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Fibre Treatment and Spinning Techniques

for West Coast Tapestries

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FIBRE TREATMENT AND SPINNING TECHNIQUES FOR WEST COAST TAPESTRIES

My West Coast tapestries rely for their artistic effects upon the fibre treatment and hand spinning techniques that I have developed over the past few years. For many tapestry weavers, commercial yarns provide the colour and shade range, and the degree of texture necessary to produce the visual impact of the weaving. These weavings, beautiful in their richness, subtlety and variety of colour, and strong in their compositional statements, use yarns as the transparent medium from which the visual image and aesthetic statement emerges. For the tapestry weaver relying upon commercially spun yarns and fibres, however, the artist is limited to the variety of colour, shade and texture available from the manufacturers; the painter, on the other hand, can blend an infinite range of colour and shade from the paints commercially available. These tapestry weavers, then, are bound not just by the framework of their art—the warp and the weft—but also by the limitations imposed by the commercial yarn industry. The fibre preparation and hand spinning techniques that I have developed gives me much more flexibility in providing the range of colour, shades, sheen and texture that I need to produce the West Coast imagery of my
tapestries -in much the same way that a painter mixes colours on a palette to produce his images.

In my work, I attempt to reflect the joy, serenity and contentment I find in the misty coastal scenes of British Columbia. It quickly became clear to me that commercial yarns were incapable of producing the statement that I wished to make. Through long and careful experimentation with blending, spinning and dyeing wool fibres, I learned to create yarns that control texture, colour and shade -and thus light values and depth of field -in my tapestries. What I strive for is an image created by fibres that, from a distance, appears to be a painting of a West Coast scene but which, on a closer approach, emerges as a tapestry weaving, and the discovered textures of the fibre become the key to the aesthetic and emotional experience of the piece. Only through the special fibre preparation and hand spinning methods I have learned have I been able to produce the tapestries that I wish to.
"Variation in Mood, Grice Bay, Tofino"
II. FOUNDATIONS - THE WARP

What I need for the warp is a smooth fibre which has both flexibility and strength - I have to be able to lift the warp hundreds of times without stretching or distorting the strands, and, at the end of this abusive treatment, have a warp that has the strength to last indefinitely into the future. As Jess Brooke emphasizes in her book, *Tapestry Weaving*, "...the warp yarn should be smooth and strong."¹

Two fibres provide the qualities necessary for a good warp thread for my tapestries - linen and cotton. Because the weft in my tapestries varies so much in thickness from one part of the weaving to another, I place great demand on the ability of the warp to stretch without distorting. Wool, spun in a tight worsted yarn, has the necessary strength; however, its great elasticity results in distortion when the weft yarn varies in thickness to any degree. Cotton has "...the most elasticity..."² of all fibres used for warping, yet has sufficient strength and durability to provide a solid foundation for a tapestry without distorting. Linen is "...lustrous, long-lasting, and has great strength."³ While it "...has little elasticity",⁴ its strength and durability makes it an ideal warp material. I have found that the length of the warp strands together with the width of the "packed" margin at the
bottom of the loom (*Sample 1*) provide enough flexibility to overcome linen's lack of elasticity.

For a cotton warp, it is essential to choose the best cotton available to ensure a good staple. Egyptian or Pima cotton in a sliver preparation is to be preferred. "A good thread with plenty of twist and sound joins is a prime requisite..."\(^5\) for a strong warp. I use a long-draw technique loading much twist into the thread. I have found that a TPI of 12 to 15 in the single gives me the strength of thread I want. The final warp yarn can be of 2, 3 or 4 ply, depending on the size of the weaving. The spun yarn next must have its twist set by transferring it under tension from the bobbin to a PVC pipe which has holes drilled in it at one inch spacing. The "pipe" bobbin is next placed in a pan of water deep enough to allow the bobbin to float freely, and then the water is boiled for 30 to 60 minutes depending on the amount of yarn, after which the yarn is wound on a niddy noddy to dry.\(^6\) The dried yarn is ready to be warped on the loom. I do not size the warp for my tapestries (*Sample 2*).

For the purposes of this paper, I used a linen warp for the sample tapestry (*Photo 1 - this is my thesis project*). I chose line flax which gives the strongest, smoothest finished yarn. The line flax used for my sample tapestry was spun in a traditional method. A distaff was dressed with a strict of line
flax. I spun the fibre with moistened fingers and a sliding, backwards draw. As with any warp thread, I had to take care in the spinning to avoid any thin sections, as the twist will build up in a thin section, causing the thread to become brittle and possibly snap. The thread in the sample tapestry was spun and plied with a typical TPI of 6 to 7 and at approximately 2200 yards per pound (Sample 3). However, I have used tow flax as well for larger tapestries that use a heavier weft. For a tow flax warp, I purchase the fibre in sliver form and spin with moistened fingers, again using a sliding, backwards draw. Tow tends to produce a heavier warp, suitable for larger tapestries (Sample 4). The demands on the skills of the spinner are greater in dealing with this thicker linen yarn. As the Olive and Harry Linder point out: “The real test of skill is to make a heavier yarn from flax fibre.” I use the same process to set the twist in my linen warp that I do for cotton.

My looms are simple home-made wooden frames which use small nails to anchor the warp top and bottom (Photo 2). The nails are spaced to produce 5 to 8 EPI (ends per inch). A larger piece using a heavier weft will have 5 EPI; a smaller piece using a finer weft will have 8 EPI. Where sections of a weaving require a particularly heavy weft and other sections require a finer one, I sometimes double warp for the heavy weft area and single warp in the fine areas. In order to create
the necessary tension, I check the warp threads as I go along, tightening any slack that appears in any previously warped threads. The outside warp thread on both sides of a small to medium loom is strengthened with a small wooden dowel or metal rod; these are tied to each of the side frames of the loom to ensure that “pulling in” is minimized. For my large looms, I use the conventional method of ties from the outer warp threads to the edge bars of the loom; these ties I keep at about 2 inches apart. At the bottom of the loom I weave in a 3 inch wide strip of heavy cardboard for packing. Then, I spin from from a sliver a thick worsted rug-type thread which I then ply and weave above the cardboard as a selvedge (Sample 1).

I am now ready to begin work on the image of my tapestry.
"September Evening - French Beach"
IIIIII. SPINNING AND FIBRE TREATMENT USING NATURAL, UNDYED FIBRES

From late October to early April, a goodly number of my West Coast seaside days are grey and overcast, as one weather system after another moves on to the coast from the Pacific. White, grey, black -these are the colours of this coastal world, with distances blocked out completely by the clouds or, at best, the shapes of the distant points of land and the hills and mountains made somewhat indistinct by the mists that are a part of these days. For the most part, it is a peaceful, tranquil world, the raging Pacific storms coming only occasionally and, hence, are memorable. As I look out at this seaside world, I am constantly struck by the subtle interplay of shape, movement and light, by the power of this landscape to bring calmness and reflection to the human soul. To capture this world in fibre, I have had to develop my own techniques for preparing and spinning my yarn -for preparing the materials of my palette.

In preparing my palette, I have to consider the unique qualities and limitations of fibre in producing a visual image that captures the mood and spirit of my beloved coast. There are a number of factors that govern my final choice of fibres from which I will build my image: the colour of the natural
fibre, the light reflective value of the fibre, and the textural potential of the fibre—all of these being subject to the effects of particular fibre preparation and spinning techniques. Let me expand on these factors. The three fibres of choice in my tapestries are wool, mohair and ramie—each chosen because, alone or together, they produce the visual impression that I need. Wool gives me a range of natural colour from white through the various shades of brown to black. I select commercial slivers from New Zealand because I can get consistent colour from sliver to sliver and because the wool is of a good quality, clean and of long staple (Sample 5). The wool of my choice is usually Romney: a wool of good colour, long staple and strength. Wool as a material of the palette, however, produces an image that tends to be flat, without a high reflective sheen. Sometimes to pick up the reflective light tones of light on water and in the sky I will use mohair from fleeces cut from our farm’s Angora goats. We take particular care to feed our goats with a high protein diet to ensure a fleece with fine, long staple of high sheen—a fibre that as spun yarn possesses a shiny, sparkly surface. Its limitation is colour: our goats give us a white fleece. My tapestries demand a range of colours and tones which possess the light reflective values of water, of wet rocks, of misted trees, of an overcast, moisture-laden sky, in full light and in
shadow. To produce these effects, I sometimes blend the mohair with wool, gathering the colour of the wool with the light reflective qualities of mohair (Sample 6). Thus, I am able to produce a palette which gives me substantial control over light reflection using natural fibres in their natural colour. The amount of mohair in the blend impacts on both the resulting colour and the intensity of reflected light; the shade of the wool sliver governs the depth of colour in the spun yarn. The interplay of fibres gives a remarkable range of colour and of light reflective values -more than enough for me to produce an image built of fibres which captures the spirit and mood of Canada's West Coast. While lacking the sheen of mohair or a mohair-wool blend, another fibre -ramie -has qualities which assist me in creating the effect of light on a dull, overcast West Coast day. Its long staple produces a fine, tight thread of stark whiteness. By using the ramie yarn sparingly, spun in a worsted style and plied, to create a sense of the light source - the bright point of the cloud cover behind which is the sun -I am able to create a light source that gives shape to the light and dark faces of rocks, trees, hills and mountains. To complete the illusion of light flowing across a body of water, I often will work a horizontal band of ramie or of mohair into the water area at the point where the land meets the water in the mid-ground. This stark white band produces the illusion of
the reflective light that parallels the distant shore in nature *(Photo 3 & Sample 7)*.

As in any design, the control of colour values in my tapestries is very important. My selection of fleece in the sliver form gives me some variation in that the slivers have many shades of the natural colour. Even with this, however, I would be too limited in the range of colour and shade I require for a weaving. I have to rely upon the fibre preparation methods and the spinning techniques that I use to give me the range that I need. Blending natural fibres is critical to preparing the palette of fibre for these West Coast tapestries. New Zealand wool producers send both natural coloured slivers and blended slivers. The blended slivers are a mix of white and dark and come in greys -but these are fairly consistent blends, so that I can rely upon the base shade in sliver after sliver *(Sample 5)*. The art comes in blending the various shades of slivers together through a carding process to produce whatever colour or shade that I want. Carding in different percentages of a darker or a lighter shade of fibre produces much of the range and subtle shift of colour tones the weavings require *(Sample 8)*. By adjusting the completeness of the blending of fibres, I produce a mottled spun thread that suggests the shifting value of a tone or shade of colour in nature *(Sample 9)*. Indeed, the spinning of the yarn gives me further
capacity to produce variety in colour. A tight worsted method intensifies the colour, whereas a modified woollen method tends to soften the intensity of the colour (Sample 1). Using a novelty spinning technique to produce a slubbed yarn produces the effect of highlights in a dark segment of the weaving. The loosely spun portion of the yarn takes on a lighter hue than the base colour of the more tightly spun yarn. Other novelty spinning methods produce similar colour variations in the yarn (Sample 10). I achieve further colour effects through plying. It is necessary to work carefully in plying the yarn, because the effect I want to avoid is that of a barber pole—two colours twisting in a spiral! First, I do not ply sharply contrasting coloured singles; rather, I work with shades of a colour—for example, two near shades of grey. When I span two colours, I ensure that the difference between the two is minimal, plying, for example, off-white with the very lightest shade of grey (Sample 11). I also use my own techniques of plying in order to achieve the results that I desire. To avoid any hint of the "barber pole" effect, I reduce the TPI of the ply in order to sustain the appearance of the one shade for a longer period of time in the actual weaving. Two singles spun with a TPI of 6 would normally be plied with a TPI of 3; I will, however, reduce the TPI in the ply to 2 or even .5 or less. The eye, being the interpretive organ that it is, tends to average the colour
tones of this plied yarn weaving in and out of the warp (Sample 11).

Just as colour plays a major part in producing the visual impact of my tapestries so does the texture of the spun yarn. All of my tapestries use finely spun worsted yarns and thick, bulky woollen yarns both in singles and in plies, although I find that I use more singles than plies. The tight worsted yarns, besides their fuller, more intense colour, produce a sense of surface, of definition. Whenever I want to produce the effect of a hard surface or a flat plane, I work with a single or plied worsted. In spinning worsted yarns, I divide the sliver, already in a semi-worsted preparation, into strips which I then spin directly into a worsted single. If I need to blend slivers to achieve a particular colour effect, I divide the slivers into the proportions that I want to mix, blend the fibres using a drum carder and then re-card until I have the fibres mixed thoroughly. I next remove the blended fibre from the drum in a full batt which I then divide longitudinally into strips. I spin the strips directly into worsted singles of varying TPI and weight. For a tighter, smoother worsted yarn, I take more care with fibre preparation. I charge hand cards with a sliver, lightly card, clamp the two cards together, and draw the fibres from the teeth of the cards. These fibres are then drawn into a pencil sliver and spun in a worsted short-
draw method. There are times when I will ply two or three worsted singles to produce greater textural effects than singles can \((Sample \ 1)\).

The bulkier yarns prepared and spun in a modified woollen method produce softer surfaces and are ideal for producing the effects of vegetation and the rough surface of agitated water. The deep texture that these yarns create generates a sense of depth and perspective for the tapestry.\(^9\)

To produce this modified woollen yarn, I spin from the commercially prepared sliver using the woollen long-draw style. Because the sliver contains many short fibres and noils, I am able to produce a modified woollen yarn. If I want a highly lofted and soft yarn, I adhere to the traditional method of producing a woollen yarn using hand cards to create a light, airy rolag.\(^10\) For the spinning, I use the traditional woollen long-draw \((Sample \ 1)\). Plying singles also produces particular textural effects. Rarely have I found it necessary to go more than a 3 ply. Indeed, the variation in texture possible in 2 ply or 3 ply yarn is tremendous. Two ply yarn in itself produces a range of effects. To begin with, two ply yarn lacks the roundness of a single or a three ply yarn; in a finished tapestry, an area of 2 ply yarns tends appear rougher than an area of singles and as textured as many 3 plies. The most common ply (single 22 ply s) produces a unique texture; by
varying the spinning-plying pattern I am able to generate different textures using 2 ply yarn. For each method - single ss ply z, single sz ply s, and single sz ply z - I achieve a slightly different surface texture in the tapestry. Three ply yarns have the potential for even greater variety in texture. By mixing differently spun singles - single sss, single ssz and single szz - and then using a different plying - ply z or ply s - I gain even further surface texture from the yarn. For a quick bulky yarn with lots of texture, I sometimes use a Navajo ply (Sample 11). Slub yarns also provide me with the texture effects that I need. Again, I spin the yarn directly from a sliver or a blended batt using a sliding back-draw. To increase the amount of texture in the yarn I will ply two slub yarns together; to give a different, more complex texture, I sometimes ply a fine, tight worsted single with a single slubbed yarn of the same colour, using the worsted as a binder (Sample 10). Another novelty spinning technique I use produces a fuzzy yarn. I spin this yarn directly from the roving using a sliding backward draw. While I draft with one hand, I pluck out some fibres with the other. This produces a fuzzy single yarn (Sample 10) with which I ply a fine worsted binder single. A tufted yarn produces some of the special textural effects that I want to achieve. I ply two singles spun zz plied s and while plying I insert small clumps of fibre between the strands (Sample
10) By using combinations of these yarn types, I am capable of creating a wide range of textural effects.

The aesthetic result of the tapestry comes from the image that these yarns produce when woven together on the loom. It is the mix of colour and texture, of the yarn, that builds the composition and mood of the piece. Clearly, the weaving technique impacts on the way in which the spun yarn produces the final image. It is this interaction of spun yarn and weaving techniques that I want to examine next.

Each area of the weaving demands its own weaving technique to produce the proper visual impact of colour, texture and form. Plain-weave (tabby) is effective for those flat surface areas of the tapestry - particularly the water, the distant hills and mountains and the sky. However, even in these areas, when a more textured, agitated surface is needed, I will abandon plain weave for weaving techniques that enhance more the texture of the spun yarn. For foreground vegetation (both brush and trees) and for water and sky areas requiring a more agitated surface (and to a lesser extent, the mid-ground), I use wrapped techniques involving a variety of stitches and knots. I will describe the use of these techniques in more detail later in this paper.

In any visual art piece, composition is a fundamental element in the success of the work. Since I work in a pictorial
tradition, I must provide the observer with the elements of the natural scene - the water, the shores, the rocks, the trees and bushes, the hills and mountains, and the sky that make up the West Coast. These elements I must also place in balance and appropriate juxtaposition, so that the final image is not only a reflection of reality but is also pleasing to the eye and to the spirit. Working in natural hand spun fibre is not the disadvantage that at first it might seem. The textured yarns I have described above, applied to the tapestry using a variety of wrapped weaving techniques, produces the rich texture of the dark foliage of the shrubs and trees that always frames a view from our shore. And because our waters are island studded and our land is deeply fjorded, the mid-ground and background of our world so often is dominated by hills and mountains; their appearance in my weavings, formed by hand spun yarn, produces the soft, indistinct surface that distance and overcast skies produce in nature. When I look at the pebbly beach and the water washing it, when I look out across the bay or up the channel, when I look up at the grey, overcast sky, I see forms and shapes whose surfaces are infinitely - but subtlety - varied in colour and texture. The uneven surface of plain weave creates an harmonic reflection of this natural world. Variations in the fibres I have chosen and the blending,
spinning and yarn techniques that I have used add to my work's echo of the wonderfully varied world around me.

I find that the seascape here on the West Coast has certain constantly repeating visual themes that I embed in the composition of my tapestries. Dark forms always are close to the viewer on our overcast days - as though in shadow because the light is generally diffused behind cloud. Distant forms are lighter than those in the foreground, and those in the mid-distance are darker than those in the background. The background forms become lighter and lighter in colour as the distance increases. Linking foreground, mid-ground and background is the water and the sky. There must be a pleasing balance between the dark, heavy, frame of foliage in the foreground and the lighter in colour - but still massive in form - hills and mountains of the mid-ground and background. The patterns of water and sky link the solid forms of vegetation and land masses and also guide the eye from foreground to mid-ground to background. These are the compositional elements that my spinning and weaving must bring into harmony. And because of the mechanics of tapestry weaving, it is necessary to progressively build foreground, mid-ground and background as the tapestry progresses, unlike oil painting where the artist can work on one section of the painting at a time.
I have three elements to deal with in creating the foreground of my tapestries: the trees and shrubs that frame the scene, the rocks and beach that lies in front of the viewer, and the water immediately in front of the beach or in front of the viewer. The trees and shrubs often frame the piece on the right or left hand side of the weaving; this placement is important for the developing perspective, which I will discuss later in this paper. Because these forms are close to the viewer, a sense of depth and texture is essential if the pictorial quality of the piece is to be sustained. To achieve this, I use the darkest sliver available to spin a thick, textured fibre. I want to generate variation in colour, in texture, in the sense of the reflected light even in what in fact is shadow produced by diffused light. Novelty spinning techniques are useful here -slubbed yarns, fuzzy yarns, and tufted yarns help create the textures that I want. Any single that I might feel I need will be done in a modified woollen method to maximize the texture and bulk of the yarn. Two and three plied yarns spun in varying methods also build the texture and colour variations that I need. In addition, I use wrapped weaving techniques to enhance the bulk and texture of the yarn. Each knot or stitch in wrapped weaving has the effect of exposing the colour and texture of a given yarn in a slightly different manner. A mix of Ghiordes knots (uncut), Swedish knots, Greek
Soumak, Oriental Soumak stitches, and chaining and twinning using the textured yarns that I have prepared and spun produces the depth and colour effects the tapestry demands (Sample 9). By using two to three warp threads for the knot or stitch, I can expose the texture of the yarn for a longer interval, thus enhancing the effect that I want. However, no single technique is responsible for producing the texture effects that I want; what is important is the mix of knots, stitches and warp intervals. I am also careful not to work these dark, textured areas horizontally across their width. Rather, I build a block of knots and stitches, working up as much as three or four inches; then I build up the adjacent block (Photo 4). The relationship between these blocks is also very important in producing the richly textured surface that I want. I leave frequent slits between the blocks, using only an occasional interlock or dovetailing stitch to tie them together horizontally. The slits allow each of the blocks to "float" somewhat in relation to each other, again enhancing the sense of the deeply textured surface of trees and vegetation. Where these foreground objects and forms meet the mid-ground and background, I also leave in a large number of slits; their resulting ability to "float" further increases the perception of depth and texture. Indeed, the whole perspective of the weaving, which offers a sense of receding distances, is aided
by loose attachment of this area of bulky, textured yarn to the adjoining areas of finer, flatter textures (Photo 5).

Colour effects are also important in this segment of the tapestry, and I rely on the interaction of fibre preparation, spinning and weaving techniques to give me the effect of shifts and shadings in colour of trees and vegetation on one of our grey, overcast days. I have discussed earlier in this paper the various methods of carding and blending fibre and the spinning techniques that I use to achieve colour variation. By blending and carding, I can create a range of shades, each one representing a subtle shift from the previous one. Taking one sliver of one shade, I create further shades by the spinning technique that I employ. The extent to which the single is spun woollen as opposed to worsted softens the intensity of the shade, the looser fibres allowing light to penetrate into the single; a more worsted single takes on a deeper shade, the more closely packed fibres reinforcing the shade of their neighbours. (Sample 1). Again, by increasing the TPI, I increase the intensity of the shade of the fibres. The tightness or looseness of two or three plied singles and the plying technique that I have used also produces variants in the shade of the yarn (Sample 11). The specialty spinning techniques that I use -slub, fuzzy, and tufted -also produce a range of shading, but in the single itself; these yarns are
potent in creating interesting and effective variations in shade (Sample 10). By impacting on the way light is reflected or absorbed, the spinning technique is key to producing the colour effects that I want.

I want now to outline how the spun yarn, when woven into the highly textured foreground of the tapestry, produces the range of colour and shade that I need. The surface exposure of any spun yarn - singles, doubles or plies - of the same colour and shade will generate a sense of the subtle shifts in light and shadow of trees and vegetation. By changing the interval in which the yarn is exposed to the viewer, I can achieve small but perceptible changes in shadings. When I want to create a sense of a mottled surface, I weave over a single warp strand. Whatever colour qualities the yarn has is exposed for the minimal interval, even though the next warp strand is covered with the same weft yarn. The points at which the weft yarn disappears and appears to the viewer takes on a slightly deeper tone than the yarn itself because of the effect of a micro shadow. In a very real sense, the yarn provides “points” of colour which reinforces in the viewers eye a highly textured, uneven surface. An increase in the number of warp threads wrapped at a time increases the exposure interval of the yarn, producing less of the “point” effect and allowing more the texture of the spun yarn to
produce the colour variation one sees in nature (Photo 6). The visual effect of this longer exposure interval is to produce a sense of a heavier, more solid surface, although still highly textured. The deep surface relief that the slit weaving produces also generates colour effects even when there is no change in the base colour of the yarn being used. Because one part of the weaving "floats" higher than its neighbour, this yarn at the slit edge has more of its surface area exposed to the impact of light; whatever surface effects the spun wool has are enhanced, causing a shift in colour tone. The same coloured yarn on the recessed side of the slit, in a micro shadow of the "floating" surface, appears darker than its immediate neighbour on the same plane and the neighbour "floating" next to it (Photo 5). Used in this manner, any woollen method single produces some of these shifts in colour tone; this effect is easily intensified by going to a single novelty thread, or by using a simple or exotic ply of the same coloured fibre.

The flatter surfaces in the foreground - the water and rocks - are produced largely with plain weave, although at times I will use a specialty technique to achieve a particular effect (Photos 6 & 7). In nature, these surfaces are harder and more uniform than the trees and shrubbery nearby; nevertheless, it is necessary to create a sense of surface
relief to suggest closer and more distant objects. To produce this sense of perspective and texture, I rely more upon the actual colour of the fibre than the play of light on the yarn, although at all times the fact that I work with fibre with its unique visual qualities is important to the total effect of the weaving. It is critical in working in this part of the weaving that the source of light - generally diffused but nevertheless brighter from one direction - play its natural role in producing highlights and shadows. What I must work with, then, is with light and dark colour and shades as I produce the impression of light impacting upon the rocks, the beach and the water in the foreground of a natural scene. Because of the harder, flatter surfaces that make up these areas, I must adapt the fibre preparation, spinning and weaving techniques that I use. In working with rocky areas in the foreground, I know that the key to producing the sense of depth and perspective rests with the effects of shadows in relation to the light source. Colour gradations and contrasts give me the effects that I want. Profound contrasts between a light and dark surface indicate a deeply recessive surface - a rock that stands up from its peers. A less profound contrast indicates a less indented surface - surfaces that are closer to the highest plain. The mix of deeply contrasted areas and more subtle gradations produces the visual impact of a rocky seashore. Usually in working in
these areas, I want to maintain a consistency of spinning technique, allowing the colour to produce the effect of a surface of fairly high relief. To achieve this, I will spin in the worsted method a medium yarn of a TPI between 1 and 2. It is the blending and carding of the shades and colours of yarn that produces the variations I am seeking, not the use of various techniques of spinning and plying to exploit the colour potential of the yarn. The yarn's surface and the consistency of texture helps to generate a sense of the hard planes and surfaces of a rocky beach.

The water in the foreground of my tapestries requires very specific fibre treatment and spinning techniques to produce the realistic but “weaverly” results that I want. Water in a bay or channel has unique surface and light effects that I must re-produce. Close-up, water has a hard, yet uneven surface (yet this surface often is regular in its pattern because of the waves); further away, the surface becomes flatter. Tidal and current patterns also impact on the appearance of the surface in that the moving water picks up the flow of light, producing particular patterns of light and dark. The natural texture of plain weave is ideal in producing the rippled effect of water, so this weave pattern dominates the water areas of my tapestries (Photo 7). Because of the linear nature of waves, the horizontal weft lends itself to
reproducing the impression of a surface of water—that is, water is marked by horizontal bands of colour and light; even so, the dominating horizontal line of the weft yarn is marked by the pattern of over and under plain weave, thus generating the quality of the ripples that are the minor intervals in all wave action. The natural appearance of water, however, is a complex mix of the surface texture and the play of light on that surface. The fact that the appearance of water is influenced by the colours and light that surround it make water treatment in a natural fibre tapestry complex. In the foreground, where the waves are more distinct because of their proximity to the viewer, I try to reproduce the shifting pattern of colour in the individual wave. To achieve this, I will use three singles, unplied, as the weft in the plain weave. I place the darkest single in the lowest position, place a lighter one above it, and the lightest one at the top. The tightness or looseness of the spun singles will generate different degrees of surface agitation, so that I can modify the impression the viewer has of the water condition. When the weft is beaten into place, these combined singles produce a subtle shift in colour tone which parallels the effect light has on a wave: a dark base becoming lighter at the apex of the wave. As a bonus, the eye of the viewer interprets these weft lines as succeeding waves approaching the shore and thus
contributes to the overall perspective of the tapestry. But more about that later.

The shape of the surrounding land forms have a significant shadow effect on the water, and that effect depends upon the direction of light. At all times, I must ensure that the light source appears consistent in its intensity, its direction, and its interaction with the water’s surface. Any point of land or overhanging object produces a shadow effect, but because this is the surface of water, that shadow is softened, diffused, without hard edges; within that shadow, the surface characteristics of the water remain (Photo 8). Because the light usually is flowing from the distant background, the water closest to the shore of a point of land must be darker than that closer to the immediate foreground; there must be progressive lightening of colour and a corresponding reduction in the shadow area the greater the distance from the land mass. At the same time, within the shadow areas, the play of light produces highlights and deeper colour tones. By adjusting the blend of the roving before spinning or by using a flicked yarn, I introduce the highlights and slight shifts in colour tones into these darker areas. I do not allow these highlights and colour shifts to extend any great length of the horizontal line of the particular weft. In joining a shadow area to a non-shadow area, I use a diagonal
interloop weave or a simple diagonal weave. The intrusion of the land form into the water produces a disturbed water pattern since the water is being moved by both wind and tide. To create the effect of such disturbance, I weave darker bands of weft yarn into the surrounding lighter ones in a pattern of lines to produce the sense of interrupted flow. These lines do not extend for the full width of the water and serve to create the effect of compression and more flow of water around the point of land. I normally use a single of the same TPI and weight for these darker lines, since I am seeking a visual rather than a textural effect (Photo 9). Whether in shadow or in direct light, water close up will have unexpected surface variations due to the confluence of wind, tide or current. To achieve the effects of these, I will on occasion use a plied yarn in the foreground - the tightness of the singles that make up the ply and the tightness of the ply will depend upon how far from the immediate foreground the disturbance is.

The creation of a sense of perspective is critical to the success of one of my tapestries, and the water plays a key role in achieving the sense of distance. In working from the water surface in the immediate foreground through to the mid-ground (I always terminate the water surface at some point in the mid-ground), I am aware of the need to use progressively finer and finer yarn for the weft. Typically, the yarn I use for the
immediate foreground water will be of a medium weight and have a TPI of 2 to 3 (this, of course, will vary with the size and scale of the tapestry and can vary when a special surface is required in this part of the tapestry); by the mid-ground, I will typically have increased the TPI 2 to 3 times, depending upon the distance the far shore is from the viewer's standpoint. In nature, just at the point where water meets land in the distance, there appears a band of light running against the distant shore. This is an absolutely flat, textureless shining. To recreate this effect, I spin a very fine yarn, use a plain weave and pack the weft very tightly. Sometimes I will use Ramie or mohair, which produce an intense white band of reflected light. The reduction in texture from foreground to mid-ground is very important in creating the necessary sense of depth and distance that the tapestry attempts to achieve. Texture alone, however, cannot give the water surface the perspective I need. The inlets, bays, harbours and coves of the West Coast are generally deep; their surfaces show a pattern of reflected light that comes from the flow of a deep body of water. At times this flow appears almost as a river of lighter coloured water moving from the foreground into the mid-ground; at others, its presence is known simply because the lightest part of the water follows the flow around land obstacles, at which point it widens and
becomes indistinct further into the mid-ground. Whether a river-like band of water or the lightest part of the water, the surface in the centre of this flow is smoother, at times almost glassy. In reproducing this visual effect in my tapestry (Photo 10), I must control the colour, surface appearance and weight of the yarn in such a way as to convince the viewer's eye that a flow of water is taking place. How far into the mid-ground, how light, and how wide the band is largely determined by the intensity and direction of the light source - the hidden sun. I adjust the colour of the foreground singles to produce this lighter area of water and continue to work it in a diagonal direction, reversing the diagonal around whatever point of land juts into the bay or inlet. I also increase the TPI and reduce the weight of the yarn from foreground to mid-ground to ensure that the viewer sees a flatter, harder surface in the distance.

The water serves as the transition from the foreground to the mid-ground in my tapestries. The deeply textured, rough dark shapes of the trees and shrubs in the foreground stand out above the surface of the mid-ground and background where they meet, giving a strong sense of planes and shapes that are close to the viewer (Photo 10). Any rocks or beach areas in the foreground have the reduced texture of a tighter spun yarn, the mix of some texture with careful colour shading producing
a sense of shadowing and uneven surfaces. The viewer’s eye follows the light segment of the water out from the foreground, around the point of land, into the mid-ground. The flow of colour and the progressive flattening of texture produced by the finer degrees of yarn that I use creates a strong sense of depth and perspective. What I do with any land forms in the mid-ground helps to determine the total depth of field of the scene. Because of the deeply fjorded nature of our coastline, many of our bays and inlets are narrow, with points of land intruding on both sides of a relatively slender body of water. I often work with a scene that has a land form in the mid-ground. In aesthetic terms, this land mass, although appearing lighter in colour than the heavy mass of foliage and trees of the foreground, nevertheless acts to balance the proportion of dark and light areas in the tapestry (Photo 11). In visual terms, this land mass helps to define the depth of field of the scene. Once again, I depend upon the colour and textural effects of the yarn to produce the result that I want. The mid-ground land form must be lighter in colour than the dark mass of the foreground vegetation, but darker in colour than the hills and mountains that make up the background (Photo 12). To produce these variations, I generally blend lighter colours of fibre into the base colour fibre I have used in the dark foreground. The degree of difference in colour
between the foreground mass and the mid-ground mass is dependent upon the direction of light, its intensity and the distance the mid-ground land mass sits from the foreground. For a given light source, the further away the mid-ground land is, the lighter in colour the blend of fibres must be. By adjusting the texture of the mid-ground land mass, I also change the sense of distance between the viewer's position and the point of land. A tight worsted single yarn in plain weave creates an unrelieved, flat surface which suggests great distance. A woollen type yarn in single or plied form, or a specialty yarn, in knots and wrapped weave, creates a textured surface that suggests a shore sufficiently close for the viewer to identify some details of its surface forms. It is essential, however, that the yarn be proportionately finer than the yarn used in the foreground vegetation in order to reinforce the impression of a receding distance between the physical forms that make up the tapestry. When working with this sort of mid-ground land form, I also work to adjust the colour tones somewhat to replicate the sense of deeply textured surfaces. A single with a slightly different colour tone, a specialty yarn, a plied weft, a particular wrapped weave technique—all these are used on a finer scale than I would in the foreground. I use weaving techniques similar to those that I use in the heavily textured areas of the the foreground, working in blocks and
using the various knots and wrapped stitches that I have already discussed. Even so, I know that this distant surface produces a flatter visual impact than anything in the foreground; I therefore avoid using slit techniques both within the mass itself or at the point of connection with the water of the mid-ground or the mountains and sky of the background (Photo 13). The relationship at the meeting point between this land mass and the surfaces of mid-ground water or background mountains is determined by distance. For closer points of land (Photo 14), I allow the suggestion of tree tops to jut into the flatter texture of water or distant mountains often using a Swedish knot technique. To suggest land further away, I will lighten the colour of land mass and will change to plain weave pattern, but will use a double or triple ply weft using medium singles of 4 to 6 TPI. I reduce the degree of intrusion of tree tops into the surrounding areas of the tapestry but will continue to use a Swedish knot technique to create this irregular edge. The more distant the land form, the lighter the colour, the less texture I allow to the surface and the smoother the edges between the land and the surrounding areas. I move progressively to finer plies or to finer and finer singles as the distance increases.

For the hills and mountains of the background, I want to produce a series of geometric shapes of a flat texture, but of
progressively lightening colour tones as the mountains recede into the distance. For these areas, I use often use a medium single zz plied s with a TPI of 4. In spinning the plies, I will on the closer mountains use on occasion singles of a slightly different colour hue, producing a surface that suggests some colour variation despite the distance. However, I do not strive to produce textural effects, relying instead upon plain weave to produce a surface of minimal relief as one would expect to see in looking out across a body of water. Indeed, the landform of the mid-ground must give a sense of much greater relief than those forms of the background to create a sense of congruency and progressive distance. Even in the background, however, the closer hills and mountains must have a greater textural quality than those receding into the distance; to achieve this, I must use ever finer singles either alone or in plies. At the same time that I produce the illusion of a flattening texture, a solidifying of surface, as the land forms recede into the distance, I also must ensure that the colours of the forms lighten in a manner consistent with the viewers experience in looking at the real world (Photo 15). Also, because the land forms are far from the viewer, the meeting edges of the mountains are fairly even, following the natural contours of land; at times, between mountains I will use an interrupted Limning technique (Photo 16) which helps to
define the form of the closer mountain from the further one. In Limning, I use a single of a darker colour but of a finer weight than the yarn in the mountain forms. I do not, however, use Limning at the edges of mountains and sky.

Generally, the sky is the dominant area of the background, and I have had to develop fibre and spinning techniques to create effects which approximate in the viewer's eye the canopy of sky and cloud. To do this, I use the sky to help produce the sense of perspective which makes the image of the tapestry believable for the viewer. In nature, the sky is a dome shape, the portion above the observer is, in a sense, closer than that part of the sky at the horizon. As a result, it is necessary to reverse the process of textural change in the weaving. The sky at the horizon must have a flatter texture than that which is higher, or closer, to the viewer. I therefore use fine single weft yarns or possibly fine plies when working with the sky at the lowest point in the horizon where mountains and sky meet. Just how fine the weft yarn is depends upon the depth of field I am working with: that is, a closer, more highly textured mountain in the background should have a correspondingly more textured sky next to it. In this area of the tapestry, I inevitably will use a plain weave technique to reduce textural effects. However, the distant mountain rises into the sky, into that portion of the dome that
is closer to the observer; the higher the mountain, the closer the elements of the sky are to the viewer, even though the mountain remains the same distance removed. I will, thus, increase the weight of the weft yarn used in the sky to suggest this change in proximity - that is, I increase the textural effects. I do not, however, exceed the weight of the yarn used in the distant mountain at those points where the sky abuts the mountain (Photo 17). In the sky area generally, though, the higher I work in the weaving, the more necessary it is to increase texture and introduce a degree of variety into the surface. Although I usually continue to use a basic plain weave technique, I begin to apply occasional texture effects from different spinning of the yarn. The key here is to allow the natural soft surface of wool to appear in the midst of the harder, flatter surface of wool spun in a relatively tight worsted method. I use a number of spinning techniques to achieve this. The simplest is to insert a short length of a thicker single spun in a loose worsted method, generally with a lower TPI; another is to use a short length of ply of two loosely spun worsted singles, plied with a TPI lower than the surrounding singles; a third is to use a piece of tufted or a flicked yarn. The area of trees and vegetation of the foreground touches the sky area from the horizon to the upper area of the visible portion of the sky (Photo 18).
juxtaposition of the dark deeply textured surface of the forest edge standing out from the flatter, more regular surface of the sky aids in producing the depth of field of the tapestry. Angular branches jut into the sky area, producing a bold relief; glimpses of the sky can be seen peeking through the less dense portions of the trees and appear as flat recessed contrasting surfaces. The progressive complexity of the sky’s surface the higher one looks in the tapestry remains recessive because of the prominence of the dark yarns and their textures. Nevertheless, the textured surfaces that I give to the sky are essential in producing the overall visual effect that I seek for my tapestries.

Sky effects, both textural and colour, also define the light source for the whole tapestry and hence are central to the creation of realism. Because of my reliance on light and dark to generate a sense of advancing and receding forms, the creation of a coherent and consistent light flow is essential for me. In terms of a natural coastal landscape, the higher the sun is in the sky, even when hidden by a cloud covering, the more diffused is the light, with a consequent reduction in contrasts between forms and shapes. Overall shadowing is reduced, and therefore there cannot be the degree of colour contrast between the lighter and darker areas. I parallel these effects in my tapestries where the sun is higher in the sky
(Photo 1). And because the light is more diffused and consequently creates softer surface contrasts, I reduce the overall textural contrasts in those areas of the tapestry most impacted by such light. At the same time, I reduce the darkness of shadow forms, whether trees of the foreground or a land mass in the mid-ground, in recognition of this light. Distant forms, too, appear in lighter colours just as they do in nature. When the sun approaches the horizon, however, we see an intensification of the light, a gathering of the light rays which produces sharp contrasts between the areas of shadow and of light (Photo 19). I recreate this intensity of light in the lower sky. I choose a white or near white fibre and spin it finely as a single or a tight two ply; I then plain weave this weft yarn tightly into a surface of minimal texture. As I move away from the source of light, both vertically and horizontally, I begin to work in stands of darker weft indicating the presence of clouds of different density which the light no longer penetrates with the same ease. The further I move from the light source into the upper sky, the darker the contrasts become. At the same time, the intensity of the light flowing through the cloud near the source obliterates the natural texture of the cloud, flattening it into a bright surface; the further one goes from the point of origin of light, the more pronounced become the textural surfaces of the cloud in the
sky. Again, I parallel this natural effect by adjusting the hand spinning techniques I apply to the weft yarn. Using a mix of colour contrasts and the surface variations I produce through spinning, I am able to give the viewer the impression of a sky one might see while walking along a beach on the Pacific coast.

This aspect of light is fundamental to the aesthetic power of my tapestries. The sky effects must be echoed in attenuated form in the water of the mid-ground and foreground; the flow of light from its source produces shadows which give both a sense of perspective and depth. Whatever forms appear in the weaving are affected by the source of light, its intensity and its quality. The range of conditions I can imitate using natural undyed yarns is not great; however, within that range of cloudy, overcast days, I can give shape to tapestries of myriad moods and shifts of light. By exploiting the natural quality of wool fibre and using a wide range of fibre preparation methods and spinning techniques, I have command of a fair repertoire of colour, textural, and surface effects. I can make the water areas appear to be rough or calm; I can make the sky to be flat, almost oppressive, or stirred with wind and moving cloud. Mountains take their proper place as they recede into the distance. The viewer's eye is drawn into the scene, flowing from foreground to mid-
ground to back-ground by the balance of shapes and the sense of shadow and flowing water and light.
IV. SPINNING AND FIBRE TREATMENT TECHNIQUES USING DYED NATURAL FIBRES FOR A TAPESTRY

I have found that the techniques of handling fibre that I use in natural, undyed tapestries do not work as dramatically or as effectively as I would wish in a full colour weaving. Indeed, because colour becomes the predominant element in the weaving, the textural variations that I produce become somewhat redundant and artificial. Patterns of colour become the point of interest for such full colour tapestries. The higher light values flatten the scene, making the effects of perspective that I seek very hard to achieve. I have come to the conclusion that flat weave techniques that exploit shifts and shadings of colour are best for this type of tapestry. Contemporary tapestry artists often working with a form of harness loom have produced the most amazing and beautiful tapestries using custom dyed or even commercial yarns. These artists understand colour and the interplay of the colour of woven fibre. Whenever I attempted a full colour tapestry using my mixture of "lumpy" and smooth weaving techniques, I have found the results to be less than what I wanted.

Recently, I have begun to use colour in my tapestries of coastal scenes - and with exciting results. As I indicated above, light effects are key to the visual impact of my
tapestries. The light effect that I am currently exploring in my weavings is that of sunlight breaking through clouds, which then spreads across the sky and onto the water surfaces. Often in the morning or in the evening, the clouds are penetrated by these light rays which seem to pick up dramatic and beautiful monotones -shades which are sometimes breathtaking but always memorable. The spreading of these colours out from the light source over the sky and onto the water's surface provides a focal point to which the eye is immediately attracted. The tapestry's perspective is significantly enhanced by the power the colour has to draw the viewer's attention into the heart of the scene. The textural and colour effects of the surrounding areas of black, greys and whites are not diminished but in fact are heightened by the demanding presence of such a contrast in colour. Indeed, the introduction of these dramatic contrasts in colour intensifies whatever effects that I normally achieve in the undyed tapestries.

The introduction of colour into my tapestries as forced me to adjust some of my techniques. As with the undyed fibres, I must concern myself with colour and with textures in preparing the weft yarn, but I now add the dye pot to the fibre preparation methods, spinning techniques and weaving patterns as a means to achieve the visual effects I want.
have settled on Ciba Kiton acid levelling dyes for no other reason that they are good dyes readily available to me. Using a variety of percentage formulas, I follow conventional dyeing methods as outlined by Linda Knutson to achieve shades of a given colour. For my purposes, however, I always dye the fibre in the sliver, not the finished spun yarn. In addition, once the fibre has been given its basic dye colour, I sometimes will rainbow dye the sliver with another colour, thus producing a mottled roving. I have included an example of a dyed sliver and of the effects of carding and blending, and finally of spinning as a part of this paper (Sample 13), I have restricted myself to one sample because the purpose of this paper is to show the relationship between fibre preparation, spinning techniques, and weaving methods in the final tapestry, not to explore in detail dyeing techniques for fibre.

By carding and blending the dyed slivers with other dyed or undyed slivers, I am able to produce further changes in the shades of colour of the fibre rolag prior to spinning. The blending of two slivers of the same colour but of a different shade creates yet a third shade of the same base colour; the percentage of each sliver making up the blended roving will determine the outcome shade. Slivers of different colours, when blended and carded together, produce yet a third colour roving but with a very complex visual result. Unlike the
mixing of paint or dyes, each fibre in the blend retains its original colour in the spun yarn (Sample 14), and it is the eye, seeing the mix of colours from a distance, completes the blending into the third colour. As a result, these blends have the capability of shifting in colour impact as the viewer approaches the weaving and the eye begins to discern the complexity of the fibre blend. Indeed, the eye will lean more to one side or other of the colour of the blend depending upon the adjacent colours—a phenomenon that produces perceived colour shifts along the length of an individual coloured weft even though the weft yarn is a single colour blend. The greater the contrast in the base colours used in this type of blend, the greater is this effect of shifting colour. The complexity of light and colour effects that I require is in part met by this form of blend. Because the eye is the final “mixer” of colour in this form of blend, the resulting “seen” colours lack the intensity or vibrancy of directly dyed yarn; however, what is lost in intensity and vibrancy is more than made up by the softening of colour distinctions at the points of change where colour must revert to natural shades of grey. This need for “feathering” where colour fades into the base greys of the sky or water is also aided through the blending of colour slivers with natural undyed slivers. A light coloured natural fibre sliver—off-white to the lighter shades of grey—softens the
base dyed colour in the resulting roving; a dark coloured natural sliver -full grey to dark grey, even black -darkens and mutes the colour of the fibre in the roving. By using different percentages of sliver fibres to make up the blend, I can adjust the degree of these effects to suit the need of the tapestry (Sample 15). I also reduce the definition of one colour in the resulting roving by deliberately doing only a partial blend of the sliver colours; the mottled rolag produces a mottled spun yarn.

The spinning techniques that I use for the coloured and blended rolags are designed to produce a yarn that has both the colour and textural effects demanded by the tapestry. I generally use a worsted method of spinning because the colour effects of the light gather near the source in the background and flow in decreasing intensity into the sky and onto the water with little or no impact upon the sky or water of the foreground. I am therefore not seeking high texture, although the resulting low texture is important in reproducing the effects of cloud and water. I use a large number of coloured singles spun in a worsted short draw method in creating colour effects, increasing the TPI and reducing the weight of the yarn further from the foreground for both sky and water. I do not want a perfectly smooth, even yarn (Photos 20 &21). I have found that by selecting a lower grade of sliver, the noils left
even after carding cause random unevenness in the spun yarn - and heightened texture and surface effects in the weaving. I do use some double plies (singles spun zz plys), but I use a very reduced TPI of perhaps 2 down as low as 0.5. These plies intensify a single colour and heighten texture and weight of yarn; for mottled yarn and for yarns of different colours and shades, these plies increase the mix of colour tones, adding to the effect of coloured light playing on the clouds and the water's surface. I do not use specialty spinning techniques to produce the coloured weft.

In the transformation of coloured yarn into light and colour effects in my tapestry, I use plain tabby weave. The coloured yarns tend to be restricted to the background and mid-ground areas of the weaving where I want reduced texture and flatter surfaces due to the distance from the viewer. Colour effects at sunrise or sunset vary greatly depending upon the thickness of the clouds, the height of the clouds, and the location of the sun relative to the horizon. As a general rule, the sun at the horizon gathers colour relative close to its location (Photo 22); the sun higher than the horizon or below it produces effects of colour higher in the sky (Photo 23). I have to shape the colour effects to conform to the conditions of the scene. A problem I have to overcome rests with the very process of tapestry weaving: I must weave the reflected
colours in the water before I weave the light source and the effects it has on the sky because the water patterns are a reflection of the sky. The cartoon is of critical importance in resolving this problem. In the actual weaving of colour effects, I depend heavily upon the yarn and its qualities to produce the results that I need. I use full colour dyed yarn to create intense moments of colour for a short interval of plain weave; I must be careful not to overuse the intense, full colours (which are dramatic and impressive) because to do so would sacrifice realism. The patterns and shadings that I weave into the tapestry are echoes of the real scene, whether in the area of the sky or the reflection in the water. The linear quality of the weft enhances these effects, since so very often in nature I see bands of light and colour in both the water and the sky. In achieving the links between colour areas, I use exactly the same techniques of linking weave that I outlined for undyed natural tapestries.
V. CONCLUSION.

Whatever success I achieve in creating the visual and aesthetic effects of my tapestries depends in good part upon the techniques and skills I have developed for fibre preparation and spinning. I feel that the methods and approaches I have developed enable me to create tapestries which capture the mood and spirit of our West Coast. Whether working in natural, undyed fibres or introducing some dyed fibre, I strive to use fibre to produce as realistic and as resonant a visual effect to the natural scene as I can. I feel that I am approaching an integration of all elements of my tapestries - fibre, dyeing, fibre preparation, spinning and weaving - that brings together all elements harmoniously to produce a scene of the West Coast which is at the same time realistic and aesthetically satisfying. To do what I want to do, I must have command of my medium - that is, the fibre and its transformation into the type of yarn that I need to create the artistic effects of my tapestries. The foundation of my art is the yarn that I use; I know that I must have absolute control over the selection of the fibre, the dyeing methods, the blending and carding techniques, and, most importantly, the spinning of the yarn to be the sort of tapestry weaver that I wish to be. It is this knowledge that has motivated me to
undertake the Master Spinner's Program and to strive to gain mastery of fibre.
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FOOTNOTES

12. Varney, *Designer Yarns*, p.79.
"Entrance to Grice Bay, Tofino, B.C."

PHOTO 1
"GROWING UP ON THE INSIDE PASSAGE"

PHOTO 10
"Grey Day in Desolation Sound"

PHOTO 17
"Sunset Over the Malahat Range"
"Mauve Evening over Cowichan Bay"
Sample 1: Basic Spinning Methods

a) Woollen
   Single z
   TPI .5 - 1
   Count: .5's

b) Worsted
   Single z
   TPI 1.5
   Count: 1.97's

c) Woollen
   Single zz
   Ply s
   TPI 1.5
   Count: 4.74's

d) Woollen
   Single z
   TPI 2 - 3
   Count: 2.37's

e) Worsted
   Single zz
   Ply s
   TPI 1
   Count: .94's

f) Worsted
   Single z
   TPI 2
   Count: .94's

g) Worsted Selvedge
   Single zz
   Ply s
   TPI 1.5
   Count: 2.1's

Warp: Line Flax
   Single ss
   Ply z
   TPI 3.5 - 4
   Count: 12.2's
Sample 2: Cotton

Single zzz
Ply s
TPI 7
Count 8.9’s
Yards per pound: 1975

Sample 3: Line Flax

a) Single ss
Ply z
TPI 4-4.5
Count 2’s
Yards per pound: 2200

b) Single sss
Ply z
TPI 3-4
Count 12.2’s
Yards per pound: 975

Sample 4: Tow Flax

Single ss
Ply z
TPI 4-4.5
Count 13.8’s
Yards per pound: 1450
Sample 5: Basic Colours of New Zealand Slivers

Sample 6: Mohair

a) Adult
   Single z
   TPI 2.5
   Yards per pound: 800

b) Buck
   Single z
   TPI 2.5
   Yards per pound: 550

c) Wool and Mohair: 50 - 50 Blend
   Single zz
   Ply s
   TPI 2
   Yards per Pound: 1050

Sample 7: Mohair and Ramie

a) Mohair (fine)
   Single z
   TPI 2.5
   Yards per Pound: 2200

b) Ramie
   Single z
   TPI 2.5
   Yards per Pound: 2575
Sample 8: Carding in percentages

a) White  
b) 30 % light grey; 70 % white  
c) 50 % light grey; 50 % white

Sample 9: Carding a mottled effect

a) Two shades of medium grey  
b) White and light grey

Sample 10: Novelty Spinning

a) Tufted -white ply with grey tufts  
b) Slub with binder  
c) Fuzzy yarn without binder
Sample 11: Plies

a) Selvedge
   Single zz
   Ply s
   TPI 1

b) Base Colour Grey
   Single zz
   Ply s
   TPI 1.5

c) Base Colour Gray Single Plied with 50% white -
   50% grey: single for gradual shading
   Single zz
   Ply s
   TPI 2

d) Same as above but with lowering TPI to .5

e) 3 Ply -2 single dark grey, 1 single light grey over
   two warp threads
   Single zzz
   Ply s
   TPI 1

f) Ply Direction
   Single zz
   Ply s
   TPIU 2

g) Ply Direction
   Single ss
   Ply z
   TPI 2

h) Ply Direction
   Single sz
   Ply s
   TPI 2

i) Ply Direction and Colour Shading
   Single ssz
   Ply s
   TPI 1.5 - 2

J) Navajo Ply
   Single z
   Ply s
   TPI 1
Sample 12: Wrapping Stitches and Knots

a) Oriental Soumak
   Single z
   TPI 1

b) Chaining
   Single s
   TPI 2

c) Tabby
   Single zz
   Ply s
   TPI 2

d) Ghiordes Knot
   Single zz
   Ply s
   TPI 1.5

e) Greek Soumak
   Single s
   TPI 2

f) Swedish Knot
   Single z
   TPI 2

g) Twining
   Spun z
   TPI 1.5

Warp: Tow Flax
   Single ss
   Ply z
   TPI 4.5 - 5
**Sample 13: Colour**  
Rainbow dyed in the sliver; spun directly; uncarded

**Sample 14: Colour**  
Developing a new shade by blending 2 separately dyed slivers

**Sample 15: Colour**  
Moving a main colour by carding natural shades
   
a) Base Colour  
b) 50/50 white and base colour  
c) 50/50 grey and base colour  
d) 33/66 dark grey and base colour