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# BOWLING ALONG

A Design Model for a Small Business Niche Market



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## **ABSTRACT 2006**

### **BOWLING ALONG**

Lawn bowls is an outdoor sport which can be played all year round on a rink of either grass or astro-turf. Traditionally the game has attracted older or more mature players as it is a non contact, low impact and social sport but in recent years younger people are also enjoying the game. Since Sports TV has hit the screen, many sporting codes have made radical changes to their dress code and their game to make it more exciting for television viewers to watch.

Little investigation has been carried out into the changes in the style of dress for lawn bowls. Although there is still a need to conform to dress requirements for competition play, in recent years logos in club colours have been printed onto the traditional white shirts.

This study evaluates a number of design models used in the production of apparel. A preliminary model was created and used to develop a set of clothing for women lawn bowlers based on information gathered from the target market, available literature and visual analysis of clothing worn for lawn bowls in New Zealand over the period 1940 to 2006. The clothing was wear trialled and results evaluated and reflected upon. Through design practise, a new design model is created that is particularly relevant to small businesses manufacturing ergonomically designed sports apparel for a niche market.

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## GLOSSARY

<b>AATCC</b>	American Association of Textile Chemists and Colorists. This is a society devoted to the advancement of textile chemistry that provides details of technical standards, regulations, specifications, logistics data and industrial catalogues etc. It also seeks to promote research and increase knowledge of the application of dyes and chemicals in the Textile Industry.
<b>Astro turf</b>	A manmade product resembling grass that provides a surface that can be played on all year round.
<b>Bias cut</b>	Fabric cut at a 45° angle from the warp or weft to enable maximum stretch in the fabric.
<b>Blind tests</b>	Tests where participants are unable to view the product being assessed.
<b>Block pattern</b>	A basic pattern from which style adaptations are made (Shaeffer, 1989).
<b>CAD</b>	Computer Aided Design. Computer software programmes that design, produce and manipulate patterns and create lay plans.
<b>CMT factory</b>	Cut, make and trim. Refers to a factory which undertakes to manufacture clothing from a given design. Patterns are usually supplied and the finished garment returned to the designer for distribution.
<b>Crocking</b>	The transference of colour from the surface of a coloured fabric to another fabric, principally by rubbing.
<b>Design (garment)</b>	The style and shape of a garment or combination of garments.
<b>Design (model)</b>	A system or process of creating, producing and marketing a range of garments.
<b>Ergonomic</b>	In this thesis, ergonomics relates to garments that have sufficient ease built into the pattern to allow for unrestricted movement without compromising the fit or design.
<b>Grading</b>	A method for increasing and decreasing patterns proportionally from one size to another in order to make a complete range of sizes (Shaeffer, 1989).

<b>Grade rules</b>	The set amount of increase or decrease designated to each grading point for any given pattern piece (Shaeffer, 1989).
<b>Grinning</b>	Stitching defect caused when threads are loose; the seam spreads to show the stitches which look like teeth in a grin (Laing & Webster, 1998).
<b>Hydrophilic layer</b>	A fabric layer in a material or garment which attracts and holds moisture.
<b>Lay</b>	A stack of fabric plies superimposed one on top of another.
<b>Lay-plans</b>	The placement of pattern pieces to meet technical requirements and to maximise fabric utilisation on any given lay.
<b>NZWBA</b>	New Zealand Women's Bowling Association.
<b>Polar fleece</b>	A brushed woven or knitted fabric generally made from synthetic fibres. The fabric is used mainly for casual or sports clothing because it is light and easily laundered (Collier & Tortora, 2001).
<b>Seye</b>	The underarm point from which shaping for the armhole begins.
<b>Seam slippage</b>	Fabric damage when yarns pull away from stitching lines because of excessive strain in the affected area (Laing & Webster, 1998).
<b>Semiotics</b>	The study of signs and symbols within the written word which transfer messages or express ideas, meanings and concepts to the reader.
<b>Skort</b>	A garment which is a cross between a skirt and shorts. The front is designed to look like a skirt with a centre front inverted pleat and the back to look like shorts.
<b>Toile</b>	A sample garment usually constructed in a similar or the same fabric as the intended final garment.

# CHAPTER 1

## INTRODUCTION

### 1.1 Overview of thesis

As the popularity of lawn bowls increases and more people, particularly young people take up the game of lawn bowls, there may be an increased demand for bowling apparel which is contemporary, functional and affordable. In this thesis, a model will be developed for the design, construction, and evaluation of a range of clothing for women lawn bowlers. The model will need to take into account those women with fashionable to more traditional tastes in apparel and will accommodate the diverse needs of a target market that ranges from young women to more mature players, from novice and/or recreational bowlers to competitive national and international players. Thus the primary aim of this research is to identify an effective design process and model to address the changing clothing needs of women lawn bowlers.

The development of desirable properties in new fibres and fabrics, people's perceived needs, functions of clothing for all occasions and the influences of fashion are forever changing and evolving with time and technology. The distinction between sportswear and street wear has become blurred and garments designed primarily for sportswear are now designed to be multifunctional and more versatile. Street clothing often displays logos of particular sporting codes or multinational companies like Nike and Adidas for example. Often a combination of national and/or club colours are included on the garments in response to sponsorship and multimedia promotions.

The design model needs to be able to be quickly adapted by the designer to meet consumer demands. Any model for a production process needs to encompass and integrate these aspects and allow for reflection and evaluation of each stage in the

production process. So that any market opportunity is not lost, the process also needs to be able to be achieved within an appropriate time frame (Deasy, 2003).

## 1.2 Background / context / significance

One of the first reports of New Zealand women participating in the game of lawn bowls was cited in The Otago Press in 1894 (Figure 1.1). A lady bowler was noted displaying considerable skill and “ventured to dispute the supremacy of men on a New Zealand bowling green”.



**Figure 1.1 Women take to the Green.**  
(Source: The Otago Press 9/1/1894, page 4).

Kelburn was the first New Zealand women’s bowling club formed in 1906. Although women played socially from the early 1900s, many women were likely to be found in the kitchen making the afternoon tea for the men. Women’s bowls really did not take a hold until after the New Zealand Women’s Bowling Association was formed in the South Island in the 1930s. Bowls became more popular with women after the Second World War when a nation wide organisation was formed in 1947 - 48, however women’s clubs were slow forming as the men owned the greens (Barlow, 2005; Coney, 1993). The New Zealand Woman’s Bowling Association had their inaugural meeting at the Otago Ladies’ Bowling Association Pavilion in 1947

(Barlow, 2005). At this meeting the women proposed to adopt the rules of the men's association – The New Zealand Bowling Association – 'with alterations and additions to suit the Women's Council' (minutes of the 1948 annual meeting, Barlow, 2005). These rules were mainly concerned with uniforms and tournament rules. At their 1949 annual meeting, the New Zealand Women's Bowling Association defined the regulation bowling uniform as 'white dresses with petticoats, sleeve length six inches from the shoulder, white bowling hats, bowling shoes (no wedgies) and stockings must be worn' (minutes of the 1949 annual meeting Barlow, 2005). Modifications were made to this rule in 1952 when cream uniforms were allowed, although the proposed challenge to the dress length was overturned and the length remained at 12 inches from the ground regardless of the height of the wearer. Accessories also had to be white and included a Panama hat, a cardigan and handbag (Regulation Dress Code, 1957). During a discussion and interview with June Best, a Centre Umpire, she said:

*"At that time the fabrics available and the cut and style of the clothing was inappropriate for the amount of movement required in the game and the uniform as such was unflattering for many."*

(Best, 2005 personal communication).

Necklaces and other jewellery were not permitted and smoking was not allowed on the green. More than one woman was known to give up the game because of the strict dress code (Barlow, 2005).

*"Records show that the issues surrounding women's dress codes would appear on most Centre and national meeting minutes for the next 50 years"* (Barlow, 2005).

In more recent years there have been many challenges to this rigid dress code (Barlow, 2005). Trousers and shorts have become acceptable dress on the green and the introduction of colour in shirts or tops to denote clubs is very popular and in some cases mandatory wear during tournament play (Else, 1993). At the Johnsonville Bowling Club, Wellington, women are still required to wear 'whites' for club play. Club colours have been introduced into T-shirts and wind-breakers

and these can be worn for identification during tournaments so long as the whole team wear the same garments of the same colour/design (Bowls New Zealand Laws of the Game, 2004). The New Zealand Women's Bowling Association (NZWBA) is the current governing body for women's lawn bowling in New Zealand. It sets the uniform code, rules and procedures for play, and organises national and international teams and tournaments (Else, 1993).

In New Zealand today, lawn bowls is a popular outdoor sport which can be played all year round on a rink of either grass or astro-turf. In recent years there has been a dramatic increase in the number of people playing bowls and in particular women. In 1991, the New Zealand Bowling Association had over 30,000 members in 614 clubs in 26 provincial centres (Else, 1993). Today there are 27 provincial centres and 727 clubs in New Zealand, around 50 of which are women's only clubs (Cairns, 2006). Most of the women's only clubs play on shared sites, like the Rotorua Bowling Club where the men's and women's clubs are on the same site and use the same facilities (Cairns, 2006). According to the membership returns to Bowls New Zealand for the 2005 to 2006 season, over 89,600 people play lawn bowls, and at least 33,507 of these are women (Cairns, 2006). These figures relate to those people who are paid up members of bowling clubs but it is thought by the Communication Executive for Bowls New Zealand, that there are considerably more people playing bowls who are not officially members of a club (Cairns, 2006). This fact is born out by the number of clubs around New Zealand who encourage the general public to participate in 'Business House' bowls tournaments and business firms who hire bowling clubs' facilities for social work functions (Torbit, 2006).

Traditionally the game has attracted older or more mature players, as it is a non contact, low impact and social sport which does not require high levels of fitness. Around one fifth of New Zealand men and women over the age of 65 play bowls, making it one of the country's most popular sports (Schaer, 2005). However an increasing number of young people are taking up the game of lawn bowls according to Bowls New Zealand marketing and development manager David Parker (Parker, 2005 personal communication). The challenge of a new sport that anyone can play

and an opportunity to socialise with a new group of people seem to be the draw cards. Some Wellington bowling clubs have taken the initiative to encourage younger players by introducing business-house [social evenings] and youth bowls as well as hosting corporate functions while popular local bands provide the music and entertainment during and after the game (Torbit, 2006). Many Wellington business firms have taken advantage of the facilities offered by bowling clubs and included a game of bowls as part of the social outing for their staff. These initiatives have definitely encouraged more young people into the game as is born out by the success of a teenage fours team from Gisborne who were runners-up in the finals of the New Zealand National Competition 2006, and the success of nineteen year old Shannon McIlroy a member of the New Zealand squad for the 2006 Commonwealth Games in Melbourne (Newton, 2005; Torbit, 2006). Shannon McIlroy is keen to see more young people enjoying the challenge of lawn bowls rather than the stereotypical contact sports like rugby and netball (Curin-Birch, 2005). Secondary school students have their own annual national tournament which attracts students from all over the country.

*“An age-old game for old age no longer. Lawn bowls is enjoying a renaissance as the young urban chic flock to the greens for a game once considered outdated and dreary. Bowls is seen as the new Kiwiana cool and a surge of interest is injecting an unusual fusion into the code”* (Torbit, 2006).

If lawn bowls is to attract more women and especially young women to clubs around New Zealand, then evidence suggests that the image of the game needs to be perceived as a contemporary, fun and a worthwhile sport and not a sport only for older people (Torbit, 2006). The aesthetics of the sport's clothing and equipment may be especially relevant to the young where personal image is often very important. To help promote this contemporary image, the prescribed uniform should keep up to date with current trends in fashion (Diamond & Diamond, 2002). The more mature women bowlers may also like to look smart on the green, but anecdotal evidence suggests that they often have difficulty finding appropriate clothing which not only fits and flatters their figures but also affords the required amount of

unrestricted movement. In New Zealand, white trousers and shorts are an acceptable mode of dress to be worn on the green. Anecdotal evidence suggests that many women currently purchase their trousers and shorts for bowling from regular clothing outlets. These garments are not designed as specialised sports apparel therefore the cut of the garments and the fabrics used may not meet the demands of the amount of stretch and movement required. Women bowlers are often encouraged to buy the club T-shirts and windbreakers sold through their clubs. These are often designed primarily for men and this practice suggests that many women may have to compromise on fit if they wish to wear the club uniform (Herlihy, 2005).

During an interview with BBC Sport online, Nigel Oldfield, Chief Executive of the World Bowls Tour 2001 indicated that Indoor Bowls in England has seen radical changes since it has become televised. To make the game more exciting for television viewers to watch, the game had to evolve to maintain audience interest. Some of the rules have changed to make the game faster, more dynamic and be completed within a shorter time frame, including sudden death finishes. The 'green' is now blue and the bowls are matched to the colour of the players' clothing kit (Oldfield, 2001). Lawn bowls in New Zealand has recently seen the introduction of coloured bowls. Some professional bowlers use these in tournaments so that their bowls can be easily distinguished from those of their opponents. 'Whites' are still commonly worn, but colours and coloured logos are being used on T-shirts and jackets. Coloured clothing for lawn bowling clubs in the United States of America and Canada is common place and each club has its own colours (Bannerman, 2005). If lawn bowls is to compete with other sports for membership and media coverage, Barlow (2005) claims that the sport of lawn bowls needs to change its image so that both younger and middle aged women will be attracted to the game. New stretch and knitted fabrics could be employed to give a more streamlined look to the bowling image and comfortable clothing may not only go a long way to dispel the myth that lawn bowls is only for the older generation but could make television viewing more interesting. In order to establish whether a need exists for contemporary bowling clothes for women in a New Zealand context, further research is needed to confirm and evaluate their requirements.

### **1.3 Aims and objectives**

Through research and reflection, this research aims to develop a design model that could enable a range of women's lawn bowling clothes to be developed, trialled and evaluated. The model will need the flexibility to encompass the possibility of conflicting aesthetic and functional requirements of a diverse target market. Arising from these aims, the following objectives have been identified.

#### **Objective 1**

Based on research in practise, a model will be developed for the design process that could be used to inform future designs and that is particularly relevant for the diverse market. Reflection on practise will focus on the appropriateness of the model for small businesses manufacturing ergonomically designed sports apparel for a small niche market.

#### **Objective 2**

This research will evaluate and document the changing fashion influences on the dress code for women lawn bowlers in New Zealand. Because women's bowling clubs in New Zealand did not exist as a separate entity from men's bowling clubs until the late 1930s, national rules for a dress code for women bowlers were not established until 1940. Therefore this study will focus on the decades from 1940 – 2006. Qualitative measures are used to analyse the bowling dress in each decade from 1940 to the present day, and influences of street wear fashion on women's bowling dress is observed.

#### **Objective 3**

A range of clothing for women bowlers will be designed and produced. The range will be based on information gathered from researching the target market, by using questionnaires, focus groups and interviewing a wide age range of current women lawn bowlers. Similarities and differences of the women's opinions will be identified in order to incorporate their needs into a design for a bowling uniform.

## **1.4 Overview of methods**

Based on information gained from the literature review, historical research, focus groups, interviews, questionnaires and fabric testing, a set of clothing for representative and social women bowlers will be designed, constructed and the performance evaluated. The effectiveness and/or acceptability of the garments will be evaluated through wear trials, and a model for the design process developed.

This research encompasses the following stages:

- **Literature review.**

The purpose of this literature review is to evaluate significant published literature on aspects pertaining to this topic such as:

- Design criteria;
- Design processes and models;
- Methods of visual analysis of dress;
- High performance sports fabrics, testing methods and construction techniques;

The selected literature evaluates and discusses the relationships between the literature and different sub issues within this research. Information was gathered from a variety of sources including books, journals, conference papers and reports, newspapers, magazines, personal communications and the internet.

- **Historical and archival research.**

This research qualitatively examines visual characteristics of women's dress worn for the game of lawn bowls from the 1940s to the present day and evaluates its relevance to the context of the sport today. Sources of information include photographs from books, magazines and bowling club archives, past minutes from Bowling Club committee meetings, personal interviews with Bowls New Zealand personnel and past and present women bowlers.

- **Research through practise.**

Interviews with women bowlers will identify criteria that are perceived as relevant to the design, construction and performance of clothing for the sport of lawn bowls. In particular the researcher will seek to identify whether the target market is a homogeneous group or whether differences exist between younger and more mature players.

Information will be gathered using:

- focus groups;
- questionnaires;
- fabric testing;
- wear trials of the prototype garments and the finished garments.

Through practise a range of bowling clothes will be designed, made and evaluated in order to develop a model for the ongoing production of women's bowling apparel. In order to guide the design of women's bowling clothes in relation to functional and aesthetic criteria and address the need for the garments to be multifunctional, design criteria such as those listed below must be elucidated:

- Fit and issues relating to perception of fit;
- Comfort issues and protection from the weather;
- Ease of donning and doffing;
- Physical characteristics of appropriate fabrics including fibres, yarns, fabric structure and garment construction issues;
- Expressive issues associated with the team nature of sport;
- Styling and aesthetic issues.

This investigation also explores the types of fabrics on the market suitable for this project and their availability. Consultation with Bowls New Zealand will ascertain the needs or requirements for clothing for women lawn bowlers including women's national or regional representative team uniforms. The garments produced will be trialled and evaluated by women bowlers during two National Tournaments in

December 2005 and January 2006. The results and implications of this research are discussed in Chapters 4 and 5.

## **1.5 Structure of Thesis**

### **Chapter 1 Introduction to thesis**

Introduction to thesis, background, aims and objectives.

### **Chapter 2 Literature review.**

The literature review reviews the published literature available pertaining to the theory of design and design models for apparel development and production appropriate for the fashion industry. Consideration is given to new fabric technology and construction issues concerned with sports wear. There are also descriptions of methods of assessing fit and comfort factors through wear trials.

### **Chapter 3 Methods.**

Describes the methods and materials used to produce the prototype garments based on a preliminary production model.

### **Chapter 4 Results.**

Analyses the visual changes of women's bowling dress from 1940 to the present day to aid the design process. The performance of the prototype garments during wear trials are also analysed.

### **Chapter 5 Evaluation.**

Describes how the research through practise has influenced the development of a new model for the ongoing production of women's bowling clothes.

### **Chapter 6 Conclusion and recommendations.**

Presents conclusions and recommendations for further study.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Design research**

Design research and its application to research projects, is a topic hotly debated by theorists and practitioners in the fields of design and in the creative and performing arts. The present thesis encompasses creativity and design research in the development of a design model for the ongoing and future development of sportswear to meet the functional and aesthetic needs of a wide age and size range of women lawn bowlers.

Nigel Cross (1984) described design as beginning with a need. Where the need is not automatically met because of certain obstacles or gaps, like the ever-changing popularity of fashion, fabrics and the whims of a diverse target market, then the formulation of a prescription to solve obstacles constitutes a design problem. This present research identifies the need for a plan or model that will allow the ongoing development of a range of sportswear for women bowlers. The design problem as described by Cross (1984), is a complex of sub issues that can be dealt with in a characteristic way by means of research, working drawings, value judgements etc. Once an acceptable solution is found to each of these sub issues, they need to be reconciled with one another (Cross, 1984). This sets the basis for a design model to be developed.

In order to address the sub problems in the initial stages of research, Deasy, (2003) suggests the designer/researcher seeks expert advice, includes ethnographic methods, builds in time for an iterative process and makes sure that the chosen methods for extracting data address all areas of the hypothesis that need verifying. Jones, (1963) and Downton, (2003) suggest the possible sources of information for the researcher are literature, photographs, internet searches, experienced persons, observations and experiment. Raheel (1994) suggests the designer should interview their clients and

then observe them in action in the environment in which the garments are to be worn. If this is done at the beginning of the design process, pitfalls in the final design can often be largely avoided. These same ideas have been reiterated by Deasy (2003), and have for this present research been incorporated into the methods described in Chapter 3. Deasy (2003) and Inez, Kohn and Ashdown (1998) advocate the use of the video and photography to record observations during the execution of any research so that an event or happening can be analysed objectively at a later date and sources of error inherent in subjective judgements can be eliminated. Inez et al (1998) found the use of video recordings particularly useful in their research into the fit of women's jackets. Because design is primarily experimental, visual and contextual, it is critical that verbal or written data is employed to inform during the design process and that compilation of the material is carefully indexed for future retrieval (Deasy, 2003). Deasy (2003) suggests that one of the dangers of design research is that it is often based on faulty assumptions and any assumptions about the intended research topic should be examined thoroughly. Deasy also points out that participants should be asked for their opinion or invited to respond to the theories of the researcher and that open ended questioning and active listening during interviews encourages discussion. Open ended questioning techniques were used by Echman, Damhorst and Kadolph (1990), when collecting data regarding in store purchase decisions made by women.

In the present research, consultation during focus groups, individual interviews with women bowlers and further discussion after the garments have been wear trialled, along with photographic evidence are employed to help eliminate any preconceived ideas or assumptions made by the researcher. The inclusion of interviews with experts in the areas of fabrics and manufacturing could help to eliminate potential problems early on in the pattern development, design and construction stages of this research and give time for the reassessment of several prototypes before making the final garments.

### 2.1.1 What is design?

Mauger (2003) and Joseph (2003) agree that design covers a broad field with a mixture of both practical activities and theoretical knowledge.

*“Product development within the design practice area draws heavily on the knowledge from research and development in inclusive design concepts involving both client and designer, that accelerate progress and innovation”* (Mauger, 2003).

Durling, Friedman and Gutherson (2002) maintain that the aim of academic research is to establish data through research methods rather than within studio practice. In some instances design research is considered a field of thinking and pure research, and is seen as a careful and academic investigation using appropriate methods, while design practice or applied research involves the integration of technology and design to assist in the advancement of innovation and to capture markets (Durling, Friedman, & Gutherson, 2002; Scrivener, 2002). Cross (1999) claims that “works of design are also works of research”, and state that the best examples of design research are purposive, inquisitive, informed, methodical and communicable (Cross, 1999). However, Laurel (2003) tends to favour a discovery led approach in which creative ideas are generated through a more serendipitous experimental method of working. Press and Cooper (2002) contend that design research is no longer a stab in the dark and careful investigation using appropriate methods underpins the future of any design work while Scrivener (2002) frames his theory of design research as:

*“a complex series of iterative stages that are recorded systematically and subject to a high degree of subjective interpretation and personal discovery”* (Scrivener, 2002).

When referring to artefacts in art and design research, Biggs (2002) describes research as:

*“a combination of objective and critical exegesis outside the object that communicates the ways in which research contributes to the advancement of knowledge”* (Biggs, 2002).

During this present research, a number of different approaches or systems for design research have been researched and several tripartite structures have emerged.

Frayling (1993) and Cross (1999) have adopted Herbert Read’s concept of three models of design research based on research into design, research by design and research for design even though Read’s distinctions deal with education and with pedagogy not with design research (Cross, 1999; Frayling, 1993).

Based on the writings of Richard Buchanan (Buchanan, 2001), Jeamsinkul and Sawadichai (2002) developed a system which is not restricted to the practice of design but applies to the more philosophical areas of design research. The model promoted by Jeamsinkul and Sawadichai (2002), encompasses:

- **Basic research** - fundamental knowledge is sought in order to establish significant facts and connections in the area of design;
- **Applied research** - focuses on how to do things and in turn allows the development of theories or models in order to establish connections and thus predict the future in particular situations;
- **Clinical research** – is applied research in a specific context. The information gained cannot be directly applied to other situations. This level of research is most used by designers and design researchers (Jeamsinkul & Sawadichai, 2002).

Downton uses the terms research for design, research about design and research through design (Downton, 2003). Downton’s research for design draws a parallel with basic research (Jeamsinkul & Sawadichai, 2002) in that it is predominantly concerned with the gathering, analysis and interpretation of information and is intended to expand the current knowledge on a topic. Downton interprets research

for design in three ways and he suggests the designer may utilise one or all of these interpretations depending on the desired outcome.

**Research for design** can be interpreted in several ways:

- To provide information and data about design which in turn inspires further investigation to take place;
- To provide information that supports a theory of design and can give clear direction for further investigation;
- To improve an already existing design (Downton, 2003).

**Research about design** is encapsulated in the statement ‘what is design, what is it about, what is it for and why do we have it?’ (Downton, 2003). The focus is on learning how to design and that practising that design will in turn lead to good design. Downton, (2003) discusses various methods of carrying out the design process and appears to concur with Asimov (1962) and Cross (1999), that there are several steps to research about the design process. Downton describes four sequential steps to the resolution of a design problem:

- **Analysis of the problem.** To critically examine and evaluate information that will guide in the decisions made regarding the design or the final outcome of a design project. In the case of this research, the problem is identified as the need for a set of sports clothing that will meet the various requirements of women lawn bowlers. Suitable fabrics and styles need to be investigated and evaluated in regards to their properties, characteristics and capabilities. The results from focus groups and questionnaires should also provide valuable information on which to base further investigation;
- **Synthesis of possible solutions and evaluation of these proposals.** A collection of alternative ways of solving the identified problem is made and some judgement made of these alternatives. The types of fabrics available, fashion influences, ergonomics of sports clothing and fit issues, will be

investigated and a selection made of the most suitable possibilities found based on performance, aesthetics and cost;

- **Choosing between alternatives solutions.** From the evidence gathered, the best choice of the possible solutions can be made. Problems can occur at this point as the choices are made by those who design the method and not by those who will ultimately use the solution therefore evaluation should be conducted by the people affected by the design outcome. Focus groups and questionnaires could help to clarify the preferred choices of the target market in this research;
- **Revision and evaluation of the decisions.** Where the outcome is relatively small and not a 'one off' as in a large building, an iterative approach can be employed to reassess the problem and outcomes. One of the dangers of design research is that it is often based on faulty assumptions. Deasy (2003) suggests that any assumptions about the intended research topic be examined thoroughly. Therefore consultation with the stakeholders is seen as paramount as a failure to do so could mean the needs, requirements and desires of the stakeholders may not be addressed and the final outcome or product may not meet consumer demands (Press & Cooper, 2002). Results from wear trials and evaluation of the prototypes carried out by women bowlers could help to address this problem in the present study and information gained from further questionnaires and discussion groups will enable the prototype to be further developed and refined.

All the above points will be relevant for consideration during the styling, pattern development and construction of the prototype designs for women's bowling clothing.

Like Downton (2003), Press and Cooper (2002) also suggest there are four main categories basic to the design process which include formulation, evolution, transfer and reaction but unlike Downton they suggest that these are not necessarily carried

out sequentially. One area often overlaps another as understanding is gained through the consultation and research processes. They describe their categories as:

- **Formulation** deals with defining the problem or concept by means of observations of trends and/or general market research;
- **Evolution** involves the generation of ideas and consumer testing of these ideas. Gathering the responses of the consumer is critical at this point so that refinements to the product can be made;
- **Transfer** refers to the implementation and production and subsequent launching of the product;
- **Reaction** addresses the outcome of the design. It also evaluates the responses of the stakeholders and the knowledge gained by the designer, (Press & Cooper, 2002).

Downton (2003) states that research through design is a way of researching and producing knowledge and using that knowledge of 'doing' together with knowledge 'gained for research', to produce a drawing, a model or an object. Downton (2003) also suggests that there are various forms of knowledge:

- Knowledge-how is practical knowledge of how to do something;
- Knowledge-that is factual knowledge, gained from reading and study;
- Knowledge-of means being acquainted with and knowing of the existence of something rather than having factual knowledge or knowing how to do something.

*"Design knowledge consists of the knowing and knowledge designers have and use concerning design and how to do it. They use the skills they have as designers, the knowledge of their discipline and knowledge from other sources as necessary."*  
(Downton, 2003).

Downton raises the question whether designing is aimed at achieving an outcome with a physical existence or can include or consist of a representation of an outcome

on paper. It would appear that a tangible object overtly displays the designer's intention and is then open to the viewer's or user's interpretation of the function and use of the object. Any design conveyed by script alone is dependent on the reader's understanding of the language used and the reader's imagination to visualise the final outcome. Downton goes on to suggest that research through designing is personal and the results can vary according to the individual's expertise in the subject therefore each result is unique and can not be replicated by another person. Again this idea draws a parallel to the idea of clinical research mooted by Jeamsinkul and Sawadichai (2002).

The concept of research into practice may go some way to providing a bridge between the theoretical research concerns and a recognition of the aspects of research that relate to practice. This approach recognises the integration of theory and practice which may contribute to a growing area of praxis in which the research areas compliment one another (Mauger, 2003). It is this concept of research into practice that is adopted for the research for this thesis. By using an iterative approach to the combination of the steps outlined by Downton (2003) in his research about design, and Press and Cooper's (2002) formulae for the design process, the resolution of the complex sub-design problems or issues will be the creation of a design model. This design model will include methods of data collection and apparel designs that will endeavour to meet the aesthetic and functional demands of women bowlers in New Zealand and will promote future development in the design of sportswear for this sport.

The final result will be the creation of a model for a design process based on this research and reflection upon the designs for products that will meet the consumer demands of diverse target markets.

## 2.2 Design models for product development

Traditionally the product development process model was represented by 'lists of product process activities' (Figure 2.1) to be completed, or models describing stages that are sequential in nature (Plumlee and Little, 1998). Some firms still use models that rely on sequential steps where a product moves orderly through a series of defined stages undertaken by separate departments within the company. More recent models tend to reflect concurrent product development processes or steps and integrate units of work carried out by multiple smaller units within the same firm or company (Plumlee & Little, 1998).

- New Product Process Activities**

  1. Initial screening
  2. Preliminary market assessment
  3. Preliminary technical assessment
  4. Detailed market study / market research
  5. Business / financial analysis
  6. Product development
  7. In-house product testing
  8. Customer tests product
  9. Test market/trial sell
  10. Trial production
  11. Pre commercialization business analysis

**Figure 2.1** Cooper and Kleinschmidt's (1986) list of new product process activities.  
(Source: Plumlee and Little, 1998).

As illustrated in Figure 2.2 for the process of bra design (Hardaker and Fozzard, 1997), each development stage i.e. concept development, pattern development, sampling and grading stages, has to be completed before moving on to the final production stage. Though this type of model may accurately depict the traditional product development process, it has several limitations in that it omits critical parts of the model needed to address a continuously changing market place and does not accommodate a means for efficient backwards and forwards reassessment of the design and development processes. In a large company where many different

departments are involved in product development, interaction between departments is often minimised and frequently some departments have no input until near the end of the process. One disadvantage is that this lack of communication of ideas between departments slows the whole process down and by the time each department has reviewed the developing product, the market opportunity may no longer exist (Erhorn & Stark, 1994; Plumlee & Little, 1998). For a small business, this model of working may not be achievable or appropriate because of the cost and time taken to manufacture and fit trial all sizes of larger garments.

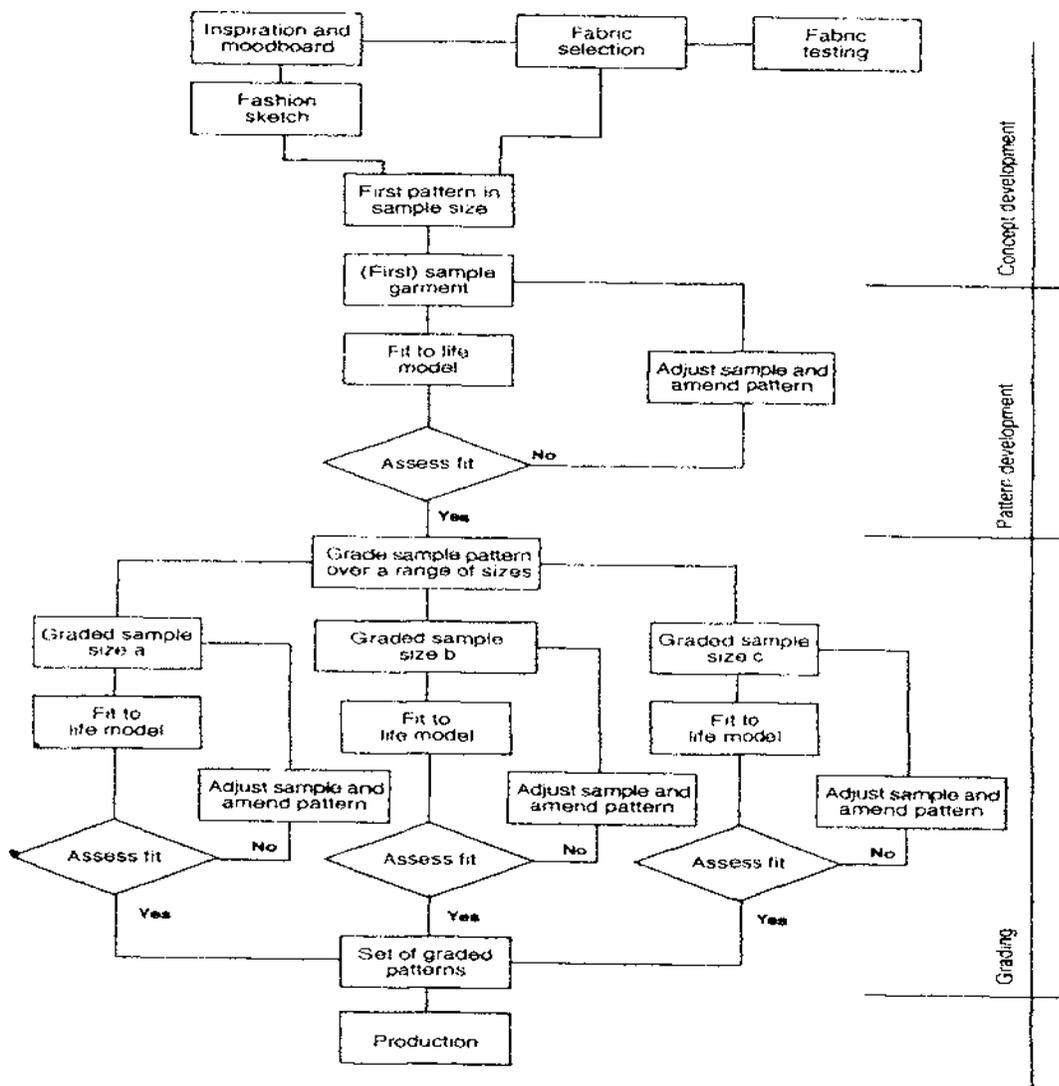
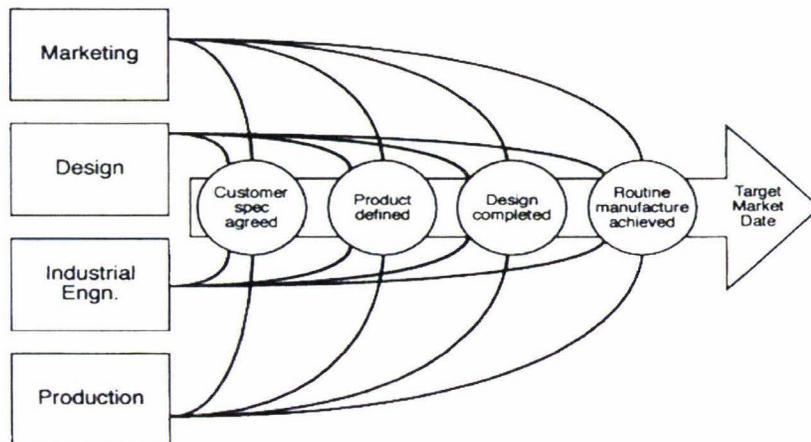


Figure 2.2 Design model for Hardaker and Fozzard's (1997) Bra Design Process.  
 (Source: Hardaker and Fozzard (1997).)

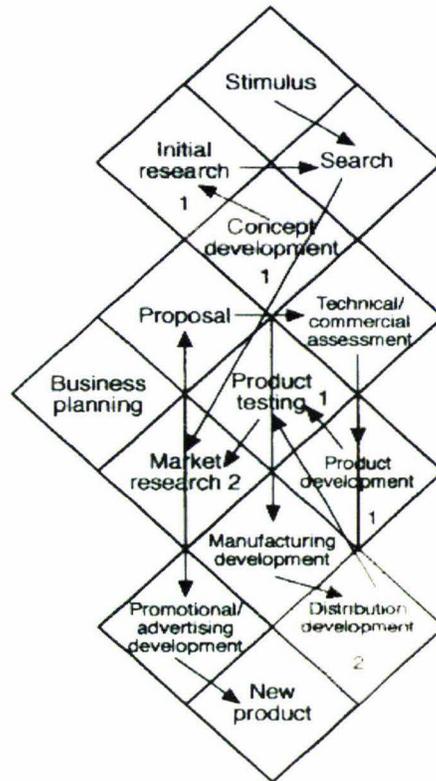
A more integrated approach, as described by Erhorn and Stark (1994) in Figure 2.3, is one in which sequential steps are represented but each step occurs simultaneously in separate departments within a firm. This model can accommodate a shortened product development cycle and allows for continuous exchange of information between departments of the same company throughout the development of the product. Both the bra design model (Figure 2.2) and the integrated process model (Figure 2.3), may be more relevant to the production of single items. In the apparel industry a range or line of clothing or products must be produced more frequently i.e. lines for each season and/or mid season lines. Neither of the above models provide alternatives for firms which outsource some aspects of their production.



**Figure 2.3** An integrated process model. Erhorn and Stark (1994).  
(Source: Plumlee and Little, 1998).

Saren (1994) takes the integrated approach one step further allowing for simultaneous activities and multidirectional movements through the production process in Figure 2.4. This approach is particularly pertinent to the early stages of the development of a fashion product since various sources like international fashion shows promoting fashion trends, national fashion trends reflecting customer needs, new fabric technology and fabric testing are all stimuli which help in the creative process of deciding on new lines for a particular market. Saren's model also

recognises with shaded blocks, activities that may outsource parts of the production with less emphasis on departments and personnel so may have the potential to be adapted for smaller companies.



**Figure 2.4.** A blocks model of the product development process.  
(Source: Saren, M. 1994).

Many smaller apparel companies outsource process activities such as pattern grading, sample machining and in the product development stages employ market research companies to assess the potential success of the new product (Poole, 2005). Saren's (1994) model may still be valid for some smaller businesses where the designer may not have all resources and have to contract some stages of the manufacture.

The models discussed in this section are relevant to big companies producing wide ranges of products for a large customer base. Production processes are similar in each case but may not entirely relevant to very small companies with small production runs and that are consequently closer to their customer.

### 2.3 Design models for apparel development

*“It is imperative that the design is for the actual use, and not the designers’ concept of the intended use”.* (Carruthers, 1999).

Many different generic product development models for the apparel industry have been developed by theorists and practitioners and over time have been adjusted and adapted to fit the purpose and methodology of the user company. According to Burns and Bryant (1997), most of these models are a linear progression and lack the depth needed for a critical analysis of the development process. Topalian (1980) suggests that all apparel design projects are unique although there are similarities and differences between one project and another and more often than not the similarities outweigh the differences. The principal similarity is that they all go through a common sequence of stages that involve research and testing:

- Approved concepts are translated into design specifications and sketches and then to actual samples;
- Materials are evaluated and ordered to construct the prototype of each design;
- Patterns are developed and fit standards finalised;
- Constructed prototypes are evaluated for fit using a fit model and in some cases provided to a consumer panel for wear testing (Hardaker & Fozzard, 1997).

A similar sequence could be employed in the design and product development component of this research.

An example of this is the systematic design process used in the development of a bra for large breasted women (Krenzer, Starr, & Branson, 2005). To determine their perceptions of the fit of sports bras and to determine design preferences, eighty two responses were recorded from a survey questionnaire administered to a select group of women who exercised regularly. In order to select appropriate fabrics for each bra design, textile tests for dimensional stability, pilling, abrasion resistance and wicking were carried out by the researchers. Design styles, materials, specifications and design criteria were ranked by the researchers, and a prototype garment developed to

address the perceived needs the women had identified in their questionnaires. These needs included comfort, support and aesthetic issues and the final design was evaluated by comparing it with other sports bras using specifications and design criteria, again contrived by the researchers. However at no time during the design development stages were the women asked their opinion of the different potential fabrics or design styles. The models developed by Cooper and Kleinschmidt (1986), Hardaker and Fozzard (1997) and Erhorn and Stark (1994), do not appear to allow for customer opinion either. In the study by Kenzer et al., (2005) an unspecified number of women carried out the wear trial of the final garment during a period of exercise in a controlled environmental laboratory. Although tests carried out under laboratory conditions can give reliable results, the tests do not always equate to conditions and stress caused through various movements the women may encounter during their daily work routine.

Hardaker and Fozzard (1997) identified fabric selection, pattern development and grading as important aspects of the design process while Krenzer et al., (2005) emphasize the need for the correct choice of fabrics. Some firms conduct research of target customers through focus groups and customer feedback while others take their concept selections to the consumer for review (Saren, 1994). According to Gruenwald (1992), the three most common sources for product ideas development come from the customers, marketing, and research and development.

Because of the different characteristics of the fabrics used in bra designs, the pattern shapes and the design styles are unique to each fabric (Hardaker & Fozzard, 1997). Therefore the design, pattern making and fit of the prototype needs to involve many instances of 'fit and amend' loops before the garment is graded and sent to production. However the design process for a new range of bras tends to rely heavily on the expertise of the designer as shown in the survey of professional bra designers (Hardaker & Fozzard, 1997). This survey indicated that the designer's working methods are heavily reliant on heuristics. Wear trials are used to further assess the fit of each prototype and the performance of the fabric. These trials are usually performed in the development stage but in some cases, trials are performed well into

production. The garments are rated by the wear trialists in terms of fit, comfort and durability on an ordinal scale (Hardaker & Fozzard, 1997).

In the fashion industry, product development models are essential to improve cost effectiveness by streamlining the process and making sure the end customer is happy with the product and the fit of the product. To achieve the optimum design it is necessary to accurately identify and document the needs that the design has to meet. This also includes accurate problem or opportunity definition and by reviewing these, errors that may occur can be eliminated and not carried through to the next process (Carruthers, 1999). Design concepts do not necessarily have to be original (Hardaker & Fozzard, 1997); in fact some existing designs may solve the problem and by interfacing selected modifications, the optimal solution can be achieved. For instance, although the process used for designing a new bra is unique for each bra and is dependent on the design and fabric characteristics, the design for a new sports bra applies modifications of known information regarding the needs of the end customer, fabrics, design shapes and the concept of support for the female figure to the new design solution. In order to optimise production and enhance sales, an apparel company must develop a process model which will identify and understand critical convergent points within the marketing, merchandising, the design and the development of the production of an apparel line or lines (Plumlee & Little, 1998). Critical convergent points are points where certain stages of the production process happen concurrently but one or more actions in one area of the production may affect the result of further actions within the whole process. A model for the development of an apparel product needs to address these things and be adaptable for:

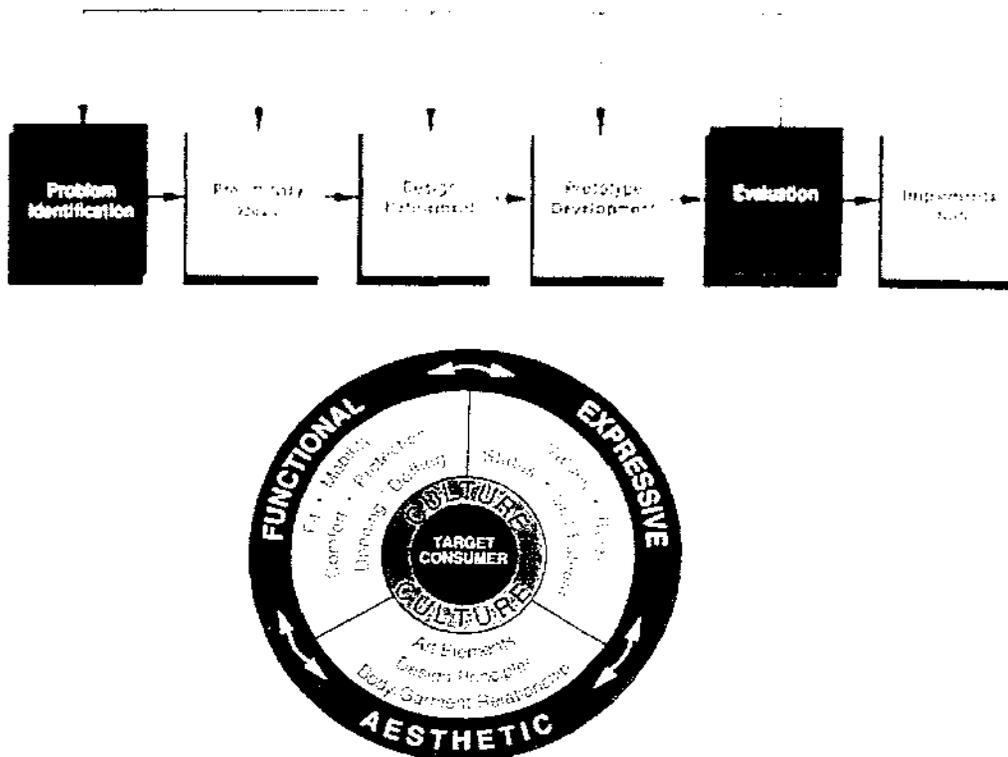
- Developing both product lines and individual products;
- Development of seasonal lines and multiple seasons annually;
- Developing new products, takeoffs and modifying existing products (Plumlee & Little, 1998).

A design model also should provide detail in terms of the methods needed to address problems associated with diverse target markets e.g.:

- The activities needed to complete the process:
- Allowing for concurrent activities:
- Encouraging the different departments within the business:
- Involvement of each department in the company at each stage of the process.

This model would be appropriate if the business is a large one but if work has to be outsourced then the outworker and/or contractor should be informed or made aware of the whole process which underpins their contribution.

Lamb and Kallal (1992) proposed a conceptual framework for apparel design in which the target consumer, their culture and their needs and wants are taken into consideration during the design process (Figure 2.5).



**Figure 2.5** Apparel Design Framework and FEA Model for Design. (Source: Lamb and Kallal, 1992).

They suggest the target consumer is at the core of the framework and a clear profile of the consumer must be developed to determine consumer preferences, physical characteristics and demographic information. The acceptability of a fashion statement or trend is closely linked with and often describes a consumers 'culture' which of course can change over time. One advantage of this model is the strong emphasis on the target consumer and the effect the culture of this target market has on the product design in terms of aesthetics, expression and functionality.

*"Culture's influence on functional considerations, although not always apparent, warrants acknowledgement. Culture determines customary uses for apparel items and typical forms for those items"* (Lamb & Kallal, 1992a).

Design criteria descriptors such as Functional, Expressive, and Aesthetic (FEA) consider the user's needs and wants.

- **Functional** considerations for an apparel product relate to its utility, such as protection, thermal comfort and ease of movement. For example the use of stretch fabrics and ergonomic design shaping of garments to allow for maximum movement in the arm and shoulder areas will be considered in this present research.
- **Expressive** considerations relate to the communicative and symbolic aspects of dress. Bowls New Zealand require New Zealand representative players to wear predominately black uniforms with the silver fern emblem on the front of the shirt and jacket. Although no logos will adorn the trial garments in this research, cognisance of the need to display club emblems and colour will be considered. The design, printing or embroidery of logos or emblems does not come into the boundaries of this thesis.
- **Aesthetic** considerations relate to the human desire for beauty and include art elements, design principles, and body-garment relationships. New colours

and shaping of the garments in the wear trial will attempt to meet the aesthetic need of the diverse range of women bowlers without compromising the fit and functionality of each garment in the collection.

It should be noted that the above design criteria are interrelated in different ways and each criteria may vary with different users and markets or different segments of the market as in this research.

Further to the FEA model, which concentrates on the consumer or user, Lamb and Kallal (1992) advocate that as many conflicts as possible, within the greater design process of the product be resolved. They favour a step by step approach using both subjective and objective measurements to rate prototypes. This approach would appear to have merit as women have to like what they wear as well as feel comfortable in the clothing. In their initial selection of clothing, many women choose clothing based on expressive characteristics such as the brand name and the image portrayed by that brand rather than purely functional criteria (Kaiser, 1997). The consumer may also consider aesthetic qualities like colour and styling before trying the items of clothing and making their final choice. Lamb and Kallal's model addresses possible conflicts by identifying the culture of the person and the culture of the situation in which the clothing will be worn.

### **2.3.1 The Design Brief**

The design brief should cover two main areas – the product and the project or resources. Dale and Oakland (1994) list four major features that play a role in the quality of a design brief:

- Avoid unnecessary complexity;
- Avoid unnecessary variety;
- Avoid unnecessary costs;
- Eliminate features known to cause problems.

While the above list appears rather negative, cognisance must be taken of the principle of simplicity. The following list suggested by Carruthers (1999) embraces

the whole process from concept to manufacture and sales but it does not indicate whether the steps should be sequential or how many times they be addressed.

Carruthers (1999) states the product brief should address the following:

- List of customer and stakeholders needs;
- Final deliverables required;
- Approval and testing requirement;
- Special operational, safety, health and environmental requirements and features;
- Key milestones in the execution of the design;
- Intermediate review requirements;
- Areas of design uncertainty;
- Logistic and configure control requirements;
- Life expectancy of the item;
- List of skills that will be required to realize this brief;
- Cost and time constraints;
- Statutory requirements;
- Aesthetic requirements or constraints;
- Ergonomic factors (Carruthers, 1999).

Each of these points has merit but for this research the marketing aspects will not be considered at this time.

## **2.4 Methods for the visual analysis of dress**

The expectations of dress codes for sporting women may be identified by visually analysing photographs, taken over a period of time, of the dress of sports women and in particular women bowlers. In broad terms, Roach-Higgins and Eicher (1992) define dress as:

*“The dress of an individual is an assemblage of modifications of the body and/or supplements to the body”* (Roach-Higgins & Eicher, 1992).

Visual analysis of a collection of clothing can distinguish common aesthetic characteristics and relationships which appear within a particular time frame while background knowledge of the historical significance of a piece of clothing can enhance the perceptual awareness of detail. Evidence from literature about a particular period of time helps to confirm any coincidence of the defining features in a collection. An examination of potential relationships to current and essential media, including fashion magazines and movies is considered necessary to gain an understanding of the outside influences and social mores which could impact on the fashion of the time (Cosbey, Damhorst, & Farrell-Beck, 2002; Kaiser, 1990, 1997; Taylor, 2002). In determining changes in fashion, fashion illustrations and photographs in magazines are useful media to observe transitions in fashion and because consumer magazines are of a serial nature they provide an ongoing record of the diversity of fashion styles (Cosbey et al., 2002).

Design characteristics of the component parts of any outfit can influence other characteristics or parts of a garment or total outfit. How these characteristics or parts are arranged or combined may create a new look, therefore the visual analysis of pictorial dress can be assessed using a variety of different types of measurements (Kaiser, 1990). A combination of nominal measurements, ordinal measurements, interval measurements and ratio measurements have been suggested as appropriate methods of assessing the visual characteristics of change in fashion. However no one system of measurement on its own is sufficient as each mode of measurement has its strengths and weaknesses (Cosbey et al., 2002; DeLong & Petersen, 2004; Kaiser, 1997; Taylor, 2002).

These different kinds of measurements are described below:

- **Nominal measurements.** This is the simplest approach to recording stylistic features of dress from pictures. Individual features are grouped according to type i.e. sleeves or necklines etc. are given a reference number according to style, the number having no quantitative meaning;
- **Ordinal measurements.** Measurements of the length and width of garments without actual measurements of the original garment being known;
- **Interval rating along a bipolar continuum.** Enables an assessment of aesthetic qualities like light versus dark, shiny versus dull, sheer versus opaque, stiff versus flowing and design characteristics like angular versus rounded, straight lines versus ambiguous surfaces, simple versus complex and fitted versus loose;
- **Ratio measurements.** This measurement utilizes the use of a grid or ruler. Features of interest are measured and converted into proportions so that different sizes of pictures within the sample are rendered comparable (Cosbey et al., 2002).

In the development of an 'instrument' to examine the relative changes in women's clothing over a period of time in two fashion magazines, Cosbey et al (2002) adapted previously tested systems for measuring garments. They referred to these as feature identification measures, body location measures and aesthetic and fit measures. Feature identification essentially used nominal measurements with added descriptive passages to differentiate between like features. Ordinal scales were used to measure length and widths of garments and these were referenced to positions or locations on the body. Semantic differential scales were used to measure descriptive qualities pertaining to the fit and the aesthetics of the garments themselves and the fabrics and embellishments. Despite the various limitations, the visual analysis instrument allowed for a systemic recording of the stylistic characteristics of specific garment features for fashion illustrations. The instrument was consequently useful in examining trends in women's clothing style diversity over time (Cosbey et al., 2002).

Cumming (2005) analysed photographs of women participating in selected sports to illustrate changes in the dress code over a set period. Only photos which showed a full-length frontal or three-quarter view of women participating in golf, tennis, cycling or mountaineering were selected for her study. Stylistic features like necklines, sleeve styles and embellishments were nominally grouped for each sport according to type, and ordinal measurements were used to record the width and length of garments. By graphing the results of these measurements, quantitative comparisons between the garments worn for each sport were able to be made.

The surfaces of the fabrics in the garments, the structure and visual effects formed the basis for the criteria used by DeLong and Petersen (2004) in their analysis of 160, 1930's evening dresses from the Goldstein Museum of Design in Minnesota. As well as the dresses being catalogued on a time line, prominent features that repeated at least 10 instances were also recorded on a timeline. These features included uneven hem lines, bias cut shapes, dress and jacket combinations, reverse silhouettes and floral print patterning. When examining any collection of artefacts, DeLong and Petersen (2004) advocate having an historical knowledge of the time period and especially the influence of the media. This knowledge helps to explain why certain features are combined to give a particular visual effect.

*“Visual analysis brings into awareness the importance of features and how they influence the character of the evening dresses. It also promotes understanding of the relationship between features of artefacts to historic periods as a window to awareness of current fashion”* (DeLong & Petersen, 2004).

In this research nominal measurements of clothing from each decade and contextual information should be sufficient to track the changes in styles of sporting clothes and to compare these with fashions of the relevant time period in order to ascertain if there is a correlation between the two.

## 2.5 Semiotics and Interpretive Design

For many years women who played lawn bowls were easily recognised in the street by their distinctive white dresses, white hats, white cardigans and accessories. This image was not always appreciated by the women and changes to the dress code were advocated over a number of years with the New Zealand Women's Bowling Association (Howat, 2005). According to Howat (2005) the younger generation of bowlers now seek a more contemporary image which is more in line with other sporting codes like tennis and golf. Research into visual characteristics of dress and changes over time could help to identify the signifying relationships between the dress code for women's bowling clothing, fashion trends and the culture of the sport.

The essence of the semiotic method lies in identifying how signs are used to represent something and constitute a form of social communication (Beasley, 2002). Semiology is the study of signs and symbols within the written word, pictorial images like paintings and photographs, sounds, and social codes which transfer messages or express ideas, meaning and concepts in such a way as to communicate ideas and thus try to avoid misunderstanding (Griffin, 2003).

*"The way we dress, what we eat and how we socialise also communicates things about ourselves, and thus can be studied as signs."* (Bathes, 1997).

Semiology is centrally concerned with social effects of meaning and the construction of social difference through signs (Griffin, 2003). Visual images have social conditions and social effects, and it is the interpretation of these rather than the image itself which is important. What one sign means depends on its relation with others therefore the image is meaningful only so long as each party understands the parameters within which the message is contained. This makes it difficult to analyse because all meanings are relational not only within the image but also in relation to other images, codes and references (Griffin, 2003; Whincup, 2004). Coded messages signify the relationship between individuals, groups and the environment in a fashion related context and underpin the inter and intra group dynamics. Social pressure exists to conform to the expectation of a majority group. Therefore 'groups' may be

considered the primary influence of individual behaviour. Lamb and Kallal (1992a) consider 'expression' one of the three major aspects of their conceptual framework for apparel design and although clothing is also a conveyer of values and beliefs it is considered by them as one of the most visible ways of expressing individual differences. However individuals are still guided by the salience of perceived group identification. (Dodd, Clarke, Baron, & Houston, 2000).

Young females are not only fashion conscious and very aware of fashion trends, but they are more likely to be influenced in their choice of clothing by their peers rather than their parents or society (Horowitz, 1982; Kernan, 1973). The young women bowlers (Figure 2.6) comply with the regulation of flat shoes and acknowledge white clothing as an appropriate and acceptable dress code for bowling, yet at the same time there are subtle messages of youth culture i.e. the bare midriff, skirts worn on the hips and even the relaxed stance of the young women. The similarity of the style of dress and the way in which the clothes are worn, identifies the girls as a team (or social grouping), but the different items of clothing worn express their individuality.



**Figure 2.6** Young women bowlers competing at the Inter Secondary Schools National Tournament in Auckland.  
(Source: (*Young Players at the Nationals.*, 2004).

The way in which individuals make clothing choices is not necessarily random but is influenced by the group of people they associate with in a given situation. This particularly applies to sports groups where the choice of clothing of the group has visible similarities and may include a club or sports logo. Generally individuals are attracted to others with similar views and membership to any group provides the individual with social identity. The approval by other members of the group of the individual's choice of clothing and the way in which the clothing is worn establishes the individual as a member of the desired group (Dodd et al., 2000; Johnson, Schofield, & Yurchisin, 2002). Individual differences are expressed but are within the confines of the approval of the group. Different values and codes of acceptability change over time as crazes and fashion cycles change (Dodd et al., 2000).

Fashion has traditionally been communicated to people through visual signs and symbols e.g. magazines (particularly fashion magazines), television, films and advertising brochures. Advertising has become a force holding cultural mores and individual behaviours (Beasley, 2002). It would appear that changes in fashion trends are achieved through various media by successive approximations of new styles towards the new targeted fashion trend (Beasley, 2002; Kaiser, 1997).

When looking at images of dress designs in magazines, the background of the photographs often indicate where the clothing should be worn i.e. outdoors, in an office, an interview situation. It should be noted that the designer of the clothing may or may not have had some influence as to how the clothing is to be shown. The age and size of the model wearing the clothes is usually an indicator of the potential customer although most models are much taller and thinner than their peers but are selected to represent the icons to which the reader may aspire (Kaiser, 1997). The accessories worn or carried also give a message about the type of person for whom the garment is targeted. Television and film are powerful mediums of persuasion and indoctrination and influence attitudes and behaviours. Films are a more subtle and powerful influence as the clothing is an integrated part of the setting or theme and the status of the characters wearing the clothing is obvious (Casselmann-Dickson & Damhorst, 1993; Kaiser, 1997). For many consumers the range of clothing is not

the sole criteria. It is the name of the company or brand that encourages them to buy. Product image is effectively entrenched in today's psyche through logo designs and influences collective perceptions (Beasley, 2002). In some advertising campaigns, it is the corporate image rather than the product that plays the major role as demonstrated in the following quote:

*'Fiona Jack a NZ based graphic designer, conducted a campaign for a non existent brand, aptly named "Nothing". Her bill boards emblazoned with slogans like "Nothing. What you've been looking for." proved extremely effective. People even rang up to ask where they could buy "Nothing"'* (Renny Ramakers, 2002).

The clothes we wear and how we wear them are indicators to others about our perceived identity and also our relationships and interactions with the groups and communities we are connected to. The clothes we wear are also influenced by and contribute to the cultures and times in which we live (Kaiser, 1997). Because of the advent of televised sport and the many sports channels available to the masses, graphics, colour and pattern have become both an aesthetic and a sign system. New sports or variations of traditional sports have seen the need for designers to come up with clothing styles to suit the requirements of the end users (O'Mahony & Braddock, 2002). The change from white to contemporary coloured clothing and accessories for indoor bowls was made to capture the interest of television viewers and appeal to a young audience (Oldfield, 2001) ( Figure 2.7).



**Figure 2.7** 'Bowls undergoes a makeover.'  
(Source: (Oldfield, 2001).

Sports clothing is required to provide many functions. Not only does it need to offer the sports person protection and comfort while participating in the sport, but the supporters and admirers of the sporting culture like to be seen wearing team colours as a means of identification with a particular sporting code. Logos are the pictorial counterparts of brand names (Figure 2.8).



**Figure 2.8** Examples of logos currently found on sports clothing

The power of the visual sign is what makes the logo so much of a recognisable and intrinsic feature of any products. Logos displayed on clothing are symbols imbued with endless arrays of meaning. For example, Ralph Laren's™ polo horseman, Lacoste's™ alligator, Nike's™ tick, the shield of K-Swiss and the three ovals of Adidas™ are worn to demonstrate adherence to a kind of heraldic signification system (Beasley, 2002).

By adopting and wearing the caps, T-shirts and jackets from organised sporting codes, viewers and supporters can increase their sense of self-worth and publicly express their community involvement (Kaiser, 1997). Brand names and logos are an important link to sports identity. By wearing casual clothing which displays distinct logos, the wearer identifies as an active, contemporary, health conscious individual who appreciates fitness and is a sports follower but not necessarily a participant in the sports advertised on the clothing.

It is important that the dress code for any sport meets the needs of the participants in both style and fit and just as importantly sends the right message about the wearer's

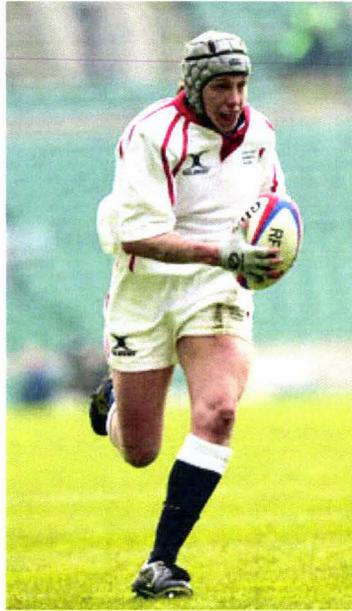
image (Jacobsen, 2003). For example the equipment managers for the US National Football League clubs liaised with Reebok™ to make clothing to suit all their players (Dodd et al., 2000). Some players liked the gear for its style and because the tight clothing made them look muscular. Jay Brunetti, equipment manager for the Houston Texans, says his players like to keep up with styles.

*“We have young men of the hip generation. They like fashion, they are into retro stuff and they like colour. One of the players likes to wear the gear at home when he is feeling casual” (Jacobsen, 2003).*

In the United States, some colleges are experiencing increasing difficulty to find uniforms that meet players’ needs. The desirable combination of factors such as school colours, garment style, size range and fit are hard to find as colours change seasonally. There appears to be a greater selection in colour ranges in men’s clothing but the men’s clothing is ill fitting on women (Wheat & Dickson, 1999).

Casselmann-Dickson and Damhorst (1993) suggest that as well as identifying an athlete as a participant of a particular sport, an athlete who is “correctly” dressed for his or her sport has a psychological edge. In their research they found that cyclists were interested in wearing aesthetically attractive cycling clothing that accurately expressed their cycling competence and that young women involved in inline skating were more likely to purchase clothing for their sport which achieved an appearance of fashion, femininity and elegance rather than functionality. They suggested aesthetic and expressive characteristics for sports clothing are important as well as the need for clothing that enhances physical performance.

The clothing worn by women rugby teams mirrors that worn by men in style and design and portrays the game as having the same rigour and to a certain extent identification with masculinity. The overall appearance of the uniform emulates men’s rugby. Padding in the shoulder area gives added breadth to the upper torso thus portraying a strong masculine image (Figure 2.9).



**Figure 2.9 Women's Rugby. Nicky Crawford playing for England.**  
(Source: RugbyNet Photo)

The reason for wearing a uniform may be specified as:

- To improve a professional image;
- Enhance worker's morale;
- Reduce status distinctions and foster communication and team work;
- Workers are judged on their performance rather than individual appearance;
- Make workers feel more camaraderie with co-workers;
- Uniforms should reflect the environment in which they are worn (Chan et al., 2003).

Chan et al (2003) describe an ergo uniform as a garment which projects a positive psychological image as well as one in which the wearers feel physically comfortable. Sports garments need to not only provide protection from the weather, they must also allow the body to comfortably adjust to heat and moisture and changing physical loads. There needs to be a balance between function and design so as to guarantee aesthetics without losing comfort (Chan et al., 2003; Lamb & Kallal, 1992a, 1992b).

## 2.6 Contemporary Trends in Sports Fashion

Sport which promotes a healthy and active lifestyle, has come to have an almost religious status in the lives of some people. The rise of the gym culture has seen men and women spending time working at changing their body shapes in an effort to look slimmer or fashionably muscular (Feldman, 1992). Not all people aspire to acquiring the perfect body but are content to engage in sport as a means of exercise and developing some level of fitness. Women bowlers are no exception. Being involved in the game is one way they can develop a level of fitness and meet and interact with friends and other like minded people. Quinn (2002) suggests there is a new 'hyper-breed' of women who achieve their ideal shape by exercise, cosmetic surgery and dieting rather than the tight restrictive clothing of the past century. This desire to attain the perfect or ideal body shape through fitness is having an influence on the design of clothing rather than the clothing influencing body shape as it has done in the past. In Figure 2.10 for example the clothing is designed for a comfortable fit and can be worn for both sport and leisure. The fabric used is soft to touch, stretchy and easy care.



**Figure 2.10** Contemporary sports and leisure clothing from the Ezibuy range.  
(Source: Ezibuy Catalogue, 2006)

The increasing demand for sportswear has been in part responsible for the development of fabric technology and high performance designs. Furthermore both mainstream and avant-garde fashions have been influenced by the utilitarian features of sportswear. Features such as hoods, zip-fronted jackets and shirts, windproof jackets, pouch pockets, Velcro™, magnetic fastenings and drawstrings have now become common place (Quinn, 2002).

Companies such as Prada incorporated the technology of these sports fabrics into their body hugging and streamlined sports collections, thus producing clothing with classic yet contemporary aesthetics which meet the expectations of the sports person and the person on the street (Quinn, 2002). Professional sports people require ergonomically designed outfits made from fabrics that are comfortable and allow for unhindered movement as well as portraying a professional and contemporary image. The cut away armholes in the garment (Figure 2.11) allows for unrestrictive arm movement while the design lines give a slimming appearance and allow for added shaping in the torso area. The fabric drapes softly and appears to stretch with bodily movements.



**Figure 2.11** Lindsey Davenport wears a body hugging two piece sports outfit at the US Open.

(Source: Australian Tennis Magazine. October, 2004).

Jeffrey Grubb of Fashion Active Laboratory, has taken these ideas a step further and has designed separates which merge sportswear with casual wear like the Ezibuy range (Figure 2.10). His garments define the body and feature exceptional elasticity and stretch recovery. The garments have the ability to ‘multitask’ i.e. to take the wearer from the office to the gym and out at night, like the ‘Cashmere Hoodie’ which can be worn at the gym then out in the evening (Quinn, 2002).

An alliance between designers and information technologists has resulted in the promotion of ‘intelligent fashion’ which integrates software, communication devices, sensors and speech-recognition systems. These garments provide the facility to make telephone calls, administer medication, communicate via the internet and store and retrieve information (Quinn, 2002). Such technology could prove invaluable to the bowler who needs to calculate wind speed and velocity and the amount of force with which to deliver the bowl. Sportswear for many sporting codes now offers a range of cutting edge designs that suit and adapt to a wide range of body shapes. Garments offer the comfort, performance and durability necessary for the fast-paced, high-tech world we now live in (Quinn, 2002).

## **2.7 Functional characteristics of fabrics**

### **2.7.1 Comfort**

As well as providing a fashionable image for the wearer, sports uniforms or sportswear should be able to strike a balance between function and design so that aesthetics are guaranteed without losing necessary comfort (Chan et al., 2003). Clothing comfort is a psychological feeling or judgement of a wearer (Chan et al., 2003). The degree of comfort depends on the wearer’s subjective perception of:

- Thermal and tactile sensations which are often affected by the external environments i.e. the weather and temperature;
- Psychological processes i.e. how comfortable the wearer feels about their appearance when wearing the garment;

- Body and apparel interactions and effects i.e. the pressure of the fabric against the skin influences the perception of fit (Hatch, 1993).

Comfort also involves several latent independent sensory factors:

- Thermal wet comfort reflects how well the heat and perspiration from the skin is transmitted to the environment. Fabrics with good moisture transfer properties feel dry against the skin even in the most humid and hot conditions or the extreme cold;
- Air permeability influences the ability of the fabric to maintain the balance of the production of body heat to equal the heat loss through the fabric. When an imbalance occurs between normal body heat and heat lost and/or heat produced through physical exercise, the sensation is that of becoming cold and clammy or hot and sticky inside the garment;
- Pressure comfort describes the pressure exerted on the body from fabric bulk, mechanical behaviour, fabric handle and fit of the garment. In order to provide ease of movement and no restraint, the garment needs to provide space or ease for required movement and the fabric should have the ability to 'give' (Chan et al., 2003).

It is important that the above factors described by Chan et al (2003) and Hatch (1993) are considered when making fabric choices for women's bowling clothes. Because lawn bowls is an all year round outdoor sport, the bowler is subjected to extremely variable weather conditions during the summer bowling season from October to April as well as during the less popular winter 'off' season. To compete effectively in competition play, the concentration of the bowler must not be distracted by feeling either too hot or too cold or by restrictive or ill fitting clothing. The fabrics used in the various items making up a bowling uniform could help maintain a temperature balance throughout the day regardless of the weather or activity levels of the player.

### **2.7.2 Insulation and Cooling**

Thermal insulation influences the extent to which the body is protected against the extremes of environmental temperatures i.e. either heat or cold. Ukponmwan (1993) describes clothing fabrics as “a buffer or barrier to the free exchange of heat and moisture between the wearer and the environment”. He contends that during the hot summer, the body requires clothing which will help to maintain the body temperature by assisting in the cooling process. Conversely, in cold weather, clothing must help maintain body temperature by reducing heat loss. Not only does the colour of any fabric strongly influence its ability to absorb and reflect solar heat, but the ability of any fabric to transmit moisture away from the body will enhance its comfort to the wearer. Heat transmission through clothing can take different forms e.g. dry transmission or conduction and diffusion of water vapour in the form of perspiration (Hatch, 1993).

Breathable fabrics are those that allow the water vapour to diffuse through the interstices between the yarns and the fibres of the yarns. Fabrics that also have the ability to ‘wick’ moisture away from the body assist cooling to take place on a person’s skin surface when that is required (Hatch, 1993). The speed at which a fabric dries is also important to the comfort of the wearer. Fabrics made from cotton, wool and viscose rayon that absorb moisture and remain wet for longer periods will also tend to lower the body temperature and be inclined to cling to the body. Wet fabrics also have the potential to become abrasive when the body moves (Collier and Tortora, 2001).

Insulating ability is of prime importance in the evaluation of fabrics used for outerwear. When the air temperature is below 27°C the rate of heat loss from the body must be slowed down to enable the body to feel comfortable (Ukponmwan, 1993). During tournament play, players may begin their game at 8am and may not finish their last game until after sunset. The air temperature may be initially cool (e.g. around 4°C - 5°C) but then rise to a daytime temperature of 30°C or even higher. Clothing needs to maintain an optimum body temperature from the

beginning to the end of the day's play. As bowls is played all year round, warm clothing is a necessity, particularly in the off season i.e. during the winter months. Hatch's (1993) review of thermal insulation concurs with that of Collier and Tortora (2001) and Kadolph and Langford (2001). All agree that fabric density and thickness influence the insulating ability of a fabric. Textured and staple fibres tend to produce yarns which trap air and thus provide insulating properties when made into fabric. The gauge of a knitted fabric is influenced by the number of needles in a measured space on a knitting machine. In general the higher the gauge or closeness of the needles, together with the fineness of the yarn, determines the fineness of the end fabric (Collier & Tortora, 2001). Fabrics which are more loosely woven or knitted and which trap air within themselves proved to be better insulators than those which are denser. A gap of not more than 5 – 6mm between the fabric and the skin increases the effect of the insulation however, increased wind velocity reduces the effect of any insulation layer, unless it is covered with an outside layer of very fine, tightly woven fabric (Hatch, 1993).

### **2.7.3 Fibre and Fabric Testing**

Quality control involves using objective means of evaluating textile products. Established standards and standard specifications, ratified by the International Standards Organisation (ISO 9001:2000, 2006), provide a basis for researchers working in different laboratories, to compare the results of textile studies and new products. Where performance is a key issue, textile products are often tested to determine whether they meet established standards in order maintain credibility with garment manufacturers and customers (Collier & Tortora, 2001; Hatch, 1993; Kadolph, 1998; Kadolph & Langford, 2001).

Jerram (1994) recommends that fabric tests should be carried out before manufacturing begins to ensure the fabric will behave and wear in a way that will satisfy the customer's requirements. Testing should be carried out prior to manufacture to ensure the right fabric for the design or use is chosen. Kadolph (1998) recommends the standard atmosphere for testing textiles as a relative humidity of  $65 \pm 2$  percent and a temperature of  $21 \pm 1^\circ\text{C}$  consistent with the

recommendation of ISO 139: 2005 Standard Atmospheres for Conditioning and Testing of Textiles. Fabric tests should be carried out to determine relevant properties such as the fibre content, weight, thread count, moisture regain, shrinkage after washing, colourfastness during the laundering process, fading and abrasion (Jerram, 1994; Kadolph, 1998). Three simple tests for fabric quality that can easily be carried out 'in house' even by small businesses involve measuring the weight, the construction and the amount of shrinkage. Tests for strength, abrasion resistance, and colour and light fastness are also important from the consumer's point of view and the reputation of the manufacturer, but these often have to be completed by a specialist testing laboratory. All of these tests are designed to make sure the fabric will perform in a predictable way (Jerram, 1994). The introduction of performance standards has helped to protect the consumer against shoddy or inferior goods; however these standards do not take into consideration criteria relating to the handle of fabrics.

Sensory panel developments in the textile industry have become an important aspect of apparel marketing as consumer demands are driven by good handle and sensory attraction. Sensory feelings and comfort are predominant in the choice of textile goods and garments by consumers (Philippe, Schacher, Adolphe, & Dacremont, 2003a). Bishop (1996) also argues that the handle of a fabric determines whether or not the fabric is suitable for the end use and the ultimate commercial success of the garment or product. While the handle of the fabric is considered important, it is a subjective judgement and the opinion only of the panel that tests the fabric. This panel would need to be familiar with current trends in the market and be aware of the needs of the target market to enable them to make a useful evaluation of the fabric and its end use. Sensory grading tools and methodologies are already available in the food and cosmetic areas and are divided into two main directions: sensory and instrumental. One disadvantage of the sensory method is the amount of time it takes for training the panel in the use of their sensory organs (Philippe, Schacher, Adolphe, & Dacremont, 2003b). The hand evaluation of textile fabrics has been one of the main sensory methods of evaluating textile fabrics. This is the reaction of the sense of touch when fabrics are held in the hand (McIntyre & Daniels, 1995; Philippe et

al., 2003b). By running the fabric of a ready made garment through the fingers or over the hand, the prospective purchaser of a textile product can make a subjective judgement about how the garment will feel against their own skin. However, unless the purchaser is very experienced in assessing the hand of fabrics, this quick test will not tell the purchaser how the garment will perform, drape or stretch around the body or how it will behave during cleaning or laundering.

Fabric Objective Measurement or FOM and the later Evaluation System for Fabrics (KES-F) devised by Kawabata and his co-workers in Japan (Kawabata and Niwa, 1992) and FAST, Fabric Assurance by Simple Testing (Kothari, 1999) used qualitative instrumental testing as a means of evaluating fabric handle, quality and related performance attributes as they apply to the perception of fabric and garment quality in specific end-uses (Bishop, 1996).

Kawabata (1992) observed that the new technology did not necessarily improve the accuracy of measuring the handle of the fabric and an acceptable methodology for handle evaluation was required (David, Stearn, & Denby, 1986). The handle of fabric can be subjective, as the visual perception of a fabric can influence the tactile perception of the fabric (David et al., 1986). The following pairs of words that contributed to describing or making a judgement of 'total hand' were identified (David et al., 1986). Using the bipolar descriptors listed below, judges were asked to rank fabrics on a Likert scale of 1 -7, 1 being as far below average as you can go and 7 being as far above average as you can go. Those bipolar descriptors marked with \* below were considered the most useful in evaluating fabric handle:

- |              |   |                     |
|--------------|---|---------------------|
| * Coarse     | - | Fine                |
| * Stiff      | - | Pliable             |
| * Rough      | - | Smooth              |
| Non-slippery | - | Slippery            |
| Heavy        | - | Light               |
| Prickly      | - | Soft                |
| * Hard       | - | Soft (in squeezing) |
| Thin         | - | Thick               |

* Cool	-	Close
Dead	-	Springy
Non-stretchy	-	Stretchy
* Rustly	-	Quiet

It is interesting to note that thermal properties and drape properties do not form a part of the current FOM and KES-F systems (Bishop, 1996), yet these are often what the consumer wishes to evaluate in handling a fabric in store.

Hand grading is complex and the tactile feeling of the fabric has to be considered along with the ‘character’ of the fabric i.e. the aesthetics, drapability and tailorability. In a research experiment to establish a set list of criteria for assessing the hand of fabrics, a selected group of 12 volunteers were trained as a ‘sensory panel’ (Philippe et al., 2003b). Their first job was to establish a descriptive vocabulary for assessing fabrics. After considerable deliberation the panel reached a consensus of a list of words to use when judging the tactile attributes of fabric. The following criteria for assessment were decided by the panel (Philippe et al., 2003a).

<b>Bipolar attributes</b>	<b>Surface attributes</b>	<b>Handle attributes</b>
Cold – warm	Hairy	Falling
Thick – thin	Soft	Nervous
Light – heavy	Granulous	Crumple-like
Supple - ridged	Sticky	elastic
	Raised	
	Greasy	
	Slippery	

**Table 2.1** Criteria for assessing the hand of fabric (Philippe et al., 2003a).

Practise in using these terms to describe the hand of a huge variety of fabrics (woven, nonwoven and knitted) was rigorous to ensure all the descriptors were well understood by each of the assessors on the panel. The panel were asked to assess the hand of four tactile finishes on cotton fabrics. The four expected properties were a soft handle, smooth surface and specific soft handle, soft handle and easy care, and easy care and anti-shrink. The results of the tests were performed by the panel under standard textile conditions ( $65\pm 2\%$  relative humidity and  $20\pm 2^\circ\text{C}$ ) and the statistical analysis showed only five of the attributes were detected as being significant. These were falling, ridged, slippery, soft and crumple-like.

In their research into sensory tactile perceptions of fabrics, Philippe et al (2003) used 11 volunteers who were motivated and available to test the attributes of 13 different fabrics. Prior to the testing, the panel had to undergo rigorous training in sensory evaluation procedures in order to obtain results that are more consistent. Tests were performed under standard textile conditions ( $65\pm 2\%$  relative humidity and  $20\pm 2^\circ\text{C}$ ). They were blind tests and samples were only used once. While this type of test would give the manufacturer consistent descriptive information regarding the 13 fabrics in the trial using a dictionary of descriptive phrases, only those people involved in the trial who were trained and experienced, could use the phrases consistently to describe the sensory perception of fabrics tested in the same way in the future. These tests carried out by Philippe et al. (2003a), determined that sensory profiling requires the skill of a trained panel to perform tests and consistently rate the feel of the fabrics during the handling tests. Consumers can give an overall preference score to a product but they do vary in sensory preference more than trained judges. Based on previous experiences with similar fabrics, consumers often have an understanding of the feel or handle of fabrics and apply this to determine the expectations of a product (Kadolph, 1998). It is important that women lawn bowlers have the opportunity to handle the range of fabrics selected for the bowling outfits. They will be the ultimate judges, as they have to wear the clothing.

#### 2.7.4 Fabric Finishes

The purpose of finishing treatments can be twofold i.e. to enhance functional properties of the fabrics and improve the aesthetics. Finishing treatment of fabrics can achieve a variety of new looks and effects which include finishing treatments like brushing, sanding, sueding etc. Some finishes add lustre; others give a muted dull effect or may make the fabric crease-resistant, crease retentive, waterproof, etc, (Philippe et al., 2003a). A finish often contributes to the 'feel' and 'hand' of a fabric. Finishing treatments may be performed on fabrics with the help of chemicals such as resin coatings, silicone softeners, etc and are the last step in the textile production process before the cutting and construction of the clothing. In chemical tactile finishing treatment, three classes of products can be used:

- Softeners;
- Garniture/thermoplastic products;
- Synthetic hardenable resins (Philippe et al., 2003a).

Some of these finishes can have undesirable effects like a stiff handle to fabrics treated with resin finishes. Commercial finishers use a combined formulation in an attempt to reduce the undesirable effects. Although some of these finishes are not permanent, the 'one shot' treatment gives optimal results with respect to the main desired properties and shows minimal side effects (Philippe et al., 2003b).

The changing needs of the market place have necessitated new fabric processing technology which in turn has contributed to the changes in the wear and aftercare properties of fabrics for work, leisure and sports clothing. In the end, the garment wearer will be the ultimate judge of the overall comfort and ease of care of the fabric. Sports men and women require fabric that will not abrade the skin during any temperature and weather conditions and will remain soft to the touch. The fabrics need to launder easily and require minimum of ironing as these garments often have to be washed and dried overnight and be ready to be worn the next day (Poole, 2005).

## 2.8 Fabrics

The sports industry which has become a multibillion dollar and multinational industry is quick to promote new and innovative fabrics which have new aesthetic and different tactile qualities and can be multi useful not only as a sports outfit but also as street wear and haute couture. Companies such as Nike™, Adidas™, Reebok™, Prada™ etc are at the forefront of producing high performance garments to meet the needs of the new sports focussed consumers. New fabrics are available which have antibacterial and deodorizing agents, screen against ultraviolet rays and self medicating components along with waterproof and anti-moisture properties. Odlo a Swiss technical sportswear manufacturer uses microscopic silver ions for antibacterial properties to inhibit bacteria and body odour. These new fabrics are easy care, stretchable and comfortable to wear (Prescott, 2003a, 2003b, 2004, 2005b).

*“Although the participants in various active sports must be kept comfortable, dry, cool, and warm or protected, matters of fashion or style are increasingly important. Colour, finishes, surface effects and cut are more and more vital, with details that are primarily decorative increasingly proving the selling point for garments”*  
(Prescott, 2003b).

Market trends in Western Europe point to a desire for natural fibres among all consumer groups but the anomaly is that man-made fibres make up the majority of all purchases (Prescott, 2003a). Many of the innovations in fabric construction are in the area of natural fibres or blends of synthetic fibres with natural components e.g. cotton and polyester blended fabrics which are widely used for sports clothing and other apparel and household linen. Although much of the high performance sports wear is made from synthetic fibres, there is an increasing use of the new techno ‘naturals’ - blends of natural fibres and technical textiles or natural fibres with sophisticated finishes (O'Mahony & Braddock, 2002) for example a new plate

knitted fabric produced by Levana knitwear company which combines 15 -20 micron merino wool fibre on one side and Tactil™ fibre on the other.

Hydrid™, a new moisture-management fabric produced by Unifi, is made with Sorbtek™ a polyester yarn which claims to move moisture faster and further than any other yarn thus keeping fabrics dryer longer. Sorbtek™ is being used in fabrics designed for the fitness market and high intensity athletes (Prescott, 2003a).

CoolMax™ and CoolMax Alta™ are fabrics developed by DuPont (Prescott, 2003a, 2003b). The specially designed fibre cross-sections transport moisture away from the skin. The double-sided fabric construction with Tactil™ yarns on the inside layer transport moisture to the outer layer where it evaporates. Garments made from these fabrics are claimed to be washable, dryable and stay soft and non-chafing. The producers also claim the fabric will also resist shrinking, odours, and mildew and will not pill with wear thus making them a good choice for sports and active wear (High Performance Fabrics, 2006). ‘Power shield’ and ‘Power stretch’ two ultra light, high performance sports fabrics are used by Go-Lite, a specialist sports company, in the design of aerobic sports pants to achieve an articulated fit, ideal for forward motion sports (Prescott, 2003b).

Nike™ has produced two new products using revolutionary fabrics for use in high performance sports wear:

- The combined effect of the design and fabric used in the “Stand-Off Distance Singlet” maximises the body’s cooling system by allowing air to flow freely over the body enhancing both convection and evaporation. “ The fabric absorbs no moisture, allowing perspiration to evaporate directly from the skin.”(Quinn, 2002);
- Dri-Fit™ is a fabric system designed to draw moisture away from the body. The hydrophobic layer closest to the body siphons the water vapour to the outer hydrophilic layer where it is spread over the surface and evaporates

with body heat. The double layer is an effective wind barrier, is highly breathable and has stretch and flexibility so movement is not impeded.

Jeffrey Grubb's 'Cashmere Hoodie' is made from yarn in which the cashmere fibre is blended with a high-denier nylon/Lycra™ fibre spun so that the cashmere is wrapped completely around each individual nylon fibre, giving the look of 100% cashmere but with added flexibility and strength. The Lycra™ is finely coated with silver ions which gives it antibacterial properties (Quinn, 2002).

The New Zealand company 'Norsetech' is producing a number of new fabrics designed to have improved thermal characteristics (Spicer, 2005).

- 'Duo Merino™' a two layered plate knitted product in which the outer layer is 21 micron merino and the inner layer is 18.5 micron merino giving thermal warmth with very little weight.
- 'Micro Merino™' combines an outer layer of 18.5 micron merino wool with 'Micro Supreme Thermal™' yarn which when worn against the skin, has a feeling of silk.
- 'Merino Max™' an outer layer of 21 micron merino wool is combined with an inner layer of Du Pont's 'Coolmax™' to give a medium weight super high performance wickable fabric which offers warmth and comfort.
- 'Outlast Merino™' is a technically advanced thermal fabric designed to store energy with a built in ability to release heat as the body cools and store heat as the body warms. This synthetic fibre is combined with an outer layer of 21 micron merino wool.

Sportwool™ is the result of research into the physiological and natural performance benefits of wool. Sportwool™ is a two layered knitted fabric with fine merino wool on the inside and a synthetic fibre on the outside. This fabric relies on the natural absorbency of wool to wick moisture away from the body and out to the surface of the fabric where it evaporates. The removal of the vapour from the microclimate

created between the skin and fabric reduces the formation of liquid sweat leaving the wearer drier and more comfortable (HSC Online, 2006).

### 2.8.1 Fabrics for UV protection

As public consciousness is raised about the dangers of overexposure to the sun's rays, UV protected yarns are now a staple of the market with the UV blocker simply added to the dye bath (Prescott, 2003a). The new Sasawashi™ fabric not only offers UV protection but is also naturally deodorising since its main component is sodium copper chlorophyllin, which absorbs the smells of acetic acid and ammonia (Prescott, 2003a).

Solarweave™ is made by a special process and claims to block at least 95% of the harmful UVB rays and at least 92% of all UVA rays, having a 30+ UPF. Solarweave™ is a soft 3 oz (75g/m<sup>2</sup>) Supplex® nylon that is light-weight, comfortable, durable, breathable and feels soft like cotton. It is ideal for sports clothes like shirts, jackets and pants. The fact that it is machine washable, quick drying, odour, mildew and stain resistant make it very easy to care for (Prescott, 2005b).

Clothing industry experts have predicted that UV rated clothing will rapidly become the next big growth area in apparel (Prescott, 2005a). A Wall Street Journal article confirmed that growth by saying:

*“the sun protective industry has become a billion dollar industry and that as the ‘boomers’ age, they become ever more worried about their health and eager to maintain their youthful looks”*  
(Prescott, 2005a).

Solarweave™, Solarknit™, Solartwillú, Solarcanvasú, Solarcottonú and Strollerweaveú are trademarks of the Solar Protective Factory (Solar Protective Factory, 2006).

## **2.9 Construction and specific design issues for sportswear**

### **2.9.1 Design issues**

Design coupled with performance functionality and lightness is seen as the key to successful sportswear apparel and layering of different fabrics and garments can produce the overall desired comfort effects (Prescott, 2004, 2005a). Laing and Webster (1998) stated that garments which were made from fabric that could stretch were perceived by wearers as more comfortable than those made from fabric which did not stretch even when the garments were identical in design and dimensions. Knitted fabrics are often used to provide this additional stretch. As well as extra room in the shoulder area, shirts for women golfers require a collar and sufficient back length to stay tucked in, allowing for uninhibited swing. Shorts and pants may need a back pocket to hold a glove when putting. Femininity is also a desirable characteristic with women's sports clothing (Wheat & Dickson, 1999).

Garment design which optimises body temperature without compromising fit and aesthetics is worthy of consideration for this research project. Originally developed to design World Cup jerseys that would combat the extreme heat footballers face in Japan and Korea at World cup 2002, the 'Cool Motion' shirt incorporated an inner layer of Dri-Fit™ and an outer layer of cotton fabric with mesh ventilation panels sewn into the sides. As the athlete runs, this design allows airflow to be channelled through the lower vents, flow over the body and exit through upper vents thus removing moisture and cooling the torso (Quinn, 2002). During the very hot weather when women bowlers are required to stand in the sun for long periods of time, some form of ventilation in the shirt could enhance comfort by helping to maximise air flow over the body.

In light of the above information, it is anticipated that for this research, knitted fabric will be used for all garments because of the potential stretch and comfort afforded by these fabrics. The uniform for women bowlers may include several individual garment components. The way in which these garments are combined, should keep

the bowler cool in the hot weather and provide the necessary added warmth during cooler temperatures when worn in layers.

### **2.9.2 Seams, stitching, needles and threads**

When designing garments to fit correctly, the designer has to be aware of the stitching process in garment manufacture to ensure enough stretch in the stitching to avoid the thread breaking and the seam coming undone and to avoid seam slippage. When sewing woven fabrics almost any seam structure is likely to be more extensible than the substrate, while for most knitted fabrics the opposite is true (Laing & Webster, 1998). Normal body movement will stretch clothing up to 25 – 30% while sports activities, which include bending and stretching of upper and lower limbs and trunk, require 40 – 60% stretch in the fabric and seams in order to accommodate these movements (Laing & Webster, 1998). The type of seam used, the fibre content, size and type of thread, the needle size and type and the number of stitches per centimetre will all impact on the effectiveness of the durability and drape of a garment (Jerram, 1994).

- **Seams.** The seams within sports garments made from stretch fabric, possibly incorporating elastomeric yarns, need to extend so that the garment allows the wearer uninhibited movement regardless of the closeness of the required fit. If the extension of the seam is less than that of the substrate, this may lead to garment distortion, wearer discomfort and eventually the seam may fail (Laing & Webster, 1998). Jerram (1994) suggests using overlocking or a mock-safety stitch to sew seams in knit fabric as they will not crack or break under strain. Woven tape should be used to back a seam when plain sew seams must be used but generally plain sew seams on knits should be avoided (Jerram, 1994).
- **Needles.** When sewing knitted fabrics, needle damage is one of the major faults causing the fabric to ladder and seams to break down during washing and wearing. Damage to the seam is characterised by frayed or broken fibres, filaments or yarns. Such damage can often be seen immediately after

stitching but frequently will not appear until after the product has been used that is when seams have been subjected to some form of tension during wear or after successive cleaning. Fabric breakdown may extend well beyond the area adjacent to the seam e.g. laddering (Laing & Webster, 1998). To minimise damage, Jerram suggests using a small ballpoint needle, regularly checking the tip of the needle for burrs and changing the needle frequently (Jerram, 1994). Ball point needles have a slight ball at the tip of the needle rather than the sharp points on regular machine needles. Ballpoints are recommended for use when stitching knitted fabric, the rationale being that the ball tips tend to push the yarns in the fabric aside as they pierce the cloth (Laing & Webster, 1998).

- **Threads.** Sewing thread must match the performance of the fabric. Jerram suggests choosing sewing thread that matches as near as possible, the fibre content of the fabric. The amount of twist in a thread plays an important role in the way in which the thread moves through the needle and imbeds in the fabric. Loosely twisted yarns or an imbalance in the final twist of the yarns can cause the thread to bunch and break as it goes through the needle (Jerram, 1994). A good sewing thread should have very few knots or slubs in a cone and be well finished so that it is able to work without breaking during high speed sewing. By using bulk nylon thread in the bobbin or looper and an all polyester thread or nylon thread in the needles, 'cracking' in the seam area can be reduced. Because they have little or no stretch, all cotton threads should be avoided when sewing elastomeric or stretch knit fabrics (Jerram, 1994). Sabaflex thread is a modified polyester thread which can be used to sew highly elastic seams. Because of its elasticity, it is recommended for use in sportswear, swimwear, lingerie and the central back seam of suit coats (Post, 2004).

If potential problems can be addressed and eliminated before manufacturing begins then much angst, time and money can be saved by the manufacturer (Jerram, 1994; Laing & Webster, 1998; Watkins, 1995).

## 2.10 Quality Assurance and Wear Trials

Quality assurance is defined as a quality level of a product and/or management of a company which leads to identifying and understanding the customers growing needs and expectations which in turn will lead to greater customer satisfaction.

*“ISO 9000 is the name given to a ‘family’ of standards that are internationally accepted to form the basis of a sound quality management system. The standard provides a framework for organisations to coordinate and manage their quality activities and to gain independent recognition for their achievements through an international certification scheme” (ISO 9001:2000, 2006).*

Designer Textiles International Limited, a New Zealand based company which specialises in the production of quality knitted textiles, found the benefits of ISO 9000 lead to greater efficiency, performance and profit and was achieved by standardizing procedures, providing an objective and thorough audit of those procedures and establishing a watertight system for solving problems (Designer Textiles, 2006). The management system was implemented to underpin strong future performance and to ensure that all the manufacturing functions were performed with maximum efficiency. Quality assurance is an iterative process and all aspects of the management of the company, the design process, fabric testing, and garment construction to design to wear trials of the prototype need to be constantly assessed for quality (Designer Textiles, 2006).

Changes in the fashion market, customer feedback and technological advancements all influence the need for continuing change and updating to any company's production design model. Changes and improvements to any product are based in part on the receipt of customer feedback as it is the customers' complaints, comments and the number of sales that determine a product's success and this information is used to make improvements to satisfy customer expectations (Kadolph, 1998). The customers remain the ultimate judge of product quality. Their

judgements can be based on their perceptions of fabric type, fibre content, comfort, durability, and previous experiences of similar products. Assumptions regarding brand names, will also influence the customers' expectations of garment quality and performance (Kadolph, 1998).

### **2.10.1 Wear Trials**

The purpose of any wear trial is to test a garment or product to see if it performs to the manufacturer's and user's expectations over a set time period (Le Pechoux & Istook, 2000). Depending on the product and the purpose of the test, wear trials or wear tests require a number of participants to wear the garment or product to be tested, over a set period of time and then provide feed back relating to the product and the product's performance. These tests can be carried out in a controlled environment such as a laboratory or in the participant's own environment. While wear trials carried out in a controlled laboratory environment will give a scientifically measured result, the results from trials carried out by people in the community or their own environment, are less likely to give reproducible results but will provide the researcher with subjective accounts of how the product will perform in the environment for which it is designed. Langmaid and Andrews (2003) recommend that questionnaires related to any wear trials need to be carefully designed as too many tightly scripted questions do not allow people to reflect and seek out the answers to the questions. Following the wear trial, questions that ask the wearer how the product felt, what they noticed and what questions they think are important should be included as part of the questionnaire (Kadolph, 1998; Langmaid & Andrews, 2003).

Because different fabrics can behave differently under different environmental conditions, especially those related to temperature and humidity, successive wear tests of the same product should be carried out under different atmospheric conditions (Kadolph, 1998). Wear tests are used to assess suitability for the target market and the likelihood of consumer acceptance. Kadolph (1998) and Langmaid and Andrews (2003) suggest there is no substitute for consumer testing and that wear tests provide information which can be used to modify and improve products. The

following documentation about a variety of wear trials that are potentially relevant and useful to this research illustrates the variety of approaches used to elicit information about a product.

- **Testing for Consumer magazine**

The 'Consumer' magazine contracts people in the community willing to test products and give their judgement about the product. Questionnaires are often used to guide the participants and their responses, but participants are always given the opportunity to express their subjective and personal opinion on other matters relating to the product or products and these are recorded in the survey results (Russell, 2006).

- **Wear trial of pre cooling vests.**

Laboratory wear trials in relation to pre-cooling vests developed specifically for use in sport (cycling), were carried out in Dunedin during 2000 (Webster, Holland, Sleivert, Laing, & Niven, 2005). Sixteen participants, eight males and eight females, were required to wear each of three cooling vests during rest, stretch, warm-up and recovery stages of exercise, but not during the 30 plus minutes run on a treadmill in a climatically controlled chamber. Each participant completed four trials, three trials wearing each of the vests under investigation and one trial (as a control) without a vest. Core and skin temperatures and heart rate of each participant were recorded at one minute intervals. Participants were asked to rate on a 7-point scale, their thermal sensations and perceptions of skin wetness every 5 minutes during each trial. Paired T-tests and ANOVA were used to identify physiological and sensory differences between cooling vests and the control. Because ease of movement is an important aspect of the wear trial, a series of wear tests which mirror the activities of the competitive cyclist, should ideally also be carried out by cyclists riding their bikes on the same day in the same place rather than running on a tread mill in a controlled environment. However, although this may provide a more accurate comparison of in use consumer acceptability of a single product, it may not provide such accurate comparisons among different products.

- **Wear trial of bras**

In the manufacture of bras a group of companies performed a trial to evaluate the performance of a garment over a set period of time. These trials were routinely performed in the development stage, but in some cases, trials were performed well into production. Panels of testers, usually a mixture of company employees and local consumers rated the garment in terms of fit, comfort and durability on an ordinal scale (Hardaker & Fozzard, 1997). The results of these tests were then referred back to the designers and amendments to the design made.

Some companies used a panel of testers to evaluate appearance, fit, comfort and support for the breasts, to select optimal fabrics for fabric performance, colourfastness, durability, and other attributes (unspecified). Trials were used throughout the design process and carried out by employees, professional models and consumers. Most companies wear trial most sizes to ensure the grading system does indeed meet the customer's requirements.

### **2.10.2 Trying on garments**

The task of trying on garments in a store is a valid evaluation of the comfort, fit and aesthetics of a garment as it is at this point that customers make their decision whether or not to purchase the garment. Holbrook (1983), in his study of using real products for research found that the tactile aspects of clothing were more influential on product perception than visual factors. Customers liked to touch the garments as well as trying them on and viewing them on their bodies for a realistic evaluation and assessment of the lines, colours and general aesthetics of the garment (Holbrook, 1983). Echman, Damhorst and Kadolph (1990) examined the importance of intrinsic and extrinsic criteria in purchase decisions for women's clothing. The 40 women interviewed in two department stores were selected because they tried on at least one garment in the fitting room. Their ages ranged from eighteen to sixty years. Questions asked included "What is it about this garment that makes you [not] want to buy it?" and "What is it about this garment that makes you dislike [like] it?" Respondents were then asked to list what they look for in general when buying that type of garment. The researcher read the open-ended questions to each participant

and recorded answers in writing. Where possible the researcher 'mirrored' or repeated the respondent's answers to be sure the responses were recorded properly. Open ended questions are useful because they can elicit unrestricted responses from participants, in contrast to dichotomous type questions where the questions offers two answer choices – yes or no. Evaluative criteria important to the participants included:

- Aesthetic criteria like colour/pattern, styling, fabric, uniqueness and appearance;
- Usefulness criteria included versatility, matching, appropriateness, and utility;
- Performance and quality included fit, comfort, care and workmanship;
- Extrinsic criteria included price, brand and competition.

Colour was the most important influencing factor on the choice of garments and fit and comfort would be compromised so long as the colour was 'right' (Echman et al., 1990). Visual criteria seem to have the greatest impact on selection of garments to try on in the fitting room as these visual characteristics have expectations of fashionability or popularity, aesthetic appeal, and self expression however both visual and fit criteria impacted on the decision to purchase.

The subjective responses seemed to indicate that they were as reliable as those acquired from a more objective and statistically analysed set data gathered from a formal written response or questionnaire (Echman et al., 1990). Free response to stimuli is a valuable type of data as subjects do not have to recode ideas and evaluations onto measurement scales and are allowed to select their own dimensions while formulating descriptions of evaluations (Damhorst, 1985; Echman et al., 1990).

### 2.10.3 Fit issues related to user satisfaction

LaBat and DeLong (1990) cited physical comfort, psychological comfort and appearance played a part in the consumer's perceived satisfaction with fit.

Fit relates to how the dimensions of the garment relate to the three dimensional body on which the garment is to be worn or displayed (Kadolph, 1998). Fit for apparel refers to how the garment relates to the individuals shape, while allowing for a general, or in the case of this project, a specific range of movement.

Testing for fit is a highly subjective task. How well a garment fits is in part based on individual perceptions of comfort and fit (Chan et al., 2003; Le Pechoux & Istook, 2000).

*"New Zealand women no longer fit the traditional hour glass figure flaunted by the film stars of the 1950's such as Marilyn Munroe and Sophia Loren. The fashion industry continues to ignore the true sizes of women who are more likely to be top heavy, rectangular or pear shaped" (Dye, 2005).*

A study of 6000 women in the United States described 46% of women to be rectangular with their waist measurement being less than 23cm smaller than the hips or the bust. Just over 20% of women were bottom heavy with hips 5cm larger than busts or more and almost 14% had busts which were 7.5cm or more bigger than their hips (Dye, 2005). An independent study of British Women published in 2004 found that the average woman's waistline had increased 15cm since the 50's. Although experts say that these body descriptions equate with women in New Zealand, some designers and manufacturers say there have not been any radical changes over recent years. "Auckland University body composition scientist Lindsay Plank said changes in New Zealand women's body shapes were to be expected in line with increasing levels of obesity." (Dye, 2005). However, no anthropometric study of New Zealand women has ever been made. Because apparel companies tend to create garments to fit one body type and develop base patterns and grade rules matching the proportions of their fit model, it has been reported that in the United States as many as 50% of

customers cannot find garments which are comfortable and fit well (Ashdown, 1998).

*“Any badly fitted garment can restrict cardio-vascular flow, cause skin abrasion, create unpleasant thermal or moisture conditions, induce irritation or cause other aggravations that strike the wearer in the form of discomfort” (Le Pechoux & Istook, 2000).*

Garment fit is influenced by the ratio of garment size to body size and the garment style, while governing the ease of movement. Chan et al., (2003) suggest that the weight, ease of movement, pressure on the body surface and ventilation are factors that can be used as measurements for garment fit. They go on to suggest that loose fitting garments allow more freedom of movement while tight fitting garments give a sculptural effect and risk the possibility of discomfort from the very close fit. This can be avoided by using stretch fabrics along with good garment design (Chan et al., 2003). Abeysekera and Liu (1997) suggest protective garments can restrict the body's movements if not correctly fitted. Tight fitting clothes can be uncomfortable while loose fitting clothes which can provide good ventilation can also interfere with movements if they are too loose. Unusually large clothes are clumsy and affect the wearer's appearance or style. Apparel that fits the body provides a neat and smooth appearance and gives the wearer maximum mobility and comfort. Achieving a good fit in apparel is difficult as the body comes in many varieties of sizes and shapes (Beasley, 2002; Shen & Huck, 1993). The upper torso is particularly difficult to fit because of the many angles and curves.

A garment that fits the wearer properly and feels comfortable on the body could enhance the self esteem of the wearer. The fit of any garment affects how the garment functions and performs. Some lawn bowling clubs supply members with unisex sizing in T-shirts and jackets, which results in less outlay on stock being held and simplification of inventory. Because of women's differing shape and dimensions, wearing smaller sizes in garments initially designed for men is not an appropriate solution (Weede, 1997).

#### **2.10.4 Fit and fit analysis of slashed jackets**

Postural expression in the shoulder and upper back areas were the focus of a study by Inez, Kohn, and Ashdown (1998). Twelve active white women between the ages of 55 and 65 representing bust size 12 or 14 were chosen because they exhibited age related postural changes that could affect the fit of clothing (Inez, Kohn, & Ashdown, 1998). The researchers chose a jacket as the test garment because it is a familiar garment for women of this age and they have established expectations of fit and size for this apparel item (Inez et al., 1998). Slashed and unslashed test jackets were constructed to fit each individual silhouette and prepared in two sizes. Equidistant slashes i.e. small regular cuts were made to the fabric vertically, horizontally and at a 45° angle (Inez et al., 1998). The 12 women were videotaped while stationary and while they used a paper cutter, but it was only in the relaxed position following the physical exertion that video data was collected. The focus area was the upper right shoulder area and the back area of each test jacket. The subjects were then videotaped wearing an unslashed jacket in their size while they turned in 360° circle. Six 'expert' fit judges viewed the videotaped images and assessed the fit of the unslashed jackets. The judges assessed the misplacement of seams, the presence of folds or stress lines in the fabric and the general volume and placement of the garment on the body. The slashed jackets were subjected to quantitative analysis. The images were calibrated by taking an image of a calibration grid against the subject's shoulder blade. The degree to which the slashes opened indicated stress areas. The range of results was analysed using a two-way analysis of variance (ANOVA). In this study, the diagnostic marker (slashes) permitted computer analysis to quantify the fit of the garment (Inez et al., 1998). Fit analysis as performed by an 'exper', requires simultaneous weighing of interrelated visual clues in three dimensions. This method is flawed as even trained observers are prone to subjective judgements (Inez et al., 1998). In this study, the data gathered showed that the expert assessment of garment fit was a valid measure, but subject perceptions of garment fit over posture was not. Subjects recognised visual changes from the front of the body i.e. the relationship between apparel fit and shoulder slope and changes caused by increased body dimension, but they were unable to recognise or

adequately assess areas that could not be seen or felt or postural changes and their impact.

*“Examination of methods used in a body of research, facilitates identification of trends that may influence progress toward theory building. Models and theories ultimately should provide greater predictive potential in practical applications by retailers and manufacturers”* (Echman et al., 1990).

These studies highlight the possibility that purchase processes may vary among types of consumers and types of products since evaluative criteria are manifestations of the consumer’s underlying values and attitudes, stored information and experience and various psychological, sociological, and economic influences (Jenkins & Dickey, 1976). It also questions the reliability of judging fit using only subjective methods.

#### **2.10.5 Judging perceptions of fit during wear trials**

Subjective measurement is critical for the assessment of clothing comfort. The fit of a garment and the extensibility of the fabric used in a garment, have great predictive power for the subjective measurement of pressure against the wearer’s skin (You, Wang, Luo, Li, & Zhang, 2002a). A panel of 18 women were required to complete a questionnaire regarding their experiences and habits when wearing tight fitting garments. Measurements of clothing pressure and fabric strain were taken during the experiment. The results showed that clothing pressure is not only related to fabric strain but also to fabric extensibility. When a garment does not fit well, the garment is resistant to the body’s movement. Critical strain areas of the body produce fabric stretch and the resultant pressure is felt by the wearer. The amount of slip between the skin and the fabric affects the extensibility of the fabric and is a contributing factor to the pressure felt by the wearer (You, Wang, Luo, Li, & Zhang, 2002b).

The objectives of a study regarding increasing the comfort of nursing brassieres by Constantakos and Watkins (1982), were to determine whether:

*“localized pressure on areas of the breasts, shoulders and back of nursing mothers could be decreased by varying specific design features of a nursing bra and whether objectively measured changes in pressure were related to noticeable changes in subjective perceptions of bra comfort”.* (Costantakos & Watkins, 1982).

A parallel can be drawn with the study by Haycock, Gillette and Shierman, (1979). Their study concluded that while running, larger breasted women athletes found good fitting and supportive bras which distributed the weight of the breasts more evenly across the chest, more comfortable than their normal bras. Costantakos and Watkins (1982), set out to demonstrate that design features can be developed which maintain body support while distributing pressure more evenly over the body. A pre-test was carried out using five nursing mothers who normally wore a cup fitting C or D. Five areas where maximum pressure was exerted were determined by using a Load Profile Analyser (LPA) (Costantakos & Watkins, 1982). They developed design features within the brassiere structure which distributed pressure concentration where the garment touched the body over a wider area thus affording greater comfort to the wearer. Ten further subjects were used to assess the comfort of the modified bras. A basic sports bra was altered to accommodate the attachments of three different design features and the same maximum pressure areas were then measured when the modified bras were wear trialled. Pressure readings using the LPA were compared between the subjects own bra and that of each of the modified bra. The wearer's subjective assessment regarding the comfort of each of the design features was also recorded.

In all cases discussed above, the objective ratings of decreased fabric strain and pressure reductions were accompanied by subjective ratings of increased comfort. The results would indicate that good design could be achieved by, in the case of bras, maintaining body support and distributing pressure evenly over the body, and in other areas of the body decreasing pressure of fabric against the skin. Although support garments are not features of this present research, results indicate any pressure or restrictions of the body caused by fabrics and/or garments could be

detrimental to the performance of the athlete, therefore it is important to note that fit can be improved to realise greater comfort in any garment.

*“Clothing comfort is a psychological feeling or judgement of a wearer, depending on subjective perceptions of visual, thermal and tactile sensations, psychological processes, body and apparel interactions and external environmental effects. It involves several latent independent sensory factors” (Chan et al., 2003).*

Based on this literature a wear trial of the prototype garments designed for women bowlers should give some reliable information for the future development of the garments. The prototype garments would need to:

- Be worn by groups of women who represent the target market;
- Be made in a variety of sizes to fit the target market groups;
- Worn on different occasions while playing bowls;
- Be made from a variety of fabrics so that preferences for handle and comfort can be judged.

Because it would seem appropriate that the trials should be carried out outside on a bowling green rather than in a controlled environment, any judgements regarding comfort factors like body temperature, ease of movement, the tactile sensations of the fabrics and ease of donning and doffing when wearing the garments, could only be subjective and dependent on the opinion of each individual wearer. However, it is more likely that the judgements from the individuals regarding comfort will be more realistic when the garments are trialled during play in a tournament over a two or three day period than when carried out under strict laboratory conditions.

## CHAPTER 3

### METHODS

#### 3.1 Introduction

Research through practise is applied in order to develop a model for the design and construction of women's bowling clothes. During this project, research about design explores the functional, expressive and aesthetic clothing needs of women bowlers in New Zealand by consulting with small groups of women in each phase of the design processes from design styles to choices of fabrics for each garment, the fit and comfort during wear trials and the overall evaluation and recommendations for future development of the project. Research through design evolves as the culmination of information gained from fabric testing, exploration of fashion influences, pattern making and construction techniques and consultation with women bowlers.

A model was sought that could be of relevance for a small business (e.g. one or two persons) and that could be employed on an ongoing basis. Elements have been adapted and extended from three types of design models:

- Downton's (2003) and Press and Cooper's (2002) sequential steps for design models. This approach has merit in that it isolates problems or sub issues which need attention;
- Lamb and Kallal's (1992) FEA model. All aspects of this model have been considered as important in this study. Recognition of the culture of bowls is achieved through the historical research and the visual analysis of photographs. The functional aspects including the ergonomic styling and fit of the bowling outfits is also major consideration. The aesthetic and expressive aspects of Lamb and Kallal's model are important in order for the final appearance of the outfit to not only meet the uniform requirements of Bowls New Zealand, but also to meet the target consumer group's request for contemporary trends and styles;
- Plumlee and Little's (1998) product development model forms the starting point or framework for the present model because it incorporates development

processes arranged in sequential steps and yet allows for reassessment at all stages of development from the conception of a new product to the marketing plan and sales, although the latter is beyond the scope of this thesis.

The application of a number of research methods in the present design process is aimed at adding more than one dimension to data acquisition and reducing the possible bias resulting from the application of just a single method.

### **3.2 Defining and analysing the design problem and sub issues**

The research problem is identified as the need for a model to enable the ongoing design and development of sports clothing that will meet the functional and aesthetic requirements of women lawn bowlers. Current literature and information pertaining to the issue was critically examined and evaluated in Chapter 2. The recommendations by Downton (2003), Cross (1999) and Press and Cooper (2002) form the basis of the process steps used in this research model. All these authors recommend using sequential steps when researching through design and also suggest that sub issues of the design problem should be identified and tackled in a systematic and iterative manner. Evaluation of the literature has revealed a number of sub issues which will apply to the model in this research.

These are identified as:

- Target market requirements
- Design development
- Pattern and prototype development
- Evaluation

Each of these sub issues need to be addressed in a systematic manner:

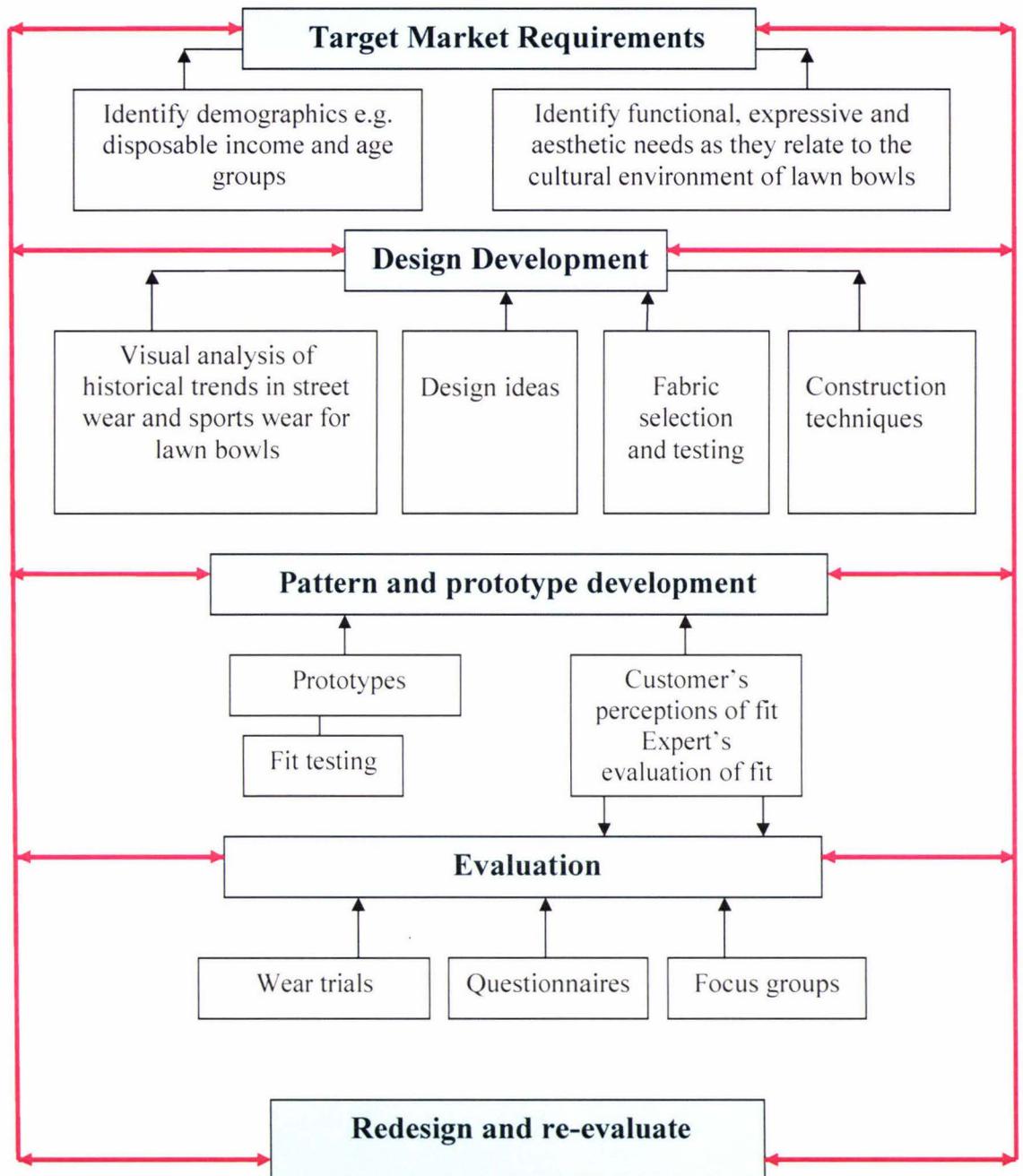
- Consider alternative ways of solving the identified problem
- Evaluate each alternative based on reliable evidence

Some judgement is made of the alternatives based on evidence from literature, interviews, focus groups, questionnaires, testing of available fabrics and wear trials of the prototype garments.

- Make a choice or decision regarding the best alternative.  
From the evidence gathered, the best choice of the possible solutions will be made. Problems can occur at this point as the choices are made by those who design the method and not by those who will ultimately use the solution. Focus groups and questionnaires will help to clarify the preferred choices of the target market.
- Implementation and evaluation of the decision.  
In this research, evaluation of the garments in the wear trials is sought from the people affected by the outcome of the garment design.

The starting point or initial model for the design development is given in Figure 3.1. Each aspect of the design development is interrelated and no one aspect stands alone. Throughout the design development each aspect will be evaluated and the views of the target market considered. The model devised by Plumlee and Little (1998) forms the basis for the preliminary model for this research which will then be modified, if this is required, as a result of reflecting on the outcome of the research. The sub issues identified in Figure 3.1 are dealt with individually but not necessarily sequentially as the target consumer is integral to and is consulted during the whole design process. This is one departure from the recommendation of Downton (2003) and Press and Cooper (2002) as these authors suggest that the target consumer is consulted at the end of the design process in order to corroborate or substantiate the final design. In their models, evaluation of the design during the development stages is made by the designers and people employed in the company. Consumer opinion is not sought until near the end of the cycle. Where the consumer does not like the product or sales do not meet the expectations of the company, then a revision of the product is made. This could be due to logistical difficulties posed by larger companies where departments operate as separate entities and regular dialogue between these entities is too time consuming or difficult. For a smaller company

with one or two individuals and a smaller target or niche market, consultation can be incorporated throughout the process.



**Figure 3.1** Preliminary design model showing the design process for designing and making of Women's Bowling Apparel.

### 3.2.1 Sub Issue 1. Investigating and establishing the target market

One of the first tasks was to identify the target consumer market in order to discover who they are, their age groups, their income and most importantly for this research their requirements regarding the functional, aesthetic and expressive needs of women's lawn bowling clothes. Following the recommendation of Deasy (2003), three methods were implemented in order to investigate the target market (Figure 3.2) and to gather data about women lawn bowlers.

Findings helped to establish the existence of different and common features of the target market such as age groups, the culture of the game of lawn bowls, specific requirements of bowls uniforms and desirable qualities of the clothing as perceived by each group within the target market.

An application for low risk ethics approval was lodged with Massey University Human Ethics Committee and approval was given to carry out two questionnaires and involve people in a number of focus groups (Appendix 1).



Figure 3.2 Three methods used to establish the needs of the Target Market

- **Interviews with relevant individuals and groups**

Interviews with relevant individuals and groups took place near the beginning of this project to find out how the rules about dress are interpreted at various levels e.g. administrative, club, and regular players to see whether a consistent view is held. It was important to establish perceptions about what the nationally recognised dress code is for New Zealand women bowlers according to the 'Laws of the Game' (*Regulation Dress Code*, 1957). It was also important to establish what is currently worn by women during club events and if this differs from the rules of the game. The following people were consulted with regard to the dress code for lawn bowls:

- The Committee of Bowls Wellington in order that the uniform met the requirements of tournament play;
- June Best. Referee and coach for lawn bowls and present active member of the Johnsonville Bowling Club Wellington;
- A Wellington lawn bowls representative and present active member of the Victoria Bowling Club Wellington;
- A past New Zealand lawn bowls representative, referee, coach and present active member of the Park Bowling Club Wellington;
- The Chairperson of Bowls Wellington was consulted because of the constraints regarding the colour of the wear trial garments for one of the tournaments;
- A group of teenage students.

Some of these interviews were of a semi formal nature. Some were informal face to face discussions while others took place over the telephone because of the difficulties of personally accessing all participants. In all interviews open ended questions were asked and notes taken and written up at a later date (Echman et al. 1990). For documentation of these interviews see Appendix 2.

- **Exploratory discussion.**

Due to the difference in methods an exploratory discussion took place with a group of six teen-age girls who were attending a bowls coaching session at the Johnsonville Bowling Club. All of the participants in this group were relatively new to the sport. They were shown a set of photographs (Appendix 3) and the preliminary concept sketches of sports clothes (Appendix 3) which were inspired from contemporary styles showing in current fashion magazines. The purpose of the photographs was to illustrate the varying dress codes for lawn bowls while the sketches were used to elicit and promote ideas and suggestions for the 'expressive and aesthetic considerations' needed in bowling apparel for younger players consistent with the recommendations of Lamb and Kallal (1992). The girls were asked to comment on the acceptability of the styles in the sketches and to describe other styles they might prefer. Preferences were expressed by each member of the group and included suggestions made regarding lengths of individual garments, tightness of fit and general garment styling. Comments were recorded in written form and at the time, modifications were made to the sketches to represent their ideas. The information from this group of young women is not recorded as a focus group. The only purpose of this meeting was to gain an insight into the types of garments and styles preferred by this age group so that these ideas could be taken into account during further design development for women's bowling clothes.

- **Focus Groups**

The use of focus groups fosters open discussion which, when prompted by leading open ended questions and tangible objects such as photographs, fabric samples and actual garments, gives a broader dimension to the discussion topic (Deasy, 2003). Tangent topics which evolve during discussion can lead to further investigation thereby enriching the knowledge base.

Five focus groups were comprised of women belonging to the Johnsonville Club, The Park and the Victoria Club (all Wellington bowling clubs). All of these women played regularly in club and interclub competitions. The first and second groups

were comprised of ten and eight women respectively, each woman having more than ten years bowling experience. The third group was comprised of seven women, each with less than ten years bowling experience. The fourth group was comprised of three young women with less than five years experience and the bowling experience of the ten women in the fifth group varied from three to fifteen years. The individual women in each group were telephoned by the researcher and asked to participate in a focus group at a designated time. A broad outline of the purpose of the focus group was explained at this point so the participants were prepared on arrival to discuss the topic of bowling clothing.

The sixth focus group took place in Gisborne, the climate in Gisborne being quite different to that of Wellington (Fouhy, 2006). During the summer months Gisborne generally experiences a more settled weather pattern, hotter summer temperatures and less wind than Wellington therefore the researcher anticipated the clothing needs of women bowlers in the Gisborne area could be slightly different. This group was comprised of seven women belonging to various bowling clubs in Gisborne. The bowling experience of these women varied from 5 years to over 20 years. The researcher anticipated that information from these women could give a further dimension to the functional requirements for bowling clothing thus rendering the final garments more versatile for New Zealand climates.

On arrival at the designated venues for each group, participants were offered refreshments and introduced to one another where necessary. At the start of each meeting, the purpose of the focus group was reiterated and how their contribution would help the project was explained. To stimulate the discussion, a set of photographs showing women participating in the game of bowls was passed around the group. The set of photographs covered a period from 1912 to 2004 and showed groups of women wearing the regulation bowling dress of their era. All questions and photographs are given in Appendix 3. A range of fabric samples were also shown to the group (Appendix 3). Chan et al. (2003) suggest that comfort is a psychological feeling or judgement made by the wearer and the degree of comfort depends on the wearer's subjective perception of thermal and tactile sensations

against the skin. By enabling the women to handle the fabric samples, they were able to assess the fabrics and make comment regarding the fabric they thought most suitable for each individual item of bowling apparel. Brief explanations of the properties of the fabrics were provided for the group, who were then asked to comment on their preferences and what they would consider to be desirable qualities in a jacket and a shirt or top and trousers or shorts for lawn bowls. Participants were then given the opportunity to comment about any other matters they considered relevant to the topic. All information from each of the focus groups was recorded in written form by the researcher and collated at a later date following the recommendation of Echman et al. (1909). Each meeting took approximately 1.5 hours. Participants were asked to fill out the first questionnaire at the conclusion of the focus group. The first focus group were not asked to fill out the questionnaire as it was considered that they were too new to the sport and would not have been able to comment with any authority on most of the questions in the questionnaire. The questions and results of the focus groups are documented and discussed in Chapter 4.

- **Questionnaires**

Two questionnaires were used in this research. The purpose of the first questionnaire was to gain general information about the target market, demographics and functional, expressive and aesthetic requirements that could be used to develop design ideas and more specific questions for the focus groups. For example, the first questionnaire was used to ascertain colour and fabric preferences as a guide for fabric purchases and to gain an insight into the disposable income and shopping habits of women bowlers in order to approximate a price range for the fabric costs and the finished garments. Questions regarding the satisfaction or dissatisfaction of the sizing and fit of every day clothes were also asked. Specific questions regarding preferred styles and items of clothing for bowling in particular were asked so that any identified problems could be addressed during the construction of the patterns and prototype garments. A copy of this questionnaire is included in Appendix 3.

The second questionnaire was used to evaluate the wear trials and is documented and reported later.

### 3.2.2 Sub issue 2. Design Development

In order to ensure all aspects of the design development phase of this research was covered the sub issue 2 was broken down in further sub issues (Figure 3.3).

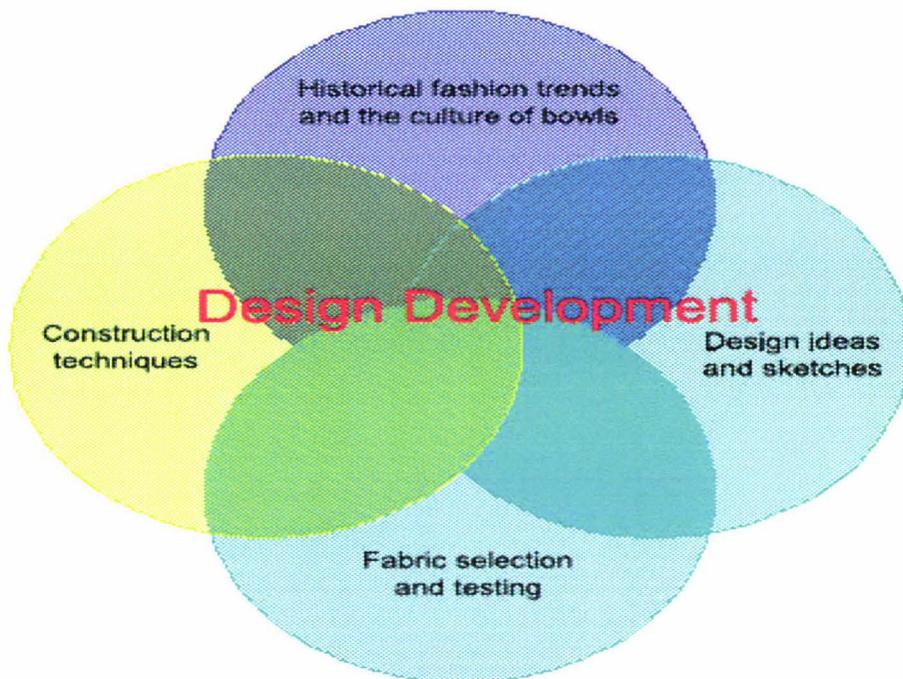


Figure 3.3 Design development sub issues

- **Historical fashion trends and the culture of bowls.**

The major focus of the historical research was to investigate the clothing worn by women lawn bowlers from 1940 to the present time and draw a comparison with the silhouette and fashion trends of street wear fashion during corresponding decades.

The objective was to see whether contemporary fashion could be successfully incorporated and accepted into future apparel designs for women's lawn bowls.

Although women did play bowls before the 1940's the National Body for Women's Bowls, which set the dress code, was not established until 1947, therefore the period of historical dress analysis for this research was defined as from 1940 to the present day. Photographs of women bowlers were collected from the Johnsonville Bowling Club archives, The National Museum Archives, The Bowls Museum New Plymouth, the Internet, library books and the researchers own collection. By systematically collating, analysing and recording information derived from photographs of women wearing bowling apparel, an understanding can be gained of the historical trends of women's bowling dress. The functionality of the clothing in relation to the sport of lawn bowling is analysed and an awareness of the expressive codes and the written and unwritten rules of the dress codes which are associated with sports women and in particular women bowlers, was noted.

*"As with all sampling of archival material which is determined by what remains in collections, the sample cannot be considered to be statistically representative. However it does allow indicative conclusions to be made for analysis"* (Cumming, 2005).

Cosbey, Damhorst and Farrell-Beck (2002) in their quantitative analysis of dress from pictorial evidence, considered three general types of measures e.g. feature identification, body location measures, and aesthetics and fit measures. Cumming (2005) used similar quantitative criteria and derived relevant descriptors to analyse photographs rather than pictorial illustration, of women engaged in a variety of sports. Of particular relevance to the present research was the aspect of Cumming's (2005) analysis which addressed the functionality of the clothes in relation to the sport rather than just the appearance of the clothing. For this present research quantitative analysis could not be verified due to the small sample number, therefore a qualitative but systematic approach was applied by using visual analysis of the collected photographs of women bowlers in each decade from 1940 to the present day. In order to visually analyse if there is a correlation between the functional, aesthetic and expressive aspects of women's bowling clothing and women's street wear fashion trends between 1940 and 2006, a framework of qualitative

measurements based on Cosbey et al (2002), Cumming (2005) and Delong and Petersen's (2004) analysis of appearance was used. The overall appearance of the garments and the technical construction of the garments and accessories were the focus of the analysis.

<b>Visual features</b>	<b>Assessed Criteria</b>
Fabric aesthetics	Perceived weight of fabric (light to heavy).
Silhouette	Angularity to roundness. Closeness of fit to the body.
Feature identification and structural embellishments.	Garment type (dress, skirt, top, jacket, trousers, shorts). Closure/ opening (e.g. location, buttons, zipper, press studs). Presence and location of gathers. Presence and location of panels. Presence and location of pleats/tucks. Presence and location of pockets (patch , inseam, welt, etc.). Types of belts and whether fastened with buckle or tied.
Neckline	Type and style of collar Neck shape (square, V-shaped, high or low).
Sleeve	Type and length.
Trousers	Length and type.
Skirt	Width, fullness and length.
Accessory type	Shoes (style, heel, colour). Headwear (type and style). Bags.
Total look	Combinations of apparel items

**Table 3.1 Recording table framework for visual feature analysis of bowling apparel.**

The framework for identification (Table 3.1) includes features such as the fabric aesthetics, the overall shape of the silhouette, feature identification and embellishments, neck line and collars, length and type of sleeve, length and fullness of the skirt, types of garments and combinations of garments worn. Accessories such as shoes and hats or purses were also considered in these analyses. These particular characteristics were chosen so that the functional natures of the items of apparel i.e. stretch, movement and ease as well as the aesthetic and expressive aspects could be analysed. These characteristics were analysed on a comparative basis to fashionable trends of the corresponding decades. A limited number of photographs representing each decade were used in the analysis, a total of 18 photographs. A qualitative analysis was made of the bowling outfits and appearance of the women shown in the photographs, a total of 40 outfits. Discussions of the analyses pertaining to the photographs are recorded in Chapter 4.

- **Design ideas**

Information and data gathered from the literature review, questionnaires, focus groups and analysis of current fashion trends were instrumental in formulating the design ideas for the designs for the bowling outfits. Primary consideration was given to the development of designs generated from the needs of the target market. Developmental drawings and sketches evolved from these needs. Cognisance was taken of comments made by the interviewees and key ideas gained from participants during the focus group meetings as well as answers given in the questionnaires concerning the functional, expressive and aesthetic needs of women's bowling clothes. Predictions of trends for fashionable dress and sportswear for other sporting codes were also taken into account. Design ideas came from the summation of the analysis of the data gathered from the target market research, historical and trends analysis and observation of sportswear currently worn by professional sports people.

The challenge was to design a set of garments that would meet the functional, aesthetic and expressive needs of diverse age groups of women and to anticipate the needs of future women bowlers.

- **Fabric selection and testing**

It was important to establish whether any of the new and innovative fabrics discussed in Chapter 2, which would meet the requirements of the researcher and the target market, could be sourced in appropriate quantities for this project. Desirable characteristics identified from the literature review included:

- A degree of stretch;
- Comfortable when worn next to the skin i.e. soft and not scratchy or prickly;
- Breathable so that the wearer does not become hot and clammy;
- Warm or cool depending on the type of garment;
- Provide protection from the sun;
- Launder easily i.e. is colourfast and colour does not transfer to other fabrics;
- Maintain original appearance over time i.e. does not fade or pill;
- Be available in a range of colours.

These criteria will be re-evaluated on outcomes of the questionnaires, focus groups and discussions with fabric suppliers.

A number of companies were consulted with regard to fabric samples and supplies. Companies were either directly approached or contacted by phone. After discussing the fabric characteristics required for this project, the availability of the fabrics, the cost and minimum purchase requirements, samples of high performance sports fabrics were obtained. A small sample of the target market (6 participants in total) was consulted semi-formally and their individual views sought regarding the selected fabrics and their colour. Final selection was determined by the cost and availability. Norsetec supplied and sponsored the 'Merino Max' fabric used in the jackets and the fabrics for the shirts, trousers, skorts and the contrast were purchased from Levana Textiles Limited. Details of the fabrics are given in Chapter 4.

Fabric testing was carried out on the available fabrics to ensure that the fabrics chosen for the final garments would perform in an acceptable and predictable way and the correct information could be given on the label (Jerram, 1994). It is most

important that the end wearer also finds the comfort and ease of care of the fabrics perform to a personal acceptable standard.

The examination of data supplied by the different manufacturers regarding the performance properties of the fabrics was particularly important as suitable and readily available fabric performance needs to be evaluated in regards to the fabrics' properties, characteristics, capabilities and cost. Comfort and serviceability must be placed in the context of climatic factors such as temperature, humidity and wind; levels of physical activity; and how to maintain desirable properties over time (Chan et al., 2003; Collier & Tortora, 2001; Hatch, 1993; Quinn, 2002).

'In house' testing was carried out on the selected fabrics. A range of laboratory tests were performed to make sure the fabrics chosen for the garments met acceptable standards, the requirements of the researcher and the end user. Tests were carried out in a standard atmosphere of relative humidity approximating  $65 \pm 2\%$  and a temperature approximating  $21 \pm 1^\circ\text{C}$  (Kadolph & Langford, 2001) and results from these tests are discussed in Chapter 4. A list of the tests performed is given in Table 3.2. The final fabrics chosen were selected on the basis of their availability, cost and performances during the above tests and examinations.

- **Construction techniques**

A range of seaming techniques were trialled to find the best seam type for the fabrics in order to accommodate stress areas in each of the garments. Types of seams trialled included:

- Plain seaming (ISO 1.01.01) using a Brother Exedra DB2B737-413 Mark II sewing machine.
- Overlocking (ISO 1.01.03) using 3 and 4 threads using a Juki MO 6714S 4 thread machine.
- Coverstitching (ISO 7.09.05) using 3 threads using a Kansai Special Model RX9803A/UTC-E

Combinations of seam types were also trialled (Table 3.3).

<b>ISO number</b>	<b>Name</b>	<b>Purpose</b>
AATCC8-2004	Colour fastness to crocking : Crockmeter method.	To determine that colour will not rub off onto other fabrics during manufacture or wear.
ISO 3759 1994	Textiles- Preparation, marking and measuring of fabric specimens and garments in tests for determination of dimensional change.	Measures shrinkage and distortion in fabrics after washing.
ISO 105-C01 1989	Colour fastness to washing.	To help determine laundering instructions
ISO 105-B02 2000	Light fastness to light: Xenon arc fading lamp test	To determine the possibility of fading or change of colour when exposed to artificial sunlight.
N/A	Visual analysis of wear and abrasion to fabrics and garments	While a scientific laboratory abrasion test was not carried out on these fabrics, a visual analysis was made of the garments after the wear trials and after laundering test fabric samples.

**Table 3.2 Tests carried out on selected fabrics**

<b>Fabric</b>	<b>ISO 4916 Seam type</b>	<b>ISO 4915 Stitch type</b>
White Coolmax™ for top	1.01.01, 1.01.03,	301, 514, 602
Striped polyester/cotton fabric for trousers and contrast	1.01.01, 1.01.03,	301, 514
Merino and Tactel™ for shorts	1.01.01, 1.01.03,	301, 514
MerinoMax™ and Coolmax™ for jacket	1.01.01, 7.09.05	301, 514, 602
Polar fleece for jacket	1.01.01, 1.01.03,	301, 514, 602

**Table 3.3**      **Types of seaming and stitch types used in trials**

Size 70 and 80 machine needles (both sharp points and ballpoints) were used to test sew each of the fabrics. Because it was readily available in suitable colours, a polyester thread ‘Polyfil 120’ was used for all experiments. No other thread was used in the stitching and seam tests. Seams which were deemed successful if:

- The tension and balance of the stitches were even within the seam;
- The stitching did not break when tugged or pulled to an extension considered to be reasonably acceptable;
- Did not show seam slippage or grinning;
- No holes or laddering appeared where the sewing needle had punctured the fabric during machining.

The results of these tests are recorded in Chapter 4.

### **3.2.3 Sub issue 3. Pattern and prototype development**

The choice of block pattern needs to be commensurate with the construction of the fabric intended for the apparel item. Trial tests for fit of the prototype garment are essential aspects of the development of any new apparel item as block patterns need to be adjusted for each individual style.

Block patterns for knitted fabrics from Massey University were used and manipulated to create the patterns for each style. Before beginning any manipulations, the original blocks were graded up to a size 16. The first prototype tops were constructed in fine Merino wool fabric and wear trialled by two people. The fit of these two garments was evaluated by the researcher and by the wearer.

- The in-production mini trial (initial prototype wear test) of the pink and black Merino top was carried out by one person. The top was worn on at least five occasions while playing bowls and the garment left in the bowls bag between games. The participant was asked to complete the first questionnaire (Appendix 3) and record any helpful comments regarding the fit and performance of the garment. The purpose of this test was to assess the behaviour, fit and ergonomic cut of the top and test the comfort of the fine Merino wool fabric. The results of this initial wear test helped to determine the final design and fabric choices for the bowling outfits. A written critical assessment was given at the end of this trial and is discussed in Chapter 4.

Once each pattern was finalised regarding fit, the pattern was graded down to a size 10 and up to a size 22. The patterns and grade rules remain with the researcher. The prototype rationale is discussed in Chapter 4.

### 3.2.4 Sub issue 4. Evaluation of the garments

Evaluation took place at each aspect of the design development stage, the pattern and prototype development stage and wear trials, shown in Figure 3.4.

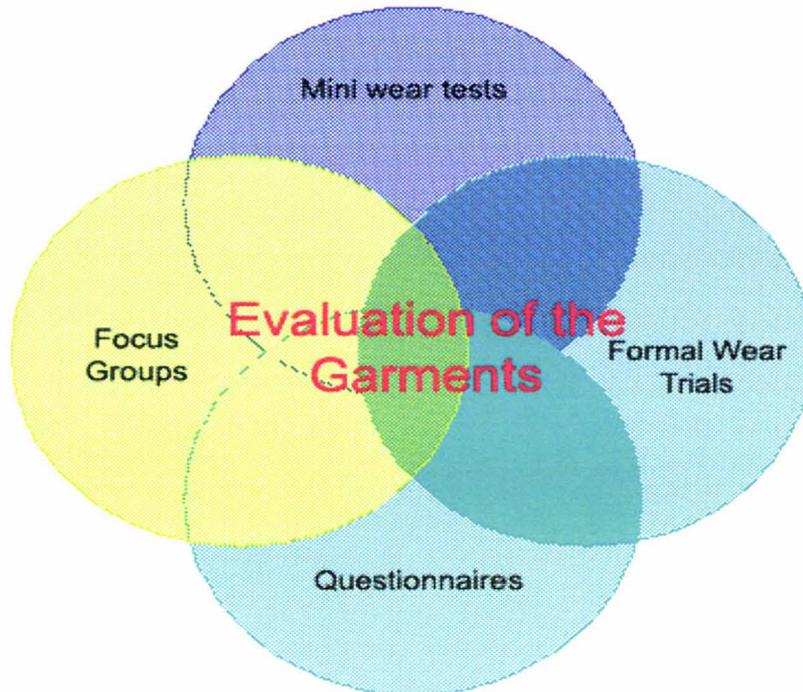


Figure 3.4 Methods used to evaluate the garments in the wear tests

The prototype Coolmax™ top was tested for fit and style by two teenage bowlers and informal comments made at the time were recorded in writing. The first prototype jacket with collar was assessed for fit and style by the researcher, the second prototype jacket with hood was semi-formally assessed by three adult women and the researcher. Comments made at the time were recorded in writing (Appendix 4).

- **Wear trials**

The purpose of the wear trials was to physically test and assess the comfort, fit and performance of the garments and fabrics over time when worn by a range of sizes and age groups of participants (Eckman, Damhorst, & Kadolph, 1990). The final

garments were worn by two sets of trialists. The first formal wear trial involved a group of six teenage girls who wore the garments while competing in the Secondary Schools National Competition in Auckland in December 2005. The second group of four women (aged 40 – 65) wore the garments while competing in the New Zealand National Competition held in Wellington during January 2006.

- **Questionnaires**

After the wear trials of the final outfits during the two separate national tournaments, a second questionnaire was used to evaluate the comfort, fit and style of each garment.

The questionnaires from Wellington were collected directly from the participants while the questionnaires from the Auckland competition were posted to the researcher one week later. A copy of this questionnaire is included in Appendix 3 and the results of all questionnaires are documented and discussed in Chapter 4.

- **Evaluative focus group**

A further focus group took place two weeks after the second wear trial. The four women who took part in the second wear trial discussed the results of the wear trial questionnaire and gave further feedback about the performance of the garments. The six younger women who took part in the wear trials were not available to meet together for a focus group but completed the second questionnaire (Appendix 4).

# CHAPTER 4

## RESULTS

### 4.1 Introduction

This chapter describes the results of the design research, including questionnaires and focus groups, the results of fabric tests and the evaluation of the prototype garments. The information gained from data collated from the questionnaires, focus groups and individual interviews was used to guide the design, the pattern development of the prototype and final garments. The results of the tests carried out on the readily available fabrics, were instrumental in helping to make the final choices of fabrics for the garments. Evaluation of the garments by the researcher and the women involved in the wear trials is also discussed in this chapter.

### 4.2 The target market

#### 4.2.1 Results and analysis of the first questionnaire

Details of the thirty-two women who completed the first questionnaire are given in Table 4.1. Results are summarised here but full responses are given in Appendix 2.

Age group	Number of respondents	Percentage of total
16 - 25	7	21.9
26 - 45	6	19
46 - 55	5	15.5
56 - 65	4	12.5
65+	10	31

Table 4.1 Number and age range of questionnaire participants

Most of the women lived in Wellington, although three of the women lived in Gisborne. Because too few women opted to divulge their range of income, a valid assessment could not be made.

Twenty-three of the women identified their player ranking; 6 skips (2 skips from the 16 – 25 year age group), 3 threes, 6 twos and 8 leads. The remaining participants did not identify their ranking. Ranking is generally an indication of the players bowling ability and is often loosely coupled with the length of time the player has been involved in competition play. Amongst this group, two women are current New Zealand umpires and one is a recognised coach. Twenty-nine of the women play in their own club's team competitions and also in interclub competitions. Nineteen women play socially, which involves play during the week where teams are made up on the day. Twenty-four women have represented Wellington at national competitions and three women have represented New Zealand at the Commonwealth Games and other international bowls competitions.

- **Buying habits**

Twenty three of the thirty two women bought items of clothing for bowling from chain stores. The reasons given included the lower cost and the wider range of sizes and styles available in one particular store (e.g. Farmers or Ballentynes both being popular choices). Seven women bought clothing from specialist bowls outlets like Ken Brown because it was felt that the clothing items in these stores were made specifically for bowling, were of superior quality and value for money. these seven women were some of the more experienced players. Many clubs sell their own polo shirts and jackets which carry the club logo and colours while some clubs supply these to all their club members. The cost is then included in their membership subscription.

If price was not a consideration three of the thirty two women would have their clothing tailor-made to achieve a good fit, three would shop at a more expensively priced store or buy from a sports specialist store. Thirteen women would still use the chain stores for the reasons given above.

- **Style**

None of the women considered their individual style as 'cutting edge'. Two teenage women thought they fitted the semi cutting edge range of styling, 20 women placed themselves as 'middle of the road' regarding their style of dress while five women tended towards the conservative end of the continuum and six ranked themselves as definitely conservative. The seven participants in the 16 – 25 age group ranged from conservative to semi cutting edge. Women were most influenced by their friends when choosing clothing. The youngest age group were also significantly influenced by retail promotions.

- **Colour**

All thirty two participants agreed that some colour should be introduced into bowling uniforms and pointed out that at the present time colour is included in the club logos on tops and jackets. However white or black were the preferred dominant colours. Six of the participants in the 16 – 25 age group tended towards only small amounts of colour as displayed currently on the shirts and jackets of the Victoria Bowling Club.

- **Fabrics**

Plain woven fabrics with some stretch were the preferred fabric types by 15 of the 25 who responded to this question. Twenty one women indicated support for stretch knitted fabrics. Garments with some element of stretch were preferred over garments with no stretch. Patterned fabrics or garments with a coloured pattern on them were preferred by the majority for top half garment while plain fabrics were preferred for bottom half garments.

- **Standard of dress and types of garments**

All 32 participants acknowledged that a standard of dress was required when playing bowls and thought teams must wear similar or the same outfits for any competition play, this could be a club uniform or a uniform devised for that competition. Whites are acceptable for club play while the rules are relaxed for social play when track

suits may be worn. There are no expectations for school bowls but during tournaments, team members are expected to wear a representative T-shirt.

The 27 women who belonged to a club and played bowls on a regular basis considered the following as essential items of clothing: Trousers and shorts, T-shirt or polo shirt, jacket and wet weather gear and a hat, cap or visor. Three-quarter pants, a sleeveless vest, warm skivvies or a jersey and track suit were desirable but not essential items. Skirts were the least preferred item. Only four women wore skirts and they commented that they sometimes found the skirts too long and poorly shaped from the hip to waist.

- **Fit**

Twenty two of the women had problems finding clothing which was comfortable and fitted their figures. Seventeen of the women were not happy with the fit of their jackets. Of these, six women felt the jackets were too bulky and three commented on the poor fit around the armhole. Three women found the sleeves too long. The common problem with the trousers was the leg length being too long. Thus jackets were most problematic as regarding fit. Twelve women made comment regarding the length of the trouser legs. Six found the crotch length too short. Twenty-two women found the T-shirt or polo shirt supplied by their clubs unflattering as they were made for men. Four women made comments to the effect that this particular garment was too square and too long in the body and sleeve for women. Four women did not have a problem with the T-shirt or polo shirt supplied by their club. Wet weather gear was consistently mentioned as being too bulky. Some found the sleeves and leg lengths of these particular garments too long.

None of the women in the 16 – 25 year age group made a comment regarding the fit of the T-shirt, jacket, shorts or trousers but two did think the uniform for bowls needed updating to attract young people into the game. Other comments from all of the participants included a shortage of tailored shorts and trousers for bowls and that warm clothing would be useful at the beginning and end of the season.

- **Hats**

Twenty of the 32 women use visors for preference but interchange between hats and caps depending on the amount of wind. One person thought visors and caps did not provide enough coverage for her ears.

- **Sizes**

The majority of women indicated they were about size 14 – 18. From my experience working with patterns and sizing however, it appeared that the women ranged in actual size from 10 – 20.

#### 4.2.2 Results and analysis of the first focus groups

The six groups were comprised of women from different clubs and of differing age groups. The groups also differed in the length of time they had been playing bowls and the levels of play they had achieved (Table 4.2).

Focus group	Number in group	Area or Club	General age group	Years involved in play	Level achieved
1	10	The Park	45+	10 years +	Umpire, coach, all levels
2	8	Johnsonville	55+	10 years	Skip, threes, twos and leads
3	7	Johnsonville	30 - 55	Up to 10 years	Coach, umpire, all levels of play
4	7	Gisborne	45- 60+	5 years +	Skip, threes, twos and leads
5	3	Victoria	16 - 20	Less than 5 years	Three, two and lead
6	10	Victoria	35 - 55	5 years +	Skip, Threes, Twos and leads

**Table 4.2 Age and experience of focus groups**

Tabulated responses from the six preliminary focus groups are given in Appendix 4. In response to the questions regarding the present dress code for women bowlers, all of the respondents stated or confirmed that during competition play, clothing must conform to the rules as laid down by Bowls New Zealand. Most respondents commented that garments below the waist must be white or black but colour can be introduced onto tops like T-shirts/Polo shirts, and jackets and vests. All of the women in five of the six groups said they would like to see some changes particularly to the shape of the upper body garments. These garments were considered generally of a poor fit as they were designed for men. They reiterated that specialist clothing available for bowls needs to be made for women rather than a unisex style so that each piece of clothing will fit a woman's figure without bulk especially under the arms. Participants suggested that all fabrics need to be of a good quality that will not snag or pill as this has been a problem in the past.

Because of the lack of choice for specialised bowling clothes for women of all sizes and ages, many women bowlers purchase their white and black clothing from chain stores like Farmers, Postie Plus, Millars etc. There is no regulation dress code for play during the off season although the players often wear track suits in the club colours or mufti.

In response to the questions regarding the fit and comfort of bowling clothing, two of the teenage bowlers preferred a looser fit to their T-shirts and found the unisex shirt they presently wear quite satisfactory. There was a consensus among the five groups of older interviewees for a fitting T-shirt in stretch fabric which does not bag at the hem with three quarter sleeves or long sleeves and a collar for protection from the sun. Five groups commented that pockets could be useful on the T-shirt. White was the preferred colour but club colours are often mandatory for play in interclub tournaments. Six of the women who require bigger sizes commented that there is little choice of style and fabric in larger sized garments and finding a garment that fits well can be a problem. Elasticised waists and a flat front rather than a fly front on trousers/shorts were generally desirable features. Generally it was claimed that the trousers/shorts are not long enough through the crotch area. Stretch fabric and elasticised waists were desirable and pockets are a necessity although the pockets

need to avoid areas where the arm swings forward when delivering a bowl. All groups considered short shorts not acceptable.

In response to the questions regarding the need for warmer clothing the respondents in four of the six groups suggested the beginning and end of season often pose a problem for bowlers as the weather is not settled and warm clothing is required, especially a garment which breaks the wind. Three groups thought a fine Merino wool fabric skivvy in black or the club colours would be most useful at the beginning and end of the season when the weather is changeable. Two women from one group and ten from another group said they wear thermals under their bowling shirts. Two groups agreed that a fitted sleeveless vest in a windproof fabric would be useful and enable good arm movement as well as affording warmth and protection to the trunk of the body. The majority of women from four of the six groups thought the jackets need to be more fitting and not bulky under the arm. After considerable discussion, the consensus from all of the women in four of the groups was that the jacket should be of a reasonably close fit, in a lightweight, windproof and shower-proof fabric with an element of stretch and the jackets should afford unrestricted movement and be long enough to cover the hip area or finish at hip level. They suggested this design would be a good replacement for the present bulky jacket made from nylon with brushed cotton lining. The majority of the women liked the MerinoMax™ fabric and thought this would make a very useful jacket for bowls and ten women thought it could double for use as street wear making it very versatile. These same women liked the feel of the white Coolmax™ fabric and the fine Merino wool fabric and thought they would both be very comfortable to wear. Ten women liked the idea of the fabric being breathable and wickable. The women from the Victoria Club thought the materials looked good but were not interested in change because their club supplied their uniform free of charge.

## **4.3 Design development**

### **4.3.1 An historical review of women's bowling clothing through visual analysis**

By visually analysing a collection of clothing within a given period, common characteristics and relationships between the garments can be observed. This observation can be particularly useful when designing garments as component parts and how they are arranged or combined are often used to create a new look (Cosbey, Damhorst, & Farrell-Beck, 2002). The analysis of 18 photographs of women's bowling clothing from 1940 to the present day will help establish if there is any correlation between corresponding decades of fashion trends and clothing for this sport. The clothing and the manner in which it was worn in the photographs was also analysed for any interpretive message about the wearer and the sport. Data from the visual analysis of the photographs is found in Appendix 5.

#### **1940 - 1950**

The military influence from WWII of square shoulders and large collars and lapels was obvious in the angularity of the fashion silhouette and general fit of the street wear fashion in the 1940s (Baker, 1991b). The military service introduced women to overalls and trousers and even though slacks became acceptable as casual street wear post WWII, these were banned from the bowling green. Up until 1935, women played in mixed teams and it wasn't until 1941 that women's uniforms were introduced in New Plymouth (Souto, 2005). The rules for the dress code in all clubs were very strictly adhered to and any transgression was punishable by exclusion from the game and being asked to leave the green (Best, 2005; Wolfe, 2001). It is interesting to note that knee length shorts and short sleeved polo shirts appeared on the tennis courts in 1933 but were not acceptable dress on the bowling green or the golf course at this time.



**Figure 4.1** Wellington Inter Provincial Ladies Bowls. Miramar Greens. January 1949. Photographer Mr Walker.  
(Source: National Archives)

The dresses being worn in Figure 4.1 are typical of the then fashionable shirt waister dress which features collar and revers, buttons to the waist, elbow length sleeves, front pockets, pleated skirt and a self covered belt and buckle. The extra fabric in the form of pleating in the skirts suggests that previously rationed fabrics were no longer in such short supply. The A-line skirts or skirts with box or inverted pleats give fullness, which in turn affords plenty of leg movement without compromising modesty. The lengths of the skirts on the women in the photograph appear to be approximately the regulation 12 inches from the ground as set by the National Association of Women Bowlers in 1938 (Coney, 1993). The sleeves on the dresses fall from a slightly extended shoulder line and are quite loose fitting which would allow unrestricted arm movement and the elbow length would give some protection from the sun. The silhouette is one of angularity at the shoulder with a close fit around the waist to hip area.

The fabric of the dresses could contain a man made fibre such as viscose rayon or nylon as the dresses do not show any crushing where the women have sat on them between playing their bowls. A white close fitting cardigan is worn by the woman delivering the bowl. The knitted fabric in the cardigan gives stretch which would easily accommodate the extended arm movement of the bowler without causing any restriction. Brown or white bowling shoes are worn with stockings. Hats are worn by all of the women. These vary in design with some being more like a cap than a panama although the majority of women appear to prefer a brimmed hat. Some hats sport a band around the crown. The colour and emblem on the band would probably denote club affiliations.

During this decade, it was important for women to appear well dressed at all times (Wolfe, 2001). The image denotes conformity. All of the women appear to be wearing the same style of white shirt-dress identifying the women as a particular group and the hat establishes the women as being 'well dressed'. The white fabric presents a cool and crisp image for a summer sport as well as suggesting a business like attitude to a worthwhile game.

As a result of the war, clothing was designed not to date and the shirt-waister dress became a popular style at the end of the 1930's. The bowls uniform worn during the decade 1940 to 1950 is very much in line with this style of dress. During this decade a hat was almost a compulsory item of any outfit. The bowls uniform also included a hat which could be seen as a fashion item as well as having the functional aspect of providing protection from the sun.

### **1950 – 1960**

During the decade 1950 – 1960, mass production along with increased production efficiency and standardization of sizing in New Zealand, resulted in lower production costs and lower retail costs. People were able to afford to purchase a range of clothing from chain stores and the term 'planned obsolescence' meaning clothes were worn for one season then discarded, became a reality (Diamond & Diamond, 2002). Fashion and function became equally important with the new synthetic fibres

like viscose rayon and nylon being increasingly made into fabrics which maintained their colour, offered lightness, minimum shrinkage, quick drying and coatings which rendered them shower proof; properties which were taken advantage of by some sports wear manufacturers (Baker, 1991a). Women's bowling uniform regulations were implemented nationally from the 1949-50 season when white clothing became mandatory. The recommended dress length was 12 inches from the ground; petticoats and stockings were a must. Dress sleeve length was 6 inches from the shoulder and no jewellery was to be worn (Barlow, 2005). This dictate of lack of fullness or relatively narrow skirts is inconsistent with the fashionable dress during this decade which included very full skirts and stiff petticoats introduced by Dior in his 'new look' the previous decade. At this time bowling clothes were manufactured specifically for this sport although the frocks were also used by croquet players. Some synthetic fabrics were used in some of these garments but the style of the shirt waister remained the mainstay of the uniform (Best, 2005).

Two photographs are analysed for years 1950 to 1960.



**Figure 4.2** Opening day at Riverside Women's Bowling Club, New Plymouth 1951.  
(Source: Bowls Museum archives).

Figure 4.2 would indicate that the uniform for women bowlers has not taken advantage of the new stretch fabrics available in the 1950s or included full skirts in the styling. Full skirts would not have been a practical option because the extra fabric could impede arm action and cause embarrassment if the skirt blew up in a high wind (Chan et al., 2003; Lamb & Kallal, 1992). The uniform for the Riverside Women's Bowling Club, New Plymouth has not changed appreciably from the silhouette of the previous decade. The shirt dress is still the most popular style. The fullness in the skirt is created by either pleating, gores, A-line shaping or a combination of any of these. Waistlines are defined by a belt and the bodice of the dress is slightly puffed at the waist that would allow for forward arching of the back and forward arm movement. The short sleeves appear to have a cuff or band at the edge. The neck is finished with a collar and revers and closes quite high. Some of the dresses appear to have pockets on the front of the skirt. The fabric appears to be quite light and shows some draping qualities indicating the fabric could be a synthetic or a mixture of natural and synthetic fibres. All of the women are wearing hats most of which have brims and a contrast band around the crown while some women are wearing caps with a back flap.



**Figure 4.3** Champion 4's team Riverside Women's Bowling Club.  
New Plymouth 1955.  
(Source: Bowls Museum Archives).

The dresses in Figure 4.3 are consistent with those in Figure 4.2. Blazers worn buttoned up, and hats appear to be considered necessary items of the uniform for this formal photograph (Figure 4.3). The styling and length of the blazers is not consistent; the front shaping being either rounded or square and in one case slightly cut away at the front edge. Monograms and badges are prominently displayed on the front and lapels of the blazer. The medals being worn by the women probably indicate their past successes in tournaments and their subsequent ranking in the club while the monograms on either side of the jacket front confirm their club affiliations. No photographs have been found which show women actually playing in the blazer which would indicate that this item of clothing was either uncomfortable or restricted play or perhaps not allowed by an unwritten dress code.

Although peddle pushers or capri pants, shorts of all lengths and jeans became popular for leisure wear and slacks for women became respectable after Queen Elizabeth II wore them in Australia during her royal visit in 1953, these fashion trends did not apparently influence the dress code for women's bowling apparel. There was concern that women wearing slacks and sporting the new short haircuts would, from behind, look like men (Wolfe, 2001).

### **1960 – 1970**

This decade saw the literal rise of the mini skirt. Skirt lengths hovered around the knee at the beginning of the decade but for the younger generation they kept on rising steadily until skirts were the shortest they had ever been, finishing just below the buttocks. The fashionable silhouette included, the empire line and the A-line; straight cut shapes that hung loose from the shoulder to the hem (Connikie, 1990). Bowling clothing held steadfastly to the shirt waister dress at a respectable length of mid calf to below the knee. The dress code for women bowlers showed little change during this decade except in some detailing and it could be said that in their own way women bowlers' demonstrated a form of protest against the then current fashion trends.



**Figure 4.4** Ladies from the New Plymouth Women's Bowling Club 1961.  
(Source: Bowls Museum Archives).

Figure 4.4 demonstrates that the style of the shirt dress has carried over into this decade and the length of the dresses is consistent with the dress code rules of the time being 12 inches from the ground regardless of the height of the wearer (Barlow, 2005). The pockets on the chest and at hip level provided a functional place for their equipment. To allow for movement, the fullness in the skirt is achieved by pleats or gores in the skirt. The fabric in the dress on the left appears to be quite dense and ridged, indicating that the fabric could be either cotton or linen while the fabric in the other dresses appears to be more fluid, although the silhouette is still quite angular at the shoulder. It is interesting to note that subtle changes are incorporated in each of the dresses. The dress worn by the woman on the far left has a collar but no revers and is fastened at the waist with a tie. The dress worn by the woman on the right features a scalloped edge on the breast and hip pockets. The belts on the dresses differ in width and the type of buckle as does the size and depth of the neck opening. White shoes worn with socks are a departure from the norm as are the two toned

shoes worn by the woman second from the left. Although the shirt-dress is still the most favoured style for women's bowling uniforms, there is a trend towards individualising these dresses. Fullness in the skirt is achieved with pleats and/or side shaping. The dresses are either buttoned to just below the waist or straight through the front. Pockets are either inseam or patch. The finish on the patch pockets vary from shaped flaps to faced shaping at the pocket mouth. Fastening at the waist of the dress is either a self covered belt or a tie. Neck finishes vary in the size and shape of the collar and the height of closure. In one case socks have replaced stockings and a variety of flat shoes are worn. The subtle individualisation of the bowls uniform by the women in Figure 4.4 may be a reflection of the influence of relaxing of standards of dress in the work place during this decade and the casual trends in clothing being worn during the weekends (Wolfe, 2001).



**Figure 4.5 Ladies at New Plymouth 1964.**  
(Source: Bowls Museum Archives).

The blazers in Figure 4.5 are worn casually unfastened in contrast to the previous decade and do not appear consistent in either front styling, length or fit. Some of the blazers are loose enough to allow for a cardigan to be worn underneath as seen on the woman second from the right in Figure 4.5. Hats are still worn although there appears to be a more individual approach to the type of hat and the position it is worn on the head.

To ensure the standard dress code was adhered to, Bowling club committees informed new women members about acceptable dress on joining a club. A letter dated 28th August 1962 from E.H. Turner, Honorary Secretary of the Johnsonville Bowling Club, to a new member advised her of the dress code which read:

Dress:	Blazer	(optional) Black with Club's monogram on pocket
	Cardigan	(optional) White
	Windbreaker	(optional) Any colour
	Beret	(optional) White
	Hat	White (regulation when playing in tournament)
	Shoes	Brown or white regulation (not wedgies)
	Dress	White (not more than 12 inches from the ground.

Very full dress is not very suitable.

A Johnsonville Club newsletter dated No.6, 1975, informed men members that the Wellington Bowling Centre had advised delegates that the recent changes to "Law 7" affecting bowling dress had caused some misunderstanding. The news letter went on to explain the meaning of the effect of the changes:

- Players, umpires and markers may wear white or tan smooth rubber soled heelless bowling shoes. However ONLY tan shoes may be worn at International games.
- Only bowlers' caps or blocked hats may be worn, floppy bowling hats are now forbidden.
- All bowling cloths must be predominantly white or be chamois; however manufacturers or sponsors are permitted to advertise in colour on the white cloth.

It is emphasised that the above is applicable to all club, centre and national play.

Although this letter was referred to the men's club, the women's club was also party to these rules. In his 1975 annual report, the President of the Johnsonville Bowling Club Harold Renwick wrote:

*"Many young people are now turning to bowls for recreation but if those in authority tend to view the laws in a Victorian aspect then I feel the game's popularity will falter."*

He was referring to the New Zealand Bowling Association Council's amended laws in respect to acceptable clothing.

### 1970 – 1980

During this decade of free marketing and deregulation, many organisations sought an upgrade to their corporate image. Staff uniforms were coordinated with company colours e.g. the ASB Bank, Post Office and Bank of New Zealand. Bowls held steadfastly to their former dress code and no colour or club logos apart from the traditional club monograms were allowed to be incorporated into the dress code.

In the later part of this decade the style for street wear was one of casualness yet it was functional and incorporated the new knitted fabrics in a wide variety of weights and textures (Herald, 1992). Track suits became popular particularly with sports people because of the ease of movement and the ease of laundering, however trousers or track suits were banned from the bowling green.



**Figure 4.6** Ladies at New Plymouth 1977.  
Source: Bannerman, 2005).

The woman bending over and delivering her bowl (Figure 4.6) could be wearing the traditional shirt waister dress, but the separate skirt and top worn by the woman on the left shows a departure from clothing worn in the previous decade, the silhouette being more rounded and soft in appearance. The top appears to be made from a knitted fabric possibly synthetic, because there is no evidence of darting and the fabric moulds softly around her waist and hips and shows no sign of strain around the arm and shoulder areas. The collar appears to be also knitted as part of the set in neck band and is fastened with one button and a name brooch to keep the front closed. The sleeves appear to have a cuff or are worn rolled up. The skirt could be a synthetic polyester fabric such as 'Crimplene™' which was reported to be a new fabric on the New Zealand market about this time (Herald, 1992). The pleats in the skirt would give increased movement yet maintain a slim silhouette. Skirt lengths for street wear fluctuated during this decade but the skirt on this woman is quite short compared with the fashionable midi length and appears to be more than the regulation 12 inches from the ground. This perhaps indicates a slackening of the enforcement of this rule in the dress code for women bowlers. White bowling shoes are evident as part of the uniform. Neither woman is wearing a hat or jewellery other than a wrist watch and sunglasses. The introduction of knitted fabrics and garments to sportswear could allow the wearer much more freedom of movement and comfort. Obvious drag lines show the strain around the armhole and upper sleeve area of the shirt-dress worn by the woman delivering her bowl. Stress in an area such as this would not enhance her performance.

### **1980 – 1990**

With more women returning to the workforce and achieving success in corporate business, the executive type of business suit became popular as did designer names or logos on clothing and accessories. 'Power dressing' was the catch phrase. The fashionable look was one of authority achieved by extended shoulder width and tailored suits in subdued colours. This decade also saw the beginning of the aerobic fitness craze. Brightly coloured Lycra™ was fully utilised to define muscle and body silhouette while the body remained decently covered (Carnegy, 1990).

Little Lycra™ was seen on the bowling green despite the increased unrestricted movement it could have afforded the bowler. The shirt-dress reigned supreme although subtle changes were beginning to infiltrate the dress code.



**Figure 4.7** The Johnsonville Ladies Pennants Team 1985.  
(Source: Johnsonville Club archives).

The shirt waister is still very much in evidence on the bowling green (Figure 4.7) although separate skirts and tops and dresses without belts featuring zip closures are evident creating a silhouette which is soft and round rather than angular. The length of the sleeve appears to be shorter but the ‘set-in’ style remains. The cut of the garments is still quite loose fitting to allow for ease of movement although there appears to be less blousing at the belted waist of the dresses worn by the two women in the middle of Figure 4.7. Skirts do not appear to include pleats but are cut to provide adequate leg movement and appear to be slightly shorter than previous decades. The fabrics in each of the outfits shown could be woven and made from synthetic yarns as they do not appear to show any crushing. Cardigans and sleeveless cardigans are worn to provide extra warmth. A variety of hat styles are still part of the uniform and as in previous decades, hat bands denoting club

affiliation are worn around the crown of the hat. Stockings are still part of the dress code.

The dress and jacket (Figure 4.8) are part of the Bowls Museum collection and were physically examined by the researcher.



**Figure 4.8 Sunray pleated skirt on bowling dress and polyester zip front jacket. Worn 1985.**  
(Source: Bowls Museum Archives).

Figure 4.8 shows a white circular sunray pleated bowling dress made by 'Towntrend'. The label attached to the inside skirt seam indicates the fabric is synthetic but gives no further detail. The jacket shown in Figure 4.8 is made from polyester and has a brushed cotton lining. A built-in hood is encased in the standup collar and elasticated bands are a feature at the wrist and the waist. Raglan sleeves are a feature of this jacket as is the open-ended zipper. This outfit appeared to fulfill the aesthetic requirements of women bowlers but few of these dresses were seen on the green because of their tendency to blow up in the wind. The jacket however was the forerunner to the change in the dress code from a white cardigan. The monogram on the left breast is machine embroidered. This outfit was worn in 1985.

## 1990 - 2000

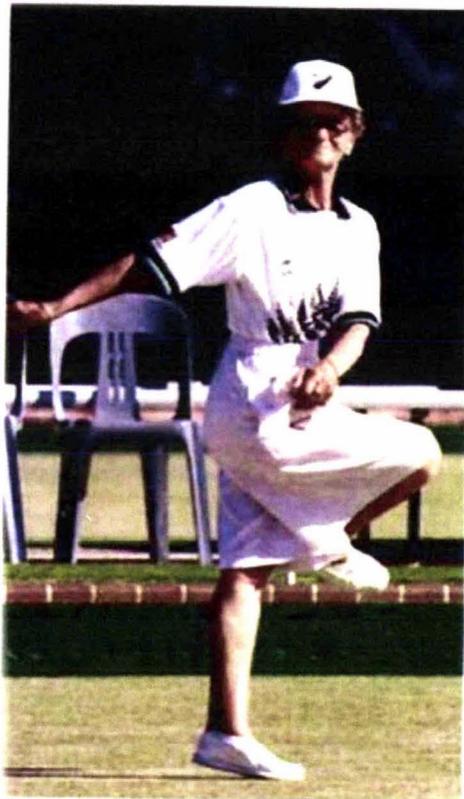
During this decade leisure wear including jeans, baggy pants, T-shirts and tracksuits that were not only safe in all social situations but were a cheaper option and acceptable for work, became common place (Feldman, 1992). Sportswear continued to influence fashion with combinations of stretch Lycra™ combined with other fabrics which gave not only freedom of movement but also glitz and glamour. Microfibre™ and Polartec™, two new fibres were increasingly used for outdoor sportswear as they were light yet flexible and gave professional sports people the competitive edge required. It was not until near the end of this decade that Bowls New Zealand included the tracksuit as part of national uniform and tailored trousers and shorts for women were allowed to be worn on the bowling green (Best, 2005). This was quite a sudden and major change.

Following the amalgamation of the men's and women's clubs to form the Johnsonville Bowling Club in 1995, a new club branding was introduced which included unisex shirts sporting a design in the club colours, and a club logo (Figure 4.9).



**Figure 4.9** Paula Meredith from the Johnsonville Club wearing club colours during a singles match against Jan Khan.  
(Source: The Evening Post 12/02/2001. Pictures by Craig Simcox).

The shirts which are modelled on a straight T-shirt pattern have no body shaping. They are made of a polyester warp knitted fabric (Hydropro-Eyelet™) and feature a placket type front opening and a knitted rib fabric collar. The fabric has a small degree of stretch and drapes quite well. The loose fitting sleeves are set into a lower arm scye and finished with a stitched hem. Ease of leg movement in the straight cut skirt is accomplished by the box pleats in the front. Pockets in the side of the skirt provide a place to carry bowling equipment. A visor is worn in place of a hat and white shoes complete the outfit.



**Figure 4.10** Judy Howat, New Zealand representative 1998.  
(Source: "Bowls" Issue 19 February 2005).

The polo shirt (Figure 4.10) is made from a knitted (possibly polyester) fabric and printed with the New Zealand silver fern. It features a contrasting collar and contrasting bands around the wide dropped-shoulder sleeves. A sewn on logo patch is evident on the right sleeve. In this instance, the shirt is worn tucked into the

waistband of the knee length culottes. The top appears to be too big and is worn tucked in for neatness thus obscuring the logo on the front. Pockets in the side of the culottes provide a place for carrying the bowler's equipment. A cap with the New Zealand logo embroidered in a prominent position on the front replaces the brimmed hat and hat band. The combination of these clothing items projects a casual appearance to the New Zealand uniform.

### **2000 - 2006**

A younger generation of women appear to be taking up the game of lawn bowls and there are apparent changes in and relaxation of the uniform code. Figure 4.11 illustrates this change with the introduction of three quarter or seven-eighths pants worn with a coloured polo shirt printed with a design. White lace up bowling shoes are worn with socks or bare legs and hats, caps or visors are optional. The overall appearance is one of relaxed casualness. A split in the side hem of the pants allows extra ease when the knee is bent. The soft knit fabric and loose styling of the polo shirt would not restrict movement in any direction and would be very comfortable to wear.



**Figure 4.11 Women at the National Bowls Tournament 2004.**  
(Source: "Bowls" Issue 19 February 2005).

All of the women in Figure 4.12 are wearing track pants, which are supplied by the club as part of the club uniform. An examination of the actual garments revealed that these pants are made from a fine 100% nylon plain weave fabric and are lined with brushed 100% cotton interlock. These pants may get very hot. They have a zipper on the bottom outside leg to allow ease of donning and doffing and an elasticised waistband for a comfortable fit. Although this club also supplies its members with a club jacket, the woman on the left (Figure 4.12) has chosen to wear her own.



**Figure 4.12 Women bowling in a club tournament. Victoria Bowling Club September 2005.**

(Source: Researchers collection)

The two white jackets have a nylon plain weave outer shell, an insulating inner, possibly Dacron™, and a cotton single knitted jersey lining. Both jackets appear to show some restriction of movement as evidenced by the drag lines under the arm and across the back of each jacket. The jacket worn by the women on the left finishes below the hip giving warmth and protection from the weather. The jacket worn by the woman in the right hand photograph finishes at the waist with an elasticised band and the elasticised band on the right sleeve of the jacket appears to be pulled up from the wrist to compensate for the drag. The woman in the middle is wearing a sleeveless jacket finishing at hip level, made from polar fleece a brushed single knit polyester fabric. All jackets have a zip front opening and pockets in the side or front

panel seam. The jackets illustrated in the middle and right hand photographs have a Victoria Club monogram embroidered on the front of the jacket. The casual style of these jackets enables them to be multifunctional; as part of the bowling uniform and as street wear combined with other garments.

In an effort to recruit new and younger members into bowling clubs, clubs took the initiative and introduced lawn bowls into schools. Many school students have shown a keen interest in lawn bowls, possibly the reasons being that it is fun, challenging, interesting and it is an alternative to the more physical and contact sports. Club members offer after school coaching and Bowls New Zealand has set up an annual National competition for school students. In New Zealand, it would appear the 2005 summer street wear trend for the younger generation includes fitting tops teamed with skirts and pants which are worn well below the waist.



**Figure 4.13** Young women bowlers competing at the Inter Secondary Schools National Tournament in Auckland December 2004.  
(Source: (*Young Players at the Nationals.*, 2004) )

The skirt and shorts worn by these young women (Figure 4.13) is indicative of the youth culture. The modification of the school uniform T-shirt by rolling the sleeves to appear sleeveless and the skirt worn on the hip is an attempt to contemporise

bowling dress. The shoes worn by these young women are not considered regulation foot wear for lawn bowls but meet the requirements of being flat. As well as providing some shelter from the sun the hats are definitely a fashion accessory and would not stay in place in windy conditions. It would appear that the dress code for this tournament has been relaxed considerably in order to accommodate young bowlers not attached to a specific club.

### **Summary of the visual analysis of photographic evidence of women's bowling clothing.**

The New Zealand Women's Bowling Association's introduction of a uniform for bowls in 1949 has, over the years, caused much controversy regarding the length of the dress and what constitutes appropriate dress. It is understandable that the style of the shirt-dress was chosen initially as it was a popular and classic style during the 1940's, an era when clothing was made to last, styles designed not to date and economical use of fabric was an issue post war. Between 1950 and 1970, strict dress standards were adhered to particularly during tournaments. The reinforcement of these strict standards of dress could have been a carry over from standards imposed on the wearing of military uniforms during WWII. The style of the shirt-dress itself lent itself to most female figures and the generous cut in the bodice, armhole and sleeve areas afforded good arm movement in spite of the fabrics being very stable and having little stretch. The fullness in the skirt was generally achieved by a variety of pleats which were sewn down to hip level giving a slim silhouette from waist to hip which mirrored the silhouette of the 1940s. Pockets were either incorporated in the side seams of the skirt or patch pockets with a variety of mouth finishes were sewn onto the front of the skirt and/or above the bust line on the bodice of the dress. Waistlines were finished with either a self-covered belt or tie. The neck of the shirt-dress was finished with a soft shirt collar and revers. Buttons and buttonholes were used to close the front opening of the dress. As new fabrics became available, these were incorporated into the bowling frock creating garments that were easier to launder and care for. In some cases zippers replaced the button openings (Figure 4.7) and darting and panelling created a straight through 'princess

style' dress. For a number of years the shirtdress remained as acceptable dress despite changes in fashion codes of street wear. Although the white frock was still the only acceptable uniform for wear during tournaments, social players introduced trousers onto the green during the 1980s when fashionable leisure wear became everyday wear for business and pleasure.

Hats were a fashion item up until the 1970s and a woman was not properly dressed unless she wore a hat (Diamond & Diamond, 1994). Hats have always been part of the bowling uniform and the hat band provided a place for the club emblem or logo to be displayed. They were also functional in that they provided protection from the sun. Caps and visors have been added to the repertoire of headwear for women bowlers (Figure 4.9). Flat shoes have always been compulsory footwear for lawn bowlers as any type of heeled shoe would destroy the flat surface of the green. White shoes in a variety of styles have been the most popular but sneakers or track shoes are often worn today (Figure 4.11).

When the first women's committee set the uniform standards in the late 1930's, shirtdresses were a fashionable style of that time. In subsequent years, bowling dress has failed to keep pace with fashion trends and it was not until women's clubs amalgamated with men's clubs that the dress code for women relaxed and women began to adopt clothing more akin to contemporary fashion. The 1990s saw the amalgamation of many women's and men's clubs who shared the same greens. Many of these amalgamated clubs adopted a club shirt which featured the new club colours and logo and women were encouraged to wear the club shirt even though it was styled on the fit for menswear (Figure 4.9). The strict dress code of the 'white frock' was abandoned and over time each bowling club appears to have set its own standard, not necessarily in line with current fashion trends, and in some cases now provides shirts and jackets for its financial members in an effort to keep continuity of dress standards. Trousers and track pants are now popular items of bowling apparel and have almost replaced the 'frock' and skirts. The current rules for bowling clothing state:

*“Club Domestic Competition (involving players from the same club only) playing attire is approved by the Club. For Club Open Competition, players in singles and members of teams or sides may wear garments of the same colour/design. For any competition above Club Open Tournament players in Singles and members of Teams or Sides, must wear garments of the same colour/design”*  
*(Regulation Dress Code, 1957).*

The culture of lawn bowls was once seen as a game for older people but younger people are now taking up the sport and enjoying the benefits of belonging to a social club with bar facilities and entertainment machines. This younger generation of bowlers bring with them their own standards of acceptable dress attire.

The next generation New Zealand designers are producing clothing which is innovative and of good quality however they have stiff competition with the ‘fast fashion’ or ‘super quick’ ready to wear retail as seen at Glassons, Supré, and Portmans who offer cheap contemporary clothing designed to last for a three month season (Schaer, 2005). Today women bowlers can buy reasonably priced items from general apparel stores or from non-specialist sportswear stores to individualise their team for a competition and use the garment later to mix and match with their own wardrobe. The cheaper ranges of fashion clothing aimed at a younger market have led to a strong inclination towards individuality and to the evolving of new styles. Skirt and trouser lengths, and where they are worn in relation to the waist reflect many different styles. It is these modes of dress which are reflected in bowling apparel and the individualistic way in which they are worn today. This research has shown there is a strong need to identify with a club by either wearing club colours or monograms on items of clothing.

Through this research, two distinct markets have emerged. The younger group of bowlers who embrace contemporary fashion require a uniform that incorporates current fashion styles but at the same time meets the approval of club standards, while the more mature woman bowler requires fashionable dress but with a more

conservative edge. At the present time there are conflicting ideas between what is acceptable dress at club level and many unwritten laws limit overtly fashionable dress or dress which shows a lot of bare flesh. To meet the needs of both groups and to satisfy the requirements of Bowls Wellington, a conservative stance is taken with the designs for this project.

#### 4.3.2 Structural properties of fabrics

The structural properties of fabrics selected for garments are given in Table 4.3 and Table 4.4.

Garment	Skort	Wool jacket	Polar fleece jacket
<b>Fabric Name</b>	<b>Merino and Tactil™</b>	<b>Merino and Coolmax™</b>	<b>Polar fleece</b>
<b>Fibre type and content</b>	57% Merino 43% Tactil	50% 21.5 micron Merino 50% Coolmax™ + 40 denier nylon binding thread.	100% polyester
<b>Yarns</b>	Staple single ply medium twist and testured filament – no twist.	Both staple yarns. Wool = 2 ply moderate S twist Coolmax™ = single ply moderate Z twist.	
<b>Fabric Structure</b>	Single Jersey plate knit	Duo layer jersey knitted separately but joined with a 40 denier Nylon binding thread. Knitted on a circular bed.	Single jersey weft knit brushed
<b>Thickness (mm)</b>	0.688mm	1.438mm	2.046mm
<b>Gauge</b>	20	14	
<b>Weight (g/m<sup>2</sup>)</b>	217 g/m <sup>2</sup>	280 - 290 g/m <sup>2</sup>	295.4 g/m <sup>2</sup>
<b>Finishes</b>	Yarn or piece dyed	Piece dyed	Brushed or napped

**Table 4.3 Fabric properties table of analysis**

<b>Garment</b>	<b>T-shirt</b>	<b>Merino top</b>	<b>Contrast</b>	<b>Trousers</b>
<b>Fabric Name</b>	<b>Coolmax™</b>	<b>Single jersey Merino</b>	<b>Fine stripe</b>	<b>Fine stripe</b>
<b>Fibre type and content</b>	Face side 50 % polyester Back 46% tactel	100% merino wool	65% Polyester 35% Cotton	65% Polyester 35% Cotton
<b>Yarns</b>	Filament and textured filament single ply yarns with low twist	Staple single ply with medium Z twist	Staple single ply with medium Z twist	Staple single ply with medium Z twist
<b>Fabric Structure</b>	Double knit pique	Single jersey knit	Single jersey knit	Double jersey knit
<b>Thickness (mm)</b>	0.704mm	0.646mm	0.571mm	0.690mm
<b>Gauge</b>	28	20	20	18
<b>Weight (g/m<sup>2</sup>)</b>	178.8 g/ m <sup>2</sup>	222.8 g/m <sup>2</sup>	128.4 g/m <sup>2</sup>	220 g/m <sup>2</sup>
<b>Finishes</b>		Yarn or piece	Yarn dyed	Yarn dyed

**Table 4.4 Fabric properties table of analysis**

### **4.3.3 Fabric Testing**

A number of tests were carried out on the fabrics chosen for the final garments to ensure they would meet the functional and aesthetic requirements of women bowlers (Appendix 6). Fabrics were tested for colour fastness to artificial sunlight and washing, dimensional stability and visually assessed for abrasion and wear.

- **ISO 105-B02 Colourfastness to artificial light: Xenon arc fading lamp test 2000.**

After 160 hours of exposure to the Xenon arc lamp, none of the fabrics used for the final garments registered more than 4.5 on the grey scale, so the experiment was continued until the fabrics had been exposed for 255 hours, the estimated equivalent of almost two years wear. All of the fabrics used in the final garments performed to an acceptable standard and should withstand prolonged exposure to the sun without fading. This is satisfactory as a bowler would expect garments to maintain their colour for at least one season without fading. Care needs to be taken to ensure the face side of the CoolMax™ white fabric is used outermost as this side showed the least yellowing after 255 hours of exposure to the Xenon arc lamp. Brighter colours could be incorporated into garments but these would need to be tested before use as those fabrics which were tested as possible alternative contrast fabrics did not perform up to an acceptable standard, with all testing 3 - 4 on the grey scale after 255 hours exposure. Results of all fabrics tested are shown in Appendix 6.

- **AATCC 8 – 2004 Colourfastness to Crocking**

This test method is designed to determine the amount of colour transferred from the wet and dry surface of coloured textile materials to other surfaces by rubbing. For this particular test a grey scale grade of less than 4 is considered unacceptable. Results for this test (Table 4.3) show that all fabrics chosen for the final garments, scored 4 or higher on the grey scale hence all were deemed acceptable.

Colour change when compared to the grey scale		
Fabric	Dry Cloth	Wet Cloth
MerinoMax™	5	5
Merino wool	5	5
Polarfleece	5	4
Contrast fabric	5	5
Trouser fabric	5	5
Merino/Tactil™	5	4.5

**Table 4.5 Results of crocking tests using wet and dry test cloths.**

All of the fabrics used except the Polarfleece fabric, when rubbed, will not transfer dye onto other fabrics when they are dry or when they are wet. These fabrics could be washed with other clothing without the risk of transferring colour onto other fabrics. The Polarfleece fabric showed some discolouration caused by loose fibres adhering to the test cloth. Therefore Polarfleece may need to be washed separately. Coolmax being white was not tested.

- **ISO 3759:1994 Test for Dimensional Stability**

All of the fabrics performed well in the test and showed less than 3% shrinkage in both the course and wale direction with the exception of the Merino/Tactil fabric (Table 4.4). This fabric showed an average of 5% shrinkage in the wale direction. In industry this could be considered unacceptable, however in this project the fabric was used for skorts, therefore, this amount of shrinkage would be considered acceptable for the design and functionality of the garment particularly if pre-washed.

<b>Fabric</b>	<b>Wale direction</b>	<b>Course direction</b>
Coolmax™	< 0.5%	< 0.5%
MerinoMax™	0%	0%
Merino wool	< 0.1%	0%
Polar fleece	< 0.1%	0%
Contrast fabric	< 0.1%	< 0.1%
Trouser fabric	< 0.1%	< 0.1%
Merino/Tactil	5%	< 0.05%

**Table 4.6 Results of the dimension stability of fabrics used in final garments.**

- **ISO 105-C01 1989. Test for colour fastness in Washing**

None of the fabrics tested showed a colour change or bled colour into either of the adjacent cloths, all scoring 5 on the grey scale. The fabrics used in the final garments can be safely washed with other garments, as they will not shed dye onto other fabrics during the laundering process. The contrast fabric can be safely used on the shirt and jacket as it did not shed dye.

### **Summary**

The laboratory tests carried out showed that the fabrics chosen for the final garments performed at a satisfactory level in accordance with the standardized tests. All fabrics in the garments can be laundered without excessive shrinking, shedding dye or colour transferring from one garment to another. However, lint from the Polarfleece fabric may adhere to some fabrics during laundering. The garments can be reasonably expected to be worn in the sun for at least two bowling seasons without the garments appearing faded. After laundering the fabrics were inspected and showed no visible signs of unacceptable changes in surface appearance due to abrasion or pilling.

### 4.3.3 Design development ideas

The primary advantage of the model used in this research is the constant input of the end users. Information from the questionnaires and focus groups strongly influenced the development of the design ideas for the bowling outfits and highlighted some differences in aesthetic and expressive requirements for two specific age groups. Although the functional requirements were consistent between the two groups, there appeared to be a need for two sets of clothes, one for the younger market and one for the more mature market, both including elements of contemporary fashion. This is consistent with the expressive need to conform to peer group expectations and perceived peer group identification (Dodd, Clarke, Baron, & Houston, 2000; Lamb & Kallal, 1992). Contemporary fashion for the teenage market to the early twenty age group at the time of writing this thesis appears to indicate a preference for lowered waistlines on skirts and trousers and fitted tops. Results from the questionnaires and focus groups in this research confirmed this. They indicate that preferred sleeve styles are worn short by either design or rolled up, skirt lengths are dictated by fashionable demands or trends. Accessories are used to individualise differences. Appearance and fit were the key issues identified by the more mature market. They required a contemporary but more classical look, preferring a sleeve finishing at least half way between shoulder and elbow and upper body garments that skim the body and finish at hip level. Lower garments needed to start at the true waist and finish below the knee. Shorts however were acceptable finishing just above the knee. The unwritten dress code requires players to show considerable decorum and modesty in their choice of dress for bowling and large amounts of exposed flesh are not acceptable. The mature group considered this aspect most important. Evidence from the visual analysis of historical bowling dress would appear to support this view.

Although there needed to be differences in the designs for both the younger age group and the older age group, it was considered by the researcher and Bowls New Zealand, that the designs for both groups should be compatible. Both younger and older players may need to team up for tournament play and club allegiance requires the same or very similar uniforms to be worn. Wearing the same uniform should

also encourage camaraderie, team work and present a professional image on the bowling green (Chan et al., 2003).

Functional requirements were the same for both groups. The consensus from participants was that the functional requirements of each garment in regard to movement, and the stretch required superseded fashion trends in all cases. Functional aspects that needed to be considered in the styling included:

- Pockets to hold bowling equipment like measures, chalk or markers, scorecards, pencil, polishing cloth, lip screen, and small personal items;
- Extra ease in the arm and shoulder areas to allow for freedom of forward and upward movement of the arms;
- Panelling in the body of the shirt and jacket to enable changes to be made in the amount of suppression to allow for different body types during pattern making;
- Elasticised waist bands in pants for comfort and ease of movement during play;
- Trousers that do not restrict leg movement or flap about and obstruct the delivery of the bowl;
- Protection from the sun in particular to the back of the neck and shoulders;
- Garments which could be layered to enable the wearer to maintain an even body temperature during play;
- Ease of donning and doffing especially with wet weather gear which needs to be able to be put on quickly and fastened or removed without dragging over the head.

Aesthetic aspects that needed to be considered in the styling included:

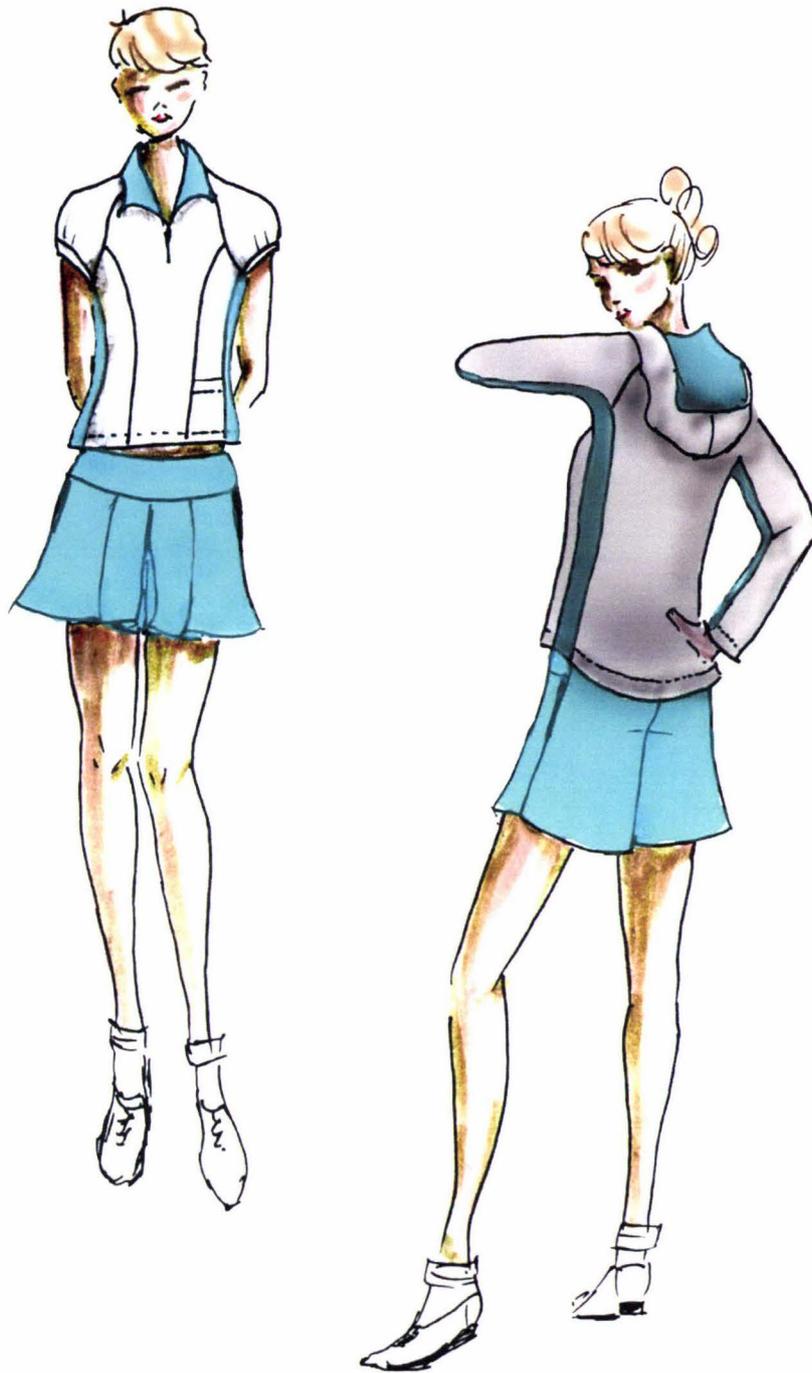
- An expressive need to show club allegiance e.g. areas on the garment where club colours and logos could be incorporated either as separate bands or collars or larger areas which could be easily sublimated, screen printed or embroidered to give club identification;

- Colours which would meet with the regulations set down by Bowls New Zealand.
- Classic styling which complies with the image of a uniform yet track current fashion trends and that will be acceptable and appeal to all age groups at the present time and in the future;
- Garments which will fit and suit a variety of figure types.
- Uniformity of design between the two market segments (younger and mature) to conform with National and Club requirements.

The preliminary sketches and final designs ideas emerging from these criteria are given in Figure 4.14, Figure 4.15 and Figure 4.16.



**Figure 4.14** Preliminary sketches for jacket, shirt and shorts.  
(Drawing source: G. Ivess)



**Figure 4.15** Final ideas for young bowlers.  
(Drawing source: G. Ivess)



**Figure 4.16** Final ideas for mature bowlers  
(Drawing source: G. Ivess)

### **Evaluation of final design ideas**

The final designs meet the functional, aesthetic and expressive requirements of both groups identified in the target market and allow for a cohesion of dress characteristics for both the young and more mature market segments, which is important for club affiliations and other expressive concerns of sporting attire. The designs provide a conservative approach conducive to the dress codes of lawn bowls yet give a contemporary appearance of leisurewear. Because the majority of women interviewed in both age groups showed a preference for tops that skimmed the body rather than being form fitting, panelling was included in the styles adopted for the shirts, the sleeveless vest and the jacket. A strong colour for the side panels gives the appearance of a more fitted effect indicative of fashion trends. The panelling allows additional ease to be added to accommodate the fuller figure when grading the patterns thus making the garments very marketable. The designs for the upper garments allow for contrast fabric and colour to be introduced into panels, collars, sleeve bands and facings to cater for the expressive needs of bowlers and to denote club affiliations. The 'tails' on the upper body garments allow the garments to appear quite short from the front view but prevent gaps appearing between the upper and lower body garments when a player bends forward to deliver a bowl. The front or back panel of the jacket, vest and pocket of the shirt are areas where club logos could be embroidered or printed (Figure 4.15 and Figure 4.16).

The shirt design features a two-piece raglan sleeve, a departure from the usual T-shirt style sleeve and the added ease across the back allows unhindered forward and upward movement of the arm without distortion to the body of the garment. The pocket inserted into the front left hand panel provides a place for bowling equipment and is designed not to impede the swing of a right-handed bowler. The contemporary style zipped collar, designed to be worn closed or open, is included in the shirt design, as a collar is mandatory to the uniform dress code (*Bowls Wellington Information Handbook*, 1999 - 2000). A slightly shorter more fitting shirt with short puffy sleeves is designed for the younger wearer in keeping with a contemporary fashion feel, whereas the sleeve designs for the mature women are longer and have

less ease placed into the sleeve band. The sleeve can be easily lengthened if a long sleeve or three quarter sleeve is required.

The jacket design includes a hood, and front zipper in line with contemporary fashion and could, like Quinn's (2002) Cashmere Hoodie', 'multitask' taking the wearer from the bowling green to casual street-wear. The open ended zipper allows the garment to be worn open, partially open or fully closed and inseam pockets, situated in both side seams, along with internal pockets give additional storage for personal items. The two piece raglan sleeve with added ease and shaping across the shoulder area, should give plenty of room for movement without the armhole appearing big and bulky. The hood is designed to give protection from cold wind but not interfere with the players' peripheral vision. The jacket is made from MerinoMax™ a double knitted fabric which has some stretch and a contrast fabric is used for the facings and for the lining inside the hood.

Two garments for the lower half of the body are designed to cater for two different age groups but are interchangeable between groups. While shorts have become a popular addition to the lawn bowlers' wardrobes, the skorts have the advantages of added leg room achieved by the front pleats and give the appearance of a short skirt from the front view and shorts from the back view. These skorts are designed to be worn on the hip with the top of the skort being just covered by the shirt. This design meets the aesthetic and functional requirements of length versus blowing up in the wind. The trousers are designed to finish at the true waist and the legs can be rolled up and fastened to achieve a contemporary three quarter look. The basque on the front of the skorts and the trousers, keep the front smooth across the stomach and the elasticised back ensures comfort when bending and ease when donning and doffing both garments. In-seam side pockets are a feature in both garments and should accommodate bowling equipment and personal items required during play. The trousers and skorts were designed and could be made in the same soft polyester/cotton double knitted fabric. This fabric drapes well and because of its stretch properties the fabric will not impede bending at the hip and knee. Ultimately, this

fabric was not used for the skort as it did not meet with the approval of Bowls Wellington and was replaced with the Merino/Tactil™ fabric.

White bowling shoes complete the outfit and a hat or visor is optional. The uniform can be individualised with additional accessories, a most important aspect to cater for the younger market.

## **4.4 Pattern and prototype development**

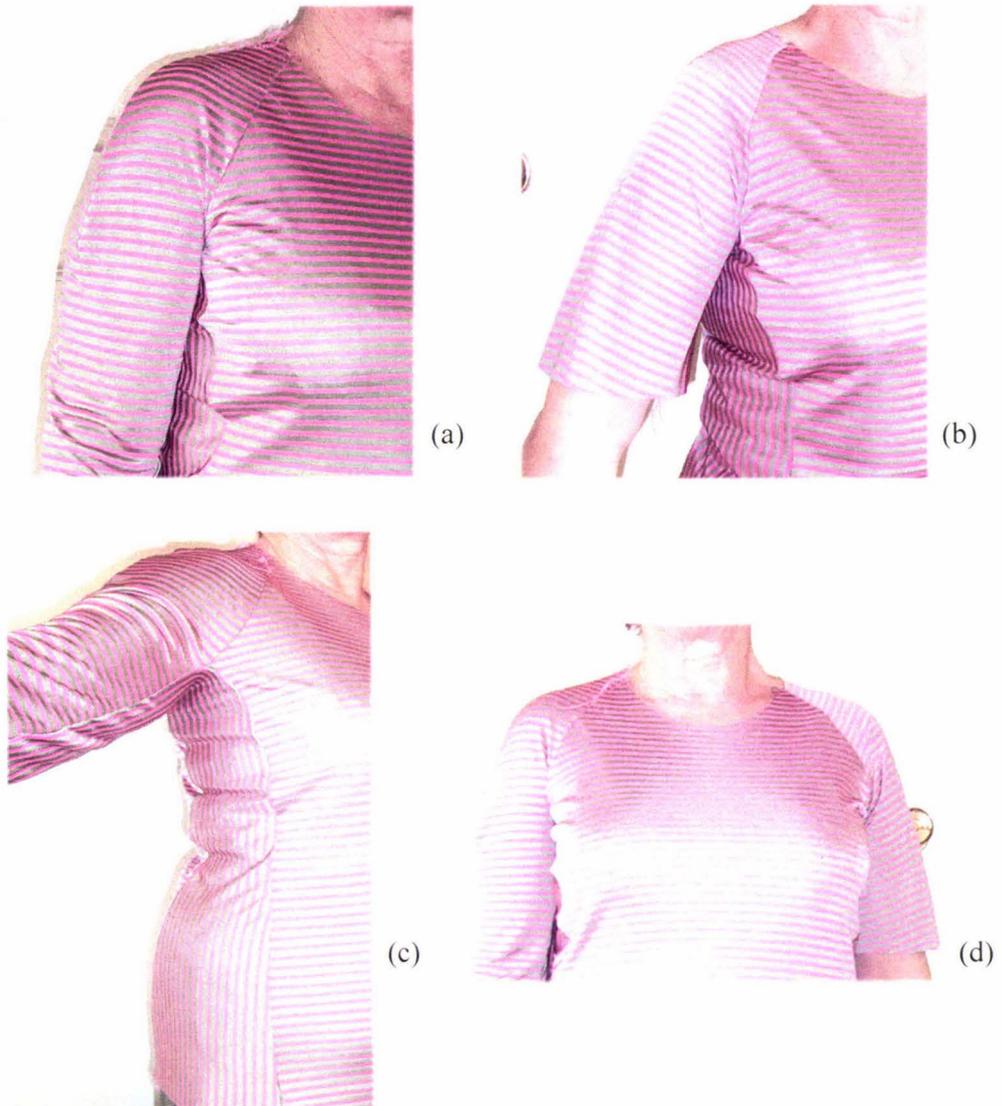
### **4.4.1 Introduction to rationales for garment patterns**

The primary aim of the pattern development for the upper body was to create patterns which provided plenty of ease in the shoulder area to accommodate a wide range of arm movement without distortion to the body of the garment or creating bulk under the arm. The pattern also needed to fit the contours of the body and provide pockets for storage of bowling equipment and personal items. As well as providing a slimming silhouette, the lower body garments also had to provide ease for movement at the hip and knee when bending and kneeling and be in line with contemporary fashion. The fabrics chosen for the toiles were jersey knits with moderate stretch in the course direction and very little stretch in the wales direction. The amount of stretch was comparable to the final shirt and trouser fabric.

- **Rationale for the shirt**

A size 16 pattern was used initially. It was decided to trial a raglan sleeve because during the planning of a raglan from a regular sleeve more ease can be introduced across the shoulder area. Adjustments were made to the under arm of the Massey basic knit block to give a better fit into the front armhole. The shoulder seams were balanced in preparation for creating a raglan sleeve. A strip gusset was included to allow for greater arm-lift without distortion to the side of the garment while panel lines through the front allowed for fitting over the bust area and aesthetically decreased the breadth across the chest area. This pattern was toiled (Figure 4.17). The result of this first toile showed that the armhole was too tight (Figure 4.17a)

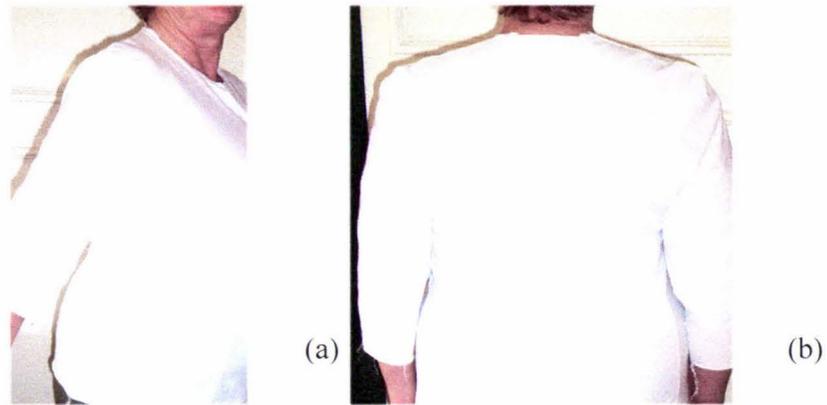
which was caused by the underarm point being raised with the insertion of the strip gusset (Figure 4.17d). The raglan shaping created a dart on the shoulder line which left a peak at the end (Figure 4.17c). An attempt to eliminate this peak was made by pivoting out the dart into the hem of the sleeve. This caused fluting along the hem edge and would have been unsuitable for a long sleeve (Figure 4.17b).



**Figure 4.17** First toile showing gusset and sleeve manipulations

- (a) armhole too tight
- (b) dart pivoted out causing fluting at hem edge
- (c) peak showing at end of dart
- (d) gusset too wide

The second toile is shown in Figure 4.18.



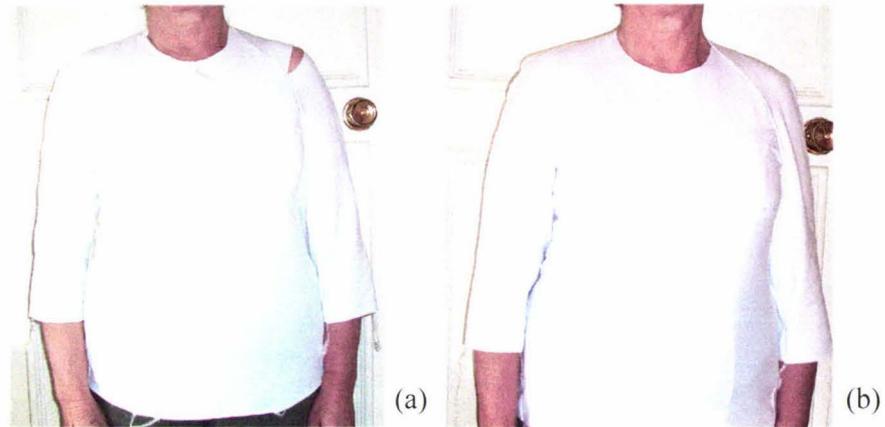
**Figure 4.18** Second toile  
(a) showing front panel and two piece sleeve  
(b) added ease in shoulder area

Developments included:

1. The raglan sleeve was developed into a two piece sleeve to allow for more ease to be introduced into the head and to create a smooth line over the shoulder.
2. Lowering the scye line enabled a continuous strip gusset to be formed from the hemline through the side body and underarm sleeve whilst maintaining the original scye-line when the arm is lowered.
3. The depth of scye was lowered 4cm and the raglan sleeve recreated. This resulted in the strip gusset being too wide to give an aesthetically pleasing result.
4. The depth of scye was lowered 2.5cm and the raglan sleeve recreated. The gusset remained at 10cm wide on the side body and narrowed to 4cm on sleeve edge.
5. A front side panel line was introduced over the bust (Figure 4.18a).
6. 1.5cm was added to front and front side panel at bust point and this increase was pivoted out into the side of the side front panel.
7. An extra 1.5cm was added to the centre of the raglan shaping on the back body and smoothed to nothing at neck and underarm. This provided extra ease across the shoulder area (Figure 4.18b).

8. Toiled pattern. The body shaping was good, but there was evidence of drag at the top of front sleeve.

The third toile is shown in Figure 4.19.



**Figure 4.19** Third toile showing adjustments to the shoulder area.  
(a) wedge area  
(b) body area too tight

Adjustments were:

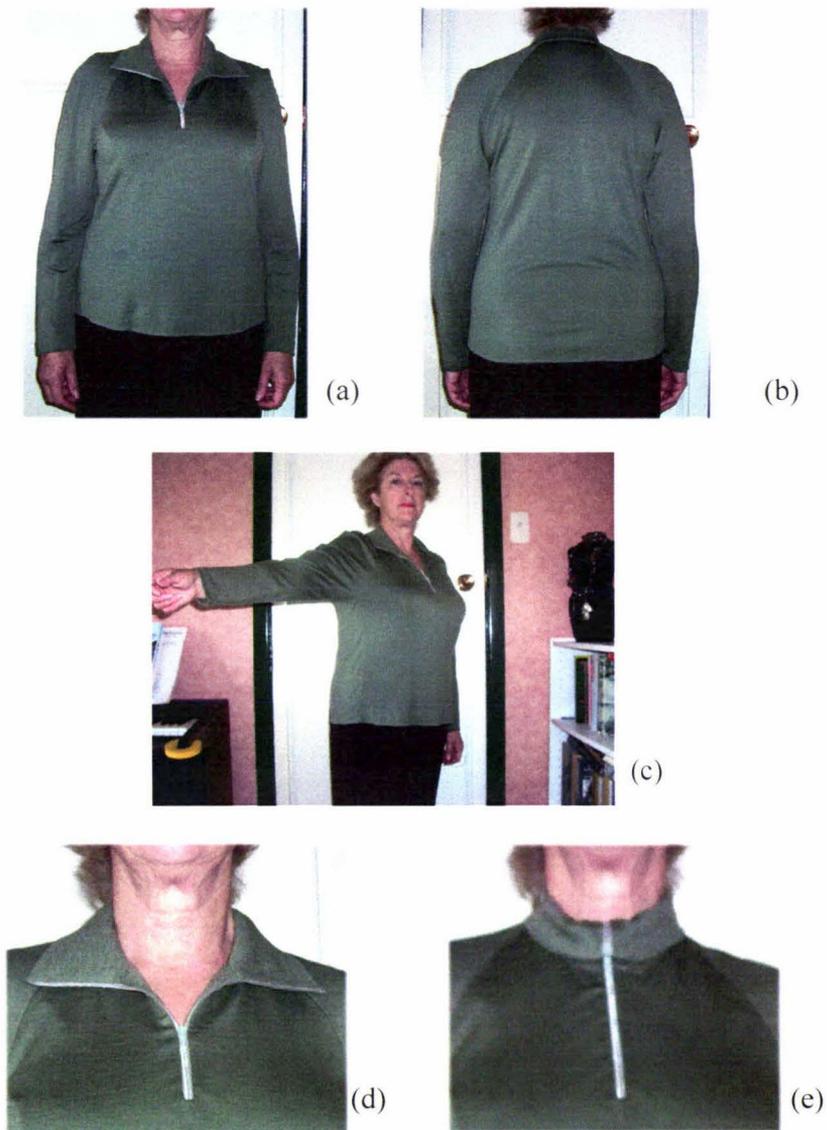
1. An extra wedge added into shoulder point and this point raised 1cm front and back (Figure 4.19a).
2. Toiled garment. Drag was eliminated over the shoulder area but the body area was too tight (Figure 4.19b).

The fourth toile focussed on collar development, arm and side shaping. This was toiled in green Merino wool fabric, because it was anticipated that one of the final garments would be made in a similar weight of Merino single knit jersey wool.

Methods were as follows:

1. 1cm added to CF and CB at hem and reduced to 0cm at neck edge.
2. Extra 0.5cm added to both side body and front panel seam, reduced to 0cm at armhole edge.
3. Collar added and 25cm zipper inserted in front panel and collar (Figure 4.20).

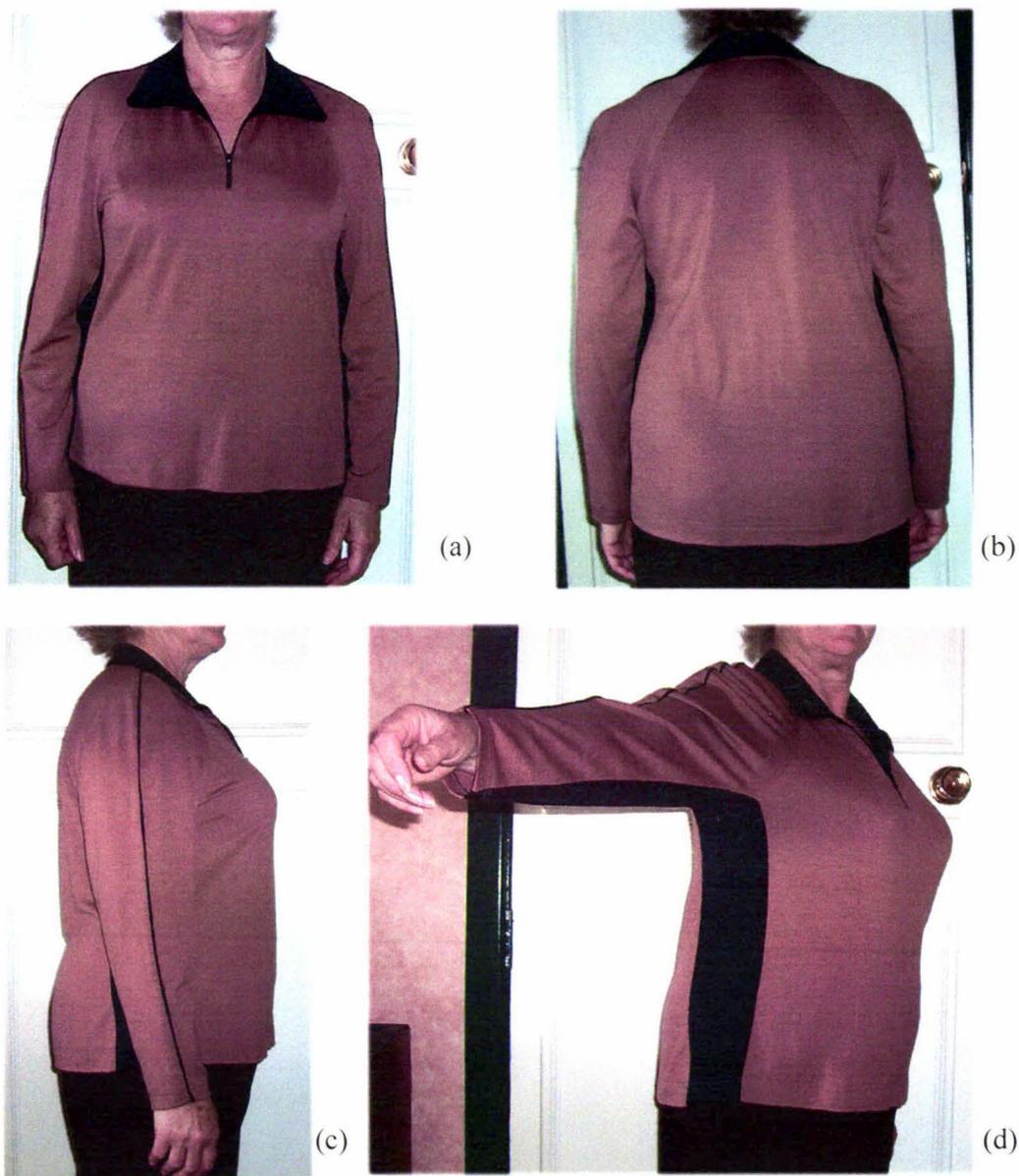
This toile showed that the shoulder seams appeared to be falling slightly towards the back. The toile also demonstrated that the arm lift could be achieved without distortion to the body of the garment.



**Figure 4.20** Fourth Toile showing added ease to the body and collar manipulations

- (a) Front view Merino wool toile with added ease.
- (b) Back view Merino wool toile with added ease.
- (c) Arm lift maintained without distortion to the body.
- (d) Collar worn open.
- (e) Collar worn closed.

The fifth toile (Figure 4.21) was made in contrasting Merino single knit jersey wool in order to assess visual appearance and appraise if any sizing differences would occur with different fabrics.



**Figure 4.21 Fifth toile showing contrast fabrics**  
(a), (b) Front, back and side view with shoulder seam corrected.  
(c) Side view showing fluting in front.  
(d) Contrast gusset to visually narrow the silhouette

This toile included the following adjustments:

1. The shoulder seam was brought forward 1cm and adjustments made to shoulder point to ensure correct seam run.
2. Hem was lengthened by 3 cm.
3. Contrast piping was used to emphasise seaming in sleeve (Figure 4.21c).

The extra width at the hem resulted in fluting occurring around the hem area of the garment (Figure 4.21 a, c and d). The piping tended to add bulk to seam and would cause some distortion in the seam if the piping was too thick. The pink Merino wool fabric and the contrasting black Merino fabric were slightly different weights and had slightly more stretch than the green Merino used in the fourth toile. This resulted in at least half a size variation.

Toile six was trialled in CoolMax™, the shirt fabric to be used in the final outfit (Figure 4.22).



**Figure 4.22** Side view showing panelling, pocket detail and sleeve finish and back view showing ‘shirt tail’ detail and shaping.

- (a) Contrast band eased onto sleeve
- (b) Shirt tail

Because the amount of stretch was less than the Merino fabric, the following adjustments were made:

1. The pattern had more ease incorporated over the bust area.
2. The width at the hem of front panel was reduced to eliminate the fluting (Figure 4.22).
3. The sleeve was shortened to mid upper arm.
4. The front edge was shortened by 2cm and the back hem lengthened by 5cm to create a 'shirt tail'.
5. A pocket was incorporated to the left hand side panel because of the reduction in the fabric stretch capabilities (Figure 4.22).

- **Grading of the shirt**

1. A 5cm grade rule was applied between sizes.
2. The revised pattern was graded from the base size 16 down to size 10 and up to size 22.
3. From size 18 up more ease was added over the bust area by increasing the grade ratio of grade points in that area.

The length of the sleeve could be easily adjusted from short to three quarters or long depending on the requirements of the wearer. The edge of the sleeve was eased onto a band of contrasting fabric (Figure 4.22 a). By shortening the front of the shirt and lengthening the 'tail' on the shirt a more pleasing line was created around the body (Figure 4.22 a and b). This adjustment was also designed to prevent a gap appearing when the bowler bent forward to deliver the bowl or when measuring or retrieving their bowl. The ease around the arm and shoulder area was not compromised by these adjustments or the change in fabric.

- **Rationale for the jacket**

The first toile (Figure 4.23) was made from polar fleece as this fabric was inexpensive and resembled the weight of the MerinoMax™ fabric which was to be used for the final garment. The polar fleece also had approximately the same amount of stretch in the course direction as the MerinoMax™ fabric.

The shirt pattern formed the basis for the jacket with the following adjustments:

1. The hem line was lowered 2 cm to allow the jacket to cover the shirt when the two garments were worn together. Not shaped at this stage.
2. Patch type pockets were incorporated into the side front panels.
3. 1cm seam allowance added to CF to allow for open ended zipper insertion.
4. Facing pattern constructed.



**Figure 4.23 First jacket toile based on shirt pattern**

- (a) Jacket made in Polarfleece with front zip detailing
- (b) Collar detail on jacket
- (c) Pocket detailing

A second jacket toile was made with the following adjustments:

1. A pattern for a hood was created and toiled. Adjustments were made to the head shaping and front edge to make the hood fit around the face and not obstruct the vision of the wearer (Figure 4.24).



**Figure 4.24** Back and front view of hood on jacket.

2. The shirt tail was mirrored in the hem line of the jacket.
3. In seam pockets were included in the front panel lines and the pocket bag attached to the front facing thus creating two extra internal pockets (Figure 4.25).



**Figure 4.25** Internal pockets created from inseam pockets.

- **Rationale for the trousers and skorts**

A Massey University trouser block size 12 was used to create the pattern for the skort because the fit model for this younger style was size 12. The trouser pattern was graded up to a size 16, and manipulations made to the pattern and fitted on the size 16 fit model. A basque was incorporated into the front of the skorts and trousers to keep a flat surface across the stomach area. By incorporating elastic in a casing at the back of the garments, the fit was then not as critical as a fully tailored garment. The skort pattern was toiled in the cotton polyester double knitted fabric anticipated for use in the final garments.

The following adjustments were made to the pattern for the trousers:

1. A 10 cm basque was established on the front pattern.
2. The dart suppression was pivoted out to give the shaping to the basque.
3. The side seam at the back waist was straightened to give extra width and the dart allowance was incorporated as ease/gathering.
4. An additional 3cm was added to the back waist to form a casing for elastic.
5. Inseam pockets were included in the side seams to sit just below the basque.
6. A mini belt was attached to the inside of the outer leg seam and a button on the outside to enable the trouser legs to be rolled and hitched up if desired.

The trouser pattern was graded up to size 22, the size of the largest participant likely to wear the garment.

The following adjustments were made to the pattern for the skort:

7. The waist was lowered 10cm in line with the present lowered waist styling.
8. A pleat allowance was added to the centre front and mid way across the front.
9. The length of the skort was designed to finish 10cm above the knee.
10. The skort was toiled in the polyester/cotton fabric and fitted on a live model.

It was decided to shorten the skort to finish mid thigh.

The skort pattern was graded up to size 18, the size of the largest participant likely to wear this garment.



Figure 4.26 Final outfit for younger bowlers.



**Figure 4.27** Final outfits for the mature bowlers.

## **4.5 Evaluation of garments by participants**

Two wear trials of the bowling outfits designed for this project took place in December 2005 and January 2006. Six secondary school students wore the garments during the Inter-secondary Bowls competition held in Auckland in mid December 2005 and four mature women wore the garments during the National Bowls Tournament held in Wellington between 3rd and 6th January 2006. The four women taking part in the trial were members of the same team entered in the fours competition.

All participants completed a questionnaire regarding their perceptions of the fit of the garments during the wear trial. (The tabulated results of the wear trials questionnaire from all 10 trialists can be found in Appendix 4).

### **4.5.1 Summary of the questionnaire results from young women re: wear trial for perceptions of the fit, aesthetics and comfort of the trial bowling clothes**

- **The Jacket**

Of the six wearers, three found the overall fit of the jacket a little bit too big although the shaping in the torso was satisfactory. One of the participants was only just a size 10 and a size 8 would have fitted her more snugly and been the correct length in the jacket and sleeves. The other two participants who found their jackets too loose in the torso but acceptable in the other areas, prefer their clothes quite tight fitting therefore they found and considered the overall fit too loose. Current fashion trends tend towards clothing which hug the body and create a more a more body revealing silhouette. Five of the six participants found the freedom of movement in the arm area very satisfactory the sixth person did not comment on the fit in this area.

- **The Shirt**

Again the same participants who found the jacket too loose also commented on the looseness in the torso of the shirt and the overall comfort of the shirt being too loose. One of the six people thought the collar was a little bit too big although it was

acceptable. This participant noted a preference for an overall tighter fit with everyday clothing. One person thought the zipper on the shirt was slightly too long. All participants found the freedom of movement in the arm area very satisfactory.

- **The Skorts**

Generally the participants were very pleased with the fabric and the fit of the skorts. Two of the six young people found the elastic in the waist a little bit tight but this did not interfere with their bowling. Three respondents would have preferred the legs to be shorter. One person who found the skorts too loose overall prefers to wear very short, tight fitting, low rider styles, although she did comment that the stretchiness of the fabric in the skorts allowed her good freedom of movement while bowling.

- **Fit and comfort of garments**

All six of the participants liked the ease of fit in all three garments and the panel shaping in the shirt and jacket. Two commented that the zipped collar was in keeping with current trends. All liked the fact that the shorts were designed to sit on the hips rather than the waist and one person liked the fact that the shorts looked like a skirt from a distance. Currently the fashion is for skirts and all varieties of trousers to be worn at least 10 cm below the waist. This length is often determined by the wearer who adjusts the garment to the desired level. All participants found the shaping in the arm and shoulder area excellent and all participants were more than happy with the choice of fabrics for all three garments.

Two of the participants did not have any negative comments and the other four made suggestions such as a skirt might be alternative option to the uniform, the bottom of the shirt and jacket could be tighter so that it hugged the body more and the addition of team colours on the clothing would be an advantage in the future although they realised this was not an option for these garments because of the constraints Bowls Wellington imposed on the use of colour, only black and white were to be used.

The polar fleece proved to be a comfortable fabric and met with the approval of the two trialists for choice of style, material and colours and ease of movement while playing. One said the polar fleece jacket was good for keeping out wind and did not make her become overheated.

Of the other four who had the MerinoMax™ jackets, one did not wear the jacket during play or at any other time as the weather during the tournament was too hot. The other three wore their jackets for a short time, for much the same reason although one person thought the jacket was very cosy especially in the evening. These three wearers commented on the comfort of having a stretchy fabric for the jacket. No one specifically commented on the handle of the fleece or wool fabric. All participants found the freedom of movement in the arm area of the jacket very satisfactory.

Only one person found the shirt a bit hot during the heat of the day. All the others liked the smooth feel of the Coolmax™ fabric against their skin and none found the fabric stuck to them or felt clammy at any time. All participants liked the amount of stretch in the fabric of the shirt which gave them further freedom of movement.

All participants liked the fabric in the shorts as it was stretchy and did not hinder leg movement while bowling. They appreciated the comfort of the fabric against their skin and although it was fine Merino wool and Tactil™ they did not find the garment hot to wear, even on the hottest day which reached a temperature of 28°C. All liked the loose fit of the leg which made the shorts feel light and airy and comfortable in the heat.

- **Aesthetics**

Three of the six participants would have liked a coloured contrast rather than the black and white stripe on the jacket and shirt. They thought the idea of stripes was fine in principle but a colour would have better identified them as a team.

At the time of wearing the clothing, the young women were pleased with the overall appearance of the uniform but on reflection one found the tail on the shirt annoying although she could not say why and another would have preferred the tail to be shorter. One of the six participants considered the whole outfit a bit old fashioned especially the tails on the shirt and jacket and the style of the shorts. She did admit her usual choice is of more close fitting styles but overall the clothing was comfortable. Two of the six people commented they would like to have had a yellow colour on the clothing to identify themselves with the Wellington region.

#### **4.5.2 Summary of the questionnaire results from mature women re: wear trial for perceptions of the fit of the trial bowling clothes.**

- **The Jacket**

All four wearers found the overall fit and shaping of the jacket perfect for them. Two women found the length of the sleeves a bit long but were happy to turn these up. All four participants found the freedom of movement in the arm area very satisfactory. All found the jacket easy to get on and off.

- **The Shirt**

All of the participants were very pleased with the fit and shaping of the shirt and again all participants found the freedom of movement in the arm area very satisfactory.

- **The Trousers**

One of the four women felt there was too much room in the leg and the length of the crotch was also a bit too long. Although the trousers were fitted and the finished hem length measured, three of the four women thought the trousers were too long. Generally they wear their bowling trousers shorter than conventional street wear so that they just touch the top of the shoe rather than meet the join at the back of the heel. One felt the elastic in the waist could have been tighter but this participant admitted she does like her waistbands quite firm. Overall comfort during play was considered by all participants to be just right.

- **Fit and comfort of garments**

All participants found the MerinoMax™ fabric comfortable to wear. One of the four women thought the fabric was very warm while another felt it may not be warm enough in cooler weather. One woman commented positively on the lightness, stretchiness and softness of the jacket fabric. All participants found the fabric in the shirt very comfortable to wear. None of the women felt clammy neither did the

fabric stick to their skin when they got hot. All found the fabric in the trousers very light weight and comfortable against their skin.

- **Aesthetics**

One did not like the horizontal stripe and two women thought the fabric felt like pyjamas. All participants liked the contrasting fabric on the jackets and the shirts although there was some disagreement on colour.

The fact that the garments were designed specifically for women, rather than unisex garments, met with the approval of all four participants. Two of the four women thought the stripes in the trousers should run vertically for larger ladies.

All four women were positive about the tails on the jackets and shirts and one thought it made the garments more feminine and elegant. All women thought the panel shaping in the shirt and jacket was very flattering for a larger figure. One remarked on the hood as being a good feature.

Consensus was that the trousers were unsuitable because of the horizontal stripes which tended to display a dazzling effect at a distance. One woman would have preferred a more tapered leg on the trousers despite the current fashion trend showing flare to the lower leg.



**Figure 4.28 Team at the New Zealand National Competition Wellington. January 2006.**  
(Source: Researchers collection)

### **4.5.3 Results from the mature women's wear trial focus group**

The focus group meeting was held 2 weeks after the wear trial. At the beginning of the meeting, the aims and objectives of the wear trial were explained to the group of four women and they were invited to give candid opinions about the fit, comfort, fabrics and styling of the garments. Each garment was discussed separately using the criteria in the questionnaire as guidelines for the discussion.

The participants began by discussing the inadequacies of their existing club jackets which included the sleeve and armhole positioned off the shoulder resulting in excess fabric under the arm and around the torso area giving a very bulky look and a cumbersome garment. The tight elasticised band forming the hem was not a popular aspect of the club jacket. All four women agreed that these features tend to restrict movement especially when an extra layer of clothing is required to be worn underneath the jacket during the cold weather.

- **The Jacket**

The participants were asked to comment about the amount of movement around the arm and shoulder area of the trial jacket. All agreed there was plenty of ease for movement in the forward and upward swing of the arm especially when driving or playing a forcing shot. One woman found that the hood tended to drag back a bit but she admitted this may have been because she didn't have the jacket far enough over her shoulders at the time. The other women did not find this happened with their jackets and suggested zipping the jacket right up might eliminate this problem. All women tried bowling with the hood up. Three of the women experienced unrestricted vision while the fourth needed to zip the jacket up to the neck to keep the hood in place. None of the women wanted the hood replaced by a collar alternative. All four women liked the length of the front of the jackets and the extended back length which elicited lots of positive comments about the style of the jacket from other players during the tournament. Three of the four women found the sleeves of the jacket slightly long when playing but satisfactory when they folded the cuffs up. None of the four participants in the wear trial wanted the jackets more fitting because the present fit allowed them to put another layer underneath if the

weather turned chilly. All found the overall comfort of the jacket very good and the strip gusset under the arm was helpful in that it allowed unhindered movement during play. When asked about the feel of the fabric against the skin two women said wool sometimes made them itchy but this fabric did not. One woman commented that the jacket was comfortable like a cardigan but was not sure how it would 'wear' when worn continuously. It was warm enough during the time of the wear trial but she queried whether it would be warm enough in colder temperatures although there was room for another layer to be worn underneath. Another woman thought another layer could easily be worn underneath without compromising the silhouette or restricting arm or body movement. Three of the four woman felt that the MerinoMax™ fabric would be warm enough as they do not feel the cold. The question was asked by two women regarding how shower proof the fabric is and if it could it be treated for water resistance.

- **The Shirt**

All four women approved of the fabric in the shirt and commented that it felt cool against the skin. They did not find the band around the edge of the sleeve restricting and were very happy with the shaping and the design and saw no need for alteration. When asked about a longer sleeve, the women thought this could be a good idea as their elbows can get sunburnt when they 'stand at the head'. A three quarter length sleeve would be useful but they weren't sure whether it would need to be looser or narrower at the cuff. All four women were happy with the size and shape of the collar. One woman commented that the collar sat nicely and was not too close to the neck. During the tournament one of the women wore her collar zipped up to protect her neck from the sun. They all agreed that the contrast on the collar broke the plain white and 'lifted' the appearance of the shirt. The contrast fabric on the collar didn't appear to get as grubby as would a white collar. All agreed the zipper was the right length and the shirt was easy to get on and off over the head. One woman would have liked two pockets on the shirt. The size of the pockets was just right. Another participant thought a high in-breast pocket could be considered for future shirt development as she has found a pocket in this position handy for her chalk and measure.

- **The Trousers**

None of the 4 women wore the trousers during the tournament but they had tried them on and done some exercise in them. They thought the shaped flat basque in the front of the trousers was very flattering and fitted well around the waist. In all four cases, the crotch length was excellent and afforded freedom of movement when bending. The women did not like the choice of fabric and although the fabric felt nice against the skin, the trousers were too wide and floppy in the legs. They suggested a heavier plain fabric would have given a more tailored look.

#### **4.5.4 Researchers evaluation and summary of the pattern development and final garments**

The patterns of all of the garments encompassed the functional needs of the bowlers and the finished garments met the functional and comfort requirements of the participants during the wear trials. The additional ease around the arm area was achieved by using a two piece raglan sleeve with additional ease added into the back sleeve seam. By using a strip gusset through the side of the garments, bulky underarm seams were eliminated and extra stretch achieved in the underarm area. Panelling in the front of the garments allowed the garments to be adjusted easily for different figure types i.e. teenage figures to the fuller mature figures. All of the garments featured pockets to hold bowling equipment and personal items.

The skort design met with the approval of the younger bowlers, the lowered waist and pleats being in line with current fashion trends but the leg length of the skort could have been shorter. The striped polyester/cotton knitted fabric used in the first skort prototype was replaced by the black Merino/Tactil™ knitted fabric for the final wear trial garments to meet the aesthetic requirements of Bowls Wellington. The participants thought that the Merino/Tactil™ knitted fabric draped well, was comfortable to wear and met the aesthetic requirements of the Bowls Wellington Committee. Elastic in the back of both the skort and trousers made for easy donning and doffing and no restriction when bending.

With the exception of the trouser fabric, all of the fabrics used in the garments performed to expectations and satisfaction of participants giving the desired amount of stretch, comfort against the skin and thermal properties.

Generally the outfits were successful for the mature players with the exception of the trousers (Figure 4.28). The objections to the trouser fabric were mainly aesthetics. The women did not like the small horizontal stripes and some thought the fabric a bit light weight. A more stable fabric than the double jersey knit used in the trouser prototype and wear trial garments could achieve a more tailored effect to the garment. The use of a plain or vertical striped fabric and more shaping to the leg of the trousers would satisfy the aesthetic needs of the more mature women.

A re-evaluation of the product development for the younger market is needed as they appear to be more aware of fashion trends than was initially recognised from the preliminary questionnaire which indicated a rather conservative view. Generally the upper body garments for the younger players were too big in the torso hence ranked as too loose. The collar was ranked by some participants as too large, the length too long and the width of the shirt at the bottom too wide in proportion to the rest of the garment. In line with the recommendations made by the participants, the following changes could be made to the garments for the younger market:

- The upper garments need to be much tighter fitting;
- The length of the skirt shorter;
- More colours introduced into the outfits by using coloured fabrics for the main garments and contrasting panels and/or coloured club logo designs;
- A greater range of garments offering different combinations would allow for individual differences to be expressed.

Two base pattern sizes should be used in the second round when designing for this diverse market as an alternative to grading from a size 16 block. Patterns manipulated from a size 12 block would ensure the length, a tighter fit and desirable aesthetics of the garments for the younger group. A size 16 block for the mature figure could build in greater ease over the bust area and afford a slightly looser fit

overall. These outfits could then be modified easily to suit a 'made to measure' scenario as the panelling in the front of the shirt and jacket allows for additional ease to be incorporated at critical points.

Although black and white only were used in these garments to accommodate the approval of Bowls Wellington for the younger team, the introduction of more colours in the shirt and jacket, either as contrast on the collar and hood lining or panelling in the garments themselves, would add more interest to the outfit as a whole and appeal to individuals or social players. The addition of club logos on the shirt and jacket would signify club affiliations as well as adding extra colour to the outfit. The use of graphics on sports clothing is increasingly used for purposes of marketing and promotions and the entire panels on both the shirt and the jacket could provide placement for graphic designs in future productions in line with fashion trends.

## **CHAPTER 5**

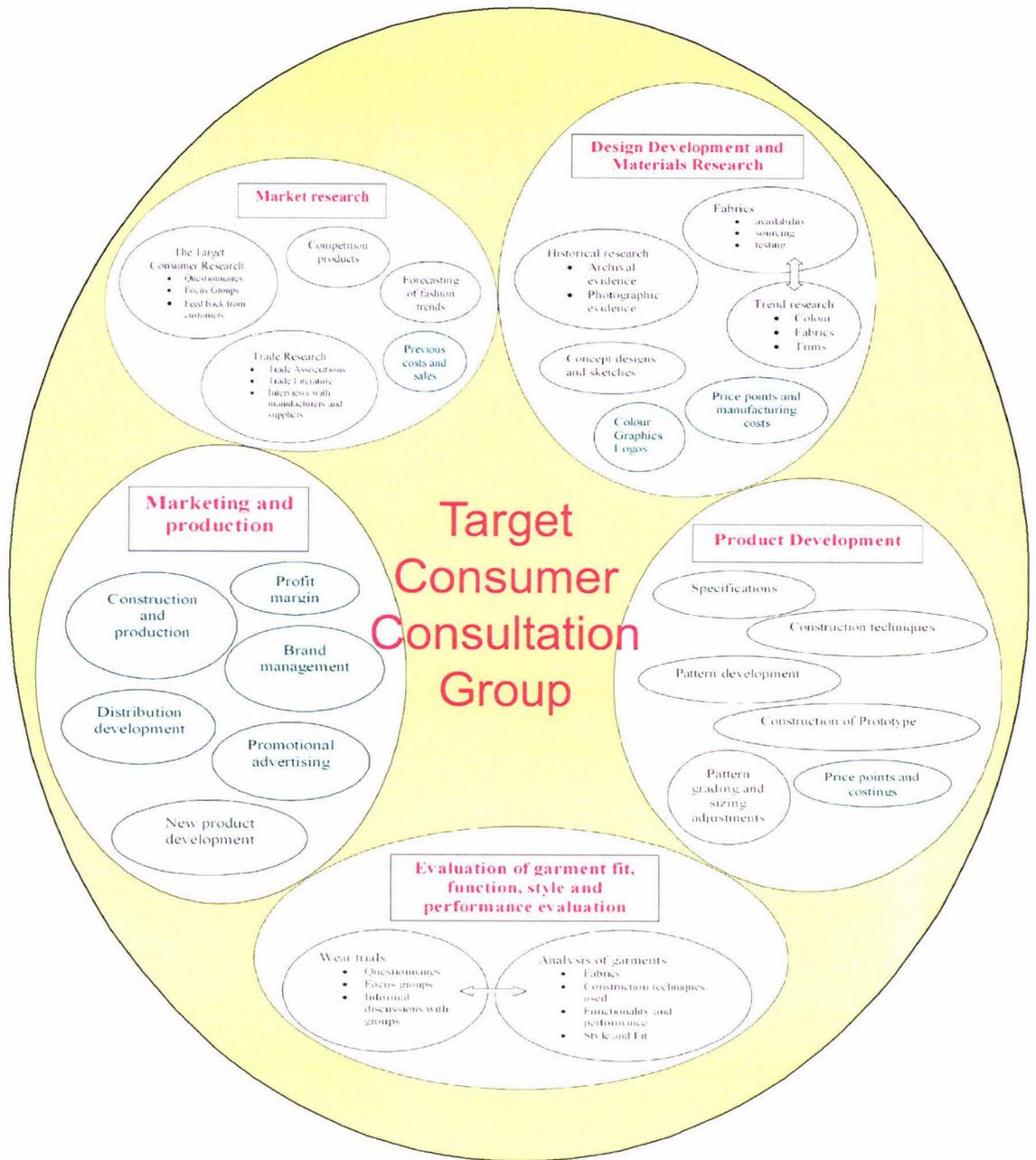
### **A ‘SMALL BUSINESS NICHE MARKET MODEL’**

#### **5.1 Introduction.**

One of the principal objectives of this research was to develop a design model for the ongoing production of women’s bowling clothing. However, as fashions change and the target market mix alters to include younger people, so too must the functional, expressive and aesthetic styling of the garments keep pace with fashion trends in sports clothing. The model must have sufficient flexibility to accommodate ongoing re-evaluation in line with the changes in requirements.

The initial model (Figure 3.1), based on Deasy (2003) and Press and Cooper (2002) has been trialled and evaluated. The new design model is now proposed (Figure 5.1) showing refinements made to the initial model in light of the experience gained during this research. Following the recommendations of Deasy (2003) and Press and Cooper (2002), this new model for the ongoing development of women’s bowling clothes (Figure 5.1) includes a number of components within it that identify with the issues arising from this research. This model supports five functional areas or components that describe the tasks and processes that need to be considered at each stage of the development of a new product. In consultation with the target market, the components share responsibility for the design and development of the new line of women’s bowling clothing and can follow one another in a cyclic but not necessarily sequential fashion making flexibility the key to the new design process. Each of the following components will be described in detail.

- Market research
- Design concepts and material research
- Product development
- Evaluation
- Marketing and production



**Figure 5.1 'Small Business Niche Market Model'**

- Influence of the Target Consumer Group
- Areas not covered in this research
- Documentation held by the researcher.
- Areas discussed in this model

The new model groups these five issues into component parts that allow for reflection and evaluation by the consumer and the designer at each phase of the design process. Often issues within one component can influence the outcomes from another component (Plumlee & Little, 1998). This research has shown that some areas within different components have to be investigated and amended several times especially during the design development and materials research component, product development component and fit and style evaluation component. For example, in this research, the fabric chosen for the trousers was found to be unacceptable during the fit and style evaluation stage. This issue will need to be referred back to the materials research stage and to the pattern development as new fabrics can influence the style, cut and sizing of the pattern. The new garment prototype needs re-evaluation by the consumer group. The new model (Figure 5.1) allows re-working and re-evaluation of any component in this manner whereas the initial model (Figure 3.1) did not. The arrows from Figure 3.1 are thus omitted because this new model allows movement between components in any order.

Literature on product development identifies several forms that new products may take. Plumlee and Little (1998) refer to these new products as:

- New to the world inventions which create a new market;
- Modifications of existing products;
- Existing products introduced to new markets.

The new model (Figure 5.1) for the ongoing development of women's bowling clothing focuses primarily on the development of new products and the introduction of these to an existing target market. The target market is placed at the centre of the model enabling consultation to take place with this group at any time during the whole process making this model suitable for small businesses and small niche markets. The small business niche market model (SBNMM) (Figure 5.1), is thus based on design theory but has the added advantage of also being based on design research through practice carried out in this research.

Many published product development models for apparel are of a sequential type quoting lists of activities to be completed (Cooper & Kleinschmidt, 1986; Hardaker & Fozzard, 1997). Such models do not allow for process activities or phases to occur concurrently or engage in backwards movement (Plumlee & Little, 1998). Some notable exceptions would include the 'Integrated Process Model' (Erhorn & Stark, 1994) and Saren's (1994) blocks model of the product development process. In their research into the development of a 'No-interval coherently phased product development model for apparel', Plumlee and Little (1998) state:

*"Most previous work in conceptualizing and modelling the new product development process has been of a generic nature contributing much to the structured understanding of the process but little depth. These published models have been beneficial in conceptualizing major phases in the process but do not provide the depth needed for optimizing the process used in a particular industry. This limitation also exists in works of those authors who have developed theoretical frameworks for the apparel design process applying existing design theory"* (Plumlee & Little, 1998).

With the additional input of design research through practice, each process component in the present SBNMM model is permitted to refer back to the target market for clarification and evaluation. This new model also provides for multidirectional movement through each of the processes, allows for simultaneous activities within the components and emphasises the relationship between the development of the product and the target market. This model places the customer at the centre of the design process as it is the customer or consumer who decides what they need and when they need it. The continuously changing fashion market can be addressed at any stage of the model and the development process time minimised for those new products that meet with the approval of the target market thus improving their cost effectiveness. For example, during the design development phase in this research the design for the top was changed several times after consultations with representatives of the target market:

- The Coolmax™ fabric replaced the Merino wool fabric in the shirt for the wear trial because the woollen fabric was considered by the researcher too hot for trialling in December and January;
- A contrast fabric was used on the collar and facings of the top replacing the piping trim in the sleeve seam and edge of the collar. This was prompted by comments from a consumer group during the prototype consultation process;
- During the prototype stages, the younger group of women did not like the ‘tail’ on the shirts but it was appreciated by the more mature players. This style was maintained as a feature but the ‘tail’ was reduced in length for all of the shirts;
- The collar on the jacket was replaced with a hood after consultation with both consumer groups as they thought it more in line with current fashion trends. The jacket was constructed and trialled in two fabrics, Merinomax™ and Polarfleece in order to ascertain preferences for the handle of the fabrics, thermal comfort and possible alternative price points. While the Polarfleece fabric was not the preferred fabric by the researcher, hence was included after the prototype trial stage, it did meet with the approval of the younger players;
- Feedback from the wear trial focus group indicated that both of the fabrics used in the jackets were acceptable and the difference in the cost of the fabrics would in turn give the consumer more choice without compromising the desired aesthetics. Both fabrics could be marketed in an ongoing situation.

Because consultation with the target market took place throughout the whole design process, the resulting products of the research i.e. the garments, have fulfilled many of the functional needs of the target consumers and could be manufactured at a price

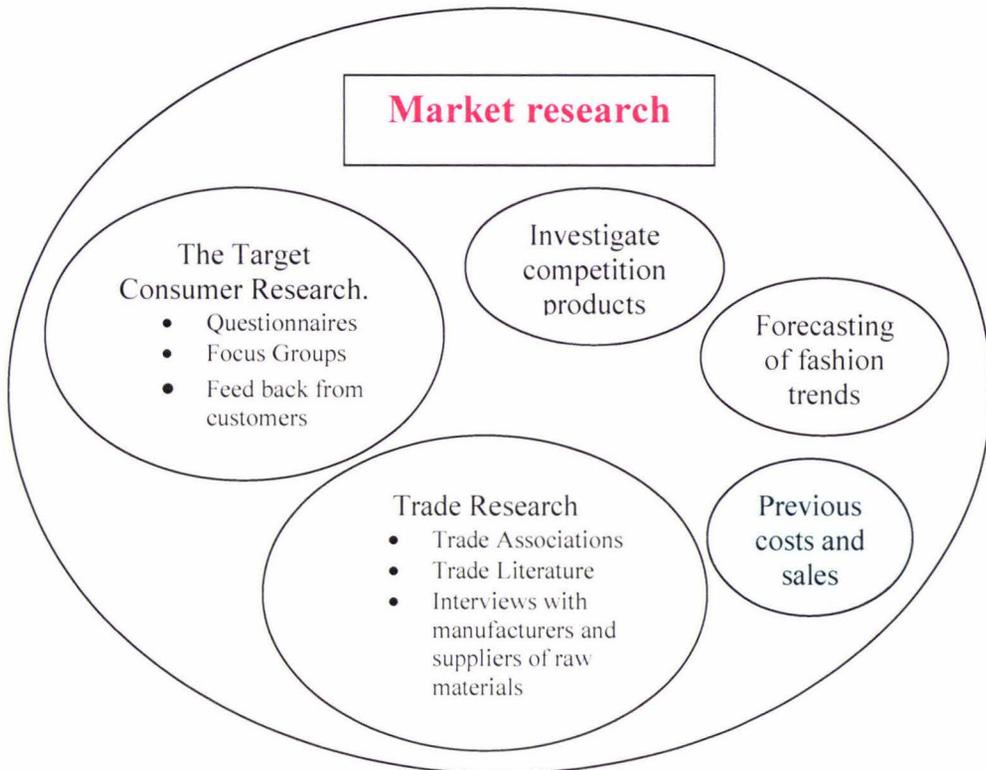
affordable to women bowlers. Providing fabrics could be accessed and dyed and/or embroidered in economical and cost effective amounts, the aesthetic and expressive attributes of these outfits could be achieved to meet the requirements of different bowling clubs and Bowls New Zealand.

In larger companies which produce several lines of clothing for a season, data regarding consumer acceptance of the products is often not available before decisions have to be made regarding the lines for the next season (Plumlee & Little, 1998). The time line between ordering fabric, delivery dates, and pre production phases often happens up to twelve months in advance of the product arriving in the shops. Consumers cannot be engaged in much of the decision-making because of this elongated period. One of the departure points for this present model is that it is designed for use by a small company of up to three people and allows for easy and ongoing communication between the designer, manufacturer and consumer and an iterative approach to and between each component in the model. Constant exchange of information with the target market throughout the whole design process reduces the time taken to gather data and make decisions regarding new lines of clothing. The outcome of apparel development is usually a line of related products for a particular season. The parameters for this model are not set as changes per season but more as a line of functional but contemporary clothing that can be adapted to meet the functional, expressive and aesthetic needs of women bowlers and the requirements of their clubs.

## **5.2 Market research**

Knowledge of the target consumer and the current market is paramount to the success of any new product (Gruenwald, 1992). The market research component of the model (Figure 5.2) gives a background to and informs the designer of the target market, competitive products, resources and evidence of sales of previous products. This component is essentially similar to the first model (Figure 3.1) but is widened to include aspects of competitors within market sales and research into competitive raw

materials. Trends in contemporary fashion and fabric technology must also be investigated at this point.



**Figure 5.2** Market research component of model.

 Area not covered in this research

- **Target consumer research.**

The demography of the target market was elucidated through focus groups and questionnaires in this research. This style of research can help to define any constraints imposed by the consumer such as personal consumption, expenditure, consumer wants and consumer feed back on product returns (Cross, 1999; Deasy, 2003; Press & Cooper, 2002). Questions specifically targeted at consumption and disposable income for sports wear may need to be included in future questionnaires

to ascertain a realistic price point. Insufficient responses to this type of question did not supply sufficient information to be useful for this research.

- **Trade research**

Trade research establishes current and future trends in fabrics, trims and fashion forecasting. Interviews with fabric and trims importers and New Zealand manufacturers are important and were undertaken in this research to establish the availability of fabrics in sufficient quantities for a production run (Carruthers, 1999; Dale & Oakland, 1994). For ongoing production, investigation into the availability of cut make and trim companies may need to be carried out during this phase to ensure the company has the facilities for manufacturing the product and is available when the clothing line is ready for production.

- **Forecasting of fashion trends.**

Media such as television, international fashion magazines, fashion shows and internet sites such as Worth Global Style Network (WGSN) an up to date site which forecasts global fashion trends, can help designers to keep abreast of fashion trends and new fabric technology (Saren, 1994). For this research, televised international games of bowls, tennis and golf were observed to gain an insight into what presently is being worn on court and on the greens, many current fashion magazines were read and Worth Global Style Network consulted for current and projected trends in fabrics, trims and sports dress.

- **Competition products.**

Before planning and designing a new line, currently available products should be investigated to establish a point of difference for the new proposed line of clothing. This point of difference could include the use of high performance sports fabric, a particular cut or design line in the garment to achieve supreme functionality, the introduction of colour and specific logos, or a higher or lower price point than competitors. All of these factors help to establish a niche in the market (Prescott, 2005). In this research, sports stores and clothing outlets were visited to establish

what clothing was available specifically for women bowlers. The apparent lack of a range of bowling clothes catering for all age groups and using newer fabrics established the niche in the market for this project.

- **Previous costs and sales.**

Once the line of clothing is established, sales from previous seasons can be indicators of successful or not so successful lines. Customer returns and feed back may also provide valuable data as to the success or failure of the line of clothing (Krenzer, Starr, & Branson, 2005). The cost of the production of each line can then be assessed to in light of this evidence. This is hypothetical in the case of this research but this step in researching the market would need to be pursued for actual production so allowance is made in the new model.

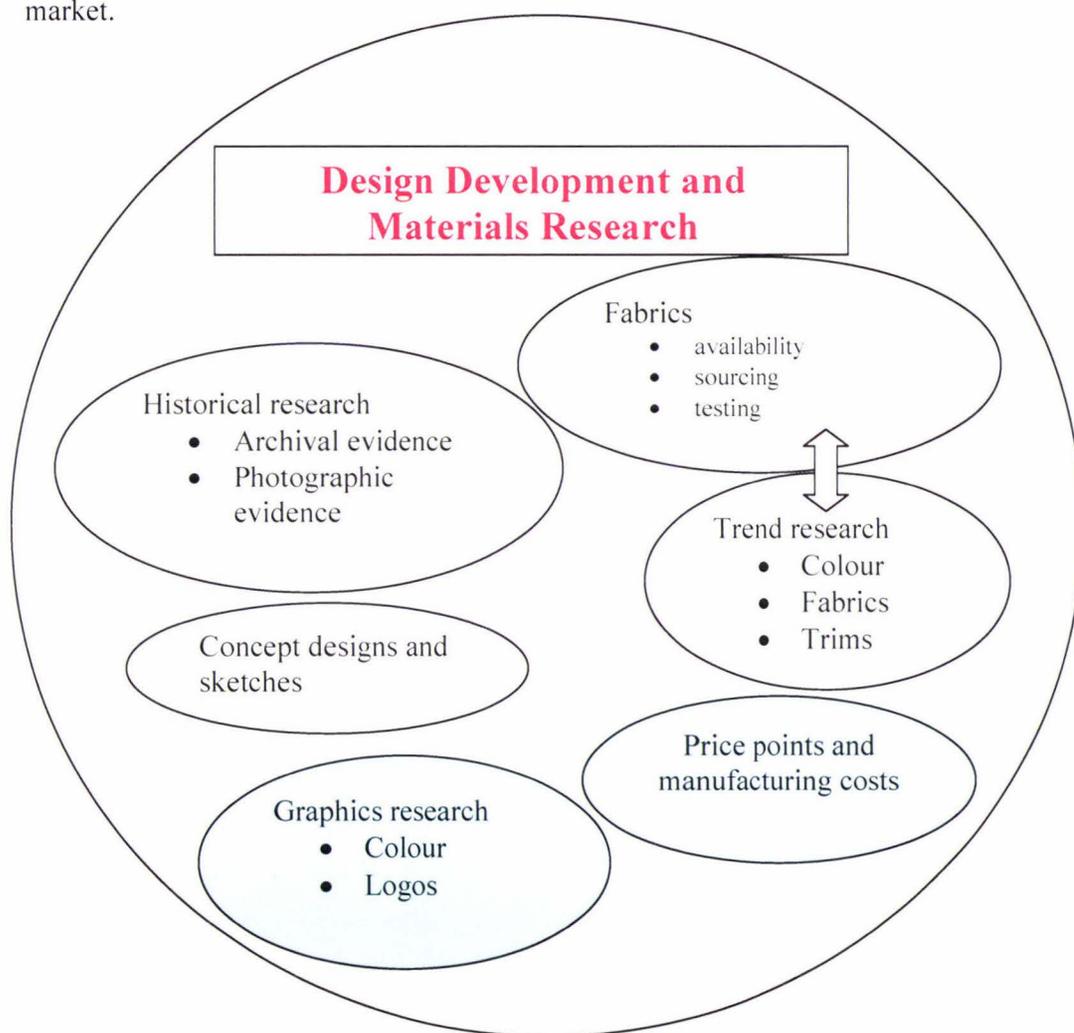
### **5.3 Design development and materials research.**

Product development is defined as the design and engineering of products which are serviceable for the target consumer, marketable, manufacturable and profitable (Chuter, 2002). Creative inspiration for the development of a new line is incubated within this component of the model (Figure 5.3).

- **Historical research.**

Background historical literature and research assisted with the identification of the culture associated with lawn bowls as suggested by Lamb and Kallal (1992) and evidence of existing products helped to pinpoint the niche in the market for any new proposed product. In the case of lawn bowls, the archival evidence together with visual research, helped to establish how the dress of the game of bowls has evolved over time. The establishment of women's clubs and the subsequent integration of many of these clubs with men's clubs have effected changes in the dress code for women lawn bowlers. Research in this area could give an indication of the dress worn by people who have played bowls in the past, together with people who are presently members of bowling clubs in New Zealand. By visually analysing

photographs of women bowlers taken over the past 55 years, the dress of the women provided an indicator of the strict rules and the adherence to these rules and regulations set down by the Women's National Body. The fact that some of these mores are still upheld today became apparent when the bowling clothing worn by women bowlers was visually analysed. It may not be necessary for this aspect of the research to be undertaken each time a new product or line of clothing is proposed. Updating fashion trends and taking cognisance of target market responses in the market research component will keep historical evidence up dated and will indicate how aspects of individual needs can be built into the uniform to address the youth market.



**Figure 5.3** Design development and materials research component of model.

Areas not covered in this research

- **Fabric research, testing and trend research.**

Trade research is closely linked to fabric research and trend research in this component. New high performance sports fabrics were investigated and tested to gauge their suitability for a line of clothing for women bowlers. Knowledge of the properties of the fibres, yarns, structures and finishes used in the fabrics, trends in the appearance and texture of the fabrics in relation to current fashion and the performance characteristics of the fabrics (e.g. regarding comfort and durability) were also investigated during this phase. In this research large swatches of the fabrics to be used in the garments were part of the focus groups' review. The women handled the fabric and assessed its potential comfort properties (Bishop, 1996; David, Stearn, & Denby, 1986). Although the people in the focus groups for this research may not have been experts in assessing the handle of the fabric, they were able to make a subjective judgement based on their previous experience with bowling clothing. As they are the ones who may wear the fabric in the future, their opinions needed to be considered. Fabric testing could be carried out by an independent laboratory if specialist equipment is unavailable to the designer. Failure to carry out these fabric tests could result in incorrect labelling, consumer dissatisfaction with the product and the consumer ultimately choosing a competitors products in the future (Chan et al., 2003; Hatch, 1993). Once the testing of the potential fabrics has taken place then the availability of the fabric becomes an important factor. The colour of fabrics and matching trims could be dictated by their availability within New Zealand. In this research the colours for the bowling uniforms were dictated by Bowls New Zealand and not by the designer, but a wider range of colours would be recommended for lines targeted at club players.

- **Price points and costing.**

Costings must be considered in all components of the model. In this component, fabric must be available in sufficient quantities to satisfy the market and at a cost that allows the clothing items to be competitively priced. To meet costs, the small manufacturer may need to consider specialising by working with specific clubs who have similar colour wave requirements which would then enable efficient use of coloured fabrics. Alternatively, the manufacturer could consider purchasing greige

cloth and having specific amounts dyed to meet club specifications as and where required. The manufacturer or small business may decide to make the garments off shore in which case they would need to cooperate with an established company already manufacturing off shore. Alternatively the small business may consider engaging an off shore specialist company in which case the fabric requirements, specification sheets and size charts would need to be supplied to the off shore manufacturer possibly through a CAD system. In either scenario the small business would need to weigh up the cost of cheaper labour cost against the duty to be paid when the garments enter New Zealand.

- **Concept design sketches.**

Consultation with the consumer group is paramount during this phase to ensure the aesthetic, expressive and functional elements of the design meet the expectations of the target market. This was achieved through the focus groups and preliminary questionnaires. A compromise may have to take place to ensure the new product does maintain its point of difference yet still meets the needs of the wearer and takes account of other interested parties like clubs and Bowls New Zealand especially for competition play. The concept sketches developed for this research helped to establish the final design for each garment but not the choice of colour. Final designs were reached after consultation with the committee of Bowls New Zealand and the women involved in the wear trials.

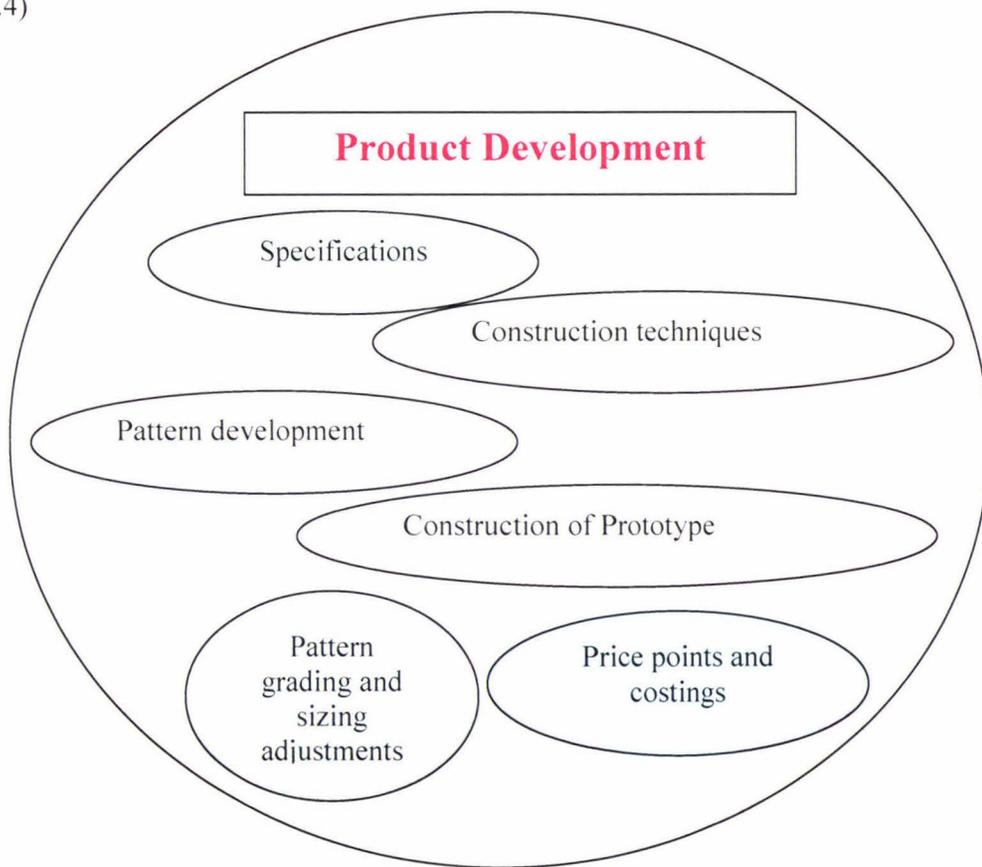
- **Graphics research**

The design sketches should include the placement on the garments of colours and potential logo designs. Logos or graphics were not included on any of the garments in this research but designated areas on the front and back of the jacket and top are indicated in the design sketches (Figure 4.16). The inclusion of colour and design logos is very important as this denotes affiliation to that club and gives the wearer a sense of belonging and acceptance into the group. People not directly connected to the sport may purchase the garments in order to identify with the sport (Dodd, Clarke, Baron, & Houston, 2000). If the overall appearance of clothes appealed to a wider market, they may be bought by other sporting codes such as tennis and croquet

and adaptations made regarding the logo and colour. The aesthetic and expressive characteristics of any sports clothing can give sports people a psychological edge over their opponents if they feel correctly dressed (Casselman-Dickson & Damhorst, 1993; Kaiser, 1997) and this was born out in some of the responses by the participants. During the wear trials one of the young women commented that she felt their team looked like a team and were really smart in their matching uniforms.

## 5.4 Product development

Once the designs for the individual garments have been finalised and the fabrics and trims selected, patterns need to be developed to reflect the new design styles (Figure 5.4)



**Figure 5.4** Product development component of model.

- Areas not covered in this research
- Documentation held by the researcher.

- **Pattern development**

Where a company has a satisfactory set of block patterns, adaptations to these blocks may be all that is required, however the prototype should be made using either the fabric chosen for the line of clothing or something very similar to ensure consistency of sizing and fit with previous garments styles as was done in this research. In this study, the change of fabric when toiling the shirt i.e. the green Merino wool fabric (Figure 4.20) to the pink Merino wool fabric (Figure 4.21), resulted in a difference of at least half a size, hence the final pattern was toiled in the Coolmax™ fabric to ensure correct sizing. Where a totally new concept is evolving as in this present research, prototypes are constructed and evaluated for fit using a fit model. In this research a size sixteen pattern was chosen as the base size because data from the questionnaires indicated that this was approximately the average size of the majority of women surveyed and the fit models available in the initial stages were also size sixteen. However the evaluations by the wear trialists showed that size 12 would be a better base size for the younger age group. Further recommendations in light of this research would indicate that the actual body measurements of clients be used to develop size charts for these specialised garments but the exact processes may vary from company to company. The new model allows further pattern development, size specifications to be adjusted and a new prototype garment to be wear trialled.

- **Construction of prototype.**

The results of the initial wear trials indicated that although the product was considered superior to existing available garments, several prototypes should ideally be fit tested in all sizes commensurate with the target market and the final prototypes made in the fabric chosen for the line. The amount of work involved in fit testing all sizes is beyond the scope of this research but would form the basis of further investigation. In this research, the prototype garments were fit tested in size sixteen and size twelve and constructed in the fabrics to be used for the final garments i.e. the jacket in the Merino wool fabric and the shirt in the Coolmax™ fabric. The garment in the Merino wool fabric was not taken past the second prototype stage due to the fact the garments were to be wear tested in potentially hot weather but this garment could be picked up easily again for a winter range.

Stitch type and seam sampling were investigated to ensure the best possible method was used for the construction of each garment in the collection. ISO standards for stitch and seam types need to be recorded on the specification sheets for reference. This is imperative should the garments be made by an off shore contracted manufacturer. In this research, a variety of seams were tested on sample fabrics to find the most suitable type of seam, stitch length and needle for each of the fabrics and garments made.

- **Pattern grading, sizing and adjustments.**

Where a CAD system is not available to the designer, to save time, this aspect of the patternmaking could be outsourced through a bureau service. The Gerber system at Massey University was used to grade the patterns from size 10 - 22, make adjustments for the larger sizes and create and print lay plans in the required sizes for each of the final garments. Grading from one base size did not prove to be satisfactory especially when grading down to the smaller sizes. Two patterns one for the mature figure and one for a younger figure need to be developed, graded and recorded on a size chart ready for outsourcing. Again, further research could establish the optimum number of base sizes required for "ergonomic" fit.

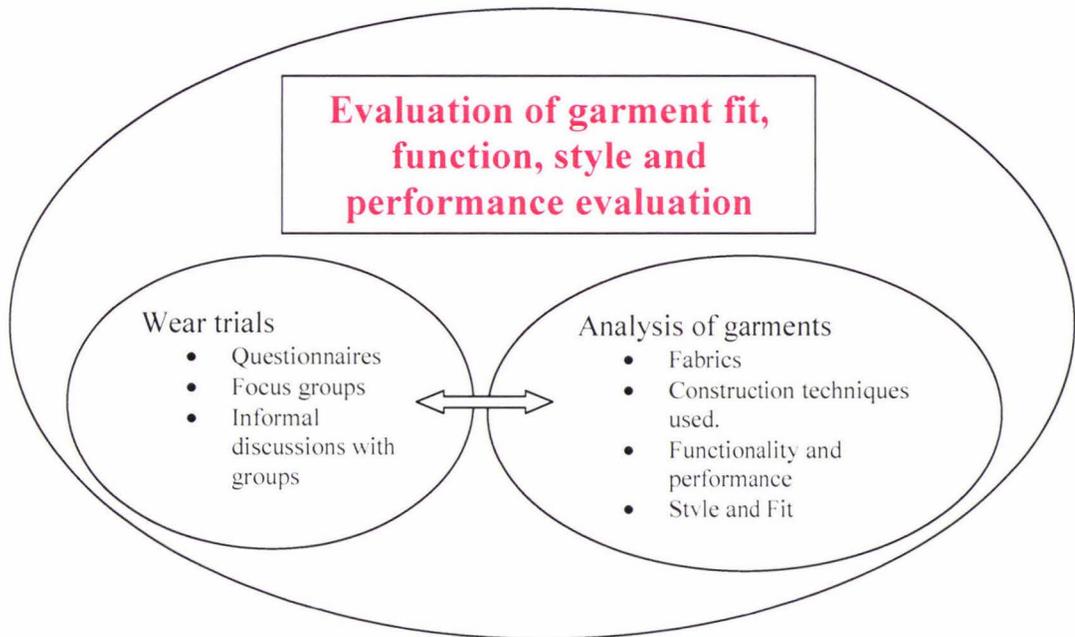
- **Specifications.**

All designs need to be accompanied by their specification sheets to ensure ongoing quality regardless whether the product is made in New Zealand or off shore. The specifications need to include a size specification that sets the criteria of tolerances and the size ratio intended, as a small business cannot make all sizes in all styles. A 'make' specification is also required, which stipulates the type of machinery to be used, size and tension of stitching and the type of thread to be used on the garment. The new model caters for changes to specification sheets including size charts and can be easily achieved because all of the aspects in this component could be dealt with 'in house'.

Because of the intellectual property involved in this work, the specification sheets for the garments produced for this thesis remain with the researcher.

## 5.5 Evaluation of fit and style

Any problems that appear as a result of these analyses need to be addressed and remedied before the garments go on to the production stage and market (Figure 5.5). This component of the design model is similar to the initial model (Figure 3.1) in that the wear trials play a major role in deciding the acceptability of each garment.



**Figure 5.5** Evaluation of garment fit, function, style and performance component of model.

- **Wear trials**

The prototype needs to be wear tested by women representing a range of sizes and figure types to ensure the garment will meet the needs of the target market when trialled under conditions of proposed use. Wear trials by a target consumer sample group have proved to be an excellent method of assessing the fit of the garment, the performance of the fabrics used in the garments and the overall suitability of the style for the intended purpose for this project. This research and the design model suggests that questionnaires, focus groups and informal discussions with participants in the wear trials are effective ways to gain information about the overall

performance and style of the garments. When the garments are wear trialled in the situation for which they are designed rather than under strict laboratory conditions a realistic evaluation can take place. In the case of this research, teams of women bowlers representing different age groups, years of experience and levels of play, were used to test the garments during two National tournaments. During the 3 – 4 days of each competition, the garments were assessed for comfort and functionality under the same conditions and a range of outdoor temperatures from early morning to late afternoon. However, in the case of this research one disadvantage was that the weather was too hot to fully test the jacket. The researcher could also gather informal information and opinions from onlookers regarding the colour, style and general appearance of the garments.

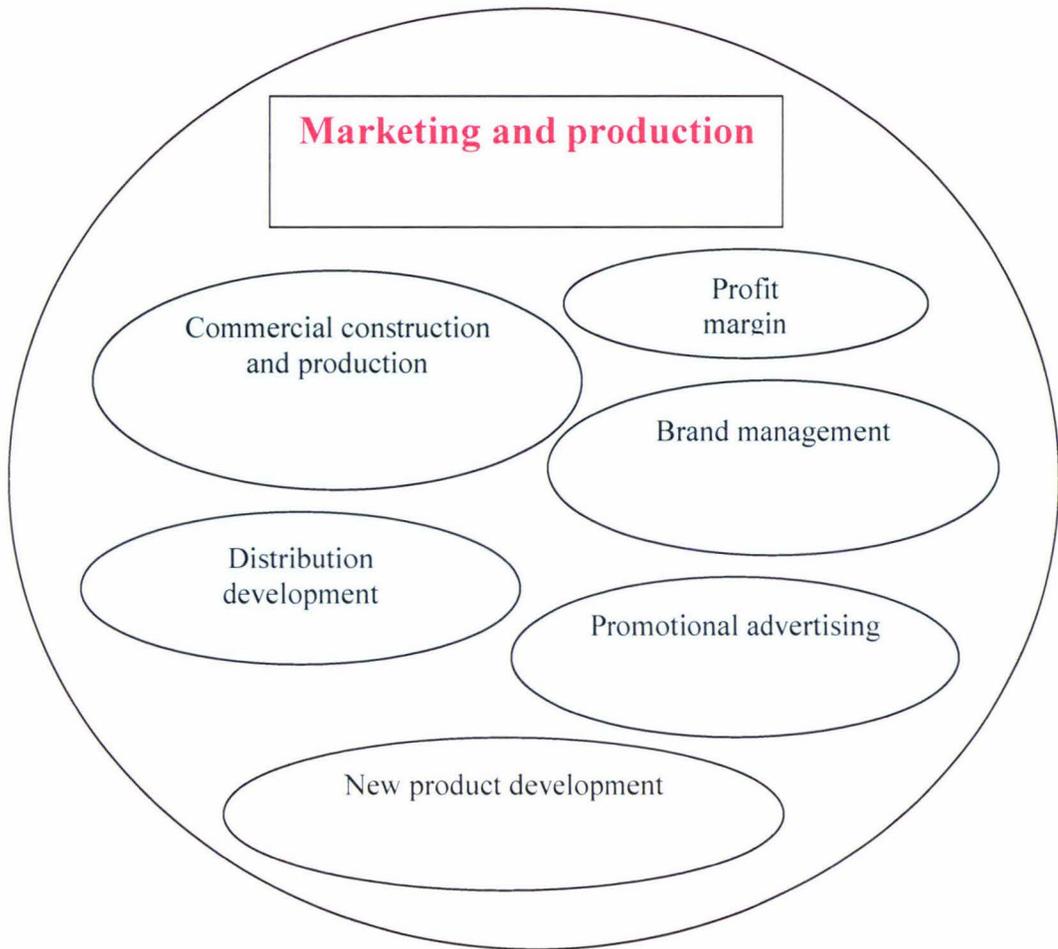
After the wear trials, if the garments did not perform to expectations then the problems can be referred to another component in the model and corrected. In the case of this project, the fabric chosen for the women's trousers would be changed and a more suitable weight and pattern used and components of design detailing and a closer fit developed for the jackets and shirts for the younger bowler. In this model the changes would be referred to the 'Design development and materials research' and 'Product development' components of the model (Figure 5.3 and 5.4) where new fabrics would be sourced and tested and new prototype garments constructed.

- **Analysis of garments.**

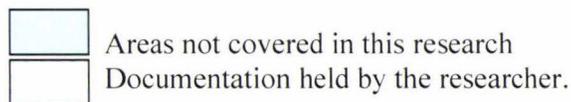
It is critical that the product is thoroughly tested by the target consumer so that potential problems with fabrics and fit can be remedied. Any problems identified by the group can be attended to at that point before being retested. In this research visual analysis as well as data from questionnaires, focus groups and informal discussions were used to evaluate the performance of the fabrics and construction techniques after the wear trials. The information from the focus groups proved to be most beneficial as the women volunteered information about aspects of the clothing that were not asked in the questionnaire for example one woman thought the MerinoMax™ jacket could be worn like a cardigan with jeans and other casual clothes.

## 5.6 Marketing and promotion

The preliminary model (Figure 3.1) does not address marketing and production at all. The design model promoted by Erhorn and Stark (1994) includes a marketing component, while Saren (1994) proposes a business plan that includes promotional advertising and distribution development. Marketing and production is not within the scope of this thesis and is therefore not discussed in detail here however the success of any item will in turn inspire a new line of apparel.



**Figure 5.6** Management of marketing and production component of model.



Some aspects or areas within this component (Figure 5.6) could be outsourced to save time and money, for example, a CMT factory has specialist equipment to construct and finish garments to a professional level. The manufacturer should investigate a variety of methods of manufacture to minimise costs, as any line of clothing must return a profit. The profit margin is an important aspect of any business and must be addressed to ensure the manufacture of the end product is viable for a small business. This component of the design model identifies areas where the ongoing costs of production need to be addressed.

### **5.7 Summary of ‘The Small Business Niche Market Model’**

The strengths of some models that allow for simultaneous activities and multi directional movements through the production process as in Saren’s (1994) model (Figure 2.4) (Model for the product development process), have supported the present ‘Small Business Niche Market Model’ (SBNMM). One of the departures in this research from previously researched models is that the target consumer is central to the whole process therefore design ideas and concepts can be recycled and improved upon after consultation with this group. This aspect differs from other models reviewed in the literature as the consumer is often only involved in the initial target market screening stage (Erhorn & Stark, 1994) or after the product is on the market where dissatisfaction with the product is reflected in sales returns and reports from customers. The advantage of this centrality of the target market is that in the initial stages the design, style and fabric choice is driven primarily by the consumer and the final prototype is assessed by the consumer before any production run takes place.

Some of the drawbacks as a sole researcher with a very small niche market encountered in this thesis were that compromise of sampling rigour was sometimes unavoidable because of the small pool of available people. For example, consistency in participants and focus group sizes was difficult to achieve. This is probably in part

a consequence of working with small groups and having limited availability in person. Because fabrics for the end product were not always available, different groups can then differ in their options of styles and fabric choice for example, there were some discrepancies in sizes and style preferences of the younger group.

Unless market research is current, ongoing and thoroughly investigated, a true interpretation of contemporary market trends and needs of the consumer market cannot be understood. The evidence gathered from this research impacts on the concept designs, fabrics to be used in the designs and the projected cost of each of the apparel items (Figure 5.3). To minimise time taken in the design concept stage, the graphics and design team or those responsible for this area, however small it may be, must have an understanding of the requirements of the target consumer. This information is gained from the market research phase (Figure 5.2). Consultation with the target consumer will confirm if the design concepts meet their aesthetic and expressive needs. The design development stages (Figure 5.3. and Figure 5.4) can be recycled as needed so that the best possible outcome can be achieved before moving on to the wear trials. Once the product prototype has reached the evaluation stage (Figure 5.5), changes can occur but the ideal is to have as little change as possible. By consulting at each phase of the process, the final product or garment in this case is most likely to meet the functional, aesthetic and expressive needs of this group.

## CHAPTER 6

### CONCLUSIONS

#### 6.1 The design model

The primary objective of this research was to create a design model for a small business catering to a niche market i.e. the ongoing production of women's bowling apparel. The main advantages of this model (Figure 5.1) of the development process for a small niche market business are:

- The consumer or target market is central to the whole process and consulted at each phase or component of the development. The process allows for cyclic movement in and out of each component in any order based on the consumer feedback and gives flexibility to attend to specific requests of the niche market;
- Because the business is small, it can work closely with the consumer and although the smallness of the target market may compromise consistency of methodology, the advantages of personal contact outweigh this;
- Good communication ensures all the people involved in the business are aware of the development happening at each phase of the model and can make sure that all phases of the process are adequately researched and developed to their potential to ensure a successful end product;
- One of the disadvantages of a small business of two or three people is the possible limitations brought about by insufficient in-depth knowledge of each phase of the clothing manufacturing business. This model (Figure 5.1) seeks to identify critical points to assist the ongoing development of a line of clothing to meet the functional and aesthetic needs of women lawn bowlers and indicates areas within the different components where critical points could be outsourced;
- The research indicated that the younger players required different designs and degrees of closeness of fit and length in the garments from those required by the more mature players. This posed a problem as tournament play requires a

team, which could consist of younger and more mature players, to wear the same uniform, therefore garments need to look the same in colour and general style and also meet the requirements of Bowls New Zealand. My solution to this problem was to use only combinations of black and white fabrics as these are universally recognised as New Zealand representative colours for this sport;

- Because the process is cyclic as well as multidirectional, ongoing production is possible as new ideas instigated by the consumer group are fed back to the consumer group as new lines for consideration and refinement. Once size charts are established, production specialists contracted and specifications for new lines produced, ongoing production and development is possible.

## **6.2 Research through practise**

By researching through practise, the second objective was to design, make, wear trial and evaluate a range of clothing to meet the functional, expressive and aesthetic needs of women bowlers.

### **Fashion influences**

The initial research incorporated an historical overview of dress worn for bowls in New Zealand from 1940 to 2006. It was found that until recently, fashion for women's bowls had changed little and although some changes have emerged particularly over recent years, the uniform does not follow high on the heels of fashion. Social mores and etiquette of dress played an important role in women's wear for this sport - lawn bowls. The institutionalised nature of the sport dictated many regulations of dress, however in recent years, there is evidence of a willingness to change to accommodate the younger players and functionality has become increasingly important for the players as well as expressive and aesthetic needs. The research into the target market identified two diverse groups. The first consisting of young women aged between 16 and 30 years of age, the second group consisting of more mature women over 45 years of age.

### **Functional needs**

Functional needs were considered of prime importance. Apart from the obvious demands of ease of movement required for this specified sport which were highlighted by the study, the needs of the target market also required garments constructed in fabrics which accommodated changing temperatures and were easy care.

The functional needs in the product development were met by:

- Using knitted fabrics with a moderate amount of stretch for all garments. The stretch inherent in knitted fabric allowed the garments to extend with the wearer's movements but return to the original shape thus maintaining a smooth and unpuckered appearance;
- Incorporating extra ease around the shoulder and upper arm area in the pattern making and including a strip gusset which allowed the sleeve/arm to be raised without distortion to the body of the garment;
- The inclusion of panels in the front of the upper garments provided an area where shaping could easily be adjusted depending on the size of the garment. Generally the larger sizes required extra width in shaping over the bust area;
- The inclusion of a basque on the front of the trousers and shorts kept bulk over the stomach area to a minimum thus creating a slimmer silhouette. An elasticised back in the trousers and shorts allowed for unrestricted expansion at the waist areas when bending over and also made for ease in donning and doffing;
- Pockets were included in all garments so that the bowler could carry necessary bowling equipment and personal items;

- The fabrics used in the garments involved in the wear trials performed well in all fabric tests.

### **Expressive and Aesthetic needs**

Expressive and aesthetic needs are equally important due to the need for sports people to feel comfortable with their appearance as well as the security of belonging to a team or specific group. Athletes who are comfortable with their overall appearance have a psychological edge over their competitors (Casselman-Dickson & Damhorst, 1993).

Expressive and aesthetic needs are met in the product development stage by:

- The garments made for the wear trials are conservative in colour because of the need to meet the requirements of Bowls Wellington and the secondary school team which competed in the National Secondary Schools competition in Auckland. The women involved in the second wear trial were very happy with the black and white colour combination because they could see the potential for use with a range of other coloured clothing off the bowling green. In the case of this research it was not possible to create a range of different coloured garments because of the cost;
- Club or region identification logos or surface decoration was not part of this brief therefore they do not feature on any garment. It was anticipated that a logo could be placed on the pocket of the top and the back and front left hand front of the jacket (Figure 4.19). The front panels of the shirt could also be used for promotional advertising if needed.

## 6.2 Suggestions for further research

During this investigation it became evident there were a number of areas or key points where this research could be furthered to enable a small business to produce a range of garments that would meet the demands of the diverse target market of women bowlers:

- The design model developed in this project could be utilised for analysis of other sporting codes like croquet, golf and tennis;
- The introduction of contemporary designs targeted at younger bowlers may help to sway the present conservative image of women's bowling dress thus making the game more appealing to a younger generation of players and media coverage. There is a need to challenge past and present perceptions of the conservative nature of the sport by introducing contemporary fashion trends and colour into the garments worn for lawn bowls (Bannerman, 2005; Oldfield, 2001). Because the target market is consulted at each point in the process, the ongoing development of new and contemporary lines could be assessed, accepted and challenges made to the present dress code for women bowlers;
- Marketing of the new product is an area not covered by this research but indications from other successful businesses show that a 'story' and some prior marketing is needed to promote a new product and persuade the bowling fraternity to make changes to their image. This may require the skills and expertise of an independent brand strategist.
- Pattern making issues.  
Many interesting issues have arisen from the pattern making aspect of this research. In order to better analyse the fit, performance and stress for specific areas of each garment, more time spent watching and videoing the prototype garments in action during the wear trials could influence further

pattern development resulting in the best fit and ergonomics of each garment. Further testing of the stretch capabilities of all of the fabrics would allow the patternmaker to factor the fabric capabilities into the actual patterns. A scientifically derived set of measurements of New Zealand women of various age brackets would be beneficial to patternmakers and although many companies have their own process for grading and manipulating patterns, base sizes can vary between companies.

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## **APPENDIX 1**

### **ETHICS INFORMATION AND CONSENT FORMS**

**A.1.1 Application for low risk research/evaluation involving human participants.**



Te Kunenga ki Pūrehuroa

**NOTIFICATION OF LOW RISK RESEARCH/EVALUATION INVOLVING HUMAN PARTICIPANTS**

*(All notifications are to be typed)*

**SECTION A**

1. Project Title "Bowling Along"  
Projected start date 31 / 03 / 2005 Projected end date 31 / 03 / 2006
2. Applicant Details *(Select the appropriate box and complete details)*

**ACADEMIC STAFF NOTIFICATION**

Full Name of Staff Applicant/s .....  
School/Department/Institute .....  
Region *(mark one only)* Albany  Palmerston North  Wellington   
Telephone ..... Email Address .....

**STUDENT NOTIFICATION**

Full Name of Student Applicant Gretchen Ivess  
Employer (if applicable) .....  
Telephone 04 4783263 Email Address g.ivess@xtra.co.nz  
Postal Address 21 Macaulay Street, Johnsonville, Wellington  
Full Name of Supervisor(s) Dr Janet Webster  
School/Department/Institute Fashion, Design and Textiles  
Region *(mark one only)* Albany  Palmerston North  Wellington   
Telephone ..... Email Address .....

**GENERAL STAFF NOTIFICATION**

Full Name of Applicant .....  
Section .....  
Region *(mark one only)* Albany  Palmerston North  Wellington   
Telephone ..... Email Address .....

Full Name of Line Manager .....  
Section .....  
Telephone ..... Email Address .....

3. Type of Project (mark one only)

Staff Research

Student Research:

PhD Research

Master's Research

Honours Research

Undergraduate Research

(individual project)

Evaluation Programme

Undergraduate Teaching Programme

Other

If Other, specify:

4. Summary of Project

Please outline in no more than 200 words in lay language why you have chosen this project, what you intend to do and the methods you will use.

(Note: all the information provided in the notification is potentially available if a request is made under the Official Information Act. In the event that a request is made, the University, in the first instance, would endeavour to satisfy that request by providing this summary. Please ensure that the language used is comprehensible to all)

Why I have chosen this project

Health professionals promote regular exercise and sensible eating as a means to a healthier lifestyle and longer life. Lawn bowls is an outdoor sport which can be played all year round on a rink of either grass or astro-turf and traditionally the game has attracted older or more mature players as it is a non contact, low impact and social sport. If lawn bowls is to attract more women and especially young women to clubs around New Zealand, then the image of the game needs to be perceived as a trendy, fun and a worthwhile sport and not a sport only for older people. The aesthetics of the sport's clothing and equipment is especially relevant to the young where personal image is very important. To help promote this trendy image, the prescribed uniform must keep up to date with current fashion trends. The more mature women bowlers also like to look smart on the green, but often have difficulty finding appropriate clothing which not only fit and flatter their figures but also afford the required amount of unrestricted movement. New stretch and knit fabrics could be employed to give a more streamlined look to the bowling image rather than the bulky and often cumbersome gear available at the present time. Modern fabrics can also give enhanced functional performance like moisture control, comfort, thermal properties and UV protection.

### What I plan to do

To design and make a range of sports garments to meet the physical and aesthetic needs of women bowlers in New Zealand.

Fashion and sports magazines, books, television programmes, films, and newspaper articles will be used to help forecast sports fashion trends. A range of ideas, styles and fashion sketches will be critiqued by a representative group of women bowlers. Fashion sketches demonstrating trends will be executed and a range of women's bowling clothes developed. Two complete outfits will be designed in accordance with the needs of women bowlers and will display cognisance of the research into appropriate styling for ease of movement and up to date styling.

The range of garments will include a jacket/windbreaker, trousers, shorts and a T shirt.

During the research process a basic pattern or block will be made and toiles from those pattern blocks will be fitted to a size 14 mature figure type.

A diary of work in process and a time line will be kept by the researcher so that deadlines will be met.

All quantitative data and information will be confidential and the names of participants will not be used.

### Methods to be used

Quantitative data gathering

Qualitative data gathering

Historical research

Semiotics

**Please submit this Low Risk Notification (with the completed Screening Questionnaire) to:  
The Ethics Administrator  
Equity & Ethics, Old Main Building  
Turitea, Palmerston North**

## A.1.2 Low risk notification acceptance



# Massey University

17 June 2005

Gretchen Ivess  
21 Macaulay Street  
Johnsonville  
WELLINGTON

OFFICE OF THE ASSISTANT  
TO THE VICE-CHANCELLOR  
(ETHICS & EQUITY)  
Private Bag 11 222  
Palmerston North  
New Zealand  
T 64 6 350 5573  
F 64 6 350 5622  
humanethics@massey.ac.nz  
www.massey.ac.nz

Dear Gretchen

**Re: Bowling Along**

Thank you for the Low Risk Notification that was received on 7 June 2005.

Your project has been recorded on the Low Risk Database which is reported in the Massey University Human Ethics Committee Annual Report.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by a campus human ethics committee.

**Please ensure that the following statement is used on Information Sheets:**

*"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.*

*If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Ethics & Equity), telephone 06 350 5249, email humanethicspn@massey.ac.nz".*

Please note that if a sponsoring organisation, funding authority, or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to a Campus Human Ethics committee. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Professor Sylvia V Rumball, Chair  
Assistant to the Vice-Chancellor (Ethics & Equity)

cc Dr Janet Webster  
Dept of Fashion & Textile Design  
WELLINGTON

Prof Sally Morgan, PVC  
Dept of Fashion & Textile Design  
WELLINGTON

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Massey University Human Ethics Committee  
Accredited by the Health Research Council



### A.1.3 Consent form for initial questionnaire

## Bowling Along

### PARTICIPANT CONSENT FORM

This consent form will be held for a period of five (5) years

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I wish/do not wish to have data placed in an official archive.

I agree to participate in this study under the conditions set out in the Information Sheet.

**Signature:** .....

**Date:** .....

**Full Name - printed** .....

If you have any further questions regarding the project 'Bowling Along', please contact

#### **Researcher**

Gretchen Ivess  
21 Macaulay Street  
Johnsonville  
Wellington

Phone (04) 4783263  
Fax (04) 4783243  
Email g.ivess@xtra.co.nz

#### **Supervisor**

Dr Janet Webster  
Massey University

Phone (04) 801 5799 ext 6540  
Email J.Webster@massey.ac.nz

#### A.1.4 Participant consent form for wear trials

## Bowling Along

### PARTICIPANT CONSENT FORM

**This consent form will be held for a period of five (5) years**

The details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I wish/do not wish to have data placed in an official archive. Your name will not be archived.

I agree to participate in this study under the conditions set out in the Information Sheet.

**Signature:** .....

**Date:** .....

**Full Name - printed** .....

If you have any further questions regarding the project 'Bowling Along', please contact

#### **Researcher**

Gretchen Ivess  
21 Macaulay Street  
Johnsonville  
Wellington

Phone (04) 4783263  
Fax (04) 4783243  
Email g.ivess@xtra.co.nz

#### **Supervisor**

Dr Janet Webster  
Massey University

Phone (04) 801 5799 ext 6540  
Email J.Webster@massey.ac.nz

General information regarding the following questionnaire.

You have the right:

- To decline to participate or refuse to answer any particular questions
- To provide information on the understanding that your name will not be used unless you give permission to the researcher
- To be given access to a summary of the findings of the study when it is concluded
- To anonymity and confidentiality

**Please take care of the clothing used in the wear trial and return to Gretchen Ivess when the trial is finished.**

**APPENDIX 2**

**INTERVIEWS**

### **A.2.1 Interview with Owner/Manager Academy Apparel Ltd.**

703 Main Street,  
Palmerston North  
12<sup>th</sup> April 2005

#### **Can you tell me about the demographics of your business i.e. the size and your target market?**

Academy Apparel employs 25 people in total, 18 of whom are machinists, 3-4 are outworkers plus cutters packers. The manager prefers workers to work on site because of the need for close supervision. The company make Polo shirts and customise them for clubs with names, stripes, armbands etc. We also have a contract with the New Zealand Army to make outdoor gear. This company make for Norsewear when they are overwhelmed with contract work.

*“Small companies like ours are a dying breed. Work force is aging as no one is training machinists. We are working with trade and industry to promote machinist training.*

*Once the free trade happens not sure what will happen but at the moment we have difficulty keeping up with our business. There has been a turn around recently back to New Zealand manufacturers because the Chinese are not interested in small runs of garment styles even though manufacturing in NZ costs 10 times more than manufacturing products overseas” (Pool, 2005).*

#### **What would you say was your point of difference?**

The points of difference for this company are the small runs for sports teams like inline hockey, cricket, rugby and being able to customise designs on uniforms for clubs, but we are learning as we go. The minimum order is 20 tops or 20 bottoms in multi sizes. When the company is approached by a team, the company investigates what the team wants and their budget. Before placing an order, clubs are given samples of the sizes so members can try on to get accurate fit.

The recent price quoted for a hockey team was \$19 + GST for shorts and tops \$60 + GST. There was no added cost for embroidery as the shorts were in a plain fabric and top sublimated. Lots of panels and piping would have increased the cost.

The design on the shirt and the actual patterns are designed on site and panels and pieces sent off to be sublimated. Sublimation is more expensive than screen printing but the process allows for sharp lines in the design and vivid and contrasting colours which are permanent. Screen printing tends to wash out and crack over time.

Minor problems with shrinkage can occur during the sublimation process as the fabric has to undergo extreme temperatures. The fabric used by this company has been re-treated which has eliminated the problem.

### **Do you make bowling clothing?**

We have had a lot of requests for clothing for bowls. Many people have come to the door wanting trousers, shorts and jackets. It is not economic to make the plain white pieces so most of this clothing is imported for about 1/3 the cost of making here. It can be ordered from overseas and arrives virtually overnight.

### **When developing your patterns do you cater for different figure types or do you make unisex garments?**

Separate sizing and shaping was used for men and women for a hockey team. We can make in a range from 8 – 20 or what ever is required. No account is taken of the different fit for older or more mature figures. Our patterns have evolved over time.

### **What fabrics do you tend to use and where do you source your fabrics**

Cotton or cotton/polyester to polyester is a new change as the new polyester is wickable, breathable and UV rated. It is only a matter of time before the Chinese bring in clothing items in these fabrics but they are not interested in small runs.

The latest fabrics have a cotton backing and synthetic top and although they feel synthetic, they don't perspire and don't give that clammy feeling.

'Hi-Cool™' fabrics are breathable and wickable – 'Beckem', 'Pele' are the fabric names. 'Hydro Tex Chopper™' 84% Poly, 16% Pu (waterproofing) imported by Charles Parson is shower proof, breathable windproof with quite a bit of stretch. It is

good for wearing under ski jacket and can be purchased for \$20 per meter. A lighter weight one is available. This fabric is excellent for jackets as it is light weight and there is no waste and no need for linings. Ordinary seaming and stitching could be used in the construction process. A seam sealer is not necessary on this fabric. This technique is used only for waterproofing the garments for the army or garments for water sports.

Most of the fabrics are imported but some companies like Levana textiles. Manakau knitting mills are playing with new fabrics to emulate these fabrics but the cost and NZ dollar is working against this. Swazi in Levin, import the Gortex fabrics, and are in competition with Norsewear.

**Do you carry out any testing on the fabrics you use in your garments?**

Fabric is sent to a commercial industrial washer/drycleaner and put through 50 washes. We rely on the textile suppliers to give us the laboratory analysis figures and information on shrinkage as they have all the figures about breathability etc. and whether it is chemically applied or in the fabric. We have to believe them. They supply swing tickets to go on the finished garments.

## **A.2.2 Interview with CEO Norsetec Ltd.**

Norsetec

34 Waione Street

20<sup>th</sup> April 9am – 10.30am

Informal discussion took place in the showroom regarding the garments on display. Norsewear the parent company traditionally made hardwearing garments suitable for farmers and the outdoors. Socks were one of their mainstays as well as heavy duty bush shirts, Swandries and shearers singlets.

Norsetec a new branding is hoping to break into the street wear market by producing contemporary clothing styles for men and women from a variety of merino wool fabrics. The designs for the clothing are generally adaptations of garments seen overseas and of competitors on the New Zealand market. At the present time the company does not have a trained fashion designer, Paul and his wife decide on the designs for the season based on his intuition of the market and personal choice. From time to time the company has used the expertise of students from various design schools to assist in the designs but the company does see the need for a fashion designer if they are to compete with other outdoor sports wear manufacturers.

The Norsetec range claims to have natural thermability. Technical yarns have been developed to improve moisture control and heat loss as well as trapping the air between the garment and the body forming a natural insulation.

A range of sample fabrics was supplied to the researcher for testing and making prototype garments.

Norsetec was happy to supply some fabrics for this research project and wished to be kept informed of design developments.

### **A.2.3 Interview with five teenage, 1<sup>st</sup> time bowlers**

Thursday 13<sup>th</sup> October 5pm. – 5.30pm

Pictures of school teams were shown as well as the historical photos.

Sketches of possible ideas for a junior bowls team uniform were analysed and preferences verbalised.

#### **Why did you choose bowls as your sport?**

Because it is a non-contact sport and not too physical.

We don't like some of the teachers who take the other sports; they put us off so we thought we would give this a go. We are all friends and know each other quite well.

#### **What do you think would be a suitable uniform for a school team other than your PE gear?**

Not baggy shorts like we have to wear. (Pulled shorts out of bag to show).

Short shorts are not good because fat thighs and cellulite might be seen.

Shorts above the knee are OK.

#### **What about tops?**

Not too baggy but not tight fitting either.

If it is too tight, then you see the sweat marks under the arms like Mr ?

#### **What about some of these ideas? (Showed sketches)**

Love the skirt especially with the pleats. If the band was a bit stretchy it would be good and it would fit several sizes. Length preferred was mid thigh.

Skirt needs to sit about 10cm from the waist

The longer shorts look good too.

I like trousers that come down to the bottom of the shoe. The  $\frac{3}{4}$  length are not very flattering.

Like the zipper in the front which goes right up to the top of the collar. You can then do it right up or leave it undone to get more air in.

Short sleeves that are cut high look good.

I like the panels in the front. They make you look slimmer.

Length should finish just at the top of the skirt. You shouldn't be able to see any stomach showing though – not a good look.

**Is there anything else you would like to see in this uniform?**

Perhaps a wrist band

Caps or visors rather than hats.

#### **A.2.4 Meeting with Bowls Wellington**

Petone, Wellington

15<sup>th</sup> November 2005

An invitation was extended to meet with the Executive Committee of Bowls Wellington to discuss the possibility of providing a uniform for 6 female students who will represent the Wellington region at the Secondary Schools Bowls competition in Auckland mid December 2005. A written explanation of the designs and fabrics used in the designs (Table A.2.1) was handed out to members of the committee and finished toiles of the jacket, T-shirt and skort were modelled by one of the young women who will be part of the team.

During the presentation the special characteristics of the high performance fabrics used in the garments was discussed and special design features to give extra ease of movement and styling were pointed out. These garments are designed to be high performance sports clothing akin to recent developments in other sporting codes like tennis, golf, cycling and cricket.

Bowls Wellington showed the T-shirt they have had especially printed for the students to wear during this competition. This T-shirt could be worn with the jacket and the skort as an alternative to the designer T-shirt although it would not give such a coordinated effect.

The committee were impressed with the total outfit and gave their approval for a modified version to be worn during the competition (for at least one day) with the following provisos:

**The jacket is to black with striped trim**

**Skort to be black**

**T-shirt to remain white with striped trim**

The 6 outfits are to be ready by 10<sup>th</sup> December 2005.

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## **Information about the bowling outfits.**

---

<b>Designs and Fabrics</b>	<p>These garments have been ergonomically designed to meet the stretch, arm lift and exaggerated movement required whilst engaged in bowling. They are made from some of the latest high tech sports fabrics which have the benefits of being breathable and wickable i.e. they keep the body cool and dry by allowing the moisture from the body to transfer quickly to the outside of the garment where it evaporates. They should thus provide enhanced comfort and functionality.</p>
<b>The T- shirt</b>	<p>The knit fabric of the shirt incorporates two types of textured polyester yarn which as well as affording an element of stretch makes the garment easy care when laundering.</p> <p>The shaping contours the body and garment in line with current styling in high performance active sports wear.</p> <p>The collar gives protection from sun on the back of the neck and can be worn zipped up and rolled over as a polo style when windy and cold.</p>
<b>The jacket</b>	<p>The two layered knitted fabric in this garment is a combination of fine Merino wool on the outside and Coolmax™ (a wickable polyester) on the inside. It is one of the top of the range sports fabrics manufactured by Norsewear New Zealand.</p> <p>Styling is similar to the shirt i.e. contoured panels.</p> <p>The continuous strip gusset down the side of the body and under the arm, allows for unimpeded extended movement of the arm without distortion to the side of the garment. Additional back length is incorporated to accommodate bending movements by the players and also afford s some warmth over the hip and lower back. Pockets and placement of pockets address requirements identified in survey.</p>
<b>What I require from the wear trials</b>	<p>The garments need to be worn during a game of bowls on at least two different occasions by the same person.</p> <p>The person will be required to fill out a questionnaire regarding the comfort of the fabric, the fit of the garments and be prepared to give verbal feedback to the researcher.</p> <p>The garments and designs will remain the property of the researcher.</p>
<b>What will Bowls Wellington gain from the wear trials?</b>	<p>A team which looks smartly dressed in coordinated outfits.</p> <p>The opportunity for young bowlers to experience the feel and comfort of high performance sports wear.</p> <p>More young people being attracted to the game because of the trendy versatile gear.</p> <p>Possible media attention during the tournament.</p>

---

**Table A.2.1 Information for the Committee Bowls Wellington**

**APPENDIX 3**  
**QUESTIONNAIRES AND RESPONSES**

A.3.1 Preliminary questionnaire



Te Kunenga ki Pūrehuroa

**‘Bowling Along’ Questionnaire**

1. Circle the numbers which best describe your
  - a) Age group    16-25,    26-35,    36-45,    46-55,    56-65,    65+
  - b) Income (optional)  
 Less than \$20 000 - \$20 000 - \$38 000,    \$38 001 – \$60 000,    \$60 000+
2. For competition play are you graded  
 Skip            Three            Two            Lead
3. Are you a                            Coach            Yes/ No  
 Umpire                                Yes/ No
4. How often do you play bowls at the following levels? Tick the appropriate box.

Level of play	Rarely	Some-times	Mostly	Only at this level	Other (specify)
Social					
Club level and own club competition					
Interclub competitions					
National level					
International level					

Using this chart as a base answer the following questions  
 Example range of shops in Wellington

Budget outlets	Clothing Chains	Individual retailers
Opportunity Shops	Jacqui E	Ken Brown (bowls specialist store)
Salvation Army	Rebel Sports	Specialist sports stores
Dress Mart	Berringers	Kirkcaldie & Stains
Warehouse	Farmers	Hamilton & Murray
Factory Outlets	Glassons	Zebranos
Ezibuy	Jean Jones	Your bowling club
K Mart	Ballentynes	Rebel Sports
	Postie Plus	Cerise

5. When shopping for clothing you would wear for bowls, which group of shops would you go to first?

- Budget outlets
- Clothing chains
- Individual retailers
- Other (specify) \_\_\_\_\_

6. Which shops would you generally go to when shopping for bowling clothes?

- |                   |                          |             |                          |                       |                          |
|-------------------|--------------------------|-------------|--------------------------|-----------------------|--------------------------|
| Opportunity Shops | <input type="checkbox"/> | Jacqui E    | <input type="checkbox"/> | Kirkealdie & Stains   | <input type="checkbox"/> |
| Salvation Army    | <input type="checkbox"/> | Kimberlies  | <input type="checkbox"/> | Your bowling club     | <input type="checkbox"/> |
| Dress Mart        | <input type="checkbox"/> | Berringers  | <input type="checkbox"/> | Ken Brown             | <input type="checkbox"/> |
| Warehouse         | <input type="checkbox"/> | Farmers     | <input type="checkbox"/> | Hamilton & Murray     | <input type="checkbox"/> |
| Factory Outlets   | <input type="checkbox"/> | Glassons    | <input type="checkbox"/> | Zebranos              | <input type="checkbox"/> |
| Ezibuy            | <input type="checkbox"/> | Jean Jones  | <input type="checkbox"/> | Cerise                | <input type="checkbox"/> |
| Postie Plus       | <input type="checkbox"/> | Max         | <input type="checkbox"/> | Rebel Sports          | <input type="checkbox"/> |
|                   |                          | Ballentynes | <input type="checkbox"/> | A private dress maker | <input type="checkbox"/> |

other (specify) \_\_\_\_\_

7. In which shop from your chosen grouping, would you be most likely to find your preferred style of bowling clothing?

.....

.....

8. What is it about the clothes in this store that you like?

.....

.....

9. If you had unlimited money to spend on your bowling wardrobe, which store would you shop at and why?

.....

.....

10. On a scale of 1 – 5 (1 being low, 5 being high), how would you rank the following in terms of importance when shopping for bowling clothes? (tick the box)

	(very unimportant) 1	2	3	4	5 (very important)
price	<input type="checkbox"/>				
range of clothing available in one store	<input type="checkbox"/>				
quality of manufacture	<input type="checkbox"/>				
quality of fabric used	<input type="checkbox"/>				
size range available	<input type="checkbox"/>				
colour range available	<input type="checkbox"/>				
Other (specify) _____					

11. How would you describe your style of dress on the following scale? (tick the box)

--------------------

Conservative Cutting edge

12. What or who influences your choice of clothing? Rank any of the following

	(very unimportant) 1	2	3	4	5 (very important)
Promotions by retailers	<input type="checkbox"/>				
Junk mail advertising	<input type="checkbox"/>				
TV programme	<input type="checkbox"/>				
Friends	<input type="checkbox"/>				
Shop assistants	<input type="checkbox"/>				
Magazines – which one(s)	<input type="checkbox"/>				

Other influences (specify) \_\_\_\_\_

13. Do you think coloured clothing should be introduced into bowling uniforms? Yes / No  
Give your reasons \_\_\_\_\_

14. If you had a choice what would be your preferred colours for bowling clothes. \_\_\_\_\_

15. Consider the following pieces of clothing and indicate which you would be most likely to wear in each of the following situations.

	Jackets	Sleeveless vests	T shirt polo shirts	Blouse	Trousers shorts	Skirt	Wet weather gear	Hats/caps
Casual play								
Club Days								
Tournaments								

16. Circle your preferences regarding types of fabrics for bowling clothing

- a) patterned fabrics or striped fabrics or plain fabrics
- b) stretch fabrics (knits) or woven fabrics (with some stretch) or plain woven.

17. Which garments do you prefer in a **patterned** fabric? \_\_\_\_\_

18. Which garments do you prefer in a **plain** fabric? \_\_\_\_\_

19. Which garments do you prefer in a **stretch knit** fabric? \_\_\_\_\_

20. Which garments do you prefer in a **woven (with some stretch)** fabric? \_\_\_\_\_

21. Which garments do you prefer in a **woven** fabric? \_\_\_\_\_

22. Is there an expected standard of dress expected in your club during competition play and/or social play? **Yes / No**  
If so how would you describe this?

\_\_\_\_\_

\_\_\_\_\_

23. What items of clothing do you consider essential to have in your wardrobe to enable you to enjoy the game of bowls?  
Consider competition and casual play.

\_\_\_\_\_

\_\_\_\_\_

24. Do you have a problem with the fit of some bowling clothing? **Yes/ No**

25. If you do have a problem, what do you find is the most common fault in terms of fit for each of the following:-

1. Jackets and sleeveless jackets \_\_\_\_\_  
\_\_\_\_\_

2. Skirts \_\_\_\_\_  
\_\_\_\_\_

3. Trousers including shorts \_\_\_\_\_  
\_\_\_\_\_

4. T Shirts, Polo shirts, blouses \_\_\_\_\_  
\_\_\_\_\_

5. Wet weather gear \_\_\_\_\_  
\_\_\_\_\_

6. Hats and caps \_\_\_\_\_  
\_\_\_\_\_

26. What size do you normally buy for

- Tops \_\_\_\_\_
- Jackets \_\_\_\_\_
- Skirts \_\_\_\_\_
- Trousers \_\_\_\_\_

Any other comments you would like to make.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Information in this questionnaire will be used only for this research project and will remain confidential.

Thank you for participating in this survey.

Gretchen Ivess

### A.3.2 Results of preliminary questionnaire

Age group	16 - 25	26 – 45	46 – 55	56 – 65	65+
Number in group	7	6	5	4	10
Income					
Grade	2 skips, 1 two, 4 leads	3 leads identified	1 three, 3 two, 1 lead	2 skips, 1 two, 1 lead	4 skips, 2 three, 1 two
Coach /umpire	none	none	none	none	1 coach , 2 umpires
Level of play	One only plays college bowls. Others mostly play at a social and club level. Two have played interclub and all have represented their school at national level.	The majority play mostly in their own club competitions and interclub competitions. Two have played at national. One plays mostly at a national level. Three sometimes play socially.	The majority of women play mostly in their own club competitions and interclub competitions. Three have played at national and one at international level. Three sometimes play socially.	All play in their own club competitions and interclub competitions. One plays mostly at national and another plays sometimes at international level. Two sometimes play socially.	The majority play mostly in their own club competitions and interclub competitions. Six played at a national level and two have played at international level.
First stop for buying bowling clothes	Clothing chains 4 Individual retailers 1	Clothing chains 3 Individual retailers 2 Budget 1	Clothing chains 5 Individual retailers 1	Budget 1 Clothing chains 2 Individual retailers 2	Clothing chains 9 Other 1
Generally shop at for bowling Clothes	n/a	Farmers and Ken Brown were the most popular stores followed by own club sales, Rebel sport and The Warehouse.	Ballentynes and Millers were the most popular stores, followed by Ken Brown. Some bought bowling clothing from The Warehouse.	Ballentynes was the most popular choice of shops followed by Ken Brown and Farmers. One person makes her own clothing.	Ballentynes is the most favoured shop followed by Farmers and Ken Brown

Where you usually buy and why	Most chose Rebel sports because the clothes are smart and trendy. there is a good selection. clothes are well made and comfortable to wear. 2 chose Ken Brown because the clothing is specialist bowling apparel.	Preference for good fit, plus the availability of a wide range of sizes and styles to choose from. Styles are more akin to streetwear.	The bowling club supplies club shirts. Other places like Farmers, Ballentynes and Millers were popular choices for the purchase of bowling clothes.	Ballentynes and Farmers were chosen because they both provide choice and a suitable fit can usually be found. Ken Brown specialises in bowling clothing, it is quality and club discount is available.	Ballentynes and Farmers have reasonably priced clothing and a good selection A1 make shirts and jackets featuring the club logo specially for the Victoria Bowling Club.
Unlimited money choice of shops	Rebel Sport specialises in sports clothing. It is functional and most of all it looks good.	Preference for Ken Brown because clothing is purpose made for bowls.	Some would stick to the same outlets while others would have clothes made by a dressmaker for a perfect fit.	Private dress maker to get a perfect fit. Kirkcaldies or a bowls specialist.	Still prefer chain stores because of the amount of choice of styles and sizes.
Important aspects of bowling clothes	Quality of manufacture was considered the most important followed by quality of fabric, range of sizes and then range available in one store.	Price and colour range considered important along with the range of sizes available. Quality of manufacture scored equally with quality of fabric used. Range in one store was moderately important. One person added style as important.	Quality of manufacture, fabric and availability of a range of sizes all scored as very important. Price and colours were the next highest scores	The range of styles available in one store, the range of sizes, quality of fabrics and colour all rated as equally important followed by quality of manufacture.	The size range was considered most important by most people followed by the quality of manufacture and quality of fabrics. The colour range available was considered quite important. Price was considered moderately to quite important.
Style line	2 conservative 1 semi conservative 2 middle 2 semi cutting edge	1 conservative 1 semi conservative 4 middle	1 semi conservative 4 middle	1 semi conservative 3 middle	2 conservative 1 semi conservative 7 middle

Influences	The opinion of friends and promotions by retailers had significant influence	Friends were considered quite influential while shop assistants and magazines least influential.	Friends were of some influence while junk mail, promotions were of a little influence. Shop assistants and magazines were not important.	Friends were most influential followed by retail promotions in the paper and through the post.	Over all most people were not influenced greatly by any of the suggestions.
Colour in bowling clothes	4 yes but only in small amounts 3 no but club colours are OK.	5 people thought colour should be introduced into bowling clothing to keep up with trends, to make the clothes more practical and to get rid of the stereotype. One person thought black and white boring.	5 people agreed with colour on uniforms as it is now part of most club uniforms. All team members must wear the same uniform when playing in a tournament.	All 4 agreed with colour in uniforms White becomes grubby easily. Colour brings team unity and gives a more modern appearance.	All 10 agreed that colour should be introduced into bowling clothes.
Preferred colours	club colours are OK. Black as this is New Zealand's national colour	Club colours Shades of blue Dark or bright colours Black	Club colours Black and yellow/gold Like blue and white	Colours worked around club colours but white should remain the main colour.	Colours representing clubs. White on the bottom half and colour on the top half.
Items of clothing worn	T-shirts and polo shirts along with trousers or shorts were the favoured items for all levels of play.	Trousers, shorts, t-shirts and polo shirts are the preferred items closely followed by jackets and head wear. Sleeveless vests had some support for tournament play. Blouses, and skirts were not considered.	Trousers, shorts, t-shirts and polo shirts are the preferred items closely followed by jackets, head wear and sleeveless vests. Blouses and wet weather gear had some support. Skirts not considered.	Trousers and shorts most preferred item. T-shirt or polo shirt necessary. Sleeveless vests together with wet weather gear and head wear also important. Skirts not considered.	The least popular were skirts and blouses. All wore jackets, and shirts of some sort, usually club shirts. Trousers were the preferred choice for club and tournament play
Stretch knit					
Patterned		0	0	1	2
Woven with some stretch fabrics		3	1	1	9
Plain woven		5	4	1	7
		2 in hot weather	1	0	0

Garments in patterned fabric	Skirt , caps, hats	Top half garments. One person didn't want any pattern at all.	Club tops and jackets. One person didn't want any pattern at all.	One person didn't want any pattern. Rest though the top half garments.	Jackets most preferred followed by tops
Garments in plain fabric	Blouse, trousers and shorts.	Trousers, shorts, shirts, jackets.	Mostly trousers and shorts	Mainly bottom half and sleeveless vests.	Bottom half garments and shirts
Garments in stretch knit	none	Waist down garments plus jackets and tops	Mostly trousers, shorts and shirts.	1 person thought none. Trousers, shorts and T-shirts were popular choices for this fabric	Tops and T-shirts most preferred
Garments in woven with some stretch	T- shirt, skirt, trousers, shorts jackets	Trousers and shorts, shirts	All garments	Trousers, and shorts. Some tops	Trousers most preferred followed by tops
Garments in woven	blouse	Summer shorts or skirts	Jackets	Jackets	none
Expected standard of dress	3 yes, 1 no	6 yes	5 yes	4 yes	10 yes
Description of standard	As long as each team wears the same colours or same outfits its fine although there are no expectations for college bowls. Club competition requires the club uniform to be worn.	Black and/or white or club colours must be worn. Regimented and sometimes archaic. Must not show too much skin and not figure hugging. Uniform not always worn as it should be.	Club uniform for club and interclub events or any competition play. Social play as dictated by the club usually white pants and club shirt.	Clean and tidy Club uniform and/or whites expected for club play and tournaments. Track pants or mufti for social play.	Expected to wear club uniform colours during competitions especially where the club is being represented. Whites are acceptable. Social play is more casual.

Essential items	Loose clothing that is breathable and light in the bottom half.	Shorts, trousers with pockets and polo shirts major items. Jackets and sleeveless vests popular. Must be comfortable. Weather proof gear.	All needed club uniform but some needed extra polo shirts, a light weight jacket, ¾ pants, warm jersey or fleecy jacket.	Wet weather gear, jacket, vest, top in club colours and a white top, trousers and shorts, cap or hat. ¾ pants and a warm skivvy.	All required a jacket, tops, most wanted a sleeveless vest and comfortable trousers or shorts. Two people considered a skirt necessary. One person wanted a track suit.
Problems of fit	1 yes, 5 no The one person who does have trouble can alterations her clothing to fit.	4 have problems 1 doesn't	2 have problems 3 have no problems.	2 have problems 2 don't	10/10 have problems
Jackets and sleeveless jackets		Set in sleeves are too bulky and jackets don't fit across the shoulders	Fit is not always good because these are made for men.	Sleeve length and the fit around the armhole of sleeveless jackets	Too long and too bulky. Sleeve length too long. 4 thought the jackets too bulky

Skirts		Not worn by this group	Maybe worn by one in this group. Problem with the shaping.	Not worn by this group	4 thought skirts were too long
Trousers and shorts		Too long and ill fitting	Too long in the leg but not long enough in the crutch. Lack of tailored styles.	Hard to get fit in the waist and the crutch area. Often too long in the leg.	The biggest problem is the leg length of the trousers and not enough room in the crutch area.
T-shirts, polo shirts, blouses		Too long in body. At some clubs the club shirts are a compulsory uniform during play.	No problems	Unflattering, are too square and made to fit a multiple of men's sizes.	Too long in the body and too long in the sleeve for women.
Wet weather gear		Too bulky. Doesn't stay waterproof and hard to find at an affordable price.	Often bulky and too long.	Same as above	
Caps and hats		Some use visors only. One person thought there was not enough protection for the ears	Visors popular		Some wear visors
Sizes		12 - XL	14 - 16/18 - L	M - XL	12 -14 - 18 range
Comments	Bowls uniforms need to be updated and brought into the 21 <sup>st</sup> C so more young people will play.	Shortage of good tailored shorts. Costs need to be kept low especially for new younger bowlers.	none	Need warm gear for playing in the off season i.e. track suits and fleecy tops.	Waist and length measurements are difficult to combine and manufacturers need to cater for short small women.

**Table A.3.1 Results of preliminary questionnaire.**

## **APPENDIX 4**

### **FOCUS GROUPS QUESTIONNAIRES AND RESPONSES PROMPT MATERIALS**

#### A.4.1 Focus group questions and responses

<p><b>Q1. What do you think of the clothes worn for bowls at the present time and would you like to see any changes made?</b></p> <p><b>Summary.</b>          Clothing needs to be more feminine and fit well without bulk especially under the arms.          Clothing must conform to the rules.          Garments below the waist have to be white or black but colour can be introduced onto tops and jackets and vests.          Fabrics need to be of a good quality that does not snag.</p>	<p><b>Group 1</b> were adamant that the clothes worn on the green had to comply with the rules set out in the rule book and any changes had to meet with the approval of Bowls New Zealand. This meant that colour could be incorporated into the garments worn above the waist like T shirts, polo shirts and jackets but white was mandatory below the waist i.e. for shorts trousers and skirts. The club's track suits however are blue. This group would be happy for the colour of their club i.e. royal blue; to be introduced for shorts trousers and skirts as the white fabric often discolours with the sun and washing.</p>
	<p><b>Group 2</b> I make my own shorts because I cannot buy a trouser or shorts that fit and are comfortable for bowls. The shirts snag very easily. They are expensive and should not do this. Jackets are too bulky under the arms and don't really fit all that well.</p>
	<p><b>Group 3</b> Black would look slimming although it can be hot. Black shorts would be ok so long as they were tailored.          Black and white is a smart uniform          Trousers should be full length.          Our uniform has a 'bloke look' would be good to look a bit more feminine.</p>
	<p><b>Group 4</b> A Polo shirt with a little trim on the collar – maybe black or the clubs colour.</p>
	<p><b>Group 5.</b> The clothes are OK. At our club we wear black and white so there are lots of black trousers around like these (track pants with white stripe down side). I wouldn't be seen dead in a skirt because they are not fashionable and not practical when you have to stride out.</p>
	<p><b>Group 6</b> What we are wearing now is OK. Don't like tight clothes</p>

<p>Q2. How could we encourage more young people or people in general to take up the game?</p> <p><b>Summary</b> The game itself needs to be shortened so that tournaments do not drag on too late in the day or over several weeks. To enable all members of the public to join in the game different tournaments need to be available during the week, weekends or evenings. College bowls to be encouraged and integrated into the main club programme. A relaxation of dress code for young members incorporating modern fashion trends.</p>	<p><b>Group 1</b></p>
	<p><b>Group 2</b> The games need to be shortened. 21 ends + is too much and the games can drag on too late. By introducing a green fee like golf where people could come along and play ad hock might help to boost numbers. Some people can't play on the week ends because they work on Saturdays or are involved with their own children and their sport. College bowls is good for those young ones not good at rugby, netball etc but who want to play a sport. It is a good place to socialise and teams can be mixed.</p>
	<p><b>Group 3</b> Keep going with the community bowls which attracts lots of people in the local community to the club. They might not join right away but it gives them an idea of the game.</p>
	<p><b>Group 4</b> By having open days when younger family members could come along with their parents or grandparents. Have to have a more modern style of uniform for the young players but not showing a bare stomach. The council could make a sports area which incorporated bowls, croquet tennis etc and the bowling clubs here could amalgamate and make one really strong club.</p>
	<p><b>Group 5</b> Between February and April there are secondary school competitions which are mixed tournaments and girls and boys can play in mixed teams. This is like a warm up to the inter-secondary competitions when we play singles and pairs.</p>
	<p><b>Group 6</b> We encourage the school kids to come along and play. We include them in our teams.</p>

<p>Q3. Should there be more competition play during the winter or off season and if so what clothing would be necessary?</p> <p><b>Summary</b> Mufti is worn during the off season. Track suits could be handy.</p>	<p><b>Group 1</b> Mufti is worn during the winter so we can wear what we like to keep warm. No club competition play happens at this time. The club track suits are worn a lot at this time.</p>
	<p><b>Group 2</b> We can wear mufti in the winter but because we don't have an Astroturf green we have to play at other clubs if we want a game.</p>
	<p><b>Group 3</b> Just wear mufti. Have to go to other clubs to play.</p>
	<p><b>Group 4</b> We just wear mufti in the winter.</p>
	<p><b>Group 5</b> There is play in the winter season run by the PBA(Professional Bowls Association). A joining fee is required.</p>
	<p><b>Group 6</b></p>

<p><b>Q4. Do you have difficulty in finding bowling clothes to fit?</b></p> <p><b>Summary</b> Those women who require bigger sizes have little choice of style and fabric and to find trousers that fit well is a problem. These clothes are not strictly sportswear. The jackets are bulky and not showerproof.</p>	<p><b>Group 1</b> Sometimes as there is little choice of places to go to buy. Bigger people have more difficulty getting a good fit and have to shop at places like Farmers. This is not sports wear.</p>
	<p><b>Group 2</b> Yes especially the trousers. Most of these women said they had enough clothing to see them to the end of their bowling days and would probably not buy any more although they could be tempted.</p>
	<p><b>Group 3</b> Not really, happy with the status quo. How I look is not really important but clean is. Jacket is too bulky under the arms, would be good if it was shower-proof too. The hood which is presently folded into the collar is too bulky around the neck. A hood can obscure your view when you are bowling.</p>
	<p><b>Group 4</b> Because our colours are black and white, there is quite a lot of choice. I get mine from Postie Plus. To find proper bowling pant yes, but I get most of my gear from the Farmers, it is the only place here that you can get bigger sizes.</p>
	<p><b>Group 5</b> No because the club orders the clothing and there are lots of sizes to choose from. You can usually get a garment to fit pretty well.</p>
	<p><b>Group 6</b> Our club clothes are ordered to given measurements and the jackets and shirts are given to club members on the understanding that they will return them if they leave the club. We don't have a problem with this. Because our club colours are black white and yellow finding black trousers/shorts is not a problem. Millars have a good range of tailored shorts and trousers which we can buy ourselves. This is weekend wear as opposed to sports wear</p>

<p><b>Q5. Regarding the fit of your bowling clothes, what aspects of the clothing do you like or find most comfortable and what aspects don't you like?</b></p> <p><b>Summary</b> Elasticised waists are desirable and a flat front rather than a fly front on trousers/shorts. Generally the trousers/shorts are not long enough through the crotch area. Stretch fabric desirable and pockets are a necessity. Pockets need to avoid areas where the arm swings forward when delivering a bowl. A fitting t-shirt in stretch which does not bag at the bottom and ¾ sleeves or long sleeves for protection from the sun. Pockets could be useful on the t shirt. Jackets need to be fitting and not bulky under the arm but still give unrestricted movement. Shorts finishing just above the knee are a very comfortable item of clothing and they look smart. The zipper at the bottom of the leg make it easy to take off the trousers. Young people don't like tight fitting clothes – they</p>	<p><b>Group 1</b> Really like the elastic waists in the trousers or shorts. Good to have a flat front for those who have a tummy. Pockets are essential to keep all our bits and pieces in when playing. (measure – a retractable tape or string for determining the bowl closest to the jack, chalk or aerosol chalk to mark any bowl which touches the jack, coins to determine which team bowls the first bowl in the game, duster to polish each bowl before delivery, score card and pencil or biro, etc).</p> <p>Some like a deep rib on the bottom of the T shirt rather than the loose fitting T which stretches over time. All agreed their jackets were too bulky especially around the armhole and were generally a poor fit. Trousers and shorts often did not allow enough movement in the back and through the crotch area when bending and crouching to either deliver the bowl or when measuring at the end of the head.</p> <p><b>Group 2</b> Some did not like the ribbing band at the bottom of the shirt as it showed off their stomach, others did not mind that. Jackets too big and don't fit well. Must have pockets in the pants, in the side seams.</p> <p><b>Group 3</b> Must have pockets but not on the side as they can get in the rode of your swing. Stretch is always fitting and comfortable. Trousers are often not long enough in the crotch area A ribbed band around the bottom of the shirt can be flattering. Ok if you have no tum.</p> <p><b>Group 4</b> I don't like the look of the skirts which ride up when you bend down to bowl. When one woman at the club bends over to play you can almost see her knickers! Long or ¾ sleeves are good as protection from the hot sun.</p> <p><b>Group 5</b> I like the shirts although they are made for men we can get a small enough size that will fit. I like the fact that they are not close fitting as you need plenty of movement although you don't want a giant tent either. These keep you cool in the summer. I like the shirts because they breathe and are soft. I like the zipper on the leg of the trousers. I like our club's uniform and I am proud to wear it.</p>
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like loose or baggy T-shirts.	They should get rid of the big round hats. Visors or caps are better.
	<b>Group 6</b> The elastic waists are a must or just elastic at the back. I like the shorts that finish just above the knee.

<p><b>Q6.</b> Would you like to have a warmer top to wear at the beginning and end of the season?</p> <p><b>Summary</b> A warm top would be very useful item – merino skivy type of garment. Also a fitting vest or jacket that is windproof. Some wear thermals under their regular bowling shirts.</p>	<p><b>Group 1</b> Definitely as it is very cold when the season begins and also Wellington weather can be cold even in the middle of summer. A wind proof jacket would be an advantage especially if it was in the club colour. Would be good if it as shower-proof as well.</p>
	<p><b>Group 2</b> Yes this would be good but it might be too expensive. Most of us are in the pension. A top in the fine Merino wool would be lovely in a colour.</p>
	<p><b>Group 3</b> Would like a warm black and white jacket A vest cut for women not for men would be a good idea.</p>
	<p><b>Group 4</b> Definitely. Even though it is hot during the peak of the summer, at the beginning and end of the season we do need warmer clothes. A wind proof jacket would be a really useful garment. A sleeveless vest would be useful garment especially if it was windproof.</p>
	<p><b>Group 5</b> No these shirts are OK. I wear a polypropylene top underneath and then I can take it off if I need to. Merino wool is too hot and needs to be very fitted – not practical.</p>
	<p><b>Group 6</b> No we just wear our thermals underneath and then we can take them off when we get too hot.</p>

<p><b>Q7. Would you consider using any of these fabrics in bowling garments?</b></p> <p><b>Summary</b>  A light weight, windproof jacket with an element of stretch. The Merino fabrics were very popular but are not windproof. The soft, non pill, white fabric for T-shirts. Fine Merino for long sleeved top for beginning and end of season. Some club jackets include a thermal lining which stops the wind.</p>	<p><b>Group 1</b> All liked the idea of a wind proof jacket which would be light weight and warm and have an element of stretch. All thought the Merino wool fabrics would be excellent for Wellington weather They liked the idea of the breathable, wickable fabrics for tops.</p>
	<p><b>Group 2</b> Love the fabrics and would love a jacket made of this fabric especially if I could wear it at other times. As long as the white ( soft white from Barlow Textiles) fabric for the shirt did not pill I think it would be great.</p>
	<p><b>Group 3</b> Like the idea of a warmer top for the cooler times. White fabric feels nice and soft so long as it doesn't pill or snag.</p>
	<p><b>Group 4</b> I would love one of these tops in the fine Merino fabric. It would be really useful at the beginning and end of the season.</p>
	<p><b>Group 5</b> No</p>
	<p><b>Group 6</b> No although the material for the shirts looks good but we have our own.</p>
<p>Additional comments</p>	

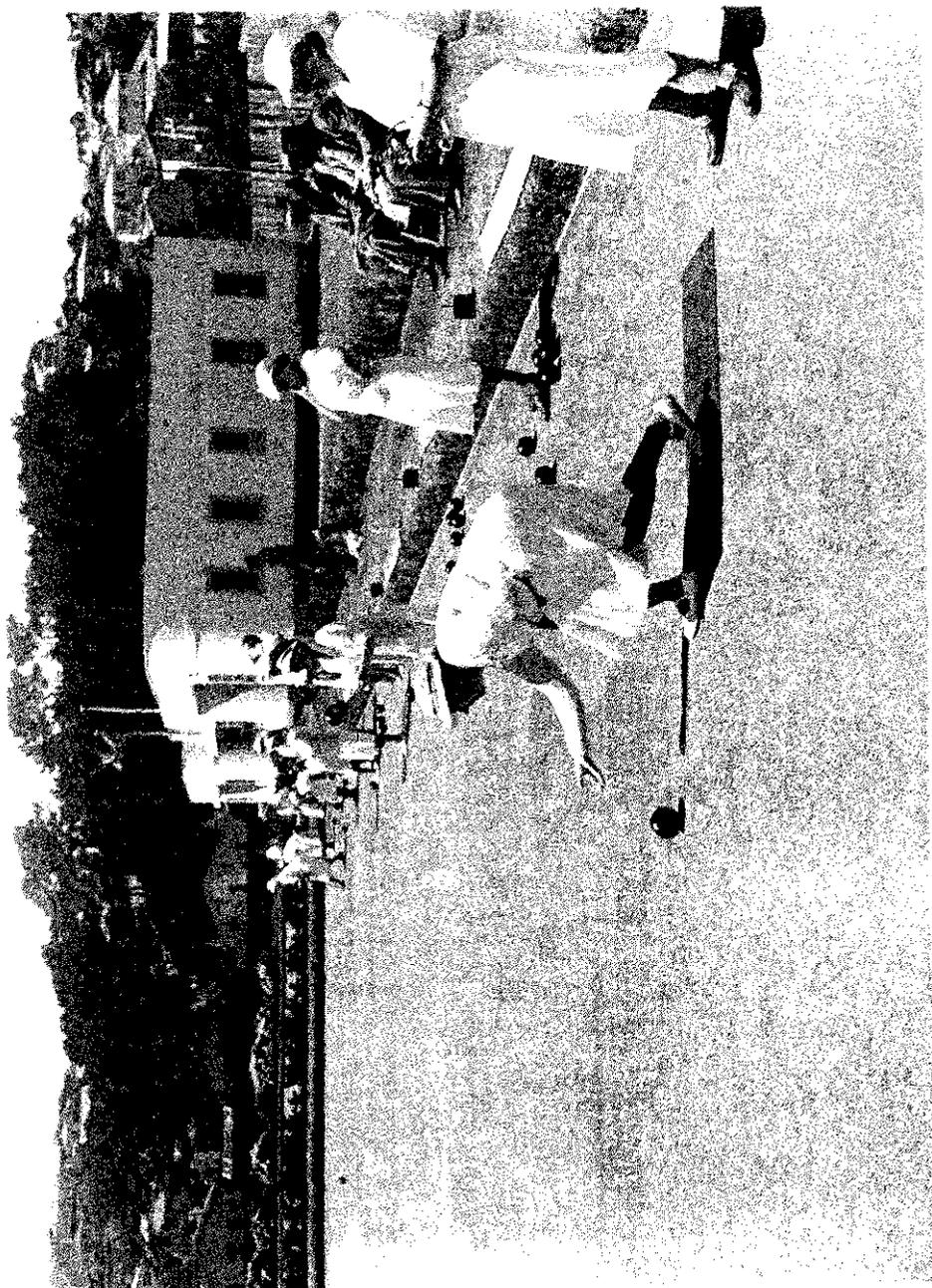
**Figure A.4.1 Results of focus group meetings.**

A.4.2 Photographic prompts used during for groups

1894



Inter-provincial Ladies Bowls. Miramar Green January 1949



Ladies at the Johnsonville Bowling Club 1986



Johnsonville Bowling Club Opening Day 1996



Australia playing New Zealand 2005



Inter Secondary Schools Tournament 2004



Inter Secondary Schools Tournament 2004



The Preston – Sims match in the women's 4's Nationals 2005



New Zealand National Team 2005

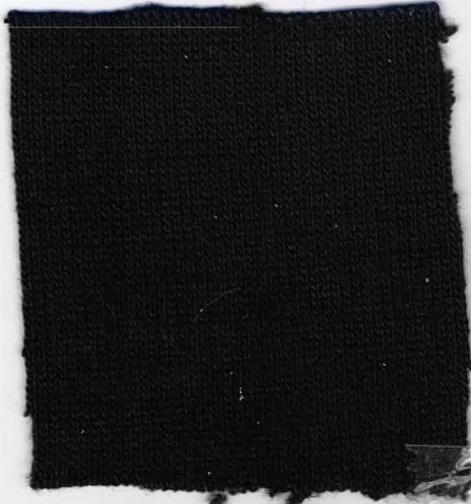


Fashion trends from 'Breeze' brochure 2005

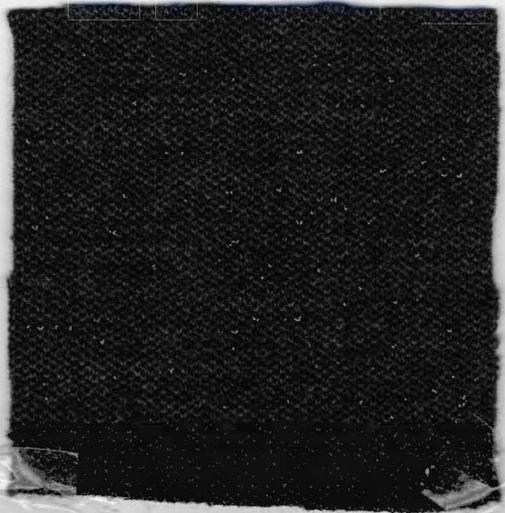


**A.4.3 Samples of Fabric Samples Shown To Focus Groups**

**MerinoMax™**



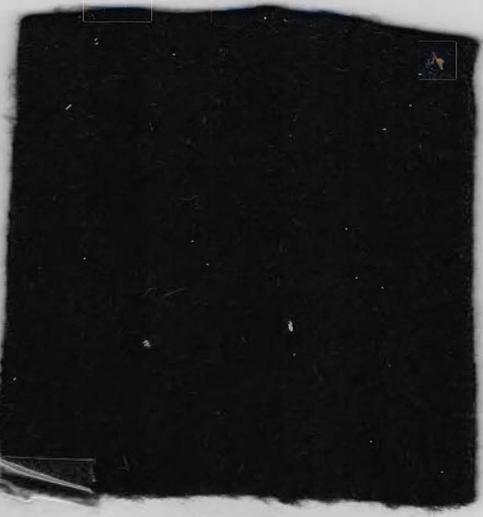
**Duo Merino™**



**Fine Merino Wool Fabric**



**Polarfleece**



**Coolmax™**



**Cotton/ Spandex**



A.4.4. Questionnaire re: wear trialists' perceptions of the fit of the trial bowling clothes

**Fit:**

**Describes how the length and width of the garments fit your body when you stand still and while you are bowling. Fit also describes how comfortable the garments feel when you are wearing them.**

**THE JACKET**

1. Freedom of movement around the shoulder and underarm area.

too much room                       not enough room                       just right

2. Shaping in the torso area

too loose                       too tight                       just right

3. Length of body of garment

too long                       too short                       just right

4. Length of sleeve

too long                       too short                       just right

5. The overall comfort of the fit of the jacket

too loose                       too tight                       just right

## THE SHIRT

6. Freedom of movement around the shoulder and underarm area.

too much room

not enough room

just right

7. Shaping in the torso area

too loose

too tight

just right

8. Length of body of garment

too long

too short

just right

9. Length of sleeve

too long

too short

just right

10. Size of collar

too big

too small

just right

11. Length of zipper in the front neck for donning and doffing (getting it on and off)

too long

too short

just right

12. The overall comfort of the fit of the shirt

too loose

too tight

just right

## THE SHORTS

13. Freedom of movement around the leg area.

too much room

not enough room

just right

14. Length through the crotch area

too long

too short

just right

15. Length of the leg

too long

too short

just right

16. Width of the leg

too wide

too narrow

just right

17. Tightness of elastic around the waist/hip

too loose

too tight

just right

18. The overall comfort of the fit of the shorts

too loose

too tight

just right

**GENERAL DESIGN AND AESTHETICS**

In the questions 19 – 21, comfort refers to softness or stiffness, smoothness or prickliness, stretchiness of the fabric and whether the fabric makes you feel hot or cold.

19. Comment on the comfort of the fabrics used in the jacket

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20. Comment on the comfort of the fabrics used in the shirt

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21. Comment on the comfort of the fabrics used in the shorts

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22. The use of contrasting fabric on the jacket and shirt

don't like the contrast

prefer another colour or fabric

just right

23. Comment on the general style of the garments for bowling

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24. What qualities of specific design features do you like about the bowling clothes you have worn?

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25. Are there any specific areas where you are dissatisfied with the bowling clothes you have worn?

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**Any other comments?**

(use back of sheet)

Thank you for participating in this wear trial.

Gretchen Ivess

#### A.4.5. Tabulated responses from wear trials

Young women wore the garments during the National Secondary Schools Tournament held in Auckland 11 – 13 December 2005.

Mature women wore the garments during the National Bowls Tournament held in Wellington 3 – 6 January 2006

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		Young Women	Mature Women
<b>JACKET</b>			
<hr/>			
Freedom of movement in shoulder and underarm	Too much room	1	0
	Not enough	0	0
	Just right	5	4
Shaping in torso area	Too loose	2	0
	Too tight	0	0
	Just right	4	4
Length of torso	Too long	3	0
	Too short	0	0
	Just right	3	4
Length of sleeve	Too long	2	1
	Too short	0	0
	Just right	4	3
Contrast fabric	Don't like contrast	0	0
	Prefer another colour	2	0
	Just right	4	0
Overall comfort	Too loose	3	0
	Too tight	0	0
	Just right	3	4

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## SHIRT

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		Young Women	Mature Women
Freedom of movement in shoulder and underarm	Too much room	0	0
	Not enough	0	0
	Just right	6	4
Shaping in torso area	Too loose	3	0
	Too tight	0	0
	Just right	3	4
Length torso	Too long	0	0
	Too short	0	0
	Just right	6	4
Length sleeve	Too long	0	0
	Too short	0	0
	Just right	6	4
Collar size	Too big	1	0
	Too small	0	0
	Just right	5	4
Length of zipper	Too long	1	0
	Too short	0	0
	Just right	5	4
Contrast fabric	Don't like contrast	0	0
	Prefer another colour	2	0
	Just right	4	4
Overall comfort	Too loose	2	0
	Too tight	0	0
	Just right	4	4

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**Young women wore SHORTS. Mature women wore TROUSERS**

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		Young Women	Mature Women
Freedom of movement around leg area	Too much room	1	1
	Not enough	0	0
	Just right	5	3
Length through crotch	Too long	1	0
	Too short	0	0
	Just right	5	4
Length in leg	Too long	3	3
	Too short	0	0
	Just right	3	1
Width of leg	Too wide	2	2
	Too narrow	0	0
	Just right	4	2
Tightness of elastic at waist/hip	Too loose	0	1
	Too tight	2	0
	Just right	4	3
Overall comfort	Too loose	1	0
	Too tight	0	0
	Just right	5	4

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**Table A.4.2 Tables of responses from wear trials.**

**APPENDIX 5**

**HISTORICAL ANALYSIS SHEETS**

### A.5.1 Analysis of bowling dress 1940 – 50

Visual feature analysis of Figure 4.2.1.		
Visual features	Assessed Criteria	Result
Fabric aesthetics	Apparent weight of fabric (light to heavy). Light cotton to heavy drill.	Medium to light weight
Silhouette	Angularity to roundness and closeness of fit to the body	Square shoulders but close to body at waist and hip.
Feature identification and structural embellishments.	Garment types: Dresses skirts, tops, jackets, trousers, shorts.	Shirt-waister dresses, close fitted cardigans.
	Closure/ opening Centre, off centre, buttons, zipper, press studs	Centre front opening. Fastened to the waist possibly buttoned.
	Presence and location of gathers	No gathers obvious
	Presence and location of panels	Not obvious
	Presence and location of pleats/tucks	Inverted pleats
	Pockets patch , inseam, welt, etc.	Patch pockets on front below the waist.
	Belts fastened with buckle or tied	Belt not seen
Neckline	Type and style of collar.	Simple collar and rever
	Neck shape square, V-shaped, high or low	V - shaped
Sleeve	Type and length	Set in sleeve - elbow length
Trousers / shorts	Length of leg, finishing at top, embellishments	none
Skirt	Width, fullness and length	Mid calf length moderately full
Accessory type	Shoes - Style, heel, colour.	Brown or white flat. Some lace up and some with strap and buckle
	Headwear - Type and style	Cap or hat with brim
	Bags	Not shown
Total look	Combinations of apparel items	Dresses, cardigans, hats, stockings, shoes.

**Table 5.1 Analysis of bowling dress 1940 - 50**

### A.5.2 Analysis of bowling dress 1950 – 1960

Visual feature analysis of Figure 4.2.2 and 4.2.3.		
Visual features	Assessed Criteria	Result
Fabric aesthetics	Apparent weight of fabric (light to heavy). Light cotton to heavy drill.	Medium to light weight Jackets possible medium weight wool
Silhouette	Angularity to roundness and closeness of fit to the body	No obvious padding in shoulders. Dresses and blazers fit close to body at waist and hip.
Feature identification and structural embellishments.	Garment types: Dresses skirts, tops, jackets, trousers, shorts.	Shirt-waister dresses. Blazers
	Closure/ opening Centre, off centre, buttons, zipper, press studs	Centre front opening. Fastened to below the waist possibly buttoned.
	Presence and location of gathers	No gathers obvious
	Presence and location of panels	Not obvious
	Presence and location of pleats/tucks	Inverted pleats
	Pockets patch , inseam, welt, etc.	Patch pockets on front below the waist.
	Belts fastened with buckle or tied	Self covered belt
Neckline	Type and style of collar.	Simple collar and rever
	Neck shape square, V-shaped, high or low	V - shaped
Sleeve	Type and length	Set in sleeve – above the elbow
Trousers / shorts	Length of leg, finishing at top, embellishments	none
Skirt	Width, fullness and length	Mid calf length moderately full
Accessory type	Shoes - Style, heel, colour.	White flat lace up could be leather or canvas.
	Headwear - Type and style	Cap or hat with brim
	Bags	Not shown
Total look	Combinations of apparel items	Dresses, blazers, hats, stockings, shoes.

**Table 5.2 Analysis of bowling dress 1950 - 60**

### A.5.3 Analysis of bowling dress 1960 – 1970

Visual feature analysis of Figure 4.2.4 and 4.2.5.		
Visual features	Assessed Criteria	Result
Fabric aesthetics	Apparent weight of fabric (light to heavy). Light cotton to heavy drill.	Medium to light weight Jackets possible medium weight wool
Silhouette	Angularity to roundness and closeness of fit to the body	No obvious padding in shoulders. Dresses and blazers fit close to body at waist and hip.
Feature identification and structural embellishments.	Garment types: Dresses skirts, tops, jackets, trousers, shorts.	Shirt-waister dresses. Blazers
	Closure/ opening Centre, off centre, buttons, zipper, press studs	Centre front opening. Buttoned to below the waist.
	Presence and location of gathers	No gathers in skirt but some gathers under bust area.
	Presence and location of panels	Not obvious
	Presence and location of pleats/tucks	Inverted pleats sewn to hip level.
	Pockets patch , inseam, welt, etc.	Patch pockets on front below the waist and inseam side pockets. Scalloped edge to one set of pockets.
	Belts fastened with buckle or tied	Self covered belt either fastened with a buckle or tied.
Neckline	Type and style of collar.	Simple collar and rever or collar and no rever.
	Neck shape square, V-shaped, high or low	V – shaped varying from high to breast level.
Sleeve	Type and length	Set in sleeve – above the elbow
Trousers / shorts	Length of leg, finishing at top, embellishments	none
Skirt	Width, fullness and length	Mid calf length moderately full
Accessory type	Shoes - Style, heel, colour.	White flat lace ups could be leather or canvas, slip-ons and two toned brown and white laceups.
	Headwear - Type and style	Cap with back flap or hat with brim. Width of brim not consistent.
	Bags	Not shown
Total look	Combinations of apparel items	Dresses, cardigan, blazers, hats, socks, stockings, shoes.

**Table 5.3 Analysis of bowling dress 1960 – 70**

#### A.5.4 Analysis of bowling dress 1970 – 1980

Visual feature analysis of Figure 4.2.6.		
Visual features	Assessed Criteria	Result
Fabric aesthetics	Apparent weight of fabric (light to heavy). Light cotton to heavy drill.	Medium to light weight. Knitted fabrics in two garments – skirt and top.
Silhouette	Angularity to roundness and closeness of fit to the body	Roundness and skimming the body. Top worn out over skirt.
Feature identification and structural embellishments.	Garment types: Dresses skirts, tops, jackets, trousers, shorts.	Shirt-waister dress. Two piece top and skirt combination.
	Closure/ opening Centre, off centre, buttons, zipper, press studs	Centre front opening buttoned to below the waist on shirt dress. Single button and broach to close front placket on knitted top.
	Presence and location of gathers	Not obvious
	Presence and location of panels	Not obvious
	Presence and location of pleats/tucks	Pleated look to knitted skirt
	Pockets patch , inseam, welt, etc.	No pockets visible.
	Belts fastened with buckle or tied	Not visible
Neckline	Type and style of collar.	Simple collar and rever on shirt dress. Knitted collar onto placket band.
	Neck shape square, V-shaped, high or low	V – shaped
Sleeve	Type and length	Set in sleeve – above the elbow
Trousers / shorts	Length of leg, finishing at top, embellishments	none
Skirt	Width, fullness and length	Mid calf moderately full
Accessory type	Shoes - Style, heel, colour.	White flat lace ups could be leather or canvas, slip-ons and two toned brown and white laceups.
	Headwear - Type and style	No hats worn
	Bags	Large white two handled bag in background.
Total look	Combinations of apparel items	Dress, skirt and top combination, stockings, shoes.

**Table 5.4 Analysis of bowling dress 1970 - 80**

### A.5.5 Analysis of bowling dress 1980 – 1990

Visual feature analysis of Figure 4.2.7 and 4.2.8.		
Visual features	Assessed Criteria	Result
Fabric aesthetics	Apparent weight of fabric (light to heavy). Light cotton to heavy drill.	Medium to light weight synthetic fabrics. Some knitted fabrics used for tops and cardigans.
Silhouette	Angularity to roundness and closeness of fit to the body	Soft roundness to shoulder lines. Shaping in dresses. Tops worn out over skirt.
Feature identification and structural embellishments.	Garment types: Dresses skirts, tops, jackets, trousers, shorts.	Shirt-waister dress. Permanently pleated circular skirt. Top and skirt combination.
	Closure/ opening Centre, off centre, buttons, zipper, press studs	Centre front opening buttoned to below the waist on shirt dress. Some zippers used to close front of dresses.
	Presence and location of gathers	Not obvious
	Presence and location of panels	Panels in one dress.
	Presence and location of pleats/tucks	Permanently pleated 'Sunray' pleated skirt.
	Pockets patch , inseam, welt, etc.	Patch pockets and inseam pockets.
	Belts fastened with buckle or tied	Not all dresses feature belts or ties.
Neckline	Type and style of collar.	Simple collar and rever on shirt dress. Knitted collar on top. Collar without rever.
	Neck shape square, V-shaped, high or low	V – shaped
Sleeve	Type and length	Set in sleeve – above the elbow
Trousers / shorts	Length of leg, finishing at top, embellishments	none
Skirt	Width, fullness and length	Mid calf length to just below the knee. Varying fullness
Accessory type	Shoes - Style, heel, colour.	White flat shoes
	Headwear - Type and style	Hats with front brim. 'Johnsonville' logo on hat band.
	Bags	None visible
Total look	Combinations of apparel items	Dress, skirt, top and cardigan combination, sleeveless top, stockings, shoes. Name badges worn on uniform.

**Table 5.5 Analysis of bowling dress 1980 – 90**

**A.5.6 Analysis of bowling dress 1990 – 2000**

<b>Visual feature analysis of Figure 4.2.9. and 4.2.10</b>		
Visual features	Assessed Criteria	Result
Fabric aesthetics	Apparent weight of fabric (light to heavy). Light cotton to heavy drill.	Medium to light weight skirt. Medium weight in culottes Knitted fabrics in both tops.
Silhouette	Angularity to roundness and closeness of fit to the body	Roundness and loose fitting tops one worn out over the skirt, the other tucked in.
Feature identification and structural embellishments.	Garment types: Dresses skirts, tops, jackets, trousers, shorts.	Skirt and top Culottes and top.
	Closure/ opening Centre, off centre, buttons, zipper, press studs	Placket front on tops with press stud closures up to the neck. Opening on skirt and culottes not obvious.
	Presence and location of gathers	Not obvious
	Presence and location of panels	Not obvious
	Presence and location of pleats/tucks	Box pleats in front of skirt. could be some pleats in front of culottes to give fullness in leg.
	Pockets patch , inseam, welt, etc.	Pockets positioned in side seams of skirt and culottes.
	Belts fastened with buckle or tied	Not visible
Neckline	Type and style of collar.	Simple knitted collar attached at neck edge and front placket.
	Neck shape square, V-shaped, high or low	V – shaped
Sleeve	Type and length	Set in sleeve – just above the elbow.
Trousers / shorts	Length of leg, finishing at top, embellishments	Culottes finishing mid knee. Elasticised back and straight band on front.
Skirt	Width, fullness and length	Skirt mid calf length and moderately full. Culottes mid knee and moderately full.
Accessory type	Shoes - Style, heel, colour.	White flat lace ups, moccasin type slip-ons, could both be leather
	Headwear - Type and style	Visor and cap
	Bags	Nil
Total look	Combinations of apparel items	Skirt and top combination, culottes and top, shoes.

**Table 5.6 Analysis of bowling dress 1990 – 2000**

### A.5.7 Analysis of bowling dress 2000 – 2006

Visual feature analysis of Figure 4.2.11. to 4.2.16		
Visual features	Assessed Criteria	Result
Fabric aesthetics	Apparent weight of fabric (light to heavy). Light cotton to heavy drill.	Medium to light weight nylon in track pants and jackets. Medium cotton drill $\frac{3}{4}$ pants Light weight fabric in skirts Knitted light weight cotton/polyester fabrics in t-shirts. Polar fleece used in sleeveless top
Silhouette	Angularity to roundness and closeness of fit to the body	Loose fitting tops worn either out over the bottom half or tucked into the waistband.
Feature identification and structural embellishments.	Garment types: Dresses skirts, tops, jackets, trousers, shorts.	$\frac{3}{4}$ pants, track pants, skirts, T-shirt/ polo shirts, long sleeved skivy, jackets – waisted and hip length.
	Closure/ opening Centre, off centre, buttons, zipper, press studs	Placket front on tops with press stud closures up to the neck. Opening on skirts not obvious.
	Presence and location of gathers	Not obvious
	Presence and location of panels	none
	Presence and location of pleats/tucks	Various types of pleats in front of skirts.
	Pockets patch , inseam, welt, etc.	Pockets positioned in side seams of track pants. Inseam pockets in jackets
	Belts fastened with buckle or tied	Not visible
Neckline	Type and style of collar.	Simple knitted collar attached at neck edge and front placket.
	Neck shape square, V-shaped, high or low	V – shaped and round neck.
Sleeve	Type and length	Set in sleeve –finishing just above the elbow. Some sleeves worn rolled up to make them shorter.
Trousers / shorts	Length of leg, finishing at top, embellishments	$\frac{3}{4}$ pants finishing just below the knee to mid calf, track pants with contrast piping on outside leg. Waists finished with elastic in casing at the

		back.
Skirt	Width, fullness and length	Worn on the hips with length finishing mid thigh. asymmetrical shape to some hem lines. pleats in front.
Accessory type	Shoes - Style, heel, colour.	White flat lace ups, moccasin type slip-ons, could both be leather
	Headwear - Type and style	Visors and caps
	Bags	Coloured bowling bags and a cream shoulder bag worn.
Total look	Combinations of apparel items	Shorts and top, skirt and top, track pants and top, sleeveless vests, jackets, flat bowling shoes, slip-ons and sneakers worn with or without socks. Sunglasses and jewellery worn.

**Table 5.7 Analysis of bowling dress 2000 - 2006**

## **APPENDIX 6**

### **FABRIC TESTS AND RESULTS**

### A.6.1 AATCC 8 – 2004 Colourfastness to Crocking

This test method is designed to determine the amount of colour transferred from the surface of coloured textile materials to other surfaces by rubbing. Colour transferred to the white test cloth (both wet and dry) is assessed by a comparison with the Gray Scale for staining and a grade is assigned. For this particular test a grade of less than 4 is considered unacceptable.

#### Method

An electric Crock Meter Code 198B was used for this experiment.

ISO 105 FO9 Standard white cloth is secured to the monitor's finger. The test fabric is secured in the bed.

The weighted finger is lowered onto the fabric and the monitor set for 10 backwards and forwards rubs.

The white test cloth is then compared to the grey scale.

#### Results

Results given in table A.6.1. All fabrics were considered satisfactory.

Colour change when compared to the grey scale		
Fabric	Dry Cloth	Wet Cloth
MerinoMax™	5	5
Merino wool	5	5
Polarfleece	5	4
Contrast fabric	5	5
Trouser fabric	5	5
Merino/Tactil™	5	4.5

**Table A.6.1 Results of crocking tests using wet and dry test cloths.**

## A.6.2 ISO 3759:1994 Test for Dimensional Stability

A sample of each of the four fabrics used in the prototype garments were tested for dimensional stability prior to the garments being cut out.

A square of each fabric 35cm by 35cm was stabilised around the edge by hand finishing. Three sets of measurements were made with thread crosses 25cm apart in both the warp and the weft direction. Actual distances were measured and recorded. Fabrics were washed in an automatic washing machine programmed for regular cycle ire auto fill, warm wash with recommended amount of washing powder, double rinse and fast spin. The samples were washed along with other clothing to simulate actual washing practice for the end garment. The samples were then tumbled dry.

The distance between the crosses were measured and recorded.

### Results given in Table A.6.2

#### Fabric for T- shirt

Coolmax™	AC	DF	GI	AG	BH	CI
Before washing	20cm	20cm	20cm	20cm	20cm	20cm
Average or Mean	19.9	19.9	19.8	20	19.9	19.8
% shrinkage	0.5%	0.1%	0.5%	0%	0.5%	0.5%
Acceptability	Weft direction		Yes	Warp direction		Yes

#### Fabric Contrast

Polyester and cotton	AC	DF	GI	AG	BH	CI
Before washing	20cm	20cm	20cm	20cm	20cm	20cm
Average or Mean	20	19.9	20	19.8	19.9	19.8
% shrinkage	0%	0.1%	0%	0.1%	0.1%	0.5%
Acceptability	Weft direction		Yes	Warp direction		Yes

**Fabric for Shorts**

Merino and Tactel™	AC	DF	GI	AG	BH	CI
Before washing	20cm	20cm	20cm	20cm	20cm	20cm
Average or Mean	20	19.9	20	19	19	19
% shrinkage	0%	0.5%	0%	5%	5%	5%
Acceptability	Weft direction	Yes	Warp direction	No		

**Fabric for Jacket**

Merino and Coolmax™	AC	DF	GI	AG	BH	CI
Before washing	20cm	20cm	20cm	20cm	20cm	20cm
Average or Mean	20	20	20	20	20	20
% shrinkage	0%	0%	0%	0%	0%	0%
Acceptability	Weft direction	Yes	Warp direction	Yes		

**Fabric for Jacket**

Polar fleece	AC	DF	GI	AG	BH	CI
Before washing	20cm	20cm	20cm	20cm	20cm	20cm
Average or Mean	19.9	20	20	20	20	20
% shrinkage	0.5%	0%	0%	0%	0%	0%
Acceptability	Weft direction	Yes	Warp direction	Yes		

**Table A.6.2 Test results for fabric dimension stability.**

### **A.6.3. ISO 105-C01 1989. Test for colour fastness in washing**

This test assesses the colourfastness of a fabric when it is washed.

#### **Method:**

The test cloth is placed between white cotton and white synthetic fabrics and machine basted together using large stitches and white thread.

Test samples are machine washed along with other clothing items on 'normal' cycle with warm water temperature approximately 40°C and detergent as recommended by the manufacturer.

After washing and rinsing cycles are completed, remove stitching along three sides and opened out. Hang to dry with only the three parts touching at the line of stitching.

Assess the staining of the white cloths against corresponding control white cloths and the grey scale for staining

Assess the test specimens for fading against the control and the grey scale for colour change. Those fabrics which show a change of 4 or more when compared to the grey scale will be deemed satisfactory.

#### **Results:**

None of the fabrics tested showed a colour change or bled colour into either of the adjacent cloths, all scoring 5 on the grey scale.

#### **A.6.4. ISO 105-B02 Colourfastness to artificial light: Xenon arc fading lamp test.**

This method makes use of both rectangular cells and cylindrical cells; this is economical in the use of the blue wool references and permits all of the fabric samples to be tested simultaneously.

##### **Method:**

A light fastness tester M237A with a MBTL (mercury/tungsten) fading lamp which correlates with both Xenon arc and day-light was used to conduct this experiment.

A set of eight standard blue wool dyeing known as 'Blue Wool References' are exposed to the same light source as the specimen fabrics to be tested. These eight pieces of cloth are dyed with different dyes of varying resistance to light. (number 8 has a very high resistance to change by light). In general it can be said that each standard is approximately twice as fast as the one below it.

The approximate number of hours required to fade each standard to a grey scale of 4 is indicated in the table below -

Blue Wool Standard	Number of Hours
1	5
2	10
3	20
4	40
5	80
6	160
7	320
8	640

Strips of the blue wool reference standards are placed in the correct numerical order, in a rectangular cell.

This cell is placed in the fastness tester along with the fabric specimens to be tested.

The fabric to be tested is mounted onto thin cardboard using double sided tape.

Half the fabric specimen is covered with card so that it is not exposed to light

Once the fabric is mounted the samples are trimmed to 89mm x 13mm.

Each prepared sample card is mounted onto the protruding hook on the stopper and fed into the cylindrical cell and the stopper replaced.

The prepared cells are inserted into the appropriate holders around the ring inside the fastness tester, ensuring that all samples face towards the lamp.

The samples are checked after 4, 8, 12, 16, 36, 60, 80, 160 hours respectively.

Set the preset counter to turn on the lamp.

For this experiment the fabrics will be exposed to the light for up to 160 hours. Fabrics which register 4 or greater than 4 on the grey scale will be deemed satisfactory.

This amount of time was chosen by the researcher because an enthusiastic bowler would expect to wear the garments for approximately 160 hours during a season i.e. 65 games of approximately 2 - 2½ hours duration. During tournaments any player may play 3 games a day. Although the garments may not be subjected to bright sunlight for the entire time, different parts of New Zealand experience different intensities of light and any fabric which resisted fading after 160 hours of exposure to the fade meter would err on the generous side of acceptability.

In this research a degree of fading equal to 4 on the grey scale after 160 hours exposure to the lamp would be considered acceptable for this set of clothing.

### Results:

All of the fabrics used in the final garments (Table 6.6) performed to an acceptable standard after 255 hours exposure to the Xenon arc fading lamp.



Figure 6.1. ISO Blue cloth samples after 255 hours exposure to artificial light.

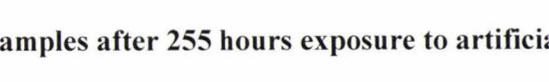
Name of fabric	Fabric sample		Degree of fade
	Covered area	Exposed area	
Merino max Black Used in jackets			N/C
Polar fleece Used in jackets			4/5
Merino Max (Grey) Used in prototype			4/5
Fabric from Earth, Sea and Sky (black) suitable for jacket			4/5
100% Merino (black) used in prototype long sleeved top			N/C
Coolmax™ (face side) Used in tops			4/5
Coolmax™ (under side) Used in tops			4
Merino and Tactel™ Used in shorts			N/C
Cotton polyester knit Used for contrast			N/C
Cotton polyester knit Used for trousers			N/C
Cotton and elastane 0 Alternative for shorts and contrast			3/4
Polyester rib (light grey blue) Alternative for shorts and contrast			4/5
Sample 1 Red orange			3
Sample 2 Pink			3
Sample 3 Aqua stripe			4
Sample 4 Yellow			4/5
Sample 5 Multi stripe			N/C

Figure 6.2. Results of fabric samples after 255 hours exposure to artificial light.