about 90% of the commercial sewing pattern business with $250 million in sales (Ettorre, 1993).

A new CEO was appointed at Simplicity in 1990 with the goal of reviving the privately held company through restructuring. The company decided to stick to its origins of marketing reasonably priced, mainstream designs, unlike the more fashionable patterns made by Butterick and Vogue. Under the new leadership, the company implemented $2 million in improvements to the New York pattern-making department. The switch to computerized pattern- making improved the company's efficiency and enabled them to become more competitive. By the early 1990s, annual sales had reached almost $100 million and revenues were up 30% percent and profits tripled (Ettorre, 1993). Simplicity Pattern Company was purchased by parent company Conso International, a well-known supplier of trimmings in 1998 (American Sewing Guild, 2011).

The 21st Century

By the year 2000, there were three leading domestic pattern manufacturers: Simplicity, McCall's, and Butterick Company Limited (who owned Vogue) (FTC, 2011). Simplicity had the largest share of the market with 45%, McCall's had a 31.5% share,

followed by Butterick with a distant 22% share (FTC v. Conso International Corporation, MP Holdings, Inc., and the McCall Pattern Company**,** 2000).

In 2000, two years after purchasing Simplicity, Conso International attempted to acquire the McCall Pattern Company at a cost of $22 million. At the time, Conso (Simplicity) was the largest U.S. sewing pattern company, and if allowed to purchase McCall's, would control more than three-quarters of unit sales in the U.S. An injunction was filed by the Federal Trade Commission (FTC) to block the proposed acquisition. The FTC cited concerns that the sale would decrease competition and offer an unfair advantage to a single dominant firm (FTC, 2011).

Butterick, (who owned Vogue) was in jeopardy of entering bankruptcy due to declining market share. One year later, in 2001, the McCall Pattern Company acquired Butterick (and Vogue) patterns. In that year, the combined annual sales for the two leading companies (Simplicity and McCall's) were estimated at $300 million. As a result of the merger, the FTC estimated that McCall's would have a 53% share of the pattern market (Clendenning, 2001). Today, as a subsidiary of McCall's, patterns continue to be marketed under the Butterick and Vogue brands (Ashdown et al., 2007).

To differentiate the three brands, each division concentrates on a broad category of styling and design. Butterick is known for more traditional styles, McCall's for more trendy and current fashion, and Vogue for sophisticated, high-fashion styles (Ashdown et al., 2007).

After purchasing Simplicity, parent company Conso International formed the Simplicity Creative Group in 2008 as a provider of crafting and sewing solutions and

products. Today, the Simplicity Creative Group distributes Simplicity, Burda, and New Look brand patterns (American Sewing Guild, 2011).

After McCall Pattern Company (McCall's, Butterick, and Vogue) and Simplicity Pattern Company (Simplicity, New Look), Kwik Sew Pattern Company, Incorporated is the next largest of the domestic commercial sewing pattern manufacturers. In 2000, Kwik Sew only had a 2−3% share of the U.S. market (FTC, 2011).

New and Emerging Technologies. There has been tremendous advancement in pattern-making technology over recent years. Companies have streamlined processes and drastically reduced the time to market for Simplicity and other brands of patterns. It typically requires 5 months to complete the product development cycle for a pattern. The cycle begins with the adoption of a new style into the line and ends when the pattern is published in a pattern catalog. Prior to publication, companies conduct 3 months of trend research on color, materials, silhouette, and trims. Some pattern companies, including Simplicity, publish pattern catalogs seasonally, or twice each year, Spring/Summer and Fall/Winter (American Sewing Guild, 2011).

Simplicity used to take almost 2 weeks to create and perfect a master pattern. Computer aided design (CAD) technology has decreased the cycle time for pattern development down to 1 week or less. Pattern layouts are also generated using CAD technology. The PDF files are e-mailed to the printer, eliminating the need for shipping charges and making printing plates, thereby saving another week of development time. The company strives to time the release of new pattern catalogues to occur simultaneously with the retail introduction of a season's newest RTW clothing (American Sewing Guild, 2011).

Gerber and Lectra are the two leading CAD products used by the majority of apparel producers today for computerized pattern-making and grading. A third, lesser know product, *cad.assyst,* is used by the leading U.S. commercial sewing pattern companies, McCall's and Simplicity, according to N. Zheleva, Application Specialist at ***assyst*** (personal communication, May 25, 2011). The North American headquarters for ***assyst*** (owned by Human Solutions), based in Cary, NC, markets a product development system that includes pattern-making and grading functions.

Future of Patterns. Dritz created the first computerized pattern in the early 1970s (Palmer & Alto, 2006). Since that time, new technologies such as body scanning and CAD have spawned the development of pattern companies such as Fit Me Patterns, who produce customized patterns based on a person's exact measurements and body type (see Figure 15). Customers are scanned at scattered locations by an Intellifit body scanner that uses low powered lasers to obtain an accurate profile of the body. With this computerized method of pattern making, customers can purchase New Look, Simplicity, and Unique brands of custom-fit patterns with alterations for their exact body shape already done (Fit Me Patterns, 2011; Palmer & Alto).

Figure 15. Fit Me Pattern and body codes. From *http://www.uniquepatterns.com/catalog*. Body codes denote figure type, such as triangle, inverted triangle, hourglass, circle, diamond, and rectangle.

Other companies, such as Modern Sewing use CAD pattern-making technology to draft custom-made patterns using measurements provided by the customer. Patterns can be delivered in a digital format via e-mail that customers can print-on-demand, saving on shipping and printing costs (Ashdown et al., 2007).

Ultimately, the future success of pattern companies hinges on the continued popularity of sewing. As the baby boomer generation ages and has more leisure time, sales of patterns, fabrics, and related sewing supplies could increase. As Clendenning (2001) suggested, "the only long-term solution is to encourage more young people to use some of their valuable leisure time for sewing" (p.1). Efforts such as the Summer Textile Exploration Program (S.T.E.P.) Apparel Development Program, conducted annually for rising high school seniors at NC State University College of Textiles is one method to introduce sewing to young adults.

U.S. Pattern Sizing

Standard sizing was developed as a way to classify body shapes and provide size increments for apparel manufacturers (LaBat et al., 2007). Although commercial pattern sizing is based on standard body measurements, few people correlate exactly to these, so slight alterations are usually required for good fit. It is advisable to take the key body measurements of bust, waist, and hip prior to purchasing a pattern. An individual's body measurements may overlap two or more sizes, in which case a single, multi-sized pattern is purchased. A multi-sized pattern contains three or more sizes within a single envelope. In addition to saving paper, this format provides more options by allowing sewers to combine several sizes to help achieve better fit. Sewers can customize the pattern by using one size to cut the bodice area and another size for the hips (Ashdown et al., 2007). An alternative is to purchase a single size pattern that most closely matches the body dimensions.

Knight (2008) advised that pattern sizes may differ from normal standard sizes found in RTW clothing. Simplicity Pattern Company (2009) warned consumers not to select their pattern size based on their RTW size, but to use their body measurements instead.

When selecting a pattern for a shirt or dress, in most instances, the bust measurement is usually the best predictor of size. However, a large busted woman may need to purchase a pattern based on the waist and hip measurements and alter the pattern to fit the bust to avoid having a finished garment that is too large in the shoulder area (Knight, 2008). For skirt or pants patterns, the waist and hip girths are preferred measurements for size prediction.

Patterns are designed with differing amounts of ease. Minimum or wearing ease is the difference between body measurements and the basic pattern required for body

movement, such as walking, bending, or sitting (see table 1). Design ease is the amount of ease over and above minimum ease incorporated into a pattern for the desired style effect, (MacDonald, 2010). Thus, the silhouette of a style or fashion is partially created by taking body measurements and adding both minimum and design ease.

Table 1

Minimum Ease Allowance for a Fitted Garment in U.S. Misses' Patterns

Body area	Ease (inches)
Bust	2
Waist	1
Hip	1 ½

Note. Adapted from *Fit for Real People: Sew Great Clothes Using any Pattern.* (p. 22), by P. Palmer and M. Alto, 2006, Portland, OR: Palmer/Pletsch Publishing.

MacDonald (2010) asserted, "An extremely important part of the apparel design process is the evaluation of garment fit, or the relationship of the garment to the body. Many factors affect this relationship, including materials, ease allowances, end use, and wearer perception" (p. 32). Patterns are classified into five major fit categories: close fitting, fitted, semi-fitted, loose fitting, and very loose fitting (see Table 2). The silhouettes illustrated in Figure 16 depict the body in relation to five different fit descriptions. The fit descriptions of patterns are found in pattern catalogs and on the backs of pattern envelopes.

Table 2

Minimum and Design Ease Allowance Based on 5Fit Classifications.

Fit Description	Bust Area	Hip Area
	Dresses, Blouses, Shirts, Tops	Skirts
Close Fitting	0-2⅞	N/A
Fitted	3 - 4	2 - 3
Semi -Fitted	4⅛ - 5	3⅛ - 4
Loose Fitting	5⅛ - 8	4⅛ - 6
Very Loose Fitting	Over 8	Over 6

Note. Adapted from Vogue #1004 Fit and Fashion pattern instruction sheet,(p. 1), Butterick Company, Inc., 1999. Measurements from the semi-fitted row used to determine amount of ease in sample patterns.

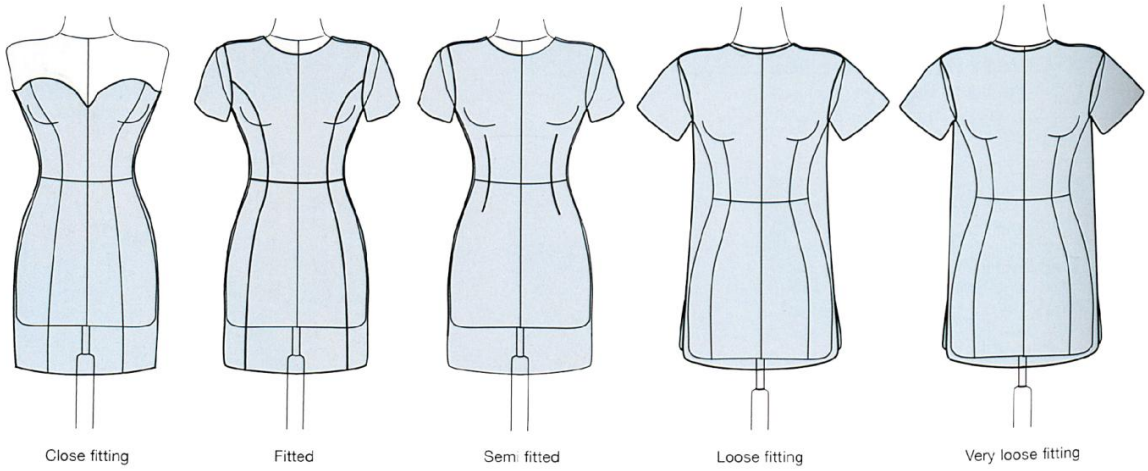

Figure 16. Silhouettes showing the body in relation to 5 fit classifications. From *How to Use, Adapt, and Design Sewing Patterns,* (p. 32), by L. Hollahan, 2010, Hauppauge, NY: Barron's.

One method of industry patternmaking utilizes a basic pattern called a sloper. This master pattern the basis upon which all subsequent patterns are drafted. Since the basic shape and ease allowance is already engineered into slopers, all new pattern designs drafted

from these basic blocks will conform to the manufacturers size specifications used in subsequent patterns (Palmer & Alto, 2006).

A sloper consists of five basic pattern pieces, a darted bodice front and bodice back, skirt front, skirt back, and sleeve (see Figure 17). Slopers are developed using an exacting, systematic method of pattern drafting. This mechanical method uses body measurements, ease, and engineering to establish a series of curves and lines onto paper using tools such as an L-square and yardstick; neck, French, and hip curve; and see-through ruler.

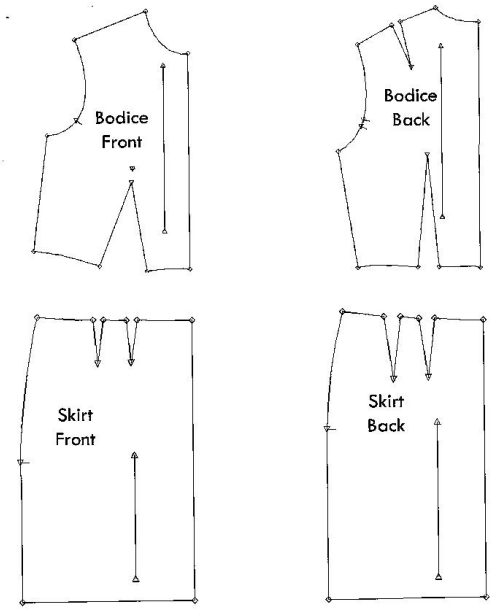

Figure 17. Example of sloper pieces used in this study: bodice front, bodice back, skirt front, skirt back. From *Introduction to AccuMark, Pattern Design, and Product ata Management* (p. 21), by J.R. Sharp and V.H. Elsasser, 2007, New York, NY: Fairchild Publications.

Several methods or systems for drafting a basic sloper exist. The purpose is to use the flat, two-dimensional pattern as a template to cut out fabric and construct a three-dimensional garment to fit the body (Fischer, 2009). The method described by MacDonald

(2010) requires 42 steps to create a basic 5-piece sloper. Telestia, another method used for more than 30 years in universities and for on-line education utilizes an all-in-one proprietary ruler with a companion textbook to teach students to draft slopers (see Figure 18).

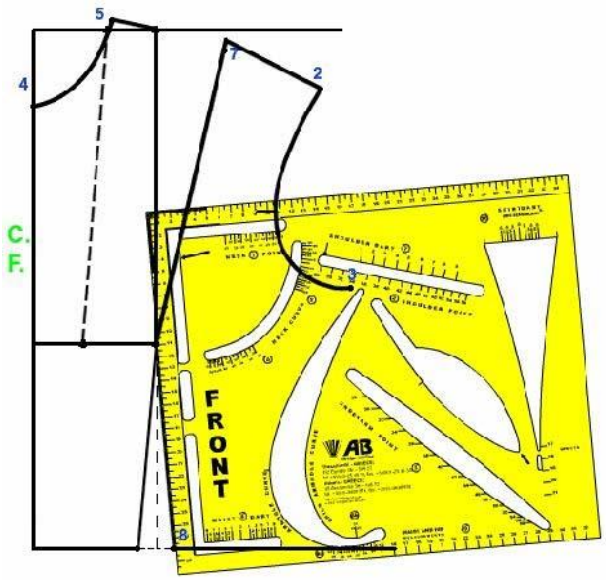

Figure 18. Telestia system for drafting slopers. From Telestia. Available online at http://www.telestia.com.

Using a set of measurements taken from a size chart or a live fit model, apparel producers draft basic blocks, or foundation patterns, which are used to create new patterns. These sets of blocks are unique to each manufacturer and reflect the desired corporate fit image of the target market. The blocks may be modified as shifts occur in fashion trends or corporate objectives (MacDonald, 2010).

In addition to RTW firms, U.S. commercial sewing pattern companies also use basic blocks to develop the fashion patterns in their lines. Home sewers can relate their individual

body proportions and measurements to all patterns of the same brand to perform pattern alterations and achieve their ideal fit (Palmer & Alto, 2006).

For sewers who lack the time or skill required to draft an original sloper, some pattern companies provide a convenient alternative. The basic blocks, or fitting shells are sold in a wide range of sizes, from size 6 to 22, with each size contained in single pattern. Currently, three of the "big four" U.S. brands that sell fitting shell patterns are Butterick, McCall's, and Vogue. Burda and Simplicity previously sold fitting shell patterns, but today they are out of print. The 10 to 12 page guide sheet included with fitting shell pattern lists steps to customize the fit to the individual wearer.

Once a sloper is drafted, the next step in pattern development is to make a toile or muslin to perfect and test the pattern. A toile is a simply constructed garment made without seam finishes, facings, or closures from inexpensive muslin or calico fabric to fit on a live house model or dress form (Fischer, 2009). Pattern alterations are made on the toile to achieve acceptable fit on the fitting model or dress form and are transferred to the paper pattern prior to making a production pattern.

History of the Development of U.S. Sizing Systems

The issue of sizing in women's apparel has been a controversial subject for well over 100 years. Early attempts to standardize sizing began in the 1920s with the advent of mass-produced women's ready- made clothing. The goal of standard sizing claimed LaBat (2007) is to "reduce or minimize consumer confusion and dissatisfaction related to apparel sizing" (p. 92). Prior to the 1920s, U.S. women's apparel sizing was patterned after the European

system, which used the half the measurement of bust circumference (in centimeters) as the size designation. Thus, a woman with a bust girth of 80 centimeters would be a size 40. The early American size system used Imperial measurements of the full bust in inches in place of metric measurements. Women's even numbered sizing ranged from 34 to 44. A U.S. woman with a bust measurement of 38 inches wore a size 38 (Handford, 2003; Palmer & Alto, 2006).

Pattern catalogs dating back to 1915 include patterns for sizes 14, 16, 18, and 20. These sizes were synonymous with the age of the wearer. Young girls, or misses, mostly unmarried, used the misses sizing of age until they were 18 to 20 years old. Once they turned that age, they were considered a woman and used bust measurement for size. In the 1920s, apparel producers desired to create a more youthful-looking garment and the "Missy" or "Misses" size range was born. The bust measurement was no longer used for ladies sizing. Ashdown et al. (2007) offered a succinct explanation, writing that, "eventually the term 'misses' replaced 'ladies', and size codes (the original age designations) replaced bust measurements as the size code, while the term 'junior' was substituted for what once had been called 'misses' " (p. 336). The development of the misses size range of 10 to 20 was one of the first developments in early attempts to standardize sizing (Handford, 2003; Palmer & Alto, 2006).

Prior to the introduction of the Missy size range, the first Women's sample size was a 36 and had a 2-inch grade between each of the sizes, as seen in Table 3. Later, in the 1920s, the new Missy sample size 16 had the same bust measurement as the Women's size 36, but only had a 1 ½ inch grade between sizes, as seen in Table 4 (Handford, 2003).

Table 3

Grade Amounts between Women's Sizes

Women's Total Girth Grades for bust, waist, and hip (inches)							
Size	32-34	34-36	36-38	38-40	40-42	42-44	44-46
Amount	2	2	2	2	2	2	2

Note. Adapted from *Professional Pattern Grading for Women's, Men's, and Children's Apparel* (p. 4), by J. Handford, 2003, New York: Fairchild.

Table 4

Grade Amounts between Misses Sizes

Misses Total Girth Grades for bust, waist, and hip (inches)							
Size	6-8	8-10	10-12	12-14	14-16	16-18	18-20
Amount	1	1	1	1½	1½	1½	1½

Note. Adapted from *Professional Pattern Grading for Women's, Men's, and Children's Apparel* (p. 4), by J. Handford, 2003, New York: Fairchild.

O'Brien and Shelton Study

Two National Bureau of Home Economics specialists, O'Brien and Shelton, collected the first accurate anthropometric data on women's sizing between 1939 and 1941. The National Bureau of Home Economics of the U.S. Department of Agriculture conducted the first widespread national sizing survey. Technicians manually measured 15,000 U.S. women in 8 states to obtain 59 body measurements. Although the sample of women used in the study was large, it did not yield data representative of the population at the time because it

failed to include women of different ethnicities as well as varied ages (LaBat, 2007). The results of the scientific study were published in 1941 in USDA Miscellaneous Publication 454, *Women's Measurements for Garment and Pattern Construction* (National Institute of Standards and Technology, 2002).

CS 215-58 Sizing Standard

The National Bureau of Standards (NBS) received a request from the Mail Order Association of America (MOAA) to develop a commercial standard using the data collected in the O'Brien and Shelton study. In 1958, CS 215-58 Body Measurements for the Sizing of Women's Patterns and Apparel was endorsed and published (LaBat, 2007).

PS 42-70 Sizing Standard

The MOAA was dissatisfied that the new standard did not result in a significant decline in the amount of returns due to poor fit and petitioned the NBS for a revision. Ten years later, the standard was revised, purportedly "to more accurately reflect the current population of women" (National Institute of Standards and Technology, 2002, p.14). Released in 1971, this new edition was designated Voluntary Product Standard PS 42-70 *Body Measurements for the Sizing of Women's Patterns and Apparel*.

Although the revised standard contained slight changes, clothing manufacturers could choose to ignore them, since adherence to sizing standards in the U.S. is voluntary (MacDonald, 2010). The revised standard was not based on any new anthropometric study, but instead was a result of manipulated data from the initial 1940 (O'Brien and Shelton) study combined with data from a few health surveys conducted from 1960-1962. According to LaBat (2007), "the revision was not a major change, but a shift in size designations as bust

girth was increased by one grade interval per size code for all figure types, based on the information that women had become larger" (p. 95). In 1983, the Product Standards (PS) on the body measurements of apparel sizing for women sizing standards, previously administered by the NBS government entity were withdrawn, and for the first time, sponsorship of sizing standards was acquired by the private sector (LaBat, 2007; National Institute of Standards and Technology, 2002).

ASTM D 5585

The American Society for Testing and Materials International (ASTM), founded in 1898, is a non-profit organization that creates voluntary performance standards for a variety of products that are used by manufacturers. This governing standards organization is responsible for the establishment and revision of voluntary apparel sizing standards that pattern companies and clothing manufacturers may utilize in product development (LaBat, 2007).

In 1995, 15 years after its initial publication, ASTM D 5585 *Standard Table of Body Measurements for Adult Female Misses Figure Type, Sizes 2–20* superseded PS 42-70. The new standard, which was not based on any new anthropometric studies, was essentially a revised version of PS 42-70. Although several anthropometric studies had been conducted between 1971 and 1995 by such entities as the National Center for Health Statistics, NASA, the U.S. Army, and U.S. Navy, ASTM neglected to utilize the data (Newcomb, 2006). The D 5585 standard was devised using the same 55 year old data from PS 42-70, along with evaluations of conventional industry practices of numerous apparel manufacturers and some data from military anthropometric studies (LaBat, 2007).

Today, the ASTM continues to review and develop the eight clothing sizing standards they are responsible for administering (American Society for Testing and Materials Intl., 2011). Although no concrete evidence exists, it is surmised that the majority of U.S. apparel firms use the ASTM D 5585 standard as the basis for producing women's clothing in the misses size range of 2 through 20 (LaBat, 2007).

The D 5585-95 (2001) standard was withdrawn in January 2010, in accordance with section 10.5.3.1 of the Regulations Governing ASTM Technical Committees. The standard was last approved in 2001, and in accordance with the regulations, standards must be updated by the end of the eighth year since they were last approved (American Society for Testing and Materials Intl., 2011). The standard will be reissued in the near future and, according to C. Istook, PhD, Professor at NC State University and ASTM technical committee member, for the first time will contain sizing data based on two main body shapes: straight and curvy (personal communication, June 30, 2011). This will be a significant departure from the singular hourglass body shape, upon which the previous standard was based.

SizeUSA

Conducted in 2002-2003, SizeUSA was the most recent and comprehensive nationwide anthropometric study of its kind. The study was funded by the U.S. Department of Commerce and multiple industry partners at a cost of $1 million. Body scanning equipment and size extraction software developed by Textile Clothing Technology Corporation $[TC]^2$ was used to obtain 200 accurate body measurements from over 10,000 volunteers in 12 cities across the country ($[TC]^2$, 2004).

The population surveyed was comprised of mostly women (65%). Body measurement data was collected from four different ethnicities and six age groups. The results of the survey showed that the U.S. population has grown taller and heavier and are changing shape (Joseph-Armstrong, 2010; Newcomb, 2006; [TC]², 2004).

This study was revolutionary, in that in addition to body measurements, demographic and psychographic data such as marital status, household income, lifestyle, education, employment status, and clothing shopping preferences was collected. For the first time, rich statistical data was available to apparel producers to help identify their target markets. Large retailers such as Dillard's and JCPenney used the data to re-evaluate their size scales, improve their grade rules, and modify their body forms (Mullet, Moore & Young, 2009; [TC]^2, 2004).

Current Apparel and Pattern Sizing

Most existing standard sizing systems are based on outdated data and are not representative of current consumers (LaBat, 2007). Today, much confusion surrounds size selection for both RTW and commercial sewing patterns. Unlike RTW firms, U.S. pattern companies use standard sizing and are in agreement about the body measurements for each size designation (Palmer & Alto, 2006). However, RTW sizing and pattern sizing *are not* the same (Hollahan, 2010).

A committee comprised of representatives from all major U.S. pattern companies is responsible for maintaining and updating pattern sizing. Members of the Measurement Standard Committee of the Pattern Fashion Industry must be in unanimous agreement before

any changes in sizing are implemented (Mansfield & Lucas, 1974). The last time changes occurred in the sizing of commercial U.S. sewing patterns was in 1972 (Palmer & Alto, 2006).

Vanity Sizing

The practice of vanity sizing is used today as a common marketing tool by apparel firms and retailers. The practice of vanity sizing began in the early 1930s by a California retailer who seized upon the idea of downsizing their size tickets by one size. A garment previously made to fit the body measurements of a size 10 was now size ticketed as a size 8. Other retailers soon emulated the practice, and manufacturers started sizing their garments up one size. The practice continued over many decades and today, the common RTW Missy sample size 8, with an average bust measurement of 36 inches, fits the body dimensions that a size 16 once did (Handford, 2003). The ASTM (2011) confirmed that due to vanity sizing, the sizing on hangtags for RTW apparel is two to four sizes smaller than the measurements in the PS 42-70 database.

Chun (2007) offered an explanation, pointing out that

> Women's ready-to-wear garment manufacturers and retailers use vanity sizing as a strategy to flatter the egos of consumers who often feel better about buying smaller sizes. This can be a successful strategy and can help to increase brand loyalty, but it also contributes to the confusion about sizing. (p. 234)

Pattern companies also engaged in the practice of vanity sizing. Patterns from the 1930s and 1940s, (when size was still a continuation of age) with a bust measurement of 34 inches were designated as size 16. Today, the same bust measurement is designated size 12, 2 sizes smaller (Palmer & Alto, 2006).

Pattern Sizing

Pattern producers and RTW sizing systems were closely aligned through the late 1920s. However, that changed in the early 1930s when RTW manufacturers began the practice of vanity sizing. In order to keep up with the ever-changing RTW sizing standards, U.S. pattern companies changed their sizing standards 4 times over the next 41 years (see Table 5) (Palmer & Alto, 2006).

Table 5

Changes in Size 16 Pattern Measurements from the 1930s to Current Standards

Year	1931	1956	1967	1972 (to current)
Size	16	16	16	16
Bust (inches)	34	36	38	38
Waist (inches)	28	28	29	30
Hip (inches)	37	38	40	40

Note. Adapted from *Fit for Real People: Sew Great Clothes Using any Pattern.* (p. 15), by P. Palmer and M. Alto, 2006, Portland, OR: Palmer/Pletsch Publishing.

The National Bureau of Standards (NBS), created in 1901, was responsible for standardizing measurements (Joseph-Armstrong, 2010). They operated under that name until 1989, when the non-regulatory agency was renamed the National Institute of Standards and Technology (NIST) (NIST, 2011). Even though the first wide scale anthropometric sizing study in the U.S. was conducted in 1940, pattern companies did not change their sizing to reflect the resultant standards (CS 215-58) issued in 1958 until 1967. In that year, "new sizing" was introduced, as pattern companies attempted to become more aligned with RTW

in the moderate price range and mail-order catalog sizing by adopting the measurements collected in the O'Brien and Shelton (1940) study (Palmer & Alto, 2006). With the new sizing, the waistline became one-inch smaller in proportion to the bust and hips. Not all patterns were produced with the new sizing, but the ones that were contained a distinctive mark of a red rectangle with "new sizing" written in white letters, as seen in Figure 19. Pattern companies advised customers to purchase a pattern one size smaller for a pattern with new sizing. A bust measurement of 36, which used to be a size 16, was now a size 14 ("Clothing repair", 2010).

Figure 19. Simplicity pattern from 1969 showing new sizing symbol.
From Heavens to Betsy Vintage, copyright 2011. Arrow points to "new sizing" logo.

The final revisions to pattern sizing occurred in the early 1970s, as slight adjustments to commercial sewing patterns were made to reflect changes in lifestyle and posture. Since many young women of that era opted to go bra-less, the bust line was lowered ⅝ inches. Next, the back waist length was lowered to accommodate a more rounded back. Last, since

foundation garments such as girdles were no longer popular, one inch was added to the waist (Ashdown et al., 2007; Palmer & Alto, 2006).

Sizing between all major U.S. brands of commercial sewing patterns has remained the same since 1972. Because of the continued use of vanity sizing by RTW manufacturers, this was the last time commercial sewing pattern sizing was similar to RTW clothing sizing (Ashdown et al., 2007).

By using standardized sizing, pattern companies avoid confusing customers who cannot try on patterns before purchasing (Ashdown et al., 2007; Palmer & Alto, 2006). Due to numerous changes in demographics because of "increased immigration, sedentary lifestyles, changing nutrition and exercise, and growth in minority groups" (Newcomb, 2006, p. 37), a size standard 41 years old may not be representative of the current population.

Commercial patterns for the misses' size range are based on the hourglass body shape (Palmer & Alto, 2006). This shape is characterized by a well-proportioned, fully developed figure with a height of 5'5" to 5'6" (Simplicity, 2009). A full bust, well-defined waist, and full hips characterize the hourglass body shape (Knight, 2008). The accepted ratio of the differences between the bust, waist, and hips for the hourglass figure is 10 to 12 ½ inches, as seen in Figure 20 (Joseph-Armstrong, 2010). Despite the fact that the majority of apparel and sewing patterns produced today are based on the ideal hourglass shape, data from the SizeUSA survey showed that the hourglass shape makes up only 8% of the current population of women and that the remaining 80% have body shapes such as rectangle, spoon, and inverted triangle (Newcomb & Istook, 2006b).

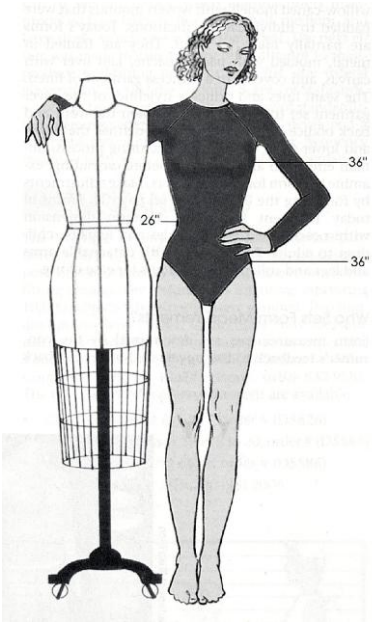

Figure 20. Hourglass body shape. From *Patternmaking for Fashion Design*, by H. Joseph-Armstrong (p. 23), 2010, Upper Saddle River, NJ: Pearson Education.

Pattern Size Selection

Pattern companies caution consumers not to select a pattern size based on their current RTW size. Instead, they recommend using body measurements to select the proper pattern size. Despite these warnings, many sewing customers purchase the wrong size and use a system of trial and error trying to find the best size for their bodies. The average RTW size 10 today fits a bust measurement of 37 to 38 inches, whereas to fit the same bust measurement, a size 16 commercial sewing pattern is required (Palmer & Alto, 2006). Thus, pattern sizing is not in alignment with RTW sizing if a pattern three sizes larger than a RTW size is necessary to fit the same bust size. Simplicity (2009) declared, "In some cases, your pattern size may be one or two sizes larger than your ready-to-wear size. But PLEASE don't

let preconceived notions stand in the way of good fit. Who's to know what pattern size you use?" (p. 2). Pattern sizing may have evolved into the inverse of vanity sizing, contributing to consumer's confusion and dissatisfaction with fit of garments created from commercial sewing patterns.

Adding to sizing confusion, bra-cup size may be a factor when selecting a pattern. As mentioned previously in this paper, patterns are created for an average B-cup. A large busted woman with a C-cup or larger may have to purchase a pattern according to her high bust measurement instead of her full bust size. If there is more than a 2-inch difference between the high bust and full bust measurement, Palmer and Alto (2006) advised sewers to buy a pattern according to their high bust and alter it for cup size. In order for a pattern to fit properly in the neck and shoulder areas, this may mean purchasing a pattern several sizes *smaller* than the pattern size recommendation provided by pattern companies based on the full bust measurement (Palmer & Alto, 2006).

Published pattern size charts and sizing of the resultant printed patterns are consistent among the major U.S. pattern companies. Pattern sizing for some sizes, although similar to, are not exactly the same as the PS 42-70 standards. Bust measurements for pattern sizes 6 through 12 are 1 inch smaller than the PS 42-70 standard. Size 14 patterns are ½ inch smaller in bust measurements than the standard. Sizes 16 through 22 have the exact bust measurements of the PS 42-70 standard. The measurements in Table 6 show missy sizes and the corresponding bust measurements from patterns compared to the PS 42-70 standard.

Table 6

Size Comparison of Bust Measurements from PS 42-70 and U.S. Patterns

Misses Size	6	8	10	12	14	16	18	20	22
	Bust measurement (inches)								
PS 42-70	31½	32½	33½	35	36½	38	40	42	44
U.S. Patterns	30½	31½	32½	34	36	38	40	42	44

Note. Adapted from *NBS Voluntary Product Standard PS 42-70*, http://gsi.nist.gov/global/docs/stds/womens-ps42-70.pdf. U.S. Pattern sizing adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009, http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

Grading of Apparel Patterns

Grading is a complex precision process used to create a complete size range of patterns using a master or sample-size pattern and scaling it up for larger sizes or down for smaller sizes. Pattern grading can be accomplished using several different techniques: manual, machine, or CAD. In manual grading, pattern pieces are shifted and hand-traced. Machine grading uses a mechanical grading machine, such as an Accurate Speed Grader seen in Figure 21. When accurate data is entered into a computer, computerized grading is the most expedient and precise method (Mullet et al., 2009). Some computer programs widely used in industry for grading patterns are *assyst*, Gerber, and Lectra.

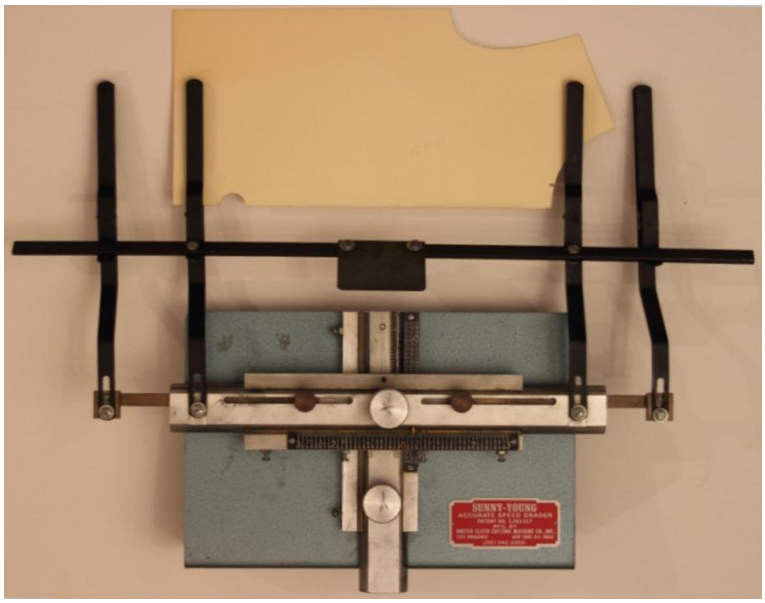

Figure 21. Sunny Young Accurate Speed Grader mechanical grading machine. Debra McLendon photo**.**

To visualize the amount of spread and see how a pattern grows in width and length from size to size, pattern pieces are dissected into conceptual vertical and horizontal areas. Instead of cutting a master pattern and spreading the various pieces apart, the same result is achieved by shifting the pattern (Price & Zamkoff, 1996).

Regardless of the method used, the goal of grading is to apply proportional increases or decreases at key locations or cardinal points on the perimeter of the pattern that transform the width and length of the pieces. The changes in growth are made according to a prescribed set of body measurements (Price & Zamkoff, 1996; Sharp & Elsasser, 2007). Conventional grading in women's wear uses a 1inch grade for smaller sizes within a size range, a 1 ½ inch grade for medium sizes, and a 2 inch grade for larger sizes (Handford, 2003; Schofield, 2007).

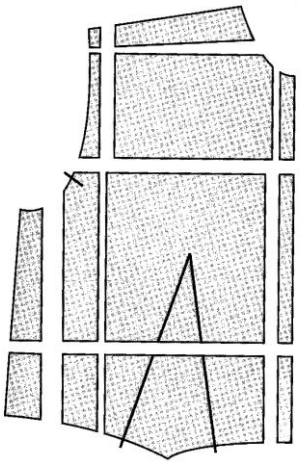

Figure 22. Conceptual areas of growth in a pattern. Adapted from *Grading Techniques for Fashion Design*, (p. 28), by J. Price and B. Zamkoff, 1996, New York, NY: Fairchild Publications.

Traditional incremental grading is based on a Cartesian graph shown in Figure 23. The graph has a horizontal axis (x) and a vertical axis (y) that intersects at right angles and divides an area in four quadrants. Using a Cartesian graph, patterns are moved left or right on the x-axis and up or down on the y-axis, as dimensional changes occur to create new sizes (Sharp & Elsasser, 2007).

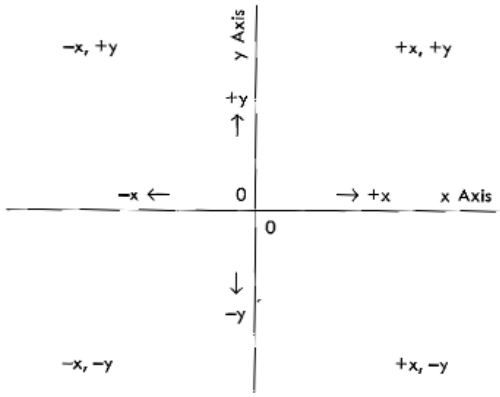

Figure 23. Cartesian graph. From *Introduction to AccuMark, Pattern Design, and Product Data Management*, (p. 23), by J.R. Sharp and V.H. Elsasser, 2007, New York, NY: Fairchild Publications.

For manual machine and computerized grading, patterns are positioned on the x-axis according to an orientation line. As pictured in Figure 24, the orientation line is usually an edge of a pattern piece or a point that will not move during grading.

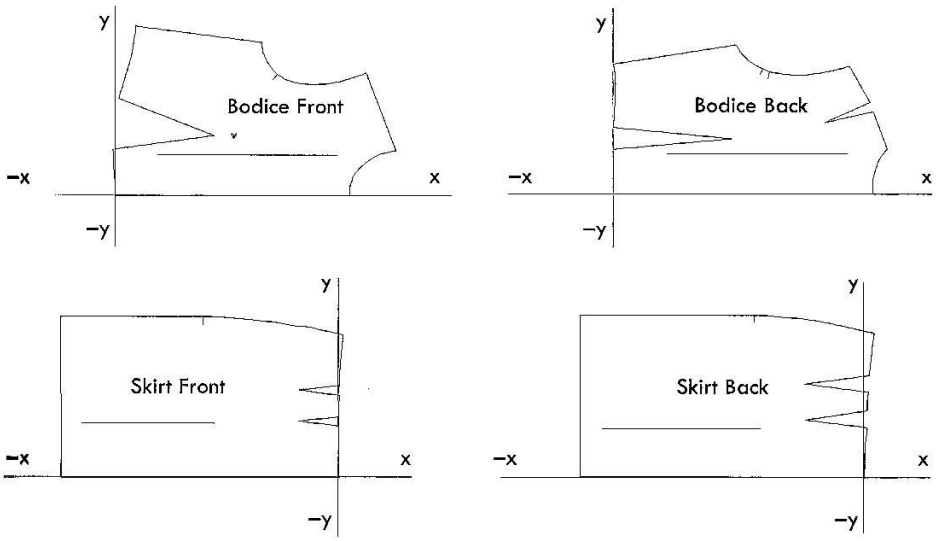

Figure 24. Proper orientation of bodice and skirt pieces on a Cartesian graph. From *Introduction to AccuMark, Pattern Design, and Product Data Management* (p. 25), by J.R. Sharp and V.H. Elsasser, 2007, New York, NY: Fairchild Publications.

Grading Systems

Anthropometric surveys are conducted to gather sizing data from a population of interest. From these studies, sizing specifications are developed. Next, grading systems are developed from sizing specifications. Pattern grading systems use the mathematical differences between body measurements for each size in a range to devise grade rules (Mullet et al., 2009).

A grade rule table is a set of measurements that indicates how far a cardinal point moves in either direction on a Cartesian graph (Sharp & Elsasser, 2007). Since U.S. sizing

standards are voluntary and vary from one manufacturer to another, each individual firm can establish their own unique grade rules (Price & Zamkoff, 1996). Information on grade rule systems is found in textbooks, apparel-manufacturing handbooks, published standards, and computerized grading manuals (Murphey, 1993).

Grading systems are comprised of two major components: grade rules and grade distributions. Mullet et al. (2009) identified two major differences between grading systems used by various manufacturers. The first difference is where break points occur. Break points are the sizes at which the amount of pattern growth changes from a 1inch to a 1 ½ inch grade and from a 1 ½ inch to a 2 inch grade. These measurements indicate the amount of dimensional growth in circumference or girth between one size and the next. The sizes at which break points occur vary between manufacturers. U.S. commercial sewing pattern break points occur at size 10 and size 12, as shown in Table 7. Break points for RTW in the misses size range usually occur at sizes 10 and 16 (Sharp & Elsasser, 2007).

Table 7

Grade Rule Table and Size Breaks for Commercial sewing patterns

Size	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22
Bust	1”	1”	1½”	2”	2”	2”	2”	2”
Waist	1”	1”	1½”	2”	2”	2”	2”	2”
Hip	1”	1”	1½”	2”	2”	2”	2”	2”

Note. Adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009, http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

The second major difference between grading systems is the manner in which the amount of grade is applied to both the circumference and length of a pattern. For example, the amount of increase in the cross-bust and waistline grade is distributed unevenly across the width of the pattern in three different areas (neck, shoulder, and underarm) because body growth does not occur evenly all in one location, as seen in Figures 22 and 25. Mullet et al. (2009) observed that the effects of where break points occur and how grades are distributed are most noticeable in the fit of garments in the extremes of a size range (smallest and largest).

Mullet et al. (2009) identified two major types of grading systems: simplified and complex. The majority of RTW manufacturers and the commercial sewing pattern industry both use simplified systems. Grade rules for simplified systems evenly divide the total change in circumference in half between the front and back pattern pieces. This allows each pattern piece to be graded by the same increment. Thus, for a 1 ½ inch grade, the front and back pattern pieces that represent half the body are both graded ¾ inch in width.

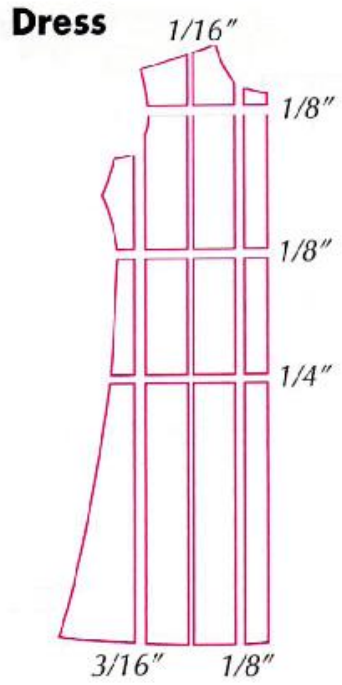

Figure 25. Example of adjustments made to increase a dress pattern by one size. From *Fit for Real People: Sew Great Clothes Using any Pattern* (p. 28), by P. Palmer and M. Alto, 1998, Portland, OR: Palmer/Pletsch Publishing.

In a complex grading system, the amount of grade is unevenly distributed, so a different set of grade rules is required for the front and back pattern pieces. Survey data from PS 42-70 indicates that slight differences in the front and back (waist arc) measurements may justify the use of a complex system. However, complex systems are difficult to manage and require additional time to accomplish, hence the reason for the popularity of simplified grading systems, like the one used by pattern companies (Mullet et al., 2009).

Commercial sewing patterns use a uniform grade. A uniform grade is when the primary body girth dimensions of the bust, waist, and hip are graded by the same amount. On basic dress patterns such as the ones used in this study, the torso front represents one-

fourth of the bust, waist, and hip girth (Mullet et al., 2009). When applying a uniform grade of 1 ½ inch, each quadrant of the torso pattern is graded by ⅜ inch in these areas. As previously explained in this paper, the amount of increase is not evenly distributed across these areas. However, when the amounts of growth for each area ($^{3}/_{16}$ inch, $^{1}/_{16}$ inch, ⅛ inch) are added together, they equal ⅜ inch, or one-fourth of the total increase in body circumference (see Figure 25). In this research, patterns were measured to determine the amount of grade applied to each size for the five different brands.

CHAPTER THREE: METHODOLOGY

Research Purpose

The primary goal of this research was to conduct a comparison of five major brands of commercial sewing patterns. The sizing specifications, grading, and fit practices currently used by leading manufacturers of patterns was examined to determine how these variables affect the fit of finished garments. To guide the research, research questions were developed related to the impact of sizing, pattern specifications, and grading on the fit of commercial sewing patterns.

A mixed-methods approach was used in conducting the study. Quantitative analysis was used to evaluate size charts, physically measure patterns and finished garments, and to evaluate grading systems. Qualitative analysis was used to evaluate the fit of finished garments using observations.

The first objective was to conduct fit tests to evaluate the difference in the fit of finished garments constructed from different brands of commercial sewing patterns. Second, patterns were analyzed to study the amount of grade used by different brands at key body areas of the bust, waist, and hip. Next, to find out if commercial sewing pattern grade rules matched the standardized sizing used by pattern companies, the grade amounts observed in patterns were compared to pattern sizing. Other pattern attributes such as amount of ease were evaluated to verify the accuracy of finished garment measurements printed on patterns.

Pattern sizing standards were compared to voluntary RTW clothing sizing standards (ASTM D 5585, PS 42-70) and other size charts from industry handbooks, textbooks, and one other pattern company not included in this study. Based on the findings, this study then

attempted to make recommendations on how pattern sizing could be modified to better meet the needs of today's U.S. home sewer. Ultimately, this study was designed to achieve a more thorough understanding of pattern sizing and to gain insight on how consumers could be provided with improved satisfaction with the fit of garments made from commercial sewing patterns.

Research Questions

This study was framed by four main research questions, each to be examined individually. The data analysis detail will address the approach used to answer each research question.

1. Does the fit profile used by the commercial sewing pattern industry conform to the body profiles of today's U.S. consumers?
2. Do finished garment measurements in key areas printed on patterns conform to the company ease specifications for each fit category?
3. Is there a difference in the fit of finished basic dresses constructed from the five brands of commercial sewing patterns under study?
4. Are the grade rules used by pattern companies at the bust, waist, and hip based on their standardized body measurements?

Data Collection

The Sample Patterns

Two brands of patterns were purchased from two of the three pattern companies that sell fitting shell patterns. Fitting shell patterns for Butterick pattern #5746 and Vogue pattern

#1004 were purchased at retail fabric stores (see Figure 26). McCall's sells a fitting shell pattern, #2718, however, it is not sold in retail fabric stores and is only available by special order.

Figure 26. Fitting shell patterns: Butterick #5746 and Vogue #1004. From Butterick Company, Inc., 2001.

Since the researcher studied the differences in grading and fit among five major brands, three additional patterns were purchased. The researcher perused pattern catalogs in an attempt to locate additional basic dress patterns with similar silhouettes and fit as the fitting shells. The prerequisites for the patterns were side bust darts; bodice front and back waist darts; and skirt front and back waist darts (see Figure 27).

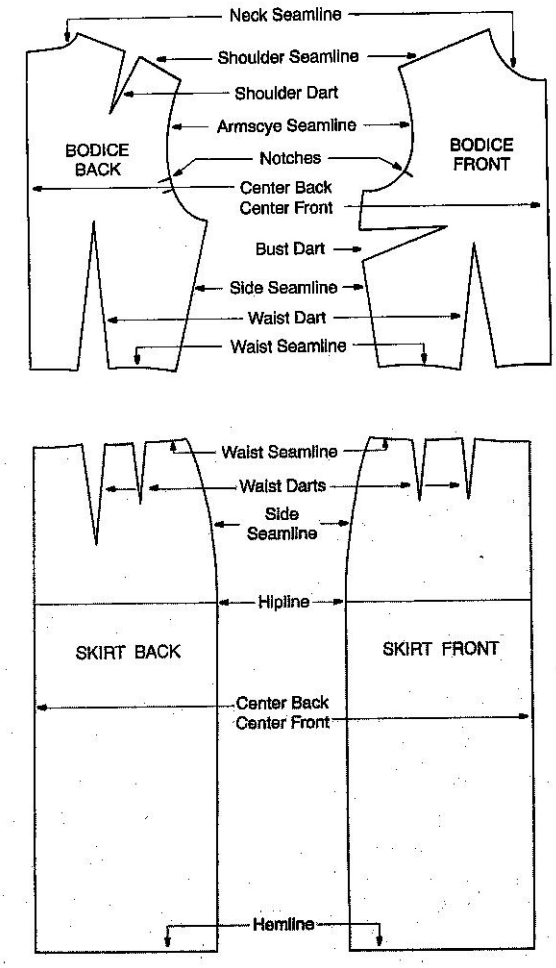

Figure 27. Pattern pieces and terminology for a basic dress. From *Principles of flat pattern design* (p. 38), by N.M. MacDonald, 2010, New York, NY: Fairchild Publications.

Patterns purchased were Burda #7664, McCall's #2401, and New Look #6968 (see Figure 28). Two of the patterns (Burda and McCall's) were sheath dresses with side bust darts and contour, or two- ended darts that replaced the original bodice and skirt waist darts. The New Look pattern featured a front and back bodice and front and back skirt with a horizontal waist seam, most similar to the fitting patterns.

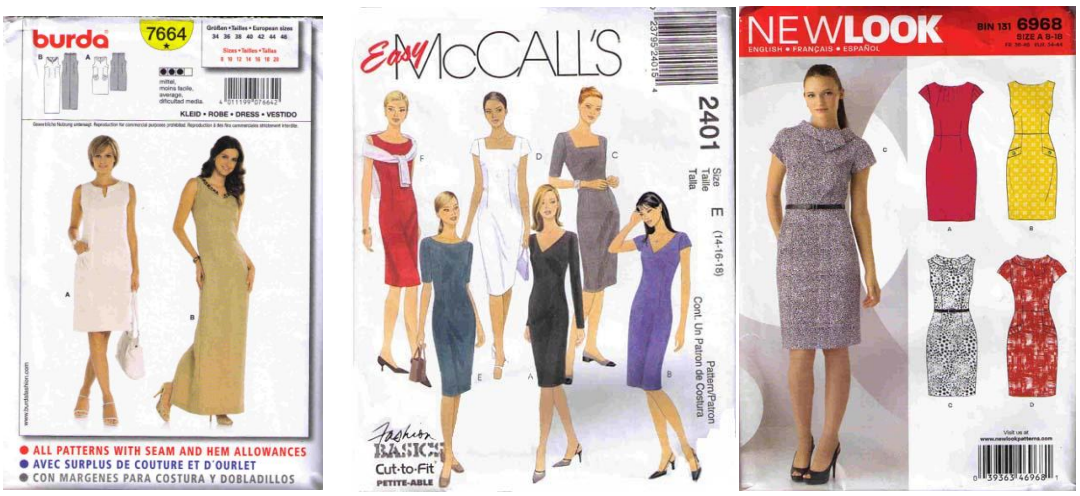

Figure 28. Sheath dress patterns under study: Burda #7664, McCall's #2401, New Look #6968. From Burda Patterns, Copyright by Verlag Aenne Burda GmbH & Co., Offenberg: Germany; McCall Pattern Co., 2007, New York: NY; Simplicity Pattern Co., 2010, New York: NY.

A garment made from a fitting pattern has a fitted bodice with seams and darts that shape the bodice to provide a close upper-body fit. The straight fitted skirt sits at the waist, has front and back waist darts, and fits smoothly over the hips. The patterns are drafted with minimum wearing ease (see Table 8).

Table 8

Minimum Ease Amounts Included in Key Body Areas for Fitting Shell Patterns

Body area	Ease (inches)
Bust	2 ½
Waist	1
Hip	2

Note. Adapted from *Fit for Real People: Sew Great Clothes Using any Pattern* (p. 20), by P. Palmer and M. Alto, 2006, Portland, OR: Palmer/Pletsch Publishing.

The Vogue fitting shell pattern envelope for pattern #1004 indicates the pattern is in the fitted category. The Butterick fitting pattern #5746 contained two versions or views and can be made as fitted or semi-fitted. Palmer and Alto (2006) maintained that the Butterick #3415 and Vogue #1000 fitting shell patterns were identical. These patterns are out of print and are no longer available. The researcher believes that the pattern numbers have changed since the 2006 study and that the two fitting shell patterns used in this study are the same basic patterns used in the Palmer and Alto study.

Since the fitted versions of both brands (Butterick and Vogue) were previously studied, the researcher decided to analyze the two brands more extensively. For the size 10 patterns under study, the *fitted* version of the Vogue brand was selected and the *semi-fitted* version of the Butterick brand was selected. To confirm what Palmer and Alto (2006) concluded, for the size 18 patterns under study, the *fitted* versions of both brands were compared. The three remaining brands of patterns, which were not fitting shells, are classified as semi-fitted by the pattern companies, and therefore should have more ease incorporated than the fitting shells.

The Sample Dresses

The researcher designated a size 10 pattern for the smallest sample size to be constructed. A size 10 is a typical sample size in both the commercial sewing pattern and RTW clothing industry. Live fit models for RTW usually wear a size 8 or 10 (Fischer, 2009). Pattern companies use youthful, size 10 models with body measurements in exact alignment with their measurement charts to conduct fit tests. The models have a B-cup bra size, flat abdomens and high, rounded derrieres (Palmer & Alto, 2006).

Second, size 10 was selected because it is one of the break points in the PS 42-70, ASTM D 5585, and commercial sewing pattern misses size range. On commercial sewing pattern size charts, the grade rule changes to a 1 ½ inch grade at size 10.

Last, size 10 was selected because a common practice in grading is to select a size approximately in the middle of the size range to be graded. Bye et al. (2008) confirmed that size 10 was the optimum base size for grading patterns in the size range of 6-14.

The researcher elected to omit setting sleeves into the sample dresses. This would allow the sample garments to be evaluated from the side view more clearly without interference of a sleeve. All the fitting shell patterns contained set-in sleeves. To assess how best to cut the armhole area since no sleeve was set-in, the researcher observed two other patterns in the study. McCall's pattern #2401 and New Look pattern #6968 each contained both sleeveless and set-in sleeve views. The different pattern versions used the same bodice front and back pattern pieces for both views, and the armscye areas were identical. Therefore, the researcher did not make any pattern adjustments on any of the fitting shell patterns in the armscye area to account for omission of the sleeve.

The relevant size 10 and size 18 pattern pieces for all brands were digitized. Digitizing is a process where hardware and software are used to enter the perimeter outlines and pattern details such as darts into a computer so the pattern may be graded or manipulated in some other way (Sharp & Elsasser, 2007). Two pieces of Gerber hardware were used to digitize the pattern pieces: the digitizing pen and the digitizing/Silhouette table. The digitizing pen or stylus is an input device used to enter data into the computer. The pattern

piece to be digitized was taped into place on a digitizing table, which received the electronic signals from the digitizing pen.

Three of the sample patterns had a bodice and skirt joined with a horizontal waistline seam. To create a one-piece sheath dress, the researcher eliminated the waistline seam by combining the bodice and skirt pattern pieces. A sheath dress is a basic dress without any waistline seam and is the foundation in patternmaking for all other dress designs, such as the tent, princess, and empire waist. The sheath dress fits the body contours and has enough ease to allow for body movement (Joseph-Armstrong, 2004). Since the sheath dress hangs from the shoulders and fits the main torso, it is a suitable design to observe the growth of body circumference between sizes (Bye et al. 2008). Therefore, the silhouette shown in Figure 29 is a suitable style to use for this case study.

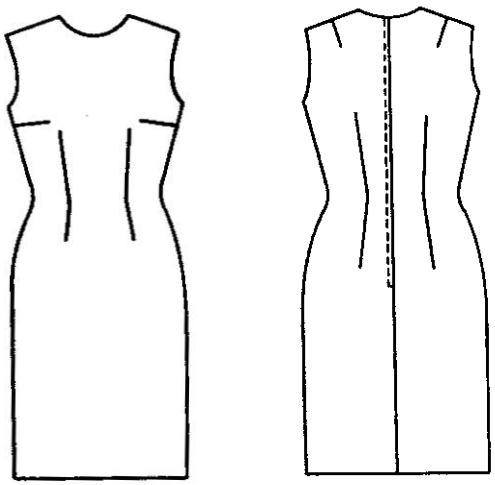

Figure 29. Sheath dress front and back. From *Principles of Flat-Pattern Design* (pp. 307 – 309), by N.M. MacDonald, 2010, New York, NY: Fairchild.

Once digitized, the bodice and skirt pattern pieces were 'trued' and joined to eliminate the waistline seam; according to common flat pattern-making manipulations used in industry (see Figure 30). The researcher used a Gerber CAD patternmaking system to perform these modifications. The skirt front and skirt back waistline darts on the fitting shell patterns were combined into a single dart before creating the new torso blocks. After joining the bodice to the skirt, a new single vertical contour dart was created and seam allowances were added to the perimeter of the pattern pieces at the appropriate locations.

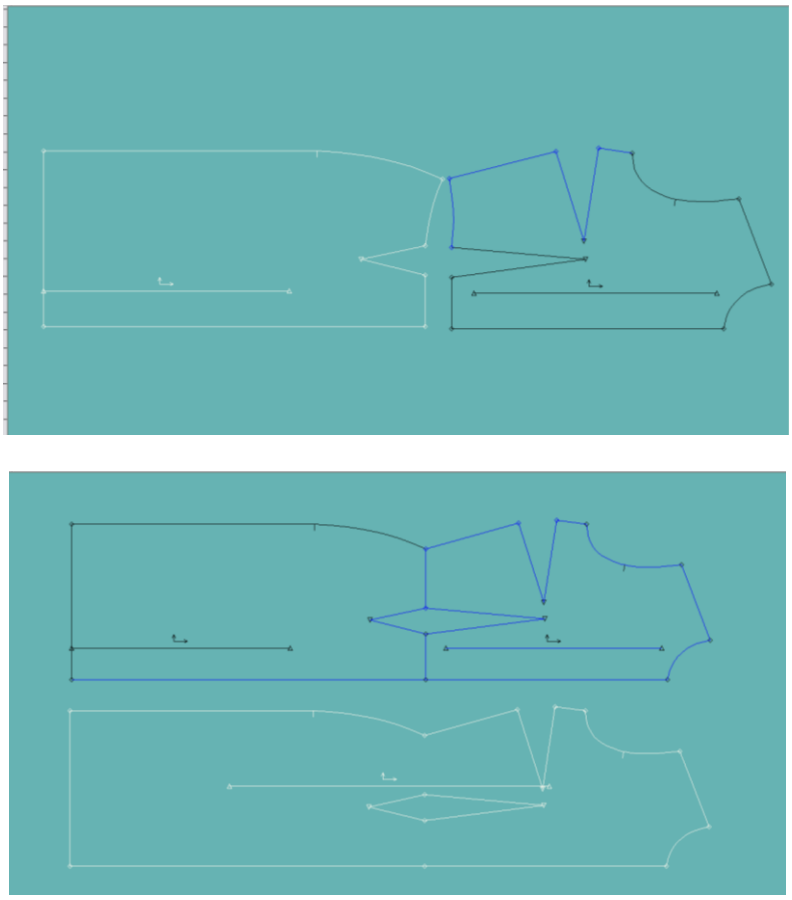

Figure 30. Screen shots from Gerber PDS of front bodice and front skirt before and after pattern manipulations.

All the size 10 sample dresses were constructed from the same fabric type and brand of bleached cotton muslin. All the size 18 sample dresses were constructed from the same fabric type and brand of unbleached cotton muslin. The garments were constructed from the commercial patterns exactly as produced by the pattern companies, except for the modifications made by the researcher on three pattern brands to create sheath dresses.

Procedure for cutting and construction of sample dresses. The researcher used Gerber/AccuMark PDS to make markers from the digitized size 10 and 18 torso block patterns. A Lectra Vector Fashion FP computer numerically controlled (CNC) cutter was used to cut each pattern piece within the marker. The pieces for each garment were bundled together by size and each brand was labeled for identification.

To reduce possible bias in the evaluation process and to ensure consistency in the cutting, construction, and final appearance of the dresses, provisions were made. Actions taken to assure uniformity in cutting and construction included the use of a Lectra CNC cutter for precision cut pattern pieces; construction of all dresses by the same individual using the same industrial machines; a consistent seam allowance; and insertion of a 22 inch long invisible zipper in the center back seam. All sewing was performed by the researcher, with over 40 years of experience sewing professionally and as a hobby.

An industrial three-thread over edge machine was used to finish the edges of all the cut pieces prior to sewing any darts or seams. Care was used not to trim any excess fabric off during over edging to maintain the proper seam allowance. An industrial Juki 301 lockstitch machine was used to sew the darts and seams. Seams were pressed open and darts were pressed to one side. Next, invisible zippers were inserted. No facings were used at the

necklines or armholes; the original seam lines were over-edged and retained the same finished edge shape as if facings had been used. A total of 10 dresses were constructed for this study.

Selection of Fit Mannequins

As previously stated in this paper, all U.S. patterns, unlike RTW, are based on standard body measurements. Several resources are available to obtain pattern-sizing information. Pattern books or catalogs, pattern envelopes, and pattern company websites include measuring charts, fit guides, and sizing information. The researcher obtained key body measurements for sizes 10 and 18 provided by the pattern industry to use for the selection of fit mannequins, as shown in Table 9.

Table 9

Body Measurements for Pattern Sizes used in Study: 10 and 18

Body Measurements (inches)		
Size	10	18
Bust	32 ½	40
Waist	25	32
Hip	34 ½	42

Note. Adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009, http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

Fit mannequins were required to try on and evaluate the sample garments in sizes 10 and 18. The researcher used a flexible tape measure to measure the bust, waist, and hip circumferences of numerous fit mannequins available at this university.

The form measurements were not exactly the same as the measurements listed on the back of the pattern envelopes for each size. Since 5 dresses were made in sample size 10, the researcher first located and measured 4 major brands of dress forms: Alvanon, Fabulous Fit, PGM, and Wolf. The manufacturers labeled all the forms as size 10. Based on the bust measurement alone, it was evident that the size 10 forms were much too large to fit sample size 10 dresses. The average bust girths of the 4, size 10 brands were nearly 38 inches. The bust measurement for a size 10 commercial sewing pattern is 32 ½ inches. Palmer and Alto (2006) confirmed that today, a RTW size 10 is made to fit bust sizes of 37 to 38 inches, so the dress form measurements were consistent with current industry practices. Next, size eight forms were measured and found to be too large. Additional dress forms in sizes six, four, and two were measured. The size 2 AlvaForm had a bust measurement closest to 32 ½ inches, the same as a size 10 bust measurement listed on pattern envelopes. This indicated a discrepancy of 5 ½ inches between the size 10 form and the size 10 patterns.

The measurements of the AlvaForm were not exactly compatible with the pattern companies' size recommendation. Size 2 is the smallest size form available from Alvanon in the U.S. Misses size range. As seen in Table 10, the bust girth of the form was ⅞ inch larger than the pattern measurement; the waist was the same, and the hip was ¾ inch larger. Alvanon states there is a ¼ inch tolerance on all measurements of their finished forms, so these differences could include greater lesser or variances (Alvanon, 2011).

Table 10

Comparison of a Size 2 Fit Mannequin to Size 10 Pattern Body Measurements

Body Area	Size 2 Form	Size 10 Pattern	Difference
Bust	33 ⅜"	32 ½"	+⅞"
Waist	25"	25"	0
Hip	35 ¼"	34 ½"	+¾"

Note. Adapted from Alvanon Inc., (2005), http://www.alvanon.com/AlvaformMissyUS.pdf (p. 5) and *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009, http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

According to Alvanon's website, "The AlvaForm Standard Series is the result from extensive analysis of our global scanned body database and various national size studies. These AlvaForms are U.S. specific and represent the shape and size of the average consumer in the market" (Alvanon Inc., 2009, p. 1). Another company document claimed "the AlvaForm is a tailor's mannequin based on current industry average measurements. We have modified the shape and posture of the body based on our extensive research and analysis of the 3D scan data derived from our customized AlvaForm business" (Alvanon Inc., 2005, p. 2). The form selected for this study to test-fit the size 10 garments is shown in Figure 31.

Figure 31. Alvanon size 2 fitting mannequin used to test-fit size 10 garments. Debra McLendon photo.

A second fit mannequin to test-fit the size 18 sample dresses was required for this study. This university did not have a fitting mannequin with the exact body dimensions as size 18 U.S. patterns. A store display mannequin was located with measurements closest to the size 18 pattern body measurements for the bust, waist, and hip. As seen in Table 11, the bust and waist girths of the form were ½ inch larger than the pattern body measurements; and the hip was ¾ inch larger. The store mannequin, as shown in Figure 32 is in a different category from a true tailor's fit mannequin, but since the key measurements were the closest to the size 18 pattern, it was utilized for the purposes of this research.

Table 11

Comparison of Store Mannequin to Size 18 Pattern Body Measurements

Body Area	Form	Size 18 Pattern	Difference
Bust	40 ½"	40"	+½"
Waist	32 ½"	32"	+½"
Hip	42 ¾"	42"	+¾"

Note. Adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009, http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

Figure 32. Store display mannequin used to fit test size 18 garments. Debra McLendon photo.

Data Analysis

Research Question 1.

Does the fit profile used by the commercial sewing pattern industry conform to the body profiles of today's U.S. consumers?

The approach to answering this question relied on published data from commercial sewing pattern companies on sizing recommendations and comparing these to body measurements obtained from various sources, including voluntary standards, an apparel manufacturing technical reference, pattern-making and grading textbooks, and an internet based pattern company. Previous research on body shapes using SizeUSA data by Newcomb and Istook (2006) was also used.

Research Question 2.

Do finished garment measurements in key areas printed on patterns conform to the company ease specifications for each fit category?

Physical measurements of tissue pattern pieces in key body areas were taken. Published data on ease allowances in the bust, waist, and hip areas for each fit category from commercial sewing pattern companies was used to analyze the pattern measurement data collected.

Research Question 3.

Is there a difference in the fit of finished basic dresses constructed from the five brands of commercial sewing patterns under study?

To answer this research question, finished sheath dress garments in size 10 and size 18 for all 5 brands were fit tested on a fit or store display mannequin. Observations were made and recorded by the researcher to visually assess the fit of the garments. Fit, the relationship of the body to the garment, is a subjective term and a matter of personal preference. Joseph-Armstrong's (2010) accepted principles of fit (ease, balance, grain, line, and set) were used to analyze the finished garments. The fit criteria for dresses are: 1) enough ease for movement without stress lines; 2) armscye and necklines should fit smoothly and not have any gapping; 3) skirt should hang straight from the hip to the bottom of the dress, creating a hemline that is parallel to the floor; 4) center front and center back of the dress (the lengthwise grain of the fabric) should line up with the center of the body; 5) waist indentation should be located at the appropriate level of the body ; 6) shoulder seam should be centered on the shoulder (Joseph-Armstrong, 2004). Following the subjective evaluations of fit, each garment was photographed on a mannequin to use the digital images as a permanent record of fit.

Research Question 4.

Are the grade rules used by pattern companies at the bust, waist, and hip based on their standardized body measurements?

This research question involved an analysis of the grading practices used by the five brands of commercial sewing patterns under study. First, pattern size charts were used to determine the correct grade rules required to meet the standards. Next, grade data from tissue pattern measurements was compared to the expected grade data from standardized body measurements to determine if the correct amount of grade was applied.

Visual materials generated using Gerber PDS computer software were used to collect data on pattern measurements at key body areas, as can be seen in Appendix D.

CHAPTER FOUR: RESULTS

The primary goal of this research was to conduct an analysis of the standardized sizing specifications and grading methods currently used by leading manufacturers of commercial sewing patterns and to determine how these variables affect the fit of finished garments. This chapter includes the results of the analysis conducted on the five brands under study.

This section of the paper presents the analysis of the data to answer the four research questions developed to guide the study. Results of the varied analyses follow.

Research Question One

Does the fit profile used by the commercial sewing pattern industry conform to the body profiles of today's U.S. consumers?

Body Measurement Comparisons among Published Size Charts

Sizing standards used by the pattern industry were used to evaluate the effectiveness of current pattern sizing in accommodating the body shapes and sizes of U.S. women in the misses size range. Since the bust measurement is typically the main body measurement used to purchase a dress pattern, it was used to compare sizing. Table 12 shows comparisons of bust measurement data obtained from seven sources: voluntary standards (ASTM D 5585-01 and PS 42-70); *The Apparel Design and Production Hand Book* (Fashiondex, 2001); *Patternmaking for Fashion Design* (Joseph-Armstrong, 2010); *Grading for the Fashion Industry* (Taylor & Shoben, 1990)*; The Dressmaker's Technique Bible: a Complete Guide to Fashion Sewing* (Knight, 2008); and Cynthia Guffey (2011), an internet based pattern company.

Not all size tables consulted included the entire size range covered in this analysis. As noted in the review of literature, U.S. patterns are sold in sizes 6-22. The ASTM D 5585 voluntary standard covers Misses sizes 2-20. Size 22 is included in another standard, D 5586 95, *Women 55+ of Misses Figure Type* (ASTM, 2006). In this standard, the bust measurement for size 22 is 43.23 inches. The bust measurement for size 20 in the D 5585 standard is 44.5 inches, so the researcher opted not to include this bust measurement in the analysis, since it was nearly 1 ¼ inches less than the smaller size below it.

Table 12

Bust Measurements Compiled from 7 Sources (inches)

Size	6	8	10	12	14	16	18	20	22
PS 42-70[a]	31 ½	32 ½	33 ½	35	36 ½	38	40	42	44
Taylor and Shoben[b]	n/a	n/a	34 ¼	36 ¼	38 ¼	40 ¼	42 ¼	44	46
Fashiondex[c]	34 ½	35 ½	36 ½	38	39 ½	41	43	45	47
ASTM D 5585[d]	34	35	36	37 ½	39	40 ½	42 ½	44 ½	n/a
Knight[e]	n/a	36	n/a	38	40	42	44	n/a	n/a
Joseph-Armstrong[f]	34	35	36	37 ½	39	40 ½	42 ½	n/a	n/a
Cynthia Guffey Patterns[g]	35	36	37	38	40	41	43	45	47
Average bust measurement from rows above[h]	**33 ¾**	**35**	**35 ½**	**37 ¼**	**39**	**40 ½**	**42 ½**	**44**	**46**

[a] National Institute of Standards and Technology, Body Measurements for the Sizing of Apparel. NBS *Voluntary Product Standard PS 42-70*, 2002.
[b]*Grading for the Fashion Industry* (p. 16), by P.J. Taylor and M.M. Shoben, 1990, Cheltenham, England: Stanley Thornes (Publishers) Ltd. Measurements for sizes 6 and 8 not included in publication; measurements converted from centimeters to inches.
[c]*The Apparel Design and Production Hand Book* (pp. 2.10, 5.12, 5.13), Fashiondex, 2001, New York, NY: The Fashiondex, Inc.
[d]*Standard table of body measurements for adult female misses figure type, sizes 2-20*, ASTM Intl., 2006, West Conshohocken, PA. Measurements for size 22 not included in publication.
[e]*The Dressmaker's Technique Bible: a Complete Guide to Fashion Sewing* (p. 23), by L. Knight, 2008, Iola, WI: Krause Publications. Measurements for sizes 6, 10, 20, and 22 not included in publication.
[f]*Patternmaking for Fashion Design* (p. 36), by H. Joseph-Armstrong, 2010, Upper Saddle River, NJ: Pearson Education. Measurements for sizes 20 and 22 not included in publication.
[g]Cynthia Guffey Patterns, retrieved from ***http://www.cynthiaguffey.com/sewing-patterns-new.htm***
[h]Measurements rounded to the nearest one-fourth inch.

As can be seen in Table 12, there has been an increase in some of the measurements over time. The PS 42-70 standard was developed in 1970, according to the literature (National Institute of Standards and Technology, 2002), and has the smallest measurements of those listed. With the exception of Joseph-Armstrong (2010), who used the ASTM standard body measurements in her book, the most recent measurements available from those listed (Knight, 2008; Guffey, 2011) are also the largest.

Table 13 shows how much smaller the U.S. pattern-sizing bust measurements are when compared to the average bust measurements from other sources over the past 41 years (seen in Table 12). What is especially significant to note is the magnitude of the difference between the pattern-sizing bust measurements and the bust measurements found most recently in use by Cynthia Guffey Patterns.

Table 13

Comparison of Bust Measurement Averages from 7 Sources to U.S. Patterns (inches)

Pattern Size	6	8	10	12	14	16	18	20	22
AVG bust measurement over last 41 years	33 ¾	35	35 ½	37 ¼	39	40 ½	42 ½	44	46
Cynthia Guffey	35	36	37	38	40	41	43	45	47
U.S. Patterns	30 ½	31 ½	32 ½	34	36	38	40	42	44
Difference from C. Guffey	4 ½	4 ½	4 ½	4	4	3	3	3	3
Difference from AVG of last 41 years	3 ¼	3 ½	3	3 ¼	3	2 ½	2 ½	2	2

Body Measurement Comparison with SizeUSA Data

Previous research on body shapes using SizeUSA data by Newcomb and Istook (2006a; 2006b) was used to evaluate how closely the U.S. pattern measurements for a specific size represent the shape profile of the female consumer population. Measurements for the size 10 from the U.S. pattern standards were compared to the top 4 shape profiles and their minimum (or smallest) group of measurements within a shape that would define a specific size.

As can be seen in Table 14, the measurements for the Size 10 are very close to the SizeUSA supported hourglass shape with very similar ratios between bust to waist and hip to waist. The bust measurements are identical and this points to an issue. This measurement shown for SizeUSA is the smallest for the hourglass shape, indicating that it should be a much smaller size than a 10. In addition, since the pattern measurement data supports an hourglass shaped figure, which is only 8% of the U.S. female population, there is a significant group of the population whose body shape and measurement requirements are not being met.

Table 14

U.S. Pattern Measurements Compared to SizeUSA Shape Profile Measurements (inches)

Body areas	Pattern Size 10	SizeUSA Rectangle (46%) (minimum)	SizeUSA Spoon (21%) (minimum)	SizeUSA Inverted Triangle (14%) (minimum)	SizeUSA Hourglass (8%) (minimum)
Bust	32 ½	30 ¼	28 ½	34 ½	32 ½
Waist	25	25	23 ½	26	24
Hip	34 ½	32 ¼	33	33	34

Note. Adapted from Newcomb & Istook (2006) and *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009. Retrieved from http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

Based on the analysis of the comparison of U.S. pattern company bust measurement values with the measurements used by standards organizations and industry professionals over the past 41 years, the U.S. pattern company bust measurements do not meet the fit profile of today's U.S. female consumer. As demonstrated in Tables 12 and 13 above, the most recent measurement charts have bust measurements 3-4 ½ inches larger than the pattern company bust measurements. In addition, analysis of pattern company data compared to SizeUSA shape data has shown that the U.S. pattern company standard supports the hourglass shape, which is only 8% of the female population.

Research Question Two

Do finished garment measurements in key areas printed on patterns conform to the company ease specifications for each fit category?

Tissue Measurement Comparisons

To evaluate the amount of minimum fit ease and design ease incorporated into each pattern, the researcher measured each tissue paper pattern piece using a see-through ruler

from sew line to sew line across the bust, waist, and hip areas. Not all pattern brands included an easily identifiable, specific area marked on the pattern pieces of where to measure the bust, waist, and hip. The Burda pattern had printed text on the dress front piece with the finished garment bust measurements, but there was not a printed line or symbol for exactly where to measure the bust. The Butterick brand semi-fitted dress pattern contained a small, ½ inch diameter circle with crosshairs in the center printed in the bust area (see Figure 33). A novice sewer might not know the meaning of the symbol. Page 9 (of 10) on the guide sheet explained the meaning of the symbol.

Indicates Bust Point and Hipline on Pattern Tissue. Measurements give total garment circumference.

Figure 33. Measurement symbol from Butterick pattern #5746 instruction sheet, p. 9. Copyright by the Butterick Company, 1998.

A separate analysis was performed on the ease amounts included in the Vogue size 10 fitting shell pattern, as shown in Table 15. No other brand of a fitting shell was studied in this size, so it was not directly compared to any other brand. According to Palmer and Alto, pattern companies include "minimum ease of approximately 2 ½ inches in the bust, 1 inch in the waist, and 2 inches in the hip" in their slopers (2006, p. 20). This data clearly demonstrates that the Vogue size 10 fitting shell was not designed with the ease generally required at the waist and the hip, which enables a garment to fit well. The bust ease is just slightly bigger than might be optimal, but the waist ease is almost ½ of the expected amount. The hip ease is about ¼ inch less than the target ease for the hip area.

Table 15

Analysis of Pattern Measurements and Ease Amounts in Size 10 Vogue Fitting Shell

Body Area	Pattern	Body	Ease
Bust	35 ¼"	32 ½"	2 ¾"
Waist	25 ⅝"	25"	⅝"
Hip	36 ¼"	34 ½"	1 ¾"

Note. Body measurements adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009. Retrieved from http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

Butterick and Vogue. As can be seen in Table 16, a second comparison between brands evaluated the amount of ease included in the size 18 fitting shells (Butterick and Vogue). The ease amounts should be the same as in the first comparison above, which are approximately 2 ½ inches in the bust, 1 inch in the waist, and 2 inches in the hip.

Neither the Butterick nor the Vogue size 18 pattern has the ideal amount of ease included in the patterns. Both exceed the ideal bust ease amount by ½ inch or more. The waist and hip ease amounts are less than ideal by ¼ to ½ inch.

Table 16

Comparison of Pattern Measurements and Ease Amounts between Butterick and Vogue Size 18 Fitting Shells

Body Area	Butterick #5746			Vogue #1004		
	Pattern	Body	Ease	Pattern	Body	Ease
Bust	43"	40"	3"	43 ⅛"	40"	3 ⅛"
Waist	32 ⅞"	32"	⅞"	32 ¾"	32"	¾"
Hip	43 ½"	42"	1 ½"	43 ¾"	42"	1 ¾"

Note. Body measurements adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009, http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

When the amounts of ease for both sizes of the Vogue fitting shells were compared, results showed that these amounts were not consistent. In the bust, there was ⅜ inch difference in ease between the size 10 and the size 18. There was ⅛ inch difference between the waist measurements. In the hip, the amounts of ease were consistent (see Table 17).

Table 17

Comparison of Pattern Measurements and Ease Amounts between 2 Sizes of Vogue Fitting Shells

Body Area	Vogue #1004 Size 10			Vogue #1004 Size 18		
	Pattern	Body	Ease	Pattern	Body	Ease
Bust	35 ¼"	32 ½"	2 ¾"	43 ⅛"	40"	3 ⅛"
Waist	25 ⅝"	25"	⅝"	32 ¾"	32"	¾"
Hip	36 ¼"	34 ½"	1¾"	43 ¾"	42"	1 ¾"

Note. Body measurements adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009. Retrieved from http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

Semi-Fitted Patterns. A fourth comparison was made between 4 brands of size 10 semi-fitted dress patterns, as shown in Table 18. According to the pattern companies, the amount of ease should equal between 4 ⅛ to 5 inches in the bust, and between 3 ⅛ to 4 inches in the hip (see Table 2). Pattern companies do not specify the amount of ease in the waist for semi-fitted patterns, so the minimum ease of 1inch was used (the same as included in fitting shells).

Table 18

Comparison of Pattern Measurements and Ease Amounts between 4 Brands of Size 10 Semi-fitted Dress Patterns

Body Area	Burda #7664			Butterick #5746		
	Pattern	Body	Ease	Pattern	Body	Ease
Bust	35 ⅛"	33"	2 ⅛"	37"	32 ½"	4 ½"
Waist	31"	26"	5"	26"	25"	1"
Hip	37"	35 ½"	1 ½"	38"	34 ½"	3 ½"
Body Area	McCall's #2401			New Look #6968		
	Pattern	Body	Ease	Pattern	Body	Ease
Bust	35"	32 ½"	2 ½"	35"	32 ½"	2 ½"
Waist	30 ¾"	25"	5 ¾"	28 ⅛"	25"	3 ⅛"
Hip	38 ¼"	34 ½"	3 ¾"	38 ¼"	34 ½"	3 ¾"

Note. Body measurements adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009. Retrieved from http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

Butterick was the only brand which contained ease measures that fit within the ideal range for both the bust and hip areas for the semi-fitted category as identified by the pattern companies. Burda, McCall's, and New look all had bust ease measures approximately 1 ½ to 2 inches smaller than the 4 ⅛ to 5 inch range expected. All brands had adequate waist ease measures. McCall's and New Look were within range on the hip ease, however, Burda was more than 1 ½ inches smaller than the 3 ⅛ to 4 inch range that would be optimal.

A comparison was done for the size 18 patterns between 3 brands and the ease allowances included in the semi-fitted dress patterns. The ease allowances for the size 18 patterns should be the same as those for the size 10 garments, and are shown in Table 19.

Table 19

Comparison of Pattern Measurements and Ease Amounts between 3 Brands of Size 18 Semi-fitted Dress Patterns

Body Area		Burda #7664	
	Pattern	Body	Ease
Bust	41 ⅛"	39 ½"	1 ⅝"
Waist	37 ¼"	32 ½"	4 ¾"
Hip	43 ¼"	41 ¾"	1 ½"
Body Area		McCall's #2401	
	Pattern	Body	Ease
Bust	42 ½"	40"	2 ½"
Waist	38"	32"	6"
Hip	46"	42"	4"
Body Area		New Look #6968	
	Pattern	Body	Ease
Bust	42 ½"	40"	2 ½"
Waist	35 ¼"	32"	3 ¼"
Hip	45 ⅞"	42"	3 ⅞"

Note. Body measurements adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009. Retrieved from http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

The results of the ease amounts from the size 18 semi-fitted patterns found that none of the brands contained ease amounts in the bust within the expected range. McCall's and New Look had approximately 1 ½ inches less bust ease than the ideal. Burda had more than 2 ½ inches less bust ease than expected. All brands had adequate waist ease amounts. McCall's and New Look hip measures were within the ideal range. The hip measures for the Burda pattern were approximately 1 ½ in less than the required amount.

A final comparison of finished garment dimensions for the bust and hip as printed on patterns was made to tissue pattern measurements between three brands of semi-fitted dresses. Physical measurements of the tissue patterns were made and recorded. These pattern measurements were compared to the finished garment specs (see Table 20). Fitting shell patterns do not have finished garment specification measurements, so they were not included in the comparison.

Table 20

Comparison of Tissue Pattern Measurements to Finished Garment Measurements

Body Area	Burda #7664 sz. 10	Burda #7664 sz. 18	McCall's #2401 sz. 10	McCall's #2401 sz. 18	New Look #6968 sz. 10	New Look #6968 sz. 18
Bust (finished Spec garment measurement)	35 ½"	41 ¾"	36"	43 ½"	35"	42 ½"
Bust (actual tissue pattern measurement)	35 ⅛"	41 ⅛"	35"	42 ½"	35"	42 ½"
Amt. of Difference b/t Spec and Actual pattern	(–⅜")	(–⅝")	(–1")	(–1")	0	0
Hip (finished Spec garment measurement)	37 ½	43 ¾"	38 ½"	46"	38"	45 ½"
Hip (actual tissue pattern measurement)	37"	43 ¼"	38 ½"	46"	38 ¼"	45 ⅞"
Amt. of Difference b/t Spec and Actual pattern	(–½")	(–½")	0	0	+¼"	+⅜

As can be seen in Table 20, the tissue pattern measurements on all brands failed to match the finished garment specs for both the bust and hip. The Burda patterns measured ⅜ to ½ inch smaller in the bust and hip than the finished garment specs. The McCall's patterns measured 1 inch smaller in the bust than expected, but matched in the hip. New Look patterns matched in the bust and were larger than the hip spec by ¼ to ⅜ inches. Based on the data in Table 20, it would not be possible to produce a garment from any of the patterns that matched the expected finished garment specs provided on the patterns.

Research Question Three

Is there a difference in the fit of finished basic dresses constructed from the five brands of commercial sewing patterns under study (Burda, Butterick, McCall's, New Look, and Vogue)?

The fit criteria of ease, grain, line, balance, and set described by Joseph-Armstrong (2010) were used to subjectively evaluate the sample garments. The 10 garments constructed from the patterns under study were placed on dress forms to be evaluated. Each dress was photographed from the front, left side, and back. Additional close-up photographs were taken of the front and back neck areas and the side armhole area. Efforts were made to photograph each garment in the same position and from the same distance. The photographs were used as visual representations for the written summary of the study findings.

Each dress was coded on the upper left bodice near the shoulder prior to being photographed to record the brand and size. The evaluation of each garment begins with 1a (Burda, size 10), and continues with 1b (Burda, size 18). The other codes were as follows:

2a-Butterick, size 10; 2b-Butterick, size 18; 3a-McCall's size 10; 3b-McCall's size 18; 4a-New Look, size 10; 4b-New Look, size 18, 5a-Vogue, size 10; and 5b-Vogue, size 18. Photographs of all sample garments under study can be seen in Appendix B.

Burda

The bust alignment points of both sizes of Burda garments were ½ inch lower than the bust point of the fit mannequins. The bust and hip areas were snug on both sizes. There was slight (½ inch) gapping at the armscye on the size 10, as seen in Figure 34. On the size 18, there was gapping in the front neck, shown in Figure 35.

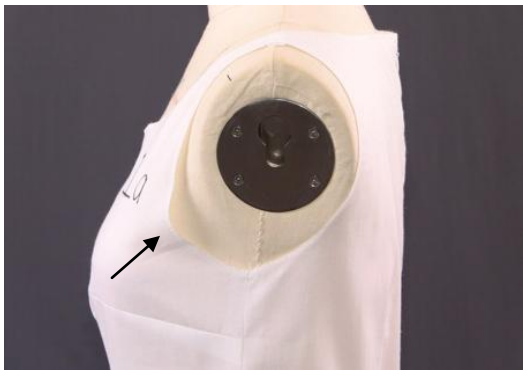

Figure 34. Close-up side view of Burda #7664, size 10. Arrow points to fit problem at armscye.

Figure 35. Close-up front and side view of Burda #7664, size 18. Arrows point to gapping at front neck.

To view the fit of the two sizes of Burda sample dresses, a pair-wise comparison can be seen in Figure 36. The waist is not well defined on either size. The fit in the hip area of the size 10 appears to be slightly tight, whereas the size 18 looks significantly tighter (See igure 36).

Figure 36. Pair-wise comparison of Burda #7664, size 10 (l) and size 18 (r) front views.

Butterick

As in the Burda brand, the bust alignment points of the Butterick samples were also ½ inch lower than the bust points of the fit mannequins. The bust area on the size 10, although it appeared to be loose, fit well according to the amount of ease it contained. In the shoulder, the seams were centered, however, the width of the shoulder seams were too wide and extended ¼ inch beyond the armscye on the size 10 (see Figure 37). The armscye areas were too wide and too low on both sizes (see Figure 38). The hip area was tight on the size 18.

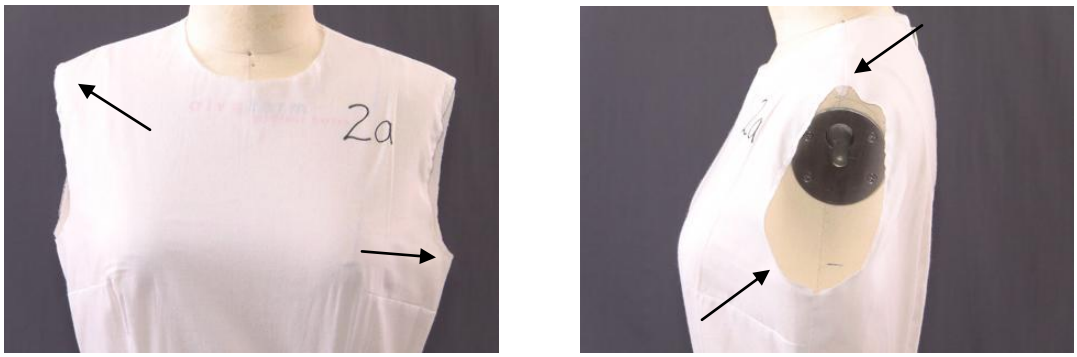

Figure 37. Close-up front and side view of Butterick #5746, size 10. Arrows point to fit problems in the shoulder and armscye.

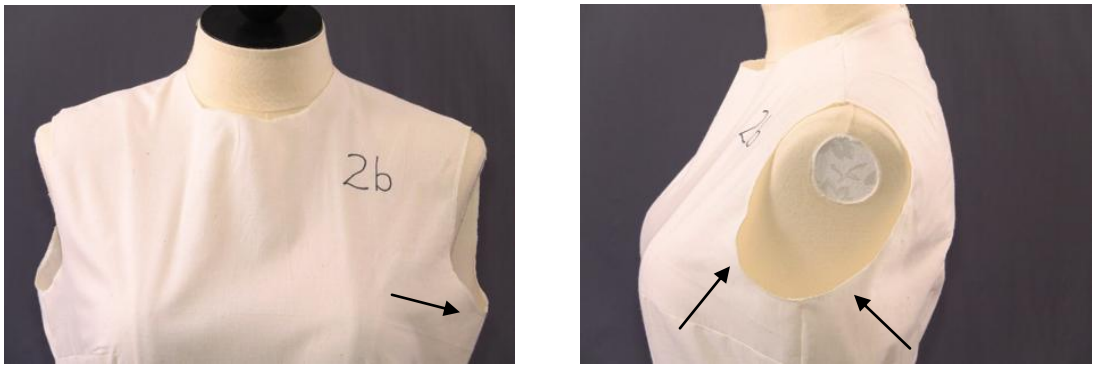

Figure 38. Close-up front and side view of Butterick #5746, size 18. Arrows point to fit problems in the armscye.

McCall's

The subjective evaluation of the McCall's garments found that the bust point was 1inch lower than the fit mannequin only on the size 10. The bust and shoulder areas were well fitting. The armscye areas were too low and too large with gapping on both sizes (see Figure 39).

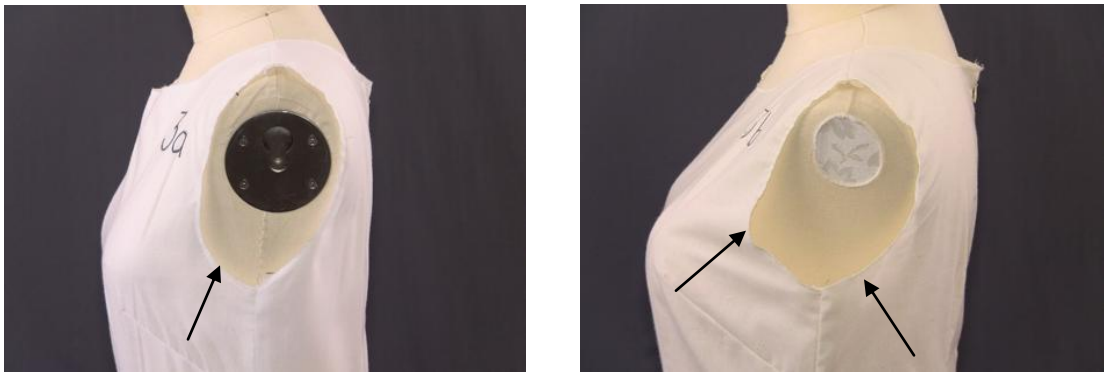

Figure 39. Close-up side view of McCall's #2401, size 10 (l) and 18 (r). Arrows point to fit problems in armscye.

New Look

The bust points on the New Look samples were from ¾-1¼ inches lower than the bust points on the mannequin. The shoulders and necklines of both sizes fit well, as did the waist and hip areas. On the size 18, there was gapping at the armscye (see Figure 40).

Figure 40. Close-up side views of New Look #6968, size 10 (l) and 18 (r). Arrows point to fit problems at bust points and armscye.

Vogue

Vogue was the final brand evaluated. The bust points on the samples were ½ inch lower than the fit mannequins'. The size 10 fitting shell had acceptable fit in the bust and waist, but was extremely tight in the hip (see Figure 41). The size 18 sample was slightly too loose in the bust, fit well in the waist, and was also snug in the hip (see Figure 42). The fit in the shoulder and neckline areas for both sizes were within acceptable limits. On both sizes, the armscye areas were too wide and too deep, and on the size 18, extended too far out at the underarm (see Figure 43).

Figure 41. Front, side, and back view of Vogue #1004, size 10. Arrows point to fit problems in the hip and armscye areas.

Figure 42. Front, side, and back view of Vogue #1004, size 18. Arrows point to fit problems in the underarm, armscye, and hip areas.

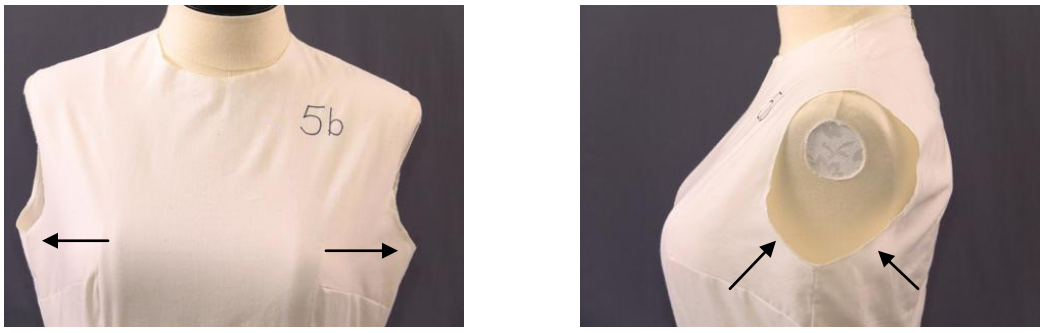

Figure 43. Close-up of Vogue #1004, size 18. Arrows point to fit problems in the underarm and armscye areas.

Research Question Four

Are the grading systems used by pattern companies based on their standardized body measurements?

A grading system is a compilation of grade rules that indicates how the amount of change is distributed throughout a pattern piece. The procedure for creating a grading system relies on a three-step process. First, an anthropometric study is conducted. Next, body measurements are derived from the sizing survey data. Last, specifications are developed from the body measurements on the amount of increase or decrease used in grading (Mullet, 2009).

Pattern Company Grade Rules

In this results section, the major girth grade amounts for the bust, waist, and hip were analyzed. An analysis of the grading system used by pattern companies must first begin by examining the size specifications used, since this is how grade rules are derived.

As can be seen in Table 21, the amount of growth from the smallest size to the largest size contains two breaks, or sizes where the amount of grade changes. With the exception of size

22, the amount of change in all three major girth areas of the bust, waist, and hip is consistent within each size, that is these body areas all increase by either 1 inch, 1 ½, or 2 inches. When the incremental changes for all major body circumferences are the same, an even or uniform grade is used (Mullet, 2009). Based on the body measurements provided by the major pattern companies, a uniform grade is utilized for sizes 6 - 20.

Table 21

U.S. pattern sizing specifications (inches)

	Body Measurements								
Pattern size	6	8	10[a]	12[b]	14	16	18	20	22
Bust	30.5	31.5	32.5	34	36	38	40	42	44
Waist	23	24	25	26½	28	30	32	34	37
Hip	32½	33½	34½	36	38	40	42	44	46

Note. Shaded areas indicate breaks where grade changes.
[a]Grade changes to 1 ½ inches.
[b]Grade changes to 2 inches.

As illustrated in Table 21, size 22 does not have a uniform grade. Although the bust and hip both increase by 2 inches from a size 20, the waist increases by 3 inches. Thus, when grading from a size 20 to a 22, an uneven grade would need to be applied in order to meet the standard measurements.

Comparison of Actual Grading Practices and Standard Grade Rules

Patterns were digitized in order to visually examine the changes that occur from grading practices used by different companies. These images are included in Appendix C.

Since the body measurements used by American and European pattern producers vary, the results begin by examining the grading practices utilized by U.S. pattern manufacturers, followed by the German owned Burda brand.

Single sized patterns: Butterick and Vogue. Two patterns, size 10 and size 18 of the Butterick and Vogue brands were purchased for this study. To physically measure the amount of grade used in sizes 6 to 22, fourteen additional patterns would need to be purchased. Since the retail price of each pattern ranged from $11.95 (Butterick) to $20 (Vogue), the decision was made not to expend the resources to purchase additional patterns. Instead, by measuring the size 10 patterns and comparing them to the size 18, the amount of increase in the measurements could verify the total amount of grade used when going from the smallest size to the largest.

Since the smallest size purchased was a 10, grading results for the smaller size 6 and 8 were not reported. Similarly, since the largest size purchased was an 18, results for sizes 20 and 22 were not reported.

By evaluating the pattern pieces at the bust, waist, and hip, the researcher verified an even grade is used in U.S. patterns, so the hipline was selected as the point of measurement to determine grade amounts. Since the hipline is a straight line perpendicular to the center front or center back line, it can be measured more consistently than the bust or waist areas. The actual tissue pattern measurements for the hiplines were recorded for the size 10 and 18 patterns. Next, the difference between the two measurements was calculated. Last, the amount of expected increase from size 10 to 18 was calculated from pattern sizing charts. The results of the grading analysis performed on the Butterick pattern can be seen in Table 22.

Table 22

Butterick #5746 Determination of Total Grade Amounts from Size 10 to 18

Size	10 to 12	12 to 14	14 to 16	16 to 18	Total Grade Amount
Expected pattern measurement	36½" to 38"	38" to 40"	40" to 42"	42" to 44"	
Expected increase	+1½"	+2"	+2"	+2"	7½"
Actual pattern measurement	36½"	n/a	n/a	43½"	
Extrapolated increase	+1½"	+2"	+2"	+1½"	7"

The results showed the Butterick patterns did not contain the correct amount of grade required to match the sizing standard, since the largest pattern measurement was ½ inch less than expected. Table 22 shows how the amount of grade should have been distributed across the range of sizes. The researcher was unable to confirm where or how the ½ inch missing grade amount occurred, only that the largest size should have included an additional ½ inch.

For the Vogue brand, results of the grading analysis performed can be seen in Table 23. According to the data, the Vogue patterns were graded correctly.

Table 23

Vogue #1004 breakdown of sizes and grade increments

Size	10 to 12	12 to 14	14 to 16	16 to 18	Total Grade Amount
Expected pattern measurement	36¼″ to 37¾″	37¾″ to 39¾″	39¾″ to 41¾″	41¾″ to 43¾″	
Expected increase	+1½″	+2″	+2″	+2″	7½″
Actual pattern measurement	36¼″	n/a	n/a	43¾″	
Extrapolated increase	+1½″	+2″	+2″	+2″	7½″

Multi sized patterns: McCall's and New Look. In contrast to the limited single sized patterns available to the researcher in the Butterick and Vogue brands, the McCall's and New Look multi sized patterns provided concrete evidence of the amount of grade used for each size. Since the amount of grade from one size to the next was measured from the printed lines on the patterns, hip measurements for each size were not required. The grading practices used by McCall's and New Look are seen in Table 24. Both brands were graded correctly.

Table 24

McCall's #2401 and New Look #6968 Breakdown of Sizes and Grade Increments

Size	10 to 12	12 to 14	14 to 16	16 to 18	Total Grade Amount
Expected increase	+1½"	+2"	+2"	+2"	7½"
Actual increase	+1½"	+2"	+2"	+2"	7½"

European sizing and Burda. According to the sizing information printed on the back of the envelope, the multi sized Burda pattern used for this study contained U.S. sizes 8 to 20. However, unlike U.S. patterns, there were no corresponding body measurements. As illustrated in Figure 44, the only indication of any measurements was contained in a line drawing on the back of the pattern envelope. What the measurements were in reference to was unclear. Were they for the finished bottom dress circumference? The finished garment measurements were inside the envelope printed on the tissue pattern pieces. Those pieces confirmed that the measurements near the line drawing on the back of the pattern envelope were the finished garment bust measurements, which ranged from 34 to 43½ inches.

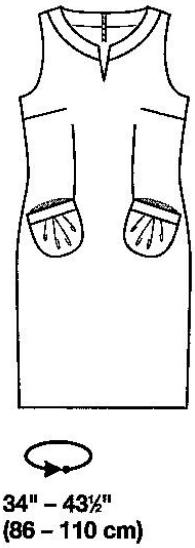

Figure 44. Line drawing indicating girth measurements.
From Burda pattern #7664. Copyright by Verlag Aenne Burda GmbH & Co.

Palmer and Alto (2006) documented that European and U.S. pattern sizing was not the same. European and American pattern sizes and corresponding body measurements from Palmer and Alto and the Burda website are compared in Table 25.

Table 25

Comparison of European (Burda) and American Size Charts

Pattern size	6	8	10	12	14	16	18	20	22
BurdaStyle bust measurement [a]	34¾"	36¼"	37¾"	39½"	41"	43½"	45½"	48"	50½"
Burda bust measurement [b]	30"	31½"	33	34¾"	36¼"	37¾"	39½"	41"	43½"
Difference between updated measurements and original U.S. patterns bust measurement [c]	4¾"	4¾"	4¾"	4¾"	4¾"	5¾"	6"	7"	7"
	30½"	31½"	32½"	34"	36"	38"	40"	42"	44"

[a]Adapted from *Women's size chart* and *Women's plus size chart.* Copyright 2009 by BurdaStyle. Inc., http://www.burdastyle.com/statics/size-chart.
[b]Adapted from *Fit for Real People: Sew Great Clothes Using any Pattern* (p. 27), by P. Palmer and M. Alto, 2006, Portland, OR: Palmer/Pletsch Publishing Inc.
[c]Adapted from *Simplicity Fit Guide* (p. 1), Simplicity Pattern Co., 2009. Retrieved from http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

It is unknown exactly when Burda last changed their sizing standards. Most likely, it was after the 2006 publication of Palmer and Alto's *Fit for Real People: Sew Great Clothes Using any Pattern;* and before the 2009 copyright of the BurdaStyle website. Although the updated Burda measurements are significantly greater than the old ones, and considerably greater than U.S. pattern sizing, they are closer to the current measurements from the SizeUSA survey (see Table 14) and Cynthia Guffey patterns (see Table 12).

The size 12 measurement of 34 ¾ inches, found in Table 25 is ¼ inch larger than the expected measurement if each measurement increases by 1 ½ inches per size. Palmer and

Alto confirmed this was due to "rounding off" when converting centimeters to inches. In addition, Burda rounds their measurements to the nearest ¼ inch (Palmer & Alto).

The results of evaluating the grading increments used by Burda shown in Table 26 confirm that Burda patterns are graded in accordance with their stated sizing. Unlike U.S. patterns, which use three different grades across the misses size range, Burda uses a consistent grade of 1 ½ inches across the entire range. To visually observe the differences in the grading between brands, see Appendix C.

Table 26

Burda #7664 Breakdown of Sizes and Grade Increments

Size	10 to 12	12 to 14	14 to 16	16 to 18	Total Grade Amount
Expected increase	+1½"	+1½"	+1½"	+1½"	6"
Actual increase	+1½"	+1½"	+1½"	+1½"	6"

Summary of Results

Does the fit profile used by the commercial sewing pattern industry conform to the body profiles of today's U.S. consumers? No.

- U.S. pattern companies' bust measurements do not meet the fit profile of today's U.S. female consumer.
- In addition, analysis of pattern company data compared to SizeUSA shape data has shown that the U.S. pattern company standard supports the hourglass shape,

which is only 8% of the female population, but is much smaller by size than would be required for today's population.

Do finished garment measurements in key areas printed on patterns conform to the company ease specifications for each fit category? Generally, no.

- None of the three fitting shells met ease requirements in all three areas. The size 10 Vogue came closest to meeting the required amount in the bust, whereas both brands of the size 18 had too much ease in the bust. All three patterns had too little ease in the waist and hip.
- The only brand to meet ease specifications for the semi-fitted category of the size 10 patterns under evaluation was Butterick #5746.
- None of the brands of the size 18 patterns met the ease specifications for the semi-fitted category.
- None of the brands evaluated met their finished garment specifications when compared to the tissue measurements.

Is there a difference in the fit of finished basic dresses constructed from the five brands of commercial sewing patterns under study (Burda, Butterick, McCall's, New Look, and Vogue)? Yes.

- Each of the ten garments evaluated fit very differently (see Appendix A for images of all of the garments and Appendix B for a chart of the compiled results).
- No single brand had acceptable fit in all body areas.

Are the grading systems used by pattern companies based on their standardized body measurements? Generally, yes.

- For sizes 8 to 18, all of the brands under study, with the exception of Butterick, based their grading on their standard body measurements.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND FUTURE RESEARCH

Brief Review of Study

Sewers have reported that better fit is the number one reason for sewing their own garments, and have sought out many different pattern brands searching for ones that provide the flattering fit they so desire (LaBat et al., 2007). Many sewers are confused about what their correct pattern size is and often purchase the incorrect size, only to find out that it is not returnable. Unlike RTW clothing, which can be tried on before purchasing, consumers must first purchase a pattern, fabric, and notions to construct a garment to find out if it fits. After investing time and money to construct a garment resulting in unacceptable fit may frustrate consumers and negatively affect pattern sales.

Although major brands of U.S. patterns use standardized sizing, the standards are vastly different from the RTW clothing sizes that consumers are accustomed to purchasing. In 1967, pattern companies used data from the 1940 O'Brien and Shelton study as a guide to develop "new sizing" in an effort to align pattern sizing closer to RTW clothing sizing (Ashdown et al., 2007). The last time U.S. pattern companies updated their sizing was in 1972 (Ashdown et al.; Palmer & Alto, 2006). It is astounding that U.S. pattern companies still base their sizing on data that is over 70 years old. Sizing surveys such as SizeUSA have confirmed that the body shapes of U.S. women have changed significantly in the nearly 40 years since pattern sizing was last revised (LaBat, 2007; $[TC]^2$, 2004).

As evidence of the prevalence of issues regarding the fit of commercial-sewing patterns, many books have been written on the subject of how to improve the fit of patterns,

such as: *Customize Your Sewing Patterns for a Perfect Fit*, by M. Morris and S. McCann; *Fit for Real People: Sew Great Clothes Using any Pattern*, by P. Palmer and M. Alto; and *How to Use, Adapt, and Design Sewing Patterns*, by L. Hollahan. In addition, sewing and fit experts such as Cynthia Guffey, and Palmer/Pletsch have conducted nationwide seminars for over 15 years to sewers on pattern adjustment methods to improve fit. Since pattern companies invest considerable sums of money to develop and market each pattern, it would be in their best interest to try to produce patterns that better meet the fit needs of today's consumer (LaBat et al., 2007; Palmer & Alto, 2006).

Palmer and Alto (2006) maintained that no one pattern brand had better fit than any other brand. The researcher studied finished garments made from five different brands to determine if there were similarities or differences between the fit of different brands.

The purpose of this study was to obtain a better understanding of the sizing, pattern specifications, grading, and fit of five major brands of commercial sewing patterns. The improved understanding of the sizing used by pattern companies was used to recommend a sizing strategy that would be more aligned with current RTW clothing sizing practices.

The study was limited by the following factors: First, fit mannequins were used to try on sample garments instead of live fit models, so differences in fit may occur due to the variations between them. Second, the body dimensions and profile of the fit mannequins may not be representative of the current population of U.S. women. Last, fitting shell patterns were not available from all brands under study, so patterns with similar fit and style were improvised.

Four questions framed this research:

1. Does the fit profile used by the commercial sewing pattern industry conform to the body profiles of today's U.S. consumers?
2. Do finished garment measurements in key areas printed on patterns conform to the company ease specifications for each fit category?
3. How different is the fit of finished basic dresses constructed from the five brands of commercial sewing patterns under study (Burda, Butterick, McCall's, New Look, and Vogue)?
4. Are the grading systems used by pattern companies based on their standardized body measurements?

Discussion of Results

To answer these questions, several approaches were utilized. First, bust measurements from U.S. pattern companies for each size were compared to seven additional sources of bust measurements. Results showed that U.S. pattern bust measurements ranged from 2 - 3½ inches *smaller* than the bust measurement used for the same size from other sources. On average, the U.S. pattern bust measurements were 2.78 inches smaller than the combined averages from the 7 sources consulted.

Since RTW sizing standards are voluntary and vary widely between manufacturers, it is impossible to directly compare pattern sizing to the multitudes of sizing standards used in RTW clothing. When looking at the body measurements of fitting mannequins used by the apparel industry, it appears that pattern sizing is out of line with the mannequins used to test

fit the same size pattern. A size 0 fit mannequin was required to fit the bust measurement of the size 10 sample dresses under study. Alvanon, a major supplier of fitting forms does not manufacture size 0 forms, size 2 is the smallest size they make in the Misses product line. The size 18 sample dresses would have required a size 12 Alvanon dress form.

Further evidence that a significant group of the population has body shapes and body measurement requirements not being met by current pattern offerings are substantiated by SizeUSA data. The fact that the smallest measurement shown for SizeUSA is the smallest for the hourglass shape indicates a 32 inch bust measurement should be assigned a much smaller size than a 10. Since the pattern measurement data supports an hourglass shaped figure, which is only 8% of the U.S. female population, by failing to address the remaining population of body shapes, pattern companies may experience lost business opportunities.

Based on the BurdaStyle body measurements shown in Table 13, it appears Burda has taken action to revise their sizing standards to be more in line with the sizes of today's consumers. In the opinion of the researcher, U.S pattern companies should follow suit by reassigning smaller size designations to their existing bust measurements. Decreasing the numerical size assigned to each bust measurement by two to three sizes would make patterns more similar to both RTW sizing and Burda sizing. For example, a bust measurement of 36 inches, which is now a size 14 pattern, could be downsized to an 8 or 10.

In answering question 1, the researcher determined that the hourglass fit profile and sizing standards used by the U.S. commercial sewing pattern industry do not conform to the majority of body profiles, and that pattern companies are not serving the fit needs of today's U.S. consumers. It is not surprising that based on the sizing recommendations provided by

the major pattern companies that many consumers purchase the incorrect size pattern. Since pattern companies seem to be practicing the opposite of vanity sizing, by assigning a larger size to a smaller measurement, they may be contributing to purchasing errors by consumers. It may be difficult for sewers to accept the fact that they need to purchase a pattern size several sizes *larger* than their usual RTW size. Another disappointing fact is that patterns are not returnable, adding to consumers' frustrations when an incorrect size is purchased.

The next phase of the research involved an objective evaluation of the patterns under study by measuring each pattern piece at the key body areas of the bust, waist, and hip. Measurements were recorded and comparisons were made between brands and sizes to determine the accuracy of the amount of ease contained in patterns.

To develop slopers, or basic fit patterns, pattern companies use their standard body measurements and then add minimum ease amounts of close to 2½ inches in the bust, 1 inch in the waist, and 2 inches in the hip (Palmer & Alto, 2006). These minimum ease amounts were used to evaluate the fitting shells. The ease amount chart based on the various fit silhouettes provided by pattern companies was used as a guide to verify if the ease amounts contained in the semi-fitted patterns under study matched these measurements (see Table 2).

In order for the fit of a garment to be assessed using the five criteria used to evaluate fit (ease, line, grain, balance, and set), ease must first be present. A garment without ease will be difficult to try on and will not drape or hang properly from the body. Ease is what gives comfort to a garment and allows the wearer to move. Unless a garment is constructed of a stretch knit fabric, such as leotards or swimwear, pattern measurements should always be

larger than the wearer's corresponding body measurements. Otherwise, the garment will be constricting and limit movement and mobility (Hudson, 1989).

The size 10 Vogue fitting shell pattern came closest to the amount of ease required in the bust, whereas the size 18 had too much ease. The amount of ease contained in both sizes of Vogue patterns in the waist and hip was inadequate. The amount of bust ease between the size 10 and size 18 was not consistent, as it should be.

Like the size 18 Vogue, the size 18 Butterick fitting shell pattern also had too much ease in the bust and the waist and hip were less than the standard. Although ½ inch less ease in the hip may seem like a small amount, lack of minimum ease becomes a significant issue in larger sizes, as the body spreads more with movements such as sitting and bending.

As noted in a previous section of this paper, Butterick and Vogue are owned by the same company, and previous research has shown that these two fitting shells are identical (Palmer & Alto, 2006). The data shown in Table 16 confirm that the two brands are not identical. Of the three fitting shells under study, the size 10 Vogue pattern came closest in meeting the amount of ease required, as the combined total ease amounts varied from the standard by ⅞. The size 18 Butterick and Vogue patterns combined total ease amounts varied by 1 ⅛ inches from the standard. Although the total amount of variance was the same for both brands (1 ⅛"), the individual amounts for each area (bust, waist, hip) were different between brands.

The next comparison was between four brands (Burda, Butterick, McCall's, New Look) of semi-fitted dresses. The bust area of semi-fitted patterns should contain between 4 ⅛ and 5 inches of ease. As seen in Table 18, Butterick was the only pattern that had

adequate ease in the bust. The other three brands all failed to have ideal bust ease. Two of the brands (McCall's and New Look) each had 1 ⅝ inches less bust ease than ideal, but did at least contain ½ inch above the minimum bust ease of 2 inches. However both sizes of Burda patterns failed to contain even the minimum bust ease of 2 inches, and had from 2 - 2 ½ inches less ease than ideal. The largest size Burda pattern had less ease than the smaller size, which is a significant problem. Based on the data in Tables 18 and 19, it is likely that garments constructed from the Burda, McCall's, and New Look brands will all fit too tight in the bust area for a semi-fitted garment.

All brands contained the minimum ease amount of 1 inch required in the waist. Pattern companies generally do not specify ease amounts for the waist, but data was collected for the purposes of this study.

The hip area of the semi-fitted patterns should include between 3 ⅛ and 4 inches of ease. Three of the four brands (Butterick, McCall's, and New Look) contained adequate ease amounts in this area. Both sizes of Burda patterns contained 1 and ⅝ inches less than ideal.

In a final analysis of all 4 brands of semi-fitted dress patterns, the Burda, McCall's and New Look brand patterns would likely produce garments with too tight a fit in the bust. Butterick was the only brand with adequate bust ease. Butterick, McCall's, and New Look patterns all contained enough ease in the hip. A garment produced from the Burda brand pattern would fit tight in the hip due to less than ideal ease. Overall, Butterick patterns provided ease amounts most consistent with the semi-fitted category. The Burda brand patterns had the highest frequency of failing to include adequate ease amounts.

The next phase of the study involved subjective evaluations of the finished sample garments on fit mannequins. On most sizes, the bust points on all brands were from ½ inch to 1 ¼ inches lower than the bust points of the mannequins, a phenomenon documented in a previous study by Murphey (1993). The mannequin may not be an accurate representation of the human body, so if the dresses were fit-tested on live models, this phenomenon may not occur.

In assessing fit of the sample dresses on the mannequins, one must take into account there were two types of fit being evaluated, fitted and semi-fitted. Although the fit of some samples may have appeared too loose or big, they may have actually contained the correct amount of ease for the category. Such was the case for the Butterick semi-fitted sample. Conversely, some semi-fitted samples (McCall's and New Look) that appeared to fit the mannequins well should have been looser fitting in the bust since they should have contained more ease for the category.

As stated previously in this paper, the girth dimensions of the fitting mannequins were from ¾ - ⅞ inch larger than the pattern measurements for the corresponding size. In assessing the fit of the finished dresses on the fitting mannequins, some of the dresses may have appeared more snug in the bust and hip areas because of this.

Previous studies have documented common problem areas resulting in poor fit. Excess neck circumference has been a problem, especially in larger garments, sizes 14-20 (Bye et al., 2008). Burda was the only brand under study that showed gapping at the front neckline on the size 18 samples.

The circumference and depth of the armscye is a second problem area for fit, based on a previous study (Bye et al., 2008). In that study, the size 16-20 armscye had excess fabric amounts, especially in the front, and needed adjustments to improve fit (Bye et al.). Of the five brands under study, Burda was the only garment with no gapping in the armscye on the larger, size 18 sample. This may be a result of the patterns having a larger dart intake in the side bust dart. Burda is the only brand with a larger dart intake in the side bust dart needed to accommodate a fuller bust on larger sizes. Patterns with too much bust ease (Butterick, Vogue) may have contributed to the high occurrence of armscye gapping observed.

The comparison of finished garment dimensions for the bust and hip printed on patterns to physical pattern measurements proved in the majority of cases the two measurements were not the same as expected. McCall's patterns measured 1 inch less in the bust than the measure printed on the pattern pieces. The hip of this same brand had measures that matched the printed dimensions. The Burda patterns measures failed to meet the printed standards in both the bust and waist. The bust measures were ⅜ inch less than ideal and the hip measures were ½ in less than expected. New Look patterns had accurate bust measures, but had hip measures that were ¼ - ⅜ inch greater than expected. If finished garment dimensions printed on patterns are inaccurate, sewers will be dissatisfied with the poor fit of finished garments. Consumers are likely to expect that measures printed on patterns are accurate and would not have any knowledge that pattern adjustments were required to achieve the stated fit.

In the final phase of this study, standardized body measurements used by pattern companies were analyzed to determine if grading systems were based on these measurements. The measurements shown in Table 22 confirm that when grading from a size 10 to a size 18, Butterick patterns were not graded in accordance with body measurements, since the total amount of grade was ½ inch less than expected.

Accurately graded patterns are critical for the creation of well fitting garments. Inaccuracies as a result of grading contained on patterns will be compounded during cutting and sewing. Unlike the Butterick brand, McCall's, New Look, and Vogue patterns were all graded in accordance with body measurements.

Burda's grading system, unlike U.S. companies' grading systems, uses a single grade of 1 ½ inches across the entire size range. The Burda patterns yielded similar results to three of the four U.S. brands, and were graded accurately according to stated body measurements.

Conclusions and Implications

In conclusion, the implications of this study are beneficial to the commercial sewing pattern industry, as well as to home-sewers and sewing professionals. The current sizing strategies used by pattern companies confuse consumers, who often purchase the incorrect size pattern. For instance, if U.S. pattern companies updated their sizing to be more like the RTW sizing that consumers are accustomed to buying, people may have fewer frustrations and not give up on sewing after making up a garment that does not fit. Burda, the leading European pattern producer, has revised their pattern sizing in an attempt to be closer to current fashion, and U.S. pattern companies should do the same.

Pattern companies should utilize current anthropometric data from sizing studies such as SizeUSA to create basic pattern blocks for body shapes that are more prevalent than the hourglass figure type. As the baby boomer population ages, there will be an increase in the next 15 years of the population of women who fall into the 55 years and older category. Pattern companies could target this mature age group by using new sizing data to produce better fitting patterns that accommodate the body changes that coincide with aging.

Sewers use fitting patterns to make a basic garment out of muslin or gingham fabric. The goal of fitting patterns is to help sewers achieve perfect fit. If these basic patterns contain too little or too much minimum ease, as found in this study, the product fails to provide customer satisfaction.

Pattern companies market patterns in five fit categories as an aid to sewers. These categories provide a guide to the consumer about the range of ease included in patterns. However, as found in this study, the majority of patterns contained less than the ideal amount

of ease specified for the semi-fitted category. Consumers will be dissatisfied with the fit of garments sewn from patterns that fail to contain the amount of ease specified. Pattern companies should either revise their patterns to meet the ease amounts indicated in the ease amount chart, or modify the charts to comply with pattern measurements.

Some pattern companies print helpful finished garment dimensions on patterns to communicate size and fit to the consumer, however, if these measurements are off by 1 inch, as was found in this study, this might add to consumers' aggravations. Currently, U.S. pattern companies do not use tolerances in their measurements. Instead of providing inaccurate finished measurements, pattern companies, much like apparel companies, could implement tolerances. If a measurement was off by plus or minus a specific amount, for example (+/–) ½ inch, the consumer would be better informed and would not be surprised by the outcome of a finished garment.

The results of this study showed that not all brands of patterns fit the same, despite the fact that they all use the same body measurements, add the same amounts of minimum ease to draft their basic patterns, and the same range of ease amounts based on the fit categories. Fitting issues were found in all brands, with some more prevalent in certain brands.

In conclusion, this study provides information on the sizing, grading, and fit practices currently used in the commercial sewing pattern industry. This information could be used to increase customer satisfaction by producing better fitting patterns that contain more accurate information to aid sewers in achieving improved fit. This insight can also be used to increase sales by developing specialized patterns for new target markets.

Future Research

This study has alluded to several areas for future research. Only a few smaller commercial sewing pattern companies are currently using available computerized technology for pattern-making and pattern adjustments. Pattern companies could use this technology to create new ways to market customized patterns. Customers could input their body measurements and existing patterns could be modified to fit and then sent to the customer in a downloadable format. Sewers living in remote locations with limited access to retail sewing stores, or people who are housebound are among those who could benefit from computerized delivery of patterns.

Emerging methods under development by $[TC]^2$ will enable people to develop computerized body scans in the privacy of their own homes (Dr. David Bruner, VP, Technology Development, $[TC]^2$, personal communication, April 8, 2010). Body scans could be uploaded to pattern companies, who could make customized patterns. Several apparel firms are already using "virtual try-on" technology, where individualized avatars are "dressed" in virtual clothing. Pattern companies could make their patterns available on the internet for customers to try on before they buy.

Pattern companies could utilize the forthcoming ASTM D 5585 voluntary product standards, which will no longer be based solely on the hourglass figure type to sell patterns featuring two different cutting lines in the same pattern. Much like multi sized patterns are today, instead of being multi *sized*, the new patterns could be multi *shaped* and have one cutting line for curvy figures and a different cutting line for straight figures.

Major pattern companies could implement a feature used by Unique Patterns to help consumers select styles that will provide good fit. Body code symbols are used to represent six different body shapes that help consumers identify pattern designs best suited for a particular body profile.

Modern information technologies such as CAD, body scanning, and internet applications could be used as a model by pattern companies to produce individualized patterns that would greatly benefit the consumer and enhance business performance. In summary, there are infinite possibilities for future research on ways to engage and inspire the next generation of sewers to ensure this valuable skill and worthwhile hobby does not disappear.

REFERENCES

Alvanon Inc. (2005). *Alvaform Standard Series USA Missy Miss 2005.* Retrieved May 30, 2011, from http://www.alvanon.com/AlvaformMissyUS.pdf

Alvanon Inc. (2009). *AlvaForm Standard Series - US*. Retrieved June 3, 2011, from http://www.alvanon.com/M03_S04_T07_Q04.html

AME Info FZ LLC. (2011). *Burda Style Arabia launched in GCC, Egypt and Levant.* Retrieved May 27, 2011, from http://www.ameinfo.com/267296.html

American Sewing Guild. (2011). *Meet notions sponsor: Simplicity Creative Group.* Retrieved May 27, 2011, from http://www.asg.org/files/notions/sponsors/Sponsor_Simplicity.pdf

ASTM International. (2006). Annual Book of ASTM Standards - Textiles, *Standard Table of Body Measurements for Adult Female Misses Figure Type, Sizes 2-20*. Copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

ASTM International. (2011). ASTM D5585-95(2001) Withdrawn Standard: ASTM D5585-95(2001) *Standard Table of Body Measurements for Adult Female Misses Figure Type, Sizes 2-20 (Withdrawn 2010)*. Retrieved May 15, 2011, from http://www.astm.org/Standards/D5585.htm

Ashdown, S., Lyman-Clarke, L. M. & Palmer, P. (2007). Sizing for the home sewing industry. In S. P. Ashdown (Ed.), *Sizing in clothing: Developing effective sizing systems for ready-to-wear clothing* (pp. 328-346). Cambridge, England: Woodhead Publishing in association with The Textile Institute; CRC Press.

BurdaStyle, Inc. (2009a). *Sewing patterns.* Retrieved May 20, 2011, from http://www.burdastyle.com/patterns?free=1&most_recent=1

BurdaStyle, Inc. (2009b, June 17). *What is open source sewing?* Retrieved May 30, 2011, from http://www.burdastyle.com/discussions/getting-started/topics/what-is-open-source-sewing

BurdaStyle, Inc. (2009c). *Size chart: Women's size chart, Women's plus size chart.* Retrieved July 30, 2011, from http://www.burdastyle.com/statics/size-chart

Butterick Company, Inc. (1999). *Fit and fashion.* Vogue pattern #1004 (p. 1). New York, NY.

Bye, E., LaBat, K., McKinney, E., & Kim, D.-E. (2008). Optimized pattern grading. *International Journal of Clothing Science and Technology, 20*(2), 79-92. Retrieved June 9, 2011, from http://dx.doi.org.www.lib.ncsu.edu:2048/10.1108/09556220810850469

Chun, J. (2007). Communication of sizing and fit. In S. P. Ashdown (Ed.), *Sizing in clothing: Developing effective sizing systems for ready-to-wear clothing* (pp. 220-243). Cambridge, England: Woodhead Publishing in association with The Textile Institute; CRC Press.

Clendenning, A. (2001, June 1). Hanging by a thread: Oldest U.S. sewing pattern companies merging operations. *Florida Times-Union*. Retrieved July 23, 2011, from http://jacksonville.com/tu-online/stories/060101/bus_6321923.html

Clothing repair and how-to tips. (2010). *Your important choice: Choice of pattern, style, pattern size, fabric and color*. Retrieved June 17, 2011, from www.crhowto.org/successful-sewing-3.html

Corcoran, C. T. (2007). Pattern company creates community. *WWD: Women's Wear Daily, 193*(29), 30-30. Retrieved May 3, 2011, from http://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=24056706&site=ehost-live&scope=site

Cumming, V., Cunnington, C. W. & Cunnington, P. E. (2010). *The dictionary of fashion history*. Oxford, England: Berg.

Devarajan, P. (2003). *Validation of 'Female Figure Identification Technique (FFIT) for Apparel' methodology*. Master's thesis, Department of Textile and Apparel, Technology and Management, North Carolina State University, Raleigh, NC. Retrieved August 7, 2011 from http://www.lib.ncsu.edu/resolver/1840.16/2577

Durack, K. T. (1997). Patterns for success : A lesson in usable design from U.S. patent records. *Technical Communication, 44*(1), 37-51.

English, K. (N.D.) *Newsstand: 1925: The Delineator*. Retrieved May 26, 2011, from. http://uwf.edu/dearle/enewsstand/enewsstand_files/Page630.htm

Ettorre, B. (1993). Simplicity cuts a new pattern. *Management Review, 82*(12), 25. Retrieved May 7, 2011, from http://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=9407150011&site=ehost-live&scope=site

Fashiondex, Inc. (2001). *The apparel design and production handbook.* New York, NY: Fashiondex.

Federal Trade Commission. (2011). *FTC to challenge Conso International Corp.'s (Simplicity) purchase of McCall Pattern Company.* Retrieved May 20, 2011, from http://www.ftc.gov/opa/2000/08/conso.shtm

FTC v. Conso International Corporation, MP Holdings, Inc., and the McCall Pattern Company (2000, August 04). Retrieved July 26, 2011, from http://www.ftc.gov/os/2000/08/consocomp.htm

Fischer, A. (2009). *Basics fashion design 03 : Construction*. Lausanne, Switzerland: AVA Academia.

Fit Me Patterns. (2011). *Fit me patterns, about us*. Retrieved July 24,2011, from http://www.uniquepatterns.com/customer-service/about-us

Gordon, S. (2006). *"Make it yourself" : Home sewing, gender, and culture, 1890-1930. [electronic resource* 0-231-51225-2]. New York, NY: Gutenberg, Columbia University Press.
Retrieved July 20, 2011, from http://www.gutenberg-e.org/gordon/print.html

Guffey, C. (2011). *Sewing patterns, body measurements.* Retrieved July 26, 2011, from http://www.cynthiaguffey.com/sewing-patterns-new.htm

Hamilton, A., & Hylton, H. (2006). Circling back to sewing. *Time, 168*(23), 100-101. Retrieved May 3, 2011, from http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=23236790&site=ehost-live&scope=site

Handford, J. (2003). *Professional pattern grading for women's, men's, and children's apparel.* New York, NY: Fairchild Publications.

Hollahan, L. (2010). *How to use, adapt, and design sewing patterns*. Hauppauge, NY: Barron's.

Holliday, H. (2001). How 'McCall's' lost its way. *Advertising Age, 72*(11). Retrieved July 27, 2011, from EBSCO*host*.
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Hudson, P. B. (1989). *Guide to apparel manufacturing.* Greensboro, NC: MEDIApparel, Inc.

IBISWorld. (2010, October). *Fabric, craft & sewing supplies stores in the US.* Retrieved May 3, 2011, from http://www.ibisworld.com/

Joseph-Armstrong, H. (2004). *Draping for apparel design.* New York, NY: Fairchild Publications.

Joseph-Armstrong, H. (2010). *Patternmaking for fashion design.* Upper Saddle River, NJ: Pearson Education.

Ketteler, J. (2010). *Sew retro: 25 vintage-inspired projects for the modern girl & a stylish history of the sewing revolution.* Minneapolis, MN: Voyageur Press.

Knight, L. (2008). *The dressmaker's technique bible : A complete guide to fashion sewing.* Iola, WI: Krause Publications.

LaBat, K. L. (2007). Sizing standardization. In S. P. Ashdown (Ed.), *Sizing in clothing: Developing effective sizing systems for ready-to-wear clothing* (pp. 88-104). Cambridge, England: Woodhead Publishing in association with The Textile Institute; CRC Press.

LaBat, K., Salusso, C., & Rhee, J. (2007). Home sewers' satisfaction with fit of apparel patterns. *Journal of Fashion Marketing and Management, 11*(3), 429-440. Retrieved March 15, 2011, from http://dx.doi.org.www.lib.ncsu.edu:2048/10.1108/13612020710763155

MacDonald, N. M. (2010). *Principles of flat pattern design*. New York; Oxford, England: Fairchild; Berg [distributor].

Mansfield, E. A., & Lucas, E. L. (1974). *Clothing construction*. Boston, MA: Houghton Mifflin.

McCall Pattern Company. (2011). *Butterick History*. Retrieved June 7, 2011, from http://butterick.mccall.com/butterick-history-pages-1007.php

Modern living: sew & reap. (1958, November 10). *Time.* Retrieved June 11, 2011, from http://www.time.com/time/magazine/article/0,9171,938058-1,00.html

Mullet, K., Moore, C., & Young, M. (2009). Concepts of pattern grading: Techniques for manual and computer grading. New York, NY: Fairchild.

Murphey, I. C. (1993). *The influence of pattern grading on bodice fit and style sense*. PhD dissertation, Clothing and Textiles, Virginia Tech, Blacksburg, VA. Retrieved May 1, 2011 from doi: http://scholar.lib.vt.edu.prox.lib.ncsu.edu/theses/available/etd-06062008-170650/

National Institute of Standards and Technology. (2002). *Body measurements for the sizing of apparel. NBS Voluntary Product Standard PS 42-70*. Retrieved June 9, 2011, from http://gsi.nist.gov/global/docs/stds/womens-ps42-70.pdf

National Institute of Standards and Technology. (2011). *ITL history, timeline: 1950 - present.* Retrieved July 9, 2011, from http://www.nist.gov/itl/history-timeline.cfm

Newcomb, E. A. (2006). *Body shape analysis of Hispanic women in the United States.* Master's thesis, Department of Textile and Apparel, Technology and Management, North Carolina State University, Raleigh, NC. Retrieved March 15, 2011, from http://www.lib.ncsu.edu/resolver/1840.16/1820

Newcomb, B., & Istook, C. (2006a). 2005 Apparel Tech Conference – Changing the way apparel companies think about body shape. *Journal of Textile and Apparel, Technology and Management, 1*(5), available online at http://www.tx.ncsu.edu/jtatm/volume5issue1/apparel_conf.htm

Newcomb, E. A., & Istook, C. (2006b). "Using SizeUSA to improve apparel fit", presented at the IFFTI Conference in Raleigh, NC, June 20-22, 2006.

Palmer, P., & Alto, M. (2006). *Fit for real people : Sew great clothes using any pattern.* Palmer/Pletsch Publishing.

Price, J., & Zamkoff, B. (1996). *Grading techniques for fashion design*. New York, NY: Fairchild Publications.

Schofield, N. A. (2007). Pattern grading. In S. P. Ashdown (Ed.), *Sizing in clothing: Developing effective sizing systems for ready-to-wear clothing* (pp. 152-198). Cambridge, England: Woodhead Publishing in association with The Textile Institute; CRC Press.

Seligman, K. L. (1996). Cutting for all!: The sartorial arts, related crafts, and the commercial paper pattern: A bibliographic reference guide for designers, technicians, and historians. Carbondale, IL: Southern Illinois University Press.

Sewing Patterns. (2009). *Welcome to sewing patterns!* Retrieved July 1, 2011, from http://www.sewingpatterns.com/

Sharp, J. R., & Elsasser, V. H. (2007). *Introduction to AccuMark, pattern design, and product data management*. New York,NY: Fairchild Publications.

Simmons, K. P. (2002). *Body shape analysis using three-dimensional body scanning technology.* PhD. dissertation, Department of Textile and Apparel, Technology and Management, North Carolina State University, Raleigh, NC. Retrieved August 8, 2011, from http://www.lib.ncsu.edu/resolver/1840.16/5555

Simmons, K. P., Istook, C., & Devarajan, P. (2004a, Summer). 'Female Figure Identification Technique (FFIT)' for apparel, Part II: Development of shape sorting software. *ournal of Textile and Apparel, Technology and Management 4*(1), 1-15. Available online at http://www.tx.ncsu.edu/jtatm/volume4issue1/articles/Istook/Istook_full_107_04.pdf

Simmons, K. P., Istook, C. , & Devarajan, P. (2004b, Summer). 'Female Figure Identification Technique (FFIT) for apparel', Part I: Describing female shapes. *Journal of Textile and Apparel, Technology and Management 4*(1), 1-16. Available online at http://www.tx.ncsu.edu/jtatm/volume4issue1/articles/Istook/Istook_full_105_04.pdf

Simplicity Pattern Company. (2009). *Simplicity fit guide*. Retrieved June 1, 2011, from http://www.simplicity.com/images/downloadablePDF/0159_FIT_GUIDE_English.pdf

Simplicity Pattern Company. (2011). *Simplicity® body measurement charts-imperial measure.* Retrieved June 30, 2011, from http://sewingpatterns.com/simplicity-charts2.html

Szeless, M. (2002). Burda fashions -- a wish that doesn't have to be wishful thinking: Home-dressmaking in Austria 1950-1970. *Cultural Studies, 16*(6), 848-862. doi:10.1080/0950238022000034219

[TC]². (2004a, February). *The National sizing survey, women: body measurement and data analysis reports on the U.S. population.*

[TC]². (2004b, September 22). [TC²] Activity, SizeUSA. *Weekly Technology Communicator.* Retrieved June 9, 2011, from http://www.tc2.com/newsletter/arc/092204.htm#tca

Taylor, P. J., & Shoben, M. M. (1990). *Grading for the fashion industry : The theory and practice.* Cheltenham, England. Stanley Thorns (Publishers) Ltd.

The Press: Old Queen, New Dress (1932, September 12). *Time.* Retrieved July 23, 2011, from http://www.time.com/time/magazine/article/0,9171,744371,00.html

Walsh, M. (1979). The democratization of fashion : The emergence of the women's dress pattern industry. *The Journal of American History, 66*(2), pp. 299-313. Retrieved June19, 2011, from http://www.jstor.org.www.lib.ncsu.edu:2048/stable/1900878

APPENDICES

Appendix A.

Body Measurement Chart (inches)

Sizes		6	8	10	12	14	16	18	20	22
Sizes-European	0	2	34	36	38	40	42	44	46	48
Bust	29 ½	30 ½	31 ½	32 ½	34	36	38	40	42	44
Waist	22	23	24	25	26 ½	28	30	32	34	37
Hip-9" below waist	31 ½	32 ½	33 ½	34 ½	36	38	40	42	44	46
Back Waist Length	15 ½	15 ½	15 ¾	16	16 ¼	16 ½	16 ¾	17	17 ¼	17 ⅜

Note. From Simplicity Pattern Company (2011). For women 5'5" to 5'6" without shoes.

Appendix B.

Garment Images

Images of Size 10 and 18 Garments Made from Five Major Brands of Commercial Sewing Patterns

Burda

Front
Burda Torso sz 10

Side

Back

Front
Burda Torso sz 18

Side

Back

Butterick

Front
Butterick Torso sz 10

Side

Back

Front
Butterick Torso sz 18

Side

Back

McCall's

Front
McCall's Torso sz 10

Side

Back

Front
McCall's Torso sz 18

Side

Back

New Look

Front
New Look Torso sz 10

Side

Back

Front
New Look Torso sz 18

Side

Back

Vogue

Front
Vogue Torso sz 10

Side

Back

Front
Vogue Torso sz 18

Side

Back

Comparison of Garment Fronts

Burda Butterick McCall's New Look Vogue

Torso Fronts sz 10

Burda Butterick McCall's New Look Vogue

Torso Fronts sz 18

Comparison of Garment Backs

Burda Butterick McCall's New Look Vogue

Torso Backs sz 10

Burda Butterick McCall's New Look Vogue
Torso Backs sz 18

Comparison of Garment Sides

Burda Butterick McCall's New Look Vogue
Torso Sides sz 10

Burda Butterick McCall's New Look Vogue
Torso Sides sz 18

Appendix C.

Comparison of Fit Problems

Summary of Subjective Fit Evaluation of Garments Made from Five Pattern Brands in Two Sizes

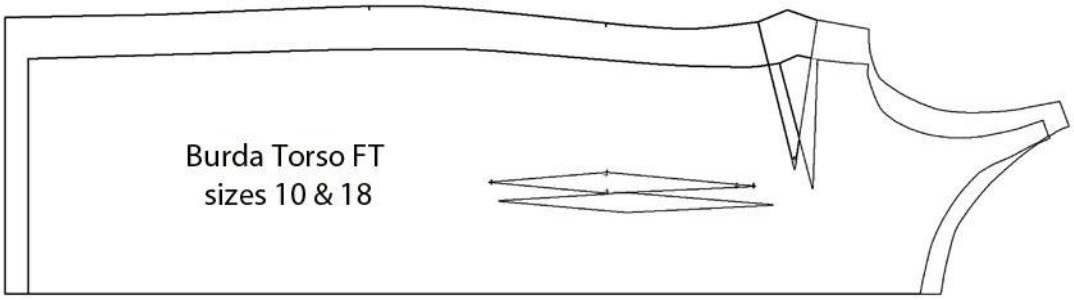
Fit Locations	Bust	Neck	Shoulder	Armhole	Waist	Hip
Burda						
10	½" too low Snug fit	Good	Good	gapping	Good	Snug fit
18	½" too low Snug fit	gapping		gapping		Snug fit
Butterick						
10	½" too low		Too wide—1/4" beyond armscye	Too wide and too low		
18				Too wide and too low		Too tight
McCall's						
10	1" too low			Too large and too low with gapping		
18				Too large and too low with gapping		
New Look						
10	¾" too low	Good	good	Good	Good	Good
18	1 ¼" too low	good	good	Gapping	Good	Good
Vogue						
10	½" too low	Good	Good	Too wide and too low	Good	Extremely Tight
18	½" too low Too loose	Good	Good	Too wide and too low	Good	Snug

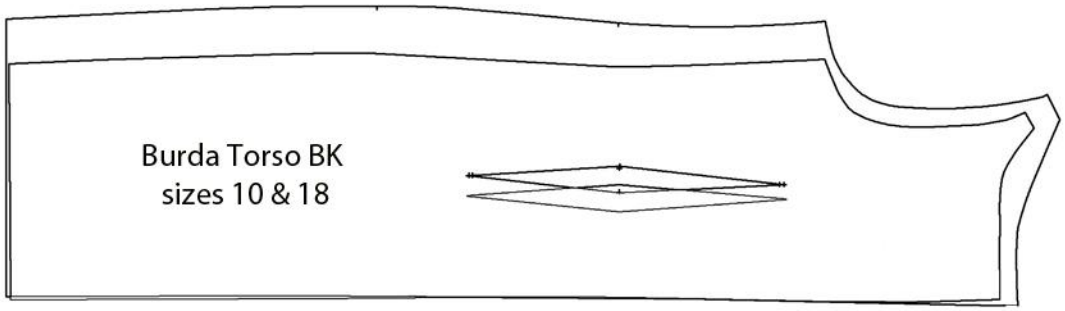
Appendix D.

Images of Nested Patterns

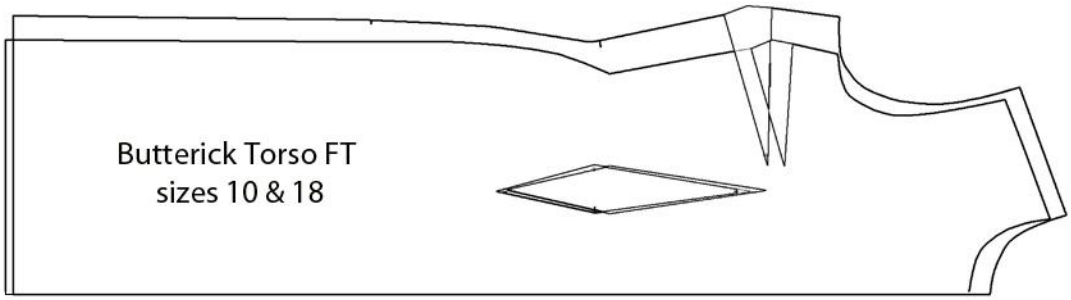
Nested Size 10 and 18 Patterns from Five Major Brands of Commercial Sewing Patterns

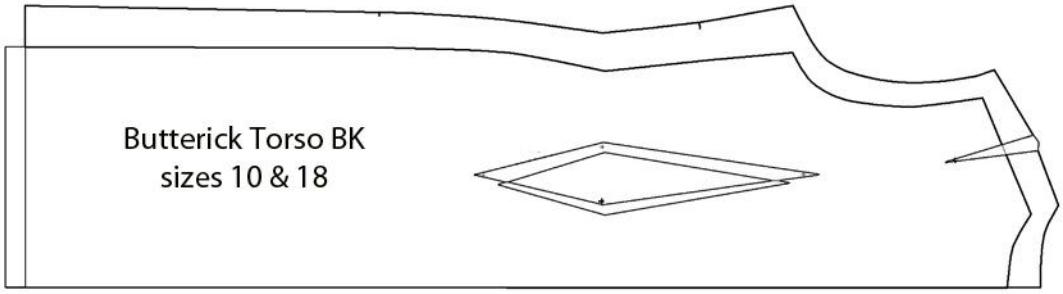
Burda



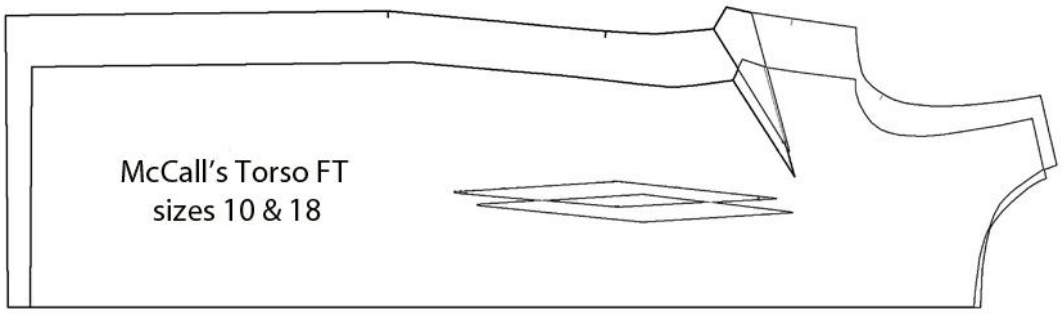


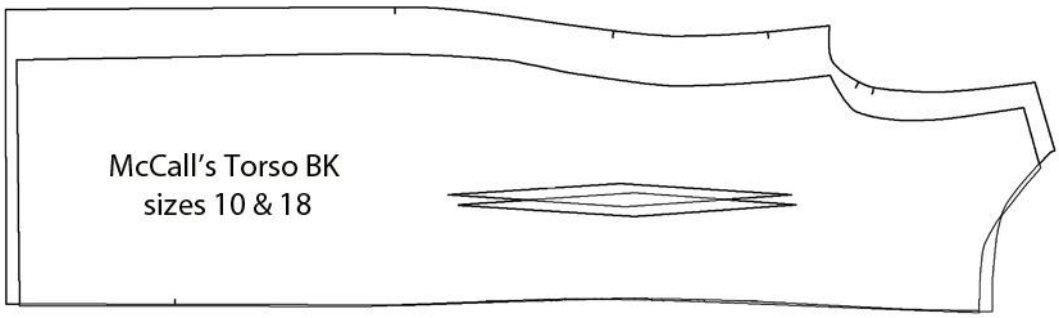
Butterick



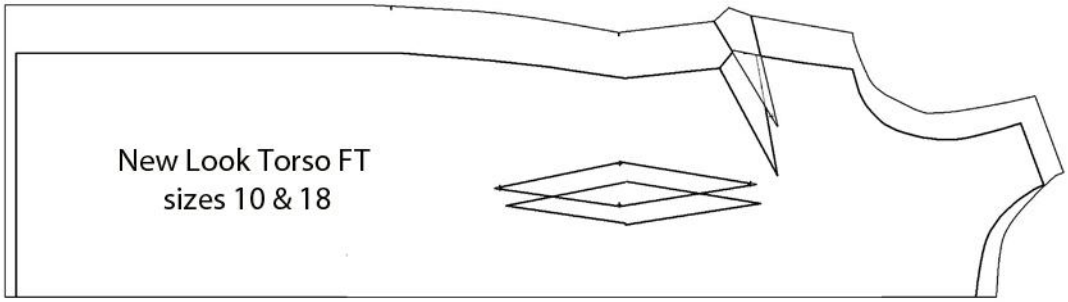


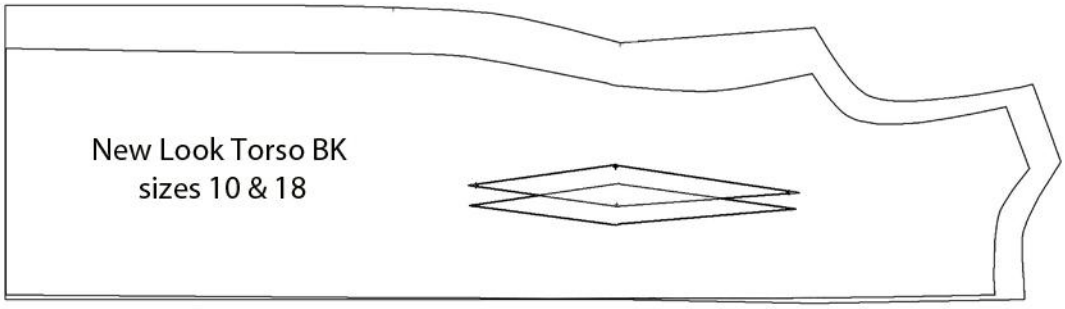
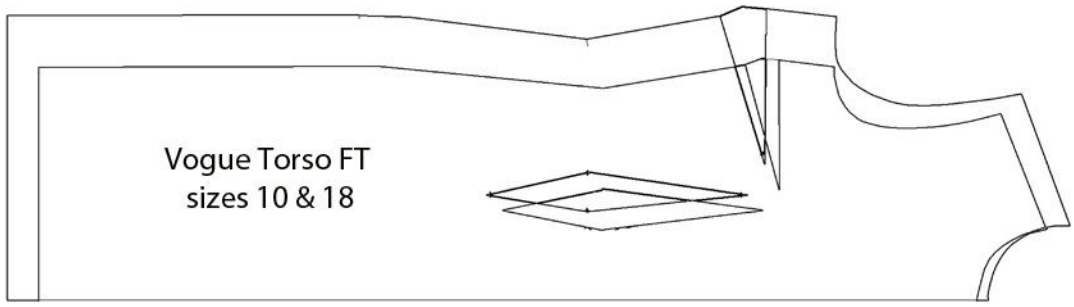
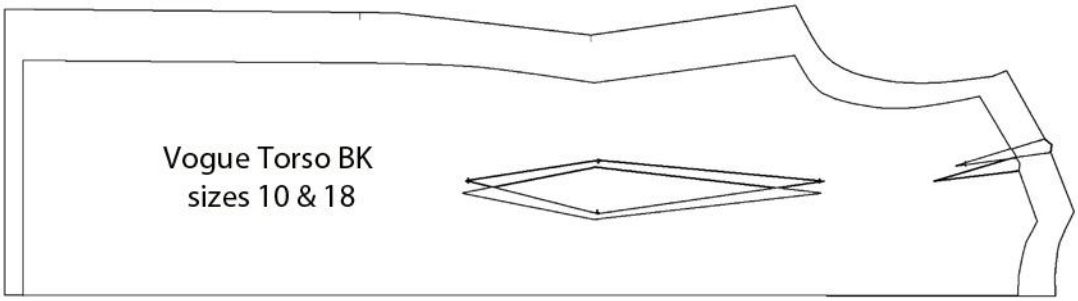
McCall's




McCall's Torso BK
sizes 10 & 18

New Look


New Look Torso FT
sizes 10 & 18


New Look Torso BK
sizes 10 & 18

Vogue