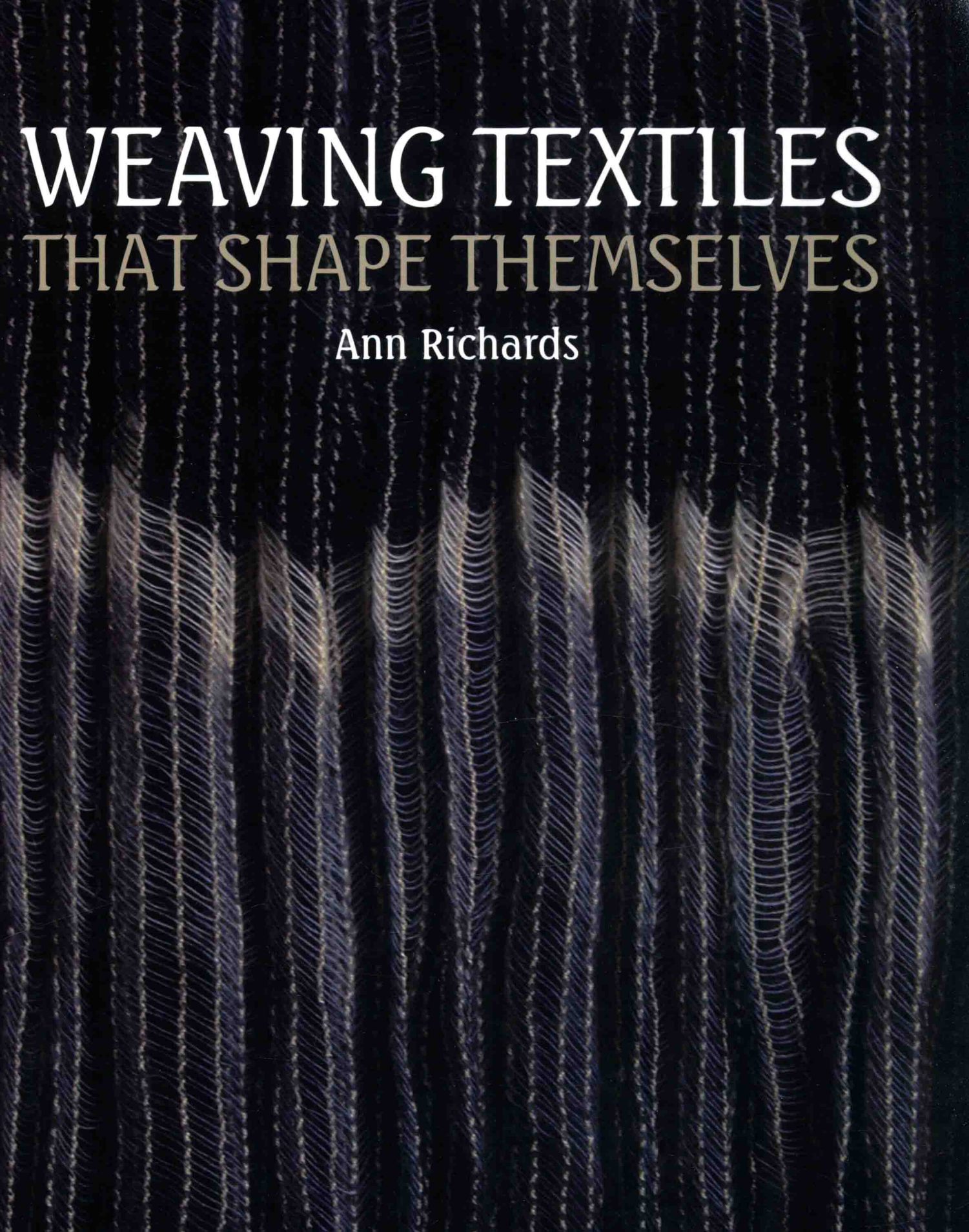
WEAVING TEXTILES THAT SHAPE THEMSELVES

Ann Richards



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Frontispiece: 'Dragonfly Pleat' scarf. Linen and silk.

Dedication
To my mother.

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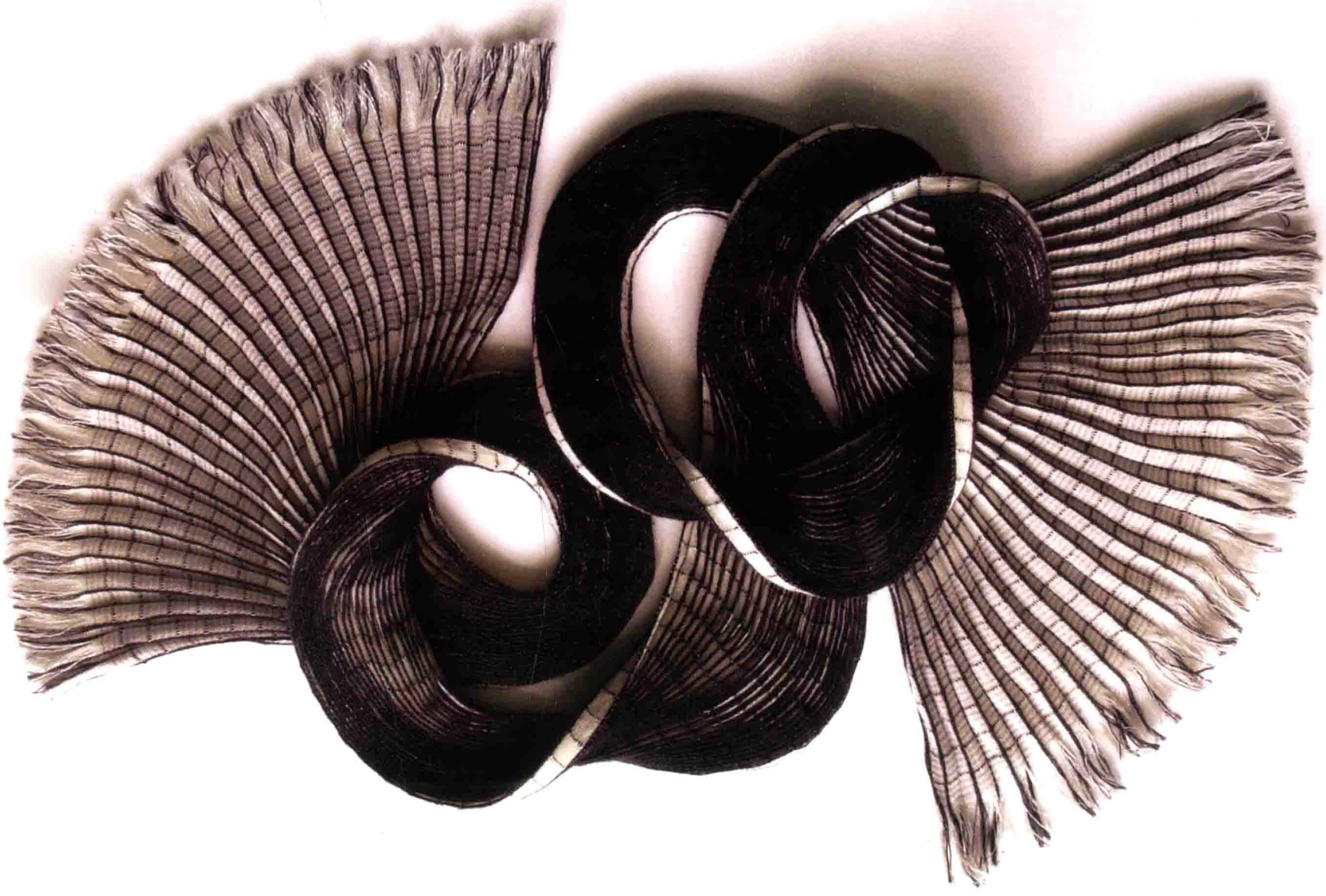

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INTRODUCTION: Woven Textiles as Self-Organizing Structures

> The structure of a fabric or its weave – that is, the fastening of its elements of threads to each other – is as much a determining factor in its function as is the choice of the raw material. In fact, the interrelation of the two, the subtle play between them in supporting, impeding, or modifying each other's characteristics, is the essence of weaving.
>
> Anni Albers, 1965

In some ways, the title of this book is, of course, meant to be playful and a little provocative. Designing and weaving textiles is hard work. Why do I want to say they can 'shape themselves'?

It makes sense to talk about 'self-organization' in designed structures because good design is not merely the *imposition* of form, but depends also on what materials and structures can do. Although the designer can start with a specific aim in view and choose what elements to put together, the materials and the structure will determine what happens, sometimes in surprising ways. Through complex interactions, these elements may organize themselves into something rather different from the intended design. This can perhaps give a

'Doublecloth Loop' scarf, in spun silk and crepe wool, designed to be interlaced around the neck in a variety of different ways. The crepe wool weft gives a textured surface to the scarf, and changes in weave structure create flared borders.

disappointing result but it may also, sometimes, produce something more subtle and interesting than the designer's first thought. Even an apparent failure can form the germ of a new idea. So it is necessary to be constantly attentive to this 'subtle play' of material and structure and be ready to respond, making best use of their characteristics. The design process must be a series of experiments, with the designer reflecting carefully upon each result and trying to understand what is happening before deciding on the next step.

Complex interactions of this sort are characteristic of all designing that is pursued through the process of making, no matter what the material, wood, clay or metal. But woven textiles show this 'self-organizing' tendency to a striking degree, especially if very strong contrasts of material and structure are used. Powerful textures can emerge during wet finishing, from the interplay of fibre, yarn twist and weave structure. Such fabrics undergo a surprising transformation from the smooth, flat state that they have on the loom, to the textured surfaces they develop when they have been soaked in water. As water is absorbed, yarns of differing elasticity pull against one another and ripple or buckle the fabric.

The most dramatic effects are produced by yarns that are very highly twisted and these form the main focus of this book. High-twist yarns can create striking, three-dimensional effects, because the stress imposed by the spinning process gives these yarns considerable energy, which is released by the addition of water. Spontaneous shrinking and spiralling movements of the yarns then cause the fabric to crinkle or pleat, creating highly textured, elastic fabrics. It is also possible to vary the yarn twist or weave structure in different areas of the fabric, resulting in differing amounts of contraction, so that rectangular pieces of fabric assume flared, curved or irregular lozenge shapes when they are wet finished. These textiles can truly shape themselves.

The book begins with an introduction to the physical properties of different textile fibres, the structure of yarns and the influence of yarn twist on the properties of yarns and fabrics, since these factors form the basis of design in woven textiles. Chapter 2 aims to give some historical context, since some techniques go back thousands of years. Chapter 3 deals with yarn counts and how these can be used for calculations of yarn diameter, cloth setting and twist angle, which provide a sound basis for weave design in general, but are particularly useful when working with high-twist yarns.

The next four chapters cover the use of various weave structures that work well with high-twist yarns and contrasting materials. This section is not intended to give an exhaustive treatment of different weave structures, since many excellent books on this topic are already available. Rather the aim is to draw attention to fundamental characteristics and properties of different *groups of structures*, showing their potential for creating textured fabrics.

Chapter 8 deals with practical techniques for handling high-twist and difficult yarns. This is followed by a short chapter, which briefly touches on some topics related to the main theme: the use of synthetic shrinking yarns, other methods of creating textured effects and shaping, and the use of high-twist and shrinking yarns with textile techniques other than weaving.

The concluding chapter discusses sampling, building on experience and the idea of design as 'reflective practice'. When working with powerful yarn twists, the unpredictability of the interactions means that apparently modest changes to any of the elements can create major repercussions within the fabric. So although there are many examples throughout the book (some with details of yarns and cloth settings), there are no projects in the form of detailed 'recipes' that are intended to be followed exactly, since any departure from precise specifications could considerably change the result. The availability of particular yarns is always variable, so it is much better to understand general principles on which personal experience can be built. However, the final chapter includes some suggestions for sampling that I hope will be helpful as a starting point for anyone who has not worked with these yarns before.

Although high-twist yarns and strongly textured textiles form the main focus of the book, I hope that much of the information on both technique and design may be useful to weavers generally. I have included illustrations of textiles by many designers and artists, and have referred in the text and bibliography to other weavers who are doing impressive work in this field. So I hope this book will also serve as a celebration of the variety and beauty of the textiles being produced in this most exuberant area of weave design.

OPPOSITE:
Wool and silk crepe yarns are played off against stiff metal yarns, to create close-fitting bracelets with rippled edges.

CHAPTER 1

FIBRES, YARNS AND WEAVE STRUCTURES

> A deep, intuitive appreciation of the inherent cussedness of materials and structures is one of the most valuable accomplishments an engineer can have. No purely intellectual quality is really a substitute for this.
>
> Gordon, *Structures*, 1978

Replace the word 'engineer' with 'designer' in this quotation from Gordon's excellent book *Structures*, and you have a good description of a successful designer/maker. There is no substitute for *working* with materials and processes to develop a deep, intuitive sense that goes beyond theoretical knowledge. Technical specifications of the properties of materials and structures are inevitably measured on the basis of 'other things being equal'. In the real situation of designing, of course, other things never are equal – everything is going on at once! This complexity can sometimes seem unmanageable. And it is here that an intuitive sense of the 'cussedness of materials and structures' really pays off.

All the same, it is well worth knowing something about the scientific measurements of the properties of different materials and structures. This forms a useful base on which to build the 'tacit knowledge' that can only be acquired through practical work. This chapter deals with some basic characteristics of fibres, yarns and weave structures and the way these affect the finished fabric. Although this involves going into apparently dry technical details, it is worth understanding these basic principles, because so much of the work of making textured textiles relies on subtle differences of material and structure. Also, in the process of examining these various properties separately, the difficulties of designing become apparent. Time and again, it is the *interplay* of properties that is important.

A fabric that spontaneously pleats itself is shown in the loomstate (top) and after wet finishing. I was a beginner in weaving when I first became aware of this effect, while trying to make a fabric with a smooth, flat surface. At the time, I was not too pleased. Later, I came to appreciate the way the cussedness of materials and structures can sometimes be a gift to the designer!

The Properties of Textile Fibres

Although a very wide range of materials can be used to make textiles, the vast majority of all textiles made from natural materials are in cotton, flax, silk or wool. So I want to look at some properties of these common materials that are particularly relevant to their use in textiles.

Strength

One of the most important properties is strength. Scientifically, this is measured by seeing how much weight a sample of the material can support before it breaks, and such tests show that flax is a very strong fibre, while silk and cotton are of moderate strength and wool is very much weaker. Weavers tend to check the strength of yarns by pulling on them to see how easily they break, which is clearly a rough and ready equivalent of the scientific test, and gives similar results. (This is not, of course, strictly comparable with the scientific test, which is done on a sample of the *fibre* itself. As weavers, we are doing our test on a structure – the *yarn*. The structure imposed by the spinning process also influences the strength of the yarn.)

Toughness

But, of course, some of the problems that arise in weaving are not really about strength as such. For example, although linen yarns are strong in the sense that they seem hard to break deliberately, they actually break more easily during weaving than silk, cotton and wool yarns, which are not as 'strong'. The issue here is *toughness*, the ability of a material to absorb energy without breaking. Silk is much the toughest of the natural fibres, with wool and cotton much less so, while flax is relatively brittle. A small amount of damage to a flax fibre easily starts a crack that runs rapidly right through the fibre and causes it to break. This ties in with the experience that linen yarns are easily damaged by the heddles and reed. A simple test for abrasion resistance is to hold a short length of yarn under tension and run a fingernail back and forth along it. It can be surprising to see how an apparently 'strong' linen yarn will sometimes break easily under this treatment. Also a shuttle hitting a linen end stuck in the middle of the shed will often snap the yarn, when a silk yarn would simply absorb the blow. In this case, it is not really the *suddenness* of the force that is the main problem, but the amount of energy the shuttle has as it flies through the shed. It not only starts cracks but also has the energy to propagate them rapidly through the material.

Stiffness

There are also often tension problems with linen yarns because flax is a very *stiff* fibre, compared with silk, cotton and wool. These differences can easily be sensed when handling yarns in these different materials. The flexibility of the wool can readily be felt and seen, as it is easily extensible, and it also shows good elastic recovery, springing back to its original length. Cotton and silk seem moderately flexible, and flax is very inflexible. Many of the weaving difficulties associated with linen yarns are due to the extreme stiffness of the flax fibre. Any slight differences in the tension of individual warp ends makes weaving difficult, compared with a wool yarn that would easily absorb these variations. Also, flax only shows elastic recovery over a small range of stresses. Beyond this point it will not spring back to its former length, so any individual threads in a warp that are accidentally stretched will become slack and interfere with weaving.

Fibre Properties in Textured Textiles

It is clear that strength and toughness are the most important properties of textile fibres, in terms of their general suitability for weaving, especially as warp yarns that must withstand both tension and abrasion. However, from the point of view of designing strongly textured textiles, the *stiffness* of fibres is particularly interesting. At first sight, the fact that linen is so stiff seems to mark it out as difficult to work with, and it is certainly often described as 'unforgiving'. But, quite apart from the fact that linen is a very beautiful material and well worth the extra effort needed in handling it, it is very useful when designing textured textiles. The extreme contrast between the stiffness of linen and the flexibility of the other natural fibres gives plenty of scope for playing these different qualities off against one another to create textured effects.

Variations in fibre stiffness also mean that the properties of high-twist yarns vary, depending on the material. Twisting fibres into yarns imposes a stress on them, and this is the cause of the texture produced by high-twist yarns. Stiff materials that resist twisting react strongly to stress and so can make particularly effective high-twist yarns. The mechanism of this stress reaction will be discussed in more detail later in this chapter. Stiffness is determined not only by the intrinsic differences, for example between such fibres as cotton, silk and wool, but also the thickness of the fibres. The stiffness of a fibre increases more rapidly than its diameter, and consequently wool, with its wide range of fibre diameters found in different breeds of sheep, is a particularly interesting material for high-twist yarns. Different reactions are given by woollen yarns constructed from fine fibres, and worsted yarns made from thicker longwools. The impact of these differences will be explored in Chapter 4.

Structure of Yarns

When, as weavers, we carry out informal tests of the physical properties of our materials by breaking yarns and so on, we are confounding the properties of the fibres themselves and that of the structures made from them – the yarns. The structure of yarns varies and can considerably modify the properties of the fibres.

This fabric uses the effect of soft pleating shown at the beginning of this chapter, but now the pleats also have a rippled effect, because of the contrast between stiff linen yarns and more flexible silk ones.