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Date: Aug 16, 2019
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR

AS A HANDSPINNERS FIBER

Master Spinners Certificate Program

Submitted to Olds College, 2013

Donna M. Rudd, copyright material
INDEPTH STUDY, LEVEL 6 MASTER SPINNERS STUDY PROJECT 2013

**Purpose:** Exploring the Form and Function of Beaver Fur as a Handspinners Fiber

**Fibers used:** Beaver fur and other various fibers for blending and comparative purposes to consider the viability of beaver fur as a ‘promising’ luxury fiber for further exploration and development at a handspinners level. It is my hope that this study will show me the characteristics of beaver fur that may be similar or different from other exotic fibers used for handspinning.

**Preparation Methods:** Sorting, shearing, clipping, razor cutting to remove the hair, dehairing guard hairs by hand and also commercial dehairer, evaluating fibers, hand carding into small rolags or punis, blending short exotic fibers with hand cards.

**Spinning Method:** Supported woollen long draw spinning technique is used throughout.

**Finishing Method:** Gentle water wash and set compared to shocking hot/cold water fulling technique

**Samples:** Skeins and knitted swatches of 100% dehaired beaver fiber and numerous other blends as a comparison of characteristics, function and end use. Fibers intended for use in blending with 60% beaver fur will be: 40% of either.....Shetland lamb wool, or cashmere, or quivit, or bison, or possum, or mink, or cotton or silk noil.

**How will the objective be accomplished?** I will shear/clip/razor beaver pelts, compare the fibers by location on the pelt for shortest and longest, dehair by hand or with commercial dehairing machinery and document my observations. The pelt will be washed prior to shearing. I will dehair by hand unless I have a large enough quantity to have it commercially done but this is unlikely. The fibers will be fluffed and carded to prepare them for spinning; samples will be kept of all blended fibers before and after being spun. ie. 100% beaver, 100% possum fiber samples and then samples of the blend of 60% beaver and 40% possum will be kept for the records. Later skeins and swatches will be part of the sample pool.

All fibers will be spun woollen long draw and plyed into 3 ply yarns before being washed or fulled. I will make some samples before I decide to do gentle washing or fulling of the skeins. I will document the yarn details such as tpi, twist direction, wpi, angle of twist etc. as part of my skein evaluations.

This study will only look at the ‘woollen preparation and spinning technique’ of beaver fur and its blends with shorter fibers, it will not address blending with longer fibers such as merino nor the worsted preparation and spinning method of preparing yarns.
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EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS FIBER

ABSTRACT

The purpose of this Indepth Study was to research the viability of beaver underfur as a handspinner’s fiber for making yarn. It was a comparative study into the characteristics of the actual beaver fur and how they related to other fibers as a blend with various exotic fine short fibers. Also, this project evaluated the features and strengths of the fine beaver underfur as an undiluted yarn. Spinning was always the main focus of this endeavour, however much was learned while obtaining and preparing the fiber source.

I had anticipated obstacles in locating beaver fur but I could never have imagined the incredible journey it took me on to source the raw material and collect information I learned about the fiber. Many experts taught me how to judge beaver pelts for primness and quality, with this knowledge I purchased pelts with the longest beaver underfur for this task.

This project showed me that beaver underfur is a challenge to remove from the pelt and to dehair the guard hairs from the underfur in a cost effective and efficient manner. Those are challenges that can be overcome with a bit of ingenuity in the future, meantime for this study it was not possible to try all methods such as chemicals or locate specific factory equipment that could remove the fur from the hide at skin level. So my studies focused on methods that I could realistically try such as shearing, clipping and cutting off the fibers by hand using razor blades.

The shortness, fineness and slickness of the beaver underfur made it a challenging fiber to spin. However, as with any fiber it just takes practice and a few special techniques to make this fur spin well. For even yarn a well-made consistently sized puni is the first step in producing a good beaver fur yarn. Beaver fur fibers are very fine and tend to compact they should be held very lightly during drafting. The twist within the hand carded puni contributions to the formation of the yarn at the drafting zone and into the newly made yarn.

The spinning wheel was set with a very light tension on the drive and brake band. A very light hand and take up were all that was needed to make these fine fibers to spin well. Using the supported long draw method was the only technique that worked well for all of the samples. Finishing or setting the twist in all the samples was done by fulling or felting them in the skeins. This proved to be the perfect solution to stabilizing the yarns which resulted in soft downy and stable yarn.

The future of a beaver underfur yarn is yet to be determined. This study proves it is possible to make astonishingly superb handspinners yarn from this fiber yet there are many
obstacles to be overcome for future use of this fiber. Issues such as the cost-effectiveness in removing the fur from the pelt so the fibers stay lengthy and dehairing the guard hairs from the underfur most likely been addressed for mink fibers in China or elsewhere. It will be for the future to determine if beaver underfur will become one of the handspinners exotic fiber supplies, it certainly has the potential as proven here.
INTRODUCTION

Much was suspected regarding spinning beaver fur but few facts were known. My first priority was to gather information about beaver fur and fiber from an historical perspective. Next I sought current research documentation to glean as much scientific information as possible. As I was gathering facts from regarding fiber I began searching for beaver fur to spin. As expected, this proved to be challenging because there was none available through traditional spinners markets. This meant I would have to seek out raw material from local resources such as trappers, fur buyers and furriers.

I realized that this project was going to be extensive. That it would be difficult to keep focused on my indepth study topic of spinning beaver underfur only. Every effort was made to spend less time exploring some fascinating sideline issues in order to fully develop my main area of research. There are many avenues of exploration that could be developed in the future should one wish to pursue them.

METHODS AND MATERIALS

Suspected information about the fiber:

I suspected that beaver underfur would be similar to mink because it was water dwelling animal living under similar environments, however I also knew beaver spent a great deal more time in water and required more oils on its fur. This assumption proved correct and I found that diligent attention and care had to be taken to remove the oil from the hides before shearing them so that the shears did not gum up with the oil. Also, the fur had to be very clean so that it did not stick together during carding or drafting while spinning. The commercially tanned hide was so clean that the fur was a joy to spin because it was free of all natural oil. One surprising fact I learned is that the beaver underfur did not resemble mink as much as I first suspected; mink did not have the density, compact, crimp or degree of fineness that the beaver had. This information was later confirmed by comparing reports from http://www.furskin.cz/identification.htm (see documents in appendix on page # 72)

Beaver fur on pelts is very dense making it a challenge to remove. Various attempts were made to remove the fur from raw salted dried hides. I also custom ordered a tanned
plucked hide from a factory in Winnipeg for some of my fiber supply. The benefit of using the tanned hide was that the coarse guard hairs were removed by speciality equipment at the tanning factory. The underfur was completely cleaned and free of natural oil making it easier to remove by hand with a razor blade. In both types of pelts (raw dried and tanned) density of the fur caused shears to plug up and quit working. I believe that it is conceivable to shear the underfur from the hides....I personally have not had the time or expertise to find the resources to explore further methods. Density, fineness and thickness of beaver fur is explored in reports issued at http://www.furskin.cz/identification.htm (see documents in appendix on page #72)

I also suspected the beaver underfur would be similar to cotton in length and fineness so it would undoubtedly be best spun using the supported woolen long draw method of spinning. This assumption proved to be correct. The micron count of the beaver fur from a histogram (commissioned by Natural Fibre Center, Olds College, see Appendix on page 72) states that the micron average is 9-11 microns. With measurements of length at various locations across the pelt the underfur was approximately 6-15mm length, making this fiber ideal for carding into a puni for supported long draw spinning.

Documented information about the fiber:

One of the first steps I had to take in developing this study was to glean all the documented information regarding Beaver fur. It was done by researching data through my local library, searching the internet on related subjects, and consulting skilled experts such as trappers, fur buyers, furriers and harvesters.

The most exciting and professional resource I found relating directly to beaver fur was found at http://www.furskin.cz/identification.htm. This astonishing web site gave
considerable information regarding beaver fur and other fibers. I was able to acquire scientific data to compare with other fibers I used for blending with the beaver fur such as mink, possum etc. This data was invaluable to this project because it provided details obtained through the use of micro-photographs, fur and skin micro-morphology for skin surface, hair follicles, hair types, shapes, sizes, lengths, structures and thicknesses.

Here is a sample of the Furskin.cz beaver fur report;

“The microscopic structure of the skin of the fine fibres, 2000x surface is usually smooth; the hairs follicles are wide with straight edges. The average follicle contains from 15 to 25 fibres in cluster.

The fine fur fibres have a circular cross-section with a diameter of 10 to 15 µm. The cuticular scales are of the cornet-like type with a smooth scale surface and usually crenated scale margins. The fine fur fibres are non-medullated.” Quoted (author, date, page unknown) www.furskin.cz, see attached Appendix on page # 72.

Structure of the hair

Some online sources stated facts about the density, fineness, length and other facts about beaver fur. However, I decided to send samples of my raw beaver fur to Olds College Natural Fibre Center for a Histogram Test, September 2012 (See Appendix Page #72) to learn details about the beaver fiber I was spinning. The fur was from a mature adult beaver with most of the guard hairs removed. The sample was taken from a raw, salted and dried hide I purchased from a local trapper. The beaver had been trapped in March of 2012 and the animal was approximately one or two years old when caught. (Weibe, R., Alberta fur buyer)
BEAVER FIBER HISTOGRAM STATES;

Average Fiber Diameter 11.64 microns  
Curvature (crimp angle) 79.5 deg/m  
Comfort Factor 98.9 %

For comparison purposes these facts are interesting because the average fiber diameter of a very good baby alpaca fleece sample would be approximately 20 u (microns), with a curve factor of 30-40 degrees/mm, and a comfort factor of approximately 80-90%.

Throughout my search for information I found that there was a professional grading system (see Appendix pages #72 for Fur Grading Chart) for fur which is used by the fur trappers, buyers and harvesters when buying and selling pelts. I met many such skilled people when attending the Canadian Trappers Convention held in Stettler, Alberta, July 2012. During this time experts taught me how to evaluate furs for density, size, length and overall quality or primness. Thus, I was able to purchase good quality furs for my shearing, dehauling and spinning experiments. From that experience I was able to custom-order a high quality tanned and plucked hide from the tannery for some of my spinning samples. When grading fur pelts, density and length are given the highest priority. For this project length of the underfur was the most essential factor to spinning good yarn.

Considerable material was gathered from historical sources which principally applied to fur felt making and methods of removing fur from hides using chemicals. I chose not to use chemicals to remove the fur from the hides because of the hazards known to us today. It was noteworthy to read historical notes that state the underfur felted well when **carotted** (raising the scales on the shafts so they would lock firmly together for felting.)
http://www.torbandreiner.com/felt-history (see appendix on pages # 72) because I planned to full or felt the yarn as soon as it was skeined to stabilize it.

Designer yarn made of beaver hide is accessible on the internet. This yarn is tanned beaver hide cut in narrow strips with fur still attached. This unusual hide/yarn is the only so called beaver yarn on the market and it not really spun yarn as handspinners know it.

*Comparison of Raw Salted & Dried Pelts vs. Tanned Pelt:*

I started my project using fur from raw, salted dried beaver hides that I had purchased from local trappers because that was the only source available to me at the time. While visiting trappers I studied how they washed the fur before they stretched and dried the hides. They did not scour them to thoroughly clean them! It was necessary to deeply rewash them using hot water and tide with a bit of bleach to remove natural oil and fine debris before allowing them to dry again. Occasionally, fine sand and even some sort of flea type eggs were found clinging onto the fiber shafts, those pelts I chose not to use. At the edges where the hide had been cut there was fat or grease from under the skin often would get caught up in the fur so I did not use those fibers either. The belly fur had fewer guard hairs and was very dense but not as long as the underfur found along the sides and back. It was these back fibers proved to be the longest and best suited for spinning.

Following a training session with the Fur Harvesters and buyers at the trapper’s convention I could better judge good quality pelts that were considered prime from those of lesser quality. Equipped with this new skill it was just a matter of searching through a large choice of pelts for ones that were dense and had the greatest length. I also was able to study the crimp pattern of the fur when assessing the quality but this was not as important to me as a hand spinner as the fiber length. For this project I found the most important factor was keeping the fibre length as long as possible when it was cut from the pelt.

A second source of obtaining beaver fur was by special ordering a tanned beaver pelt from a tanning factory in Winnipeg, Manitoba. Their pelts are in prime condition without flaws with long dense fur, plucked of all the guard hairs, commercially tanned, cleaned, and without the tips being trimmed off. What the factory could not do, was cut the fur at skin level leaving it one long length that was good for spinning! They could cut the fur in assorted lengths for design and pattern purposes....but their equipment was not designed to cut just at skin level.

How best remove the fur from the tanned pelt? For this project, the answer was to cut off the beaver underfur using a razor blade to cut one narrow strip at time. This fur without
the guard hairs; it was very clean and long including the non-brittle tips of the underfur...making this ideal hand spinning fibers. Often tips of fiber bearing animals such as sheep and alpaca have tender tips that are a result of exposure to the elements, when these tips break off during processing they cause snarls and neps in yarns and result in loss of production. In the case of this very fine slippery beaver under fur, every millimetre of length was needed to contribute to the twist and strength of the yarn.

_Fur Removal Techniques Explored:

Removing the fur from the pelts became a major problem for this project. I needed only the fine underfur to spin my samples and dehairing the coarse guard hairs by hand was very time consuming. Ultimately, all the fibre was obtained by either removing it with shears, clippers or razor blades. The custom ordered tanned and plucked hide did not arrive until 95% of the samples had already been spun.

The first raw dried pelts were sheared using commercial wool/alpaca shears. This type of shears cut the short underfur too high from the skin leaving it too short for good spinning yarn. Also, after a while the shears would just ride-up on the coarse guard hairs instead of staying near the skin....resulting in much of the underfur being destroyed.

These commercial wool/alpaca shears were just too large to cut close to the skin and they chopped up the fine under fur too much to keep the fibers long enough for good spinning fibers.

A friend suggested using #40 clippers, the type that veterinarians use to clip fur close to the skin. This method was used but I found that the clippers did only a small area before refusing to cut more. I changed the blades, the heads, rested the clippers, and cooled the clippers etc....but it just did not work.
By far the most effective method of removing the fur from the pelts was using a razor blade. By cutting strips of fur from the pelts it resulted in the longest most uniform fiber for spinning and leaving very little fiber on the pelts.

Using old fashioned or chemical methods to remove fur from the hides was ruled out as they were too time consuming or too hazardous. An attempt to soak the fur from a rotted hide was a unsuccessful endeavor.
Fibre Preparation Techniques:

All the fibre preparation of the beaver fur was basically the same once it was cut from the hides...it was dehaired by hand however; a small amount was mill dehaired. Most of the spun samples are made from hand dehaired beaver fur because the mill dehaired fiber proved too contaminated with guard hair to use.

A few raw hides were sheared with commercial shears and dehaired with local mini mill dehairing equipment. Twisted Sisters fiber mill, Beaumont, Alberta adjusted their dehairing machine in an experimental fashion in an attempt to successfully dehair beaver underfur from the guard hair. The dehairing machine did remove masses of the guard hairs, but it did not do a very good job of extracting all guard hairs. Indeed it seemed to simply mix up the shorter cut up pieces with the finer underfur making it a real challenge to dehair the mass by hand which is definitely required if I am to use the fiber for hand spinning.

Custom ordering a plucked/tanned hide proved to be a superb but expensive method of obtaining an excellent source of beaver underfur for spinning. The guard hairs were 95% removed and the underfur was not trimmed at the tips, leaving it naturally long and excellent for spinning. I found no evidence of tender tips and I expect if there had been
tender tips that they would have come off during the processing. The underfur was very clean and easy to remove.

Hand carding was the only technique used to prepare and blend fibers for this project. I did experiment with drafting from a carded fiber mass but all attempts were unsuccessful. Carding opened and blended fur with other fibers to build small delicate rolag type structures called a puni. The fibers are basically separated and opened on the teeth of the cards before being rolled off over a center rod. The rod is removed after the fibers have been rolled up to form a soft airy tube. This leaves the fibers already partially rotated in a mini tornado formation ready to be drawn into the drafting zone and enter into the yarn twist. Carding the beaver underfur from the tanned hide was a delightful experience because fibers were completely clean and opened easily in the hand carding process. None of the blended samples were made from the tanned beaver underfur because the pelt did not arrive until after all the blended samples had been made. However, 100% beaver underfur samples were made using tanned beaver underfur.

The beaver fur cut from the raw salted dried hides had slight greasiness and stickiness at times, so care had to be taken not to compact the puni while holding it during drafting and spinning.

All the blended yarn samples are made with beaver underfur cut with a razor blade from a raw, salted, dried pelt and dehaired by hand as this is the material that I had on hand at the time I was making the samples. (The tanned, plucked hide did not arrive until all my blended samples had been completed and most of my project was finished).

I choose to blend fibers with 60% beaver for this project because I knew that I would not have an abundant supply of beaver fiber for 70 or 80% blends. If 50/50 blend was used I
felt that some of the exotic fibers may have obscured and overpowered the beaver underfur in the yarn.

The beaver fur blended very well with all other fibers but especially with the shorter fibers such as mink and cotton. The mink sample actually had more guard hair than the beaver that I dehaired. The cotton blend was a perfect match and I loved the blend! I was very frustrated with the possum fiber. It was a real mixed bag of microns and lengths and of overall very poor quality making the blended yarn very disappointing indeed! I loved how the silk noils held the short beaver fur together and made an excellent textured yarn. I think the camel/beaver blend and the beaver/cashmere blends were my second favorites because of the pleasing hand that both yarns exhibited. The bison, qiviut and yak blended yarns were soft and lofty with such lovely halos that I would enjoy making more blends in the future. Blending beaver with longer fibers such as paco-vicuna, angora, and shetland lamb were an experiment in blending very short fine fibers with longer fine fibers. Blending with the hand cards took extra work to make sure the blend was complete and fully done. The real proof was found during the drafting when longer fibers would pull into the drafting zone leaving the shorter fibers behind. However, I still wanted to do longer fibers for the challenge and to see what would come of it. For a more complete analysis of my findings each sample has a complete evaluation accompanying it.

RESULTS

I suspected that spinning the beaver underfur would be best spun using the supported long draw woollen method because the beaver underfur is short and very fine like cotton which is generally spun this way. I tried several methods of spinning the beaver underfur first from different fiber preparation techniques such as clouds, large rolags, even just from a mass of sheared fiber. However the best method I found for spinning this fine short fiber was when it was prepared first into a puni. The reason I came to this conclusion is that beaver underfur compacts very readily and it takes very little pressure for it to effortlessly clump up and not draw well. The other benefit of using a puni is the twist built up from the formation of a puni during the removal from the hand cards assists drafting of the fibers into the configuration of the very first area of the drafting zone. This makes a uniform consistent yarn. Spinning a good beaver yarn is also very difficult due to its slippery nature along with its tendency to compact during drafting.

All the beaver no matter if it came from the raw, salted dried beaver hides or the tanned plucked hide was prepared by hand carding the fibers numerous times and making
them into light and airy punis. I tried a tight compact puni...that was not a wise idea as beaver fur naturally compacts and tends to bind up just before the drafting zone causing clumps during drafting and contributing to uneven yarns.

By using the supported long draw method I was able to control not only the amount of twist that entered into the drafting zone but also the amount of tension that was along the yarn line. My spinning wheel take up tension was set very light and with almost no tension at all on the scotch brake...just barely enough to allow a slight pull in tension. I had to lace the newly spun yarn across the hooks 2-4 times so that the tension would not pull apart the fine slippery fibers.

I used the smallest whorl my Schacht wheel had which was set at 15:1 and many times I wished I had a smaller whorl. To compensate for that I would treadle a couple of extra times during each length before it was pulled onto the bobbin. This fiber was so tricky that if a secondary guard hair was left in the twist of the singles during drafting it weakened the yarn at that point it allowed the fibers to drift apart.

Because the beaver underfur is 8-11 microns it is so delicate that it effortlessly spins very fine. The short and slippery fibres proved to be a real challenge to spin at a wheel ratio of 15:1 as lots of twist is required in the singles. I also had to increase my eye glasses strength for this project so that I could keep careful watch over every operation as the yarn developed. Knitting yarns are typically three ply yarns as this makes a rounder yarn suitable for a knit stitch and most patterns other than lace. Beaver underfur being very fine and short must be spun tightly into a very fine high twist single than plied for strength, stability and volume. The beaver underfur 100% three ply yarns provide these elements. The 100% two ply yarn is also a soft, fuzzy and supple yarn that is finer and delicate. The two ply yarn could be used for knitting fine lace patterns where warmth and softness are required such as a lacy scarf, tam or gloves.

The only blend I did not full was the 35% Shetland lamb/5% silk noil, because I felt that the wool and silk made a naturally strong durable yarn with just a gentle washing and final wacking. I did try some sample yarns with other various washing and finishing techniques but they did not result in stable or durable yarns. They are not included as part of this research paper.

From previous experience with spinning down fibers I suspected that I would need to full the beaver yarns to make them strong and stable and this proved to be correct. Historical data stated that beaver underfur was prized for its felting properties. All other yarns were finished by washing the spun yarns in hot soapy water with agitation and quickly rinsed in very cold water. This was repeated a number of times before a final rinse. Every sample
had the excess water removed by pressing with a cotton towel before the yarn was wacked on the counter top several times to allow the yarn to bloom before it was hung to dry with no tension. Having the fibers full within the yarn was a very important process because it caused the fine short beaver fibers to constrict and adhere to neighboring fibers making the yarn structure stable and strong.

During the first stages of washing the yarns, especially those yarns made from fibers cut by commercial shears (which resulted in very short fur indeed) the shorter fibers fell out into the water during the washing and fulling process. This was not a common occurrence with most of the blends or with beaver underfur that was removed by using #40 shears or the razor blades because this fur was longer and more uniform in length. The fulling process was a very important factor in making the two ply yarn a strong, stable and very usable yarn. The fulled yarns often obscured the twist making counting tpi and angle of the twist difficult at times.

Knitting the samples of beaver yarn was a real delight. The yarns were soft and fuzzy with a very slick feel to them. There was always a feeling of warmth in my hands as I knit. I tried to use the same size knitting needle for most of the samples however there were a few times that I choose larger needles for a few of the thicker yarns. I believe many of the yarns would have knitted lace exceptionally well but I did not make lace samples for this project.

The yarns that tended to shed during fulling were generally the same yarns that shed a bit during knitting. It is apparent that the reason for shedding in these yarns was caused from the loss of very short fibers that were cut and damaged by the commercial wool/alpaca shears.

Knitting yarns that require characteristics of warmth, softness, lightness and stability would be met using beaver underfur yarns. Constructing two or three ply yarns has proved to be a successful endeavor when the fine underfur beaver fibers are carefully prepared, spun, and finished to make a secure, balanced, and supple knitting yarn.
CONCLUSION

This project was a mystery waiting to be explored. It was a pleasure to pursue the unknown, to build new skills and to integrate skills already known to me. There were some enormous obstacles to overcome with regard to fiber supply and developing just the right skills to spin the elusive slippery fibers. There were just so many questions that I needed answers, techniques to be tried and research to delve into. Yet I continued because I had a vision and desire to learn that I cannot explain.

Yarns made from various exotic fibre blends are all good quality; secure, soft, springy and suitable for a wide range of uses. Those yarns made from 100% beaver under fur were all surprisingly stable, soft and elastic although some shed excessively due to shorter fibers. The finishing techniques that I suspected of working were fulling/felting were indeed the key to making a strong stable yarn from these fine underfur fibers.

I believed that beaver underfur would best be prepared by making punis similar to cotton...this proved correct...except for one adjustment! The punis could not be too tight. They had to be formed and removed from the cards so they were soft, airy and light, yet not too large and lofty. Also, the beaver underfur compressed very easily and tended to clump whenever it was held too tightly during drafting. A gentle touch and light grasp was very important when holding the punis during drafting so that the fibers did not compact. Punis also helped to develop a good twist in the yarn.

Spinning this fur using the point of contact or supported long draw method did prove to be the best method of spinning these slippery short fibers.

Beaver underfur blended effortlessly and thoroughly with exotic short fibers and it generally blended well with longer fibers such as paco-vicuna and silk. It was a real challenge to draft short beaver fur uniformly with the longer fibers and many of the samples that had longer fibres do not have consistent grists. However, the longer fibers hold the shorter fibers within the yarn. They still appear to be very stable and lovely yarns.

One challenge throughout this project was obtaining good dehaired fiber to spin. A great amount of time was spent learning about pelt quality by grading and how best to remove beaver fur from the pelts in sufficient condition to spin it well. There are a number of samples showing fibres that were removed using various methods and ending up in assorted conditions. I felt it was essential that I submit all of the samples...the good, the bad and the ugly, as they are fundamental learning tools.

Spinning the beaver and exotic fiber blends first and 100% beaver fibers last, gave me the opportunity to accustom myself to the quirkiness of spinning beaver underfur before tackling the
most challenging 100% pure fur samples. Many of the pure beaver fur samples had specific challenges that had to be overcome in one way or another. Treading for just the right amount of twist was always a challenge which often eluded me on a bad day.

All the challenges I encountered made the finished yarns all the more satisfying to me. The fact that 100% 2ply beaver underfur yarn resulted in a reliable and stable yarn was a pleasant surprise. It confirms to me that there is a future for 2 and 3 ply beaver yarn. This summer I plan on using the balance of the pelt fur to spin into a lightweight shoulder shawl with 100% 2 ply beaver fur.

The subject of spinning beaver underfur has potential that has not been fully explored or investigated. There are many opportunities left to study regarding this subject, for indeed it feels unfinished in several ways.
TRAPPED RAW STRETCHED & WASHED BEAVER PELT

This pelt was washed twice to ensure that the fiber no longer held any of the beaver's natural oil before removing the fiber from the leather. It was stretched flat so there are no wrinkles during the drying process and then commercial shears such as those used for shearing alpacas were used to remove the fur. Attempts were made to remove the fibers using human and dog hair clippers but they would not cut the fibers. Both types of shears had difficulty shearing the beaver and I believe it was because of the very coarse guard hairs that could be as coarse as 60 microns and the very fine short dense under fur that was as fine as 9-11 microns. The large alpaca shears did not do a very good job of shearing this fiber as it would 'ride up' the coarse guard hairs causing the fine down fibers to be chewed into very short pieces. The result was such a wide variety of fine under fur lengths that when it was de-haired and spun these very short fibers shed from the yarn in huge quantities. Another problem caused from this shearing was that the shears cut the guard hairs into a large variation of lengths and these shortened lengths of stiff coarse guard hairs became a huge problem to remove during the hand or commercial de-hairing process.

After much experimenting I found the best method of removing the beaver fiber from the pelt was by laying the fur to one side with a ruler and cutting it off in narrow rows with a razor blade. This method made neat cuts and gave lovely long fibers with no second cuts or chewing up of the fibers. All of the blended samples in my in-depth study were made with the fibers removed from the pelt using the razor and removing the guard hair by hand.
Raw beaver pelt where fur was removed with razor blade in narrow strips.
TRAPPED RAW STRETCHED & WASHED BEAVER PELT

HEAD

CHEEK

BEHIND FRONT LEG

BELLY SAMPLES

BACK LEG AREA

TAIL

BACK LINE SAMPLES
There was a remarkable difference between working with the raw pelts and the tanned/plucked pelt. Because the pelt was tanned it was completely clean and free from any natural oil or grease and free of any dirt or small parasites that were attached to the raw pelt.

This pelt was custom ordered through International Fur Dressers and Dyers, Winnipeg, Manitoba. The guard hairs were plucked out during the tanning process by specialized equipment. Guard hair removal by this method is expensive but the pelt is almost totally free of all three types of guard hairs especially the coarsest ones.

A special machine at the factory can shear the fur from the hide however it cannot shear the fur at skin level only. It shears the fur numerous times at varying heights before it reaches skin level. This is how various designs are added to furs so the furriers make elegant garments. Since this shearing technique would not work for this project my pelt was ordered with no shearing. It is important the tips remain intact because it is the tips that give the added length needed to spin the fibers well.

To remove the fur from the tanned and plucked hide I tried a fine #40 clipping blade (used by veterinarians during surgeries) and found that it worked only for a 3x3 inch square before dulling the blade. Beaver fur appeared too dense for #40 clippers to cut continuously without damaging the fibers.
The final and most effective method of removing the longest and most uniform fibers from the tanned and plucked pelt was by cutting the fur off in 6 inch long rows approx. $\frac{1}{16}$ of an inch wide with a razor blade. It worked quickly once a rhythm was obtained and was well worth the effort.

Removing the fur from the tanned and plucked beaver pelt with a razor blade provide the longest most uniform fibres of all. The back and side fibres are the darkest and longest providing as much as 1.5 – 2 ounces of under fur from one pelt. The lighter shorter belly fur yielded approximately 10 grams and this contained fine secondary guard hairs not removed by plucking because they did not extend beyond the length of the underfur.
TANNED AND COMMERCIAL DE-HAIRED BEAVER HIDE

HEAD
CHEEK
BEHIND FRONT LEG
BELLY SAMPLES
BACK LINE SAMPLES
TAIL
BACK LEG AREA
BEAVER FURSKIN IDENTIFICATION REPORT:

Castor fiber; BEAVER

French: Castor

Distribution areas

In the past the beaver was found throughout Europe, Asia and North America. The European beaver is now very rare and is protected by the state authorities. The Canadian variety of beaver found in North America has a larger population. The difference between the varieties is only miner the Canadian species has a narrower head and its skin is darker in colour.

Description of the fur

The skin of beaver is from 50 to 100 cm long and light-brown in colour. The guard hairs are straight, and are apparently longer than the fine under-fur fibres. These coarse hairs are lustrous, bark-brown or red-brown in colour and relatively scarce.
The guard hairs of the Canadian form of beaver are dark-brown or black. The coat of the beaver skin is relatively dense. The length of the under-fur fibres is from 6 to 15 mm; the longest guard hairs are from 25 to 55 mm long.

The Fibers

The microscopic structure of the skin of the fine fibres, 2000x surface is usually smooth; the hairs follicles are wide with straight edges. The average follicle contains from 15 to 25 fibres in cluster.

The fine fur fibres have a circular cross-section with a diameter of 10 to 15 µm. The cuticular scales are of the cornet-like type with a smooth scale surface and usually crenated scale margins. The fine fur fibres are non-medullated.

The intermediate fibres are very similar in structure to the fine fibres but are longer (from 15 to 30 mm), and their width is from 20 to 25 µm. The cuticular scales are cornet-like, smooth on the surface and usually crenated at the margins. The intermediate fibres are usually non-medullated.

The cuticular structure

The guard hairs are circular in cross-section of a guard hair, 1000x-section in the lower part, and ellipsoidal in the middle and upper parts of the shaft. The diameter of these fibres is from 25 to 65 µm. The cuticle consists of even tile-like scales with a smooth surface and rippled scale margins. The medullar structure is visible only in some guard hairs; a large proportion of these hairs are non-medullated. The medulla in the coarser guard hairs is wide, unbroken and central symmetrical-shaped. The medulla is of the lumpy type with an amorphous infilling substance.
Numerical code for beaver skin structure;

Surface of the skin;  1-2-3

Fine fur Fibers;  1-5-1-2-4-0-0-0-0-10.15-6.15

Intermediate fibers;  1-5-1-2-4-0-0-0-0-20.25-15.55

Guard Hairs;  1.2-2-1-22-4.2-1-1-13-8-25.65-25.55

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BEAVER FIBRE WAS CUT AND DEHAIERED USING VARIOUS METHODS

The beaver under fur that was used for these samples was removed from the hides by using various methods. The fibre was dehaired principally by hand although one sample shows a yarn made from samples processed with mini mill dehair equipment for comparison purposes.

Two sources of fur were used, one was raw beaver pelts obtained directly from local trappers and the second that was custom ordered from a tannery where it had been tanned with the guard hairs plucked to remove them.

Most samples of yarn are made of beaver underfur from the raw stretched pelts as they are what I had available until near the end of my project when the tanned hide arrived. Samples include those that had been removed by brushing, razor blade, commercial shears, #40 clipper head and plucked. Cutting the fibers from the leather was accomplished best by using razor blades and cutting very thin strips of fur, thus insuring that fibers remain as long as possible.

Numerous forms of dehairing were explored; hand dehairing, commercial dehair equipment, floating fur fibers in water and plucking at the tannery. All the samples except the tannery plucked fibers were hand dehaired as this resulted in the most meticulous method of removing all types of guard hairs from the underfur. The tannery plucked hide had some guard hair remnants remaining within the underfur either as broken fibers or shorter fibers not caught by the equipment.
100% Beaver
under Fur
Yarns
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT:  
Single  100% Beaver Underfur from Tanned/plucked Pelt

PREPARATION METHODS:  This fiber was removed from the tanned/plucked pelt with a razor blade in long thin strips before being hand carded and made into light fluffy punis. It is important to keep the punis light and fluffy and not make the puni too tight as the fibers do compact easily while holding the puni during drafting. The yarn was fulled by washing in hot soapy water and rinsed in cold clean water numerous times to allow the fibers to bind together and create a durable healthy singles yarn.

SPINNING METHODS:  This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: Z  ANGLE OF TWIST: 35 degrees  WPI: 32  TPI: 18-20  PLY:  COUNT: 15 s

EVALUATION AND CONCLUSION:  Spinning the single beaver yarn from the hand carded puni is always a challenge because the fiber tends to be very slick. However, the natural twist action built into the puni assists in the beginning of the twisting action needed during the first drafting motions. I have attempted to spin beaver fiber from carded mass of beaver fiber and from other preparations but I have found that the coiled action of the puni is what works best in getting the fibers to start a yarn formation.

A very light take-up tension and lots of twist is important as the fine short beaver fibers will draft apart easily. Making a strong single beaver yarn is a real challenge because of the fiber shortness, slipperiness and fineness. However, with careful fiber preparation, wheel setting and a very light hold to the fiber so that it does not compact during drafting makes this yarn possible. I found that a great deal of twist was needed to make the yarn stable and using my 15:1 whorl was not enough, I had to insert extra twists before the fiber was drafted onto the bobbin. It was important that the tips of the beaver under fur were strong and healthy because they not only added to the length of this short fiber but they added to the stability of the yarn twist. This under fur is so fine and short (8-11 microns (Histogram, Olds College, Natural Fibers, Sept. 2012) with dense hair follicles of 15-25 fibres per cluster (www. furskin.cz, Dec. 2012 website). The fine under fur fiber cuticular scales are smooth, fine and non-medulated making this fur a challenge to spin but very warm and durable when the yarn has been fulled. It is important to full this fine yarn to make it stable and durable otherwise the fibers will drift apart. The knitted samples are light and airy yet strong enough for a fine lacy garment because it was fulled well as a single yarn.
100% Beaver Underfur from Tanned/plucked Pelt
Single

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A
HANDSPINNERS YARN

FIBER CONTENT: 2 ply 100% Beaver Underfur Cut from Commercially Tanned and Plucked Hide with Razor Blade at Skin Level.

PREPARATION METHODS: Removing the underfur from the pelt with a razor blade has proven to be the best method so far, it results in the longest most uniform fur fibers with no second cuts or loss of fibers due to clipper damage. It is very easy to take the cut fibers and card them into light fluffy punis ready for spinning, care is taken not to compact the fibers in any manner.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn

TWIST: ZZS  ANGLE OF TWIST: 20 degrees  WPI: 20  TPI: 8  PLY: 2  COUNT: 18 s

EVALUATION AND CONCLUSION: Fibers cut from the plucked tanned pelt were long and even, they carded easily into punis before being spun. Because the fibers were all uniform in length and micron they drafted easily and evenly resulting in yarn that is more consistent in grist than previous methods.

This 2 ply yarn was a real joy to spin and finish, I was at first concerned that the unfinished yarn may not hold together as the singles tend to be rather fragile if not tightly twisted, however the fibers were evenly twisted in both singles and plied well for an even 2 ply yarn that held together before and after finishing. I fulled the yarn by washing it in hot water with mild soap and vigorously rinsing it in cold clear water numerous times before wacking the yarn on the counter top and allowing it to dry with no tension.

This 2 ply yarn is strong, durable, soft and furry! It was easy to knit into the swatches and shed very little overall. It is flexible, pliable and lightweight, although it is not as bulky or elastic as the 100% beaver fur 3 ply yarns it shows good stitch definition and is unexpectedly durable.

From this yarn I am so pleasantly surprised I feel assured that beaver under fur 2ply yarns that are correctly fulled will make an excellent yarn for any garment where warmth, durability, suppleness and flexibility are important; garments such as mittens, gloves, hats, lacy vests, scarves, stoles and shawls.
100% % Beaver Underfur Cut from Commercially Tanned & Plucked Hide with Razor Blade at Skin Level

2 ply yarn

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: **(3 ply)** 100% Beaver Underfur Cut from Commercially Tanned/plucked Hide with a Razor Blade at Skin Level.

PREPARATION METHODS: Removing the under fur from the pelt with a razor blade has proven to be the best method so far, it results in the longest most uniform fur fibers with no second cuts or loss of fibers due to clipper damage. It is very easy to take the cut fibers and card them into light fluffy punis ready for spinning, care is taken not to compact the fibers in any manner.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: **ZZZS** ANGLE OF TWIST: 21 degrees WPI: 15 TPI: 7 PLY: 3 COUNT: 15 s

EVALUATION AND CONCLUSION: This razor cut under fur is very uniform and makes very uniform punis, resulting in a yarn where the grist is even and consistent. These uniformly cut fibers draft from the fiber supply easily and smoothly if they are not compacted while being held in my hand making the twist flow to the orifice and along the hooks to the bobbin. Another factor contributing to this superior yarn is that there are no guard hairs or second cuts that would cause snarls or nepes to build up in the yarn.

This three ply yarn was finished by fulling it in hot and cold water baths numerous times with vigorous action and mild soap before rinsing out the yarn and wacking it on the counter before hanging it without tension to dry.

Comparing this yarn to the other 100% beaver yarns done in this study shows me that this yarn shed the least of them all and had no fiber clumps caused from a build-up of fine short clumps of underfur in the drafting zone. This yarn is very uniform/consistent, light and fuzzy yet durable and strong.

I would enjoy using this yarn for a garment where warmth is important and it could be worn against the skin with no prickle factor. I would make knitted or crocheted garments such as hats, tams, scarves, mittens, gloves, lacy vest and shawls with this yarn.
100% Beaver Underfur Cut from Commercially Tanned/plucked Hide with a Razor Blade at Skin Level

3 ply yarn

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 ply 100% Beaver Underfur Sheared Using #40 Clipping Shear Head from Commercially Tanned/plucked Hide.

PREPARATION METHODS: #40 clippers cut close to the skin surface, leaving fibers longer than those sheared with commercial sheep/alpaca shears. #40 clippers basically sheared the fur at skin level leaving very little of the fur on the hide allowing for a longer staple length for spinning purposes. These fibers were than very easy to prepare by lightly carding into soft airy punis ready for spinning.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZZS  ANGLE OF TWIST: 23 degrees  WPI: 18  TPI: 6  PLY: 3  COUNT: 20 s

EVALUATION AND CONCLUSION: This beaver under fur was by far the easiest and most enjoyable of all the preparations to card and spin, it also resulted in the most consistent 3 ply yarn. I believe that because the #40 clippers were able to shear the under fur right at skin level this made the fibers as long as possible which at times was over one inch long.

The punis were easy to make into soft light airy forms so that all the fibers drafted evenly and smoothly into the drafting zone, there were no guard hairs causing clumps and no short fibers creating slubs.

The resulting yarn was generally more even and uniform than other 100% beaver yarns, however one has to always be vigilant when spinning not to compact the puni or fiber source when holding it before the drafting zone. Beaver fur tends to compact easily and tightly therefore it will clump up and create lumps in the drafting zone and yarn. I have found it only takes a light touch to fluff up the fibers again either in the fiber source or the yarn. This 3 ply yarn was finished by fulling it in hot and cold water to stabilize it and the results are a very soft, fuzzy durable yarn. This yarn would make excellent garments where warmth and softness are important, garments such as scarves, tams, mittens, gloves, wristlets and lacy shawls.
100% % Beaver Underfur Sheared Using #40 Clipping
Shear Head from Commercially Tanned/plucked Hide

3 Ply

Sheared from tanned hide

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT:  **3 Ply**  100% Beaver Underfur Brushed (not cut) from Belly of the Hide.

PREPARATION METHODS: This fiber was brushed (not cut) from the hide of the beaver at the belly area where there are very few large guard hairs but more very fine light shorter guard hairs. These guard hairs were removed by hand before the fibers were hand carded into punis for spinning. The yarns were set by repeatedly dashing them in hot and cold water to full them.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZZS  ANGLE OF TWIST: 28  WPI: 19  TPI: 8-9  PLY: 3  COUNT: 22 s

EVALUATION AND CONCLUSION: This 3 ply yarn was a delight to spin because it was approximately half an inch long at the longest with many fibers being slightly shorter. However, having said that, 100% beaver still proves to be rather difficult to draft because it compacts just before the drafting zone in between my fingers which sometimes makes clumps draw into the drafting zone. Blends rarely have this problem and I find that the longer the beaver fibers are the less compacting issue I have.

Upon studying the crimp of the belly fur closely I saw it was shallow and the fibers did not have the long slim tips that help secure the fibers in the yarns. This particular yarn appeared to be slightly over twisted, because a great deal of twist was needed to keep the yarn from drifting apart when spinning. Another problem that came up when spinning 100% beaver with such short slippery fibers was that it wanted to spin very fine but over twisting in areas would cause those areas to snap easily.

The resulting yarn was very soft and knitted into a swatch well, it proved to be stretchy and durable and shed very little. So while it had its challenges to spin the result was very good. This yarn would make an excellent accent yarn for a garment where light weight, warmth, drape and slight halo affect are important. Small garments such as mittens, hats, gloves and scarves would be ideal for using this beaver yarn either as an accent yarn for the full project.
100% Beaver Underfur Brushed (not cut) from Belly of the Hide
3 ply from brushed and hand dehaired fibers
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANSPINNERS YARN

FIBER CONTENT: 2 ply 100% Beaver Underfur from Commercial Sheared Pelt & Commercially Dehaired Followed by Hand Dehairing.

PREPARATION METHODS: The shears did not work well when cutting the fur from the pelts because the coarse guard hairs caused the blades to rise up and cut the fibers higher than skin level. As a result the short fine underfur which is usually ½ inch long became various lengths under ½ inch with many short pieces of guard hairs that were not removed by the commercial dehairing process. I still dehaired by hand the commercially dehaired fibers before carding and spinning.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZS  ANGLE OF TWIST: 22  WPI: 22  TPI: 6  PLY: 2  COUNT: 6 s

EVALUATION AND CONCLUSION: Spinning 2 ply 100% beaver was exactly the same as for single. I had to be sure there was lots of twist in all the yarn or it would drift apart during plying. When I compared the 2 and 3 ply yarns there was a difference not only in the grist but also in strength. The 3 ply yarns had an extra degree of strength given to it from the extra yarn. When I washed and fulled the 2 ply yarns shed even more than the 3 ply yarn. when I was knitting swatches the yarn and knitted sample would shed from friction. I liked the feel and lightness of the 2 ply yarn as it spun into a beautiful fuzzy lightweight yarn. It did not make as fine a yarn as I thought an 11 micron count fiber should spin into. However, because this beaver was sheared from the pelt by commercial shears it had too many chewed up lengths of fibers to be consistently ½ inch so that would explain why the short fine fibers shed during washing and knitting.

I feel that because this 2 ply yarn does not have good stability that I would not encourage further development or use of it and would look into other options for shearing the fur from the pelts so that consistent lengths obtained. Also, because inconsistent lengths of guard hairs were cut by the shears the very short spiky pieces could not be removed by the commercial machinery or by hand resulting in some prickle factor in the yarn.
100% Beaver Underfur from Commercial Sheared Pelt
& Commercially Dehaired Followed by Hand Dehairing

2 Ply

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 ply 100% Beaver Underfur from Commercial Sheared Pelt & Commercial Dehair Equipment

PREPARATION METHODS: The shears did not work well cutting the fur from the pelts as the coarse guard hairs caused the blades to rise up and cut the fibers higher than skin level. As a result the short fine underfur which is usually ½ inch long became various lengths under ½ inch with many short pieces of guard hairs that were not removed by the commercial dehairing process. I still dehaired by hand the commercially dehaired fibers before carding and spinning. I had to make the punis tighter than normal so that the fibers would draft well and not slip apart.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZS  ANGLE OF TWIST: 30 WPI: 20 TPI: 6 PLY: 3 COUNT: 14 s

EVALUATION AND CONCLUSION: This 100% beaver was very difficult to spin well or fine because of the vast array of fiber lengths which was also the reason for a great deal of shedding of fine fibers when washing the yarns during the fulling process. In order to have the fibers stay together in a single ply a great deal of twist was required to keep the short fine fibers in the twist. I was surprised that I could not spin a fine highly twisted 100% beaver single ply yarn with this fiber and I believe it was because of the huge variety of fiber lengths and the smoothness of the underfur. Even though it had lovely organized crimp it was very slippery in the puni and yarn. The single yarn became much thicker than I wanted but that was what it had to be in order that it stayed strong enough to ply. The resulting 3 ply yarn fulled beautifully, it was very springy and soft with a lovely halo. Knitting the sample was a real joy and I enjoyed the flexibility and softness of the yarn while watching the stitches bloom before my eyes. I can see where this yarn is softer, warmer and lovelier than the beaver/mink blend which was a favorite of mine. This yarn would make an exceptional yarn for warm exotic type garments such as mittens, scarves, hats and shawls if the time came when all the guard hairs could be eliminated by better dehairing methods.
100% Beaver Underfur from Commercial Shears
& Commercial Dehair Equipment

3 ply
A Tactile Experience with 100% Beaver Yarns
Single yarn from plucked tanned hide

2 ply razor blade cut from tanned plucked hide

3 ply razor blade cut from tanned plucked hide
3ply sheared with #40 clippers, tanned/plucked hide

3ply brushed fur from belly of raw hide

2ply cut with wool/alpaca shears from raw hide

3ply cut with wool/alpaca shears from raw hide
60% beaver Under Fur and 40% Exotic Fiber blends
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 40% Mink

PREPARATION METHODS: The mink was purchased in cloud form at $14 USD per ounce. The beaver was dehaired by hand and hand carded to open the fibers before both fibers were carded several times to combine the fibers and prepare punis for spinning from one end.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZZS ANGLE OF TWIST: 20 WPI: 20 TPI: 6-7 PLY: 3 COUNT: 30s

EVALUATION AND CONCLUSION: The mink was surprisingly coarse compared to the beaver and contained few fine guard hairs. At first I thought the mink was dominating the blend because of its relative coarseness, but as the spinning was commencing I could see the attributes of the beaver coming through demonstrating the fineness of micron. The mink added a degree of bulkiness to the yarn whereas the beaver fur tended to compact during spinning. The fibers spun very fine naturally and required a good amount of twist to keep the yarn from pulling apart before it was plied to a 3 ply yarn and subsequently fulled. The yarns were fulled by washing repeatedly in very hot soapy water and then immersed in very cold water all the while being agitated, this procedure was followed by a good wacking against the counter top to even out the twist and fluff out the fibers. The yarns shed a lot of mink fibers during washing but less so during the wash of the knitted samples.

The result was a rounded, strong 3 ply yarn with a soft fluffy hand that is very warm and light. This would make wonderful knitting yarns to use in either smaller lightweight garments such as mittens, hats, or scarf where warmth is important or it could be used in more open knitted patterns because it is so warm that a lightweight lacy vest would have exceptional comfort.

When the knitted samples were washed the yarn really bloomed in the swatch and filled the loops completely, so I knitted a swatch using knitting needles a full size larger (#4) to study the difference. I personally prefer the swatch completed with the smaller sized needles (#3) but can see where this yarn would be perfect for light open knitting with larger needles also.
RAW FIBER SAMPLE, 3 Ply

Beaver & Mink

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A
HANDSPINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 40% Possum

PREPARATION METHODS: The possum was purchased raw, plucked and unwashed, with a large variety of fiber micron and fiber lengths overall. No effort was made to sort and separate the quality of the fibers. They were chosen randomly before being opened with hand cards. The two fibers were blended by hand carding numerous times before being made into punis.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZSZ  ANGLE OF TWIST: 25  WPI: 18  TPI: 5  PLY: 3  COUNT: 14s

EVALUATION AND CONCLUSION: This blend was very interesting because of the great variety of microns and lengths in the possum fiber. The longer length of the possum made the spinning easier during drafting but the resulted in a rather hairy yarn with fine longer possum ends sticking. The drafting zone was slightly thicker so the fibers would hold together during spinning and I would suggest that was because of the variety in possum fiber lengths and also the larger micron count of the mink. The yarn was thicker and bulkier than that yarn spun from beaver/mink and I believe that was also a result of some very coarse guard hairs in the possum compared to the mink which had fine or no guard hair. There was less shedding during washing than the beaver/mink blend and the resulting yarn was soft but not as soft as the beaver/mink blend.

This yarn is still wonderfully soft and warm; it is strong and lofty making it suitable for garments such as hats, mitts and garments that require less stressful use. Because there would be a slight prickle factor from the possum guard hairs this may not be the best yarn to use for a scarf worn against the skin, yet it would make an excellent vest and sweater or other lightweight garment. The prickle factor would only be slight because the guard hairs appear to be under 30 microns.
RAW FIBER SAMPLE 3 Ply
Beaver & Possum

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 40% Brown Cotton

PREPARATION METHODS: The brown cotton was purchased roving. To prepare the blend with beaver both fibers were separately carded to open the fibers before blending together. They were chosen randomly before being opened with hand cards to make the punis.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZSZ  ANGLE OF TWIST: 26  WPI: 24  TPI: 8-9  COUNT: 26s

EVALUATION AND CONCLUSION: This cotton was very similar to beaver; in micron count and length. The difference was that the cotton occasionally made slubs in the drafting zone. It carded very uniform and created a perfect puni, still I had to be very careful not to compact the puni during drafting. It naturally spun into a very fine yarn and at times it was difficult to keep enough twist in the fibers to keep it from drifting apart even though I used my highest wheel ratio and added twist.

This would make an excellent blend to spin on a support spindle and quill wheel. When finishing the yarn I washed it in very hot water with a mild soap and rinsing it before drying it with very slight tension. I did not wack this yarn as I did not want it to fluff or full so that the yarn would clearly show stitch definition when knitted.

This very soft springy yarn would make excellent garments that would be worn against the skin. The cotton content adds lightness, airiness and breathability to the yarn. Small clothing articles such as light weight vests, scarves, tams, gloves and lace sweaters would be very comfortable and attractive.
RAW FIBER SAMPLE 3 Ply

Beaver & Brown Cotton

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 40% White Silk Noil

PREPARATION METHODS: The silk noil and beaver fibers were both carded separately to open the fibers well before carding them together three times to blend the fibers fully. The beaver had been washed while on the pelt and sheared off in strips with a razor blade then carefully hand dehaired before it was carded. Punis were made from the blended fibers.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZZS  ANGLE OF TWIST: 28  WPI: 21  TPI: 5  PLY: 3  COUNT: 19 s

EVALUATION AND CONCLUSION: This yarn blend was a real joy to work with, I noticed immediately when blending the fibers that the fine silk noil caught the short fine beaver fibers into the puni and held them well during spinning and also in the resulting yarn. There was very little shedding during washing of neither this yarn nor the knitted swatches. As I was spinning the fine silk fibers assisted the fine beaver fibers to draft well whereas in other blends such as the mink there were times when both fibers tended to matt or clump up in the puni during drafting so great care had to be taken during drafting. This yarn is not as hairy as possum, but not as soft and smooth as the brown cotton blend nor as fine and delicate as the mink blend.

I love the texture of this blend and believe this yarn to be very durable and warm, it would not exhibit drape or luster however. The resulting three ply yarn has an excellent soft hand and because of its durability and lightness it would make excellent small garments that could be worn against the skin such as scarves, camisoles, wristlets, mittens and even wonderful lace socks. I think that a set of mittens, hat and matching scarf would be an excellent use of this type of yarn.
RAW FIBER SAMPLE 3 Ply

Beaver & White Silk Noil

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A
HANDBINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 40% Camel Down

PREPARATION METHODS: The commercial camel down was purchased as a washed carded cloud so in preparation for blending with beaver fur I recarded to open the fibers. The beaver fur was carded numerous times to open the fine fur before blending with the camel down on the cards. This time I layered the camel down first on the cards then the beaver between layers of camel down. I blended the fibers numerous times before making punis to spin from.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZZS ANGLE OF TWIST: 17 WPI: 24 TPI: 5-6 PLY: 3 COUNT: 25 s

EVALUATION AND CONCLUSION: The camel down was very fine but not as fine as the beaver fur, and it was longer and yet they blended well when carded. However, when drawing fibers from the punis there was still the occasional time when only fine beaver fur fibers came creating slight slubs. This tells me that a more thorough carding was needed. The camel down was an excellent companion fiber for the beaver as it assisted it to bind within the yarn.

I did not wack the yarn when washing the yarn to set the twist as it appeared to be a very stable 3 ply yarn without the need for a fulling. The resulting three ply yarn is rather fuzzy with what appears to be mostly camel down fibers extending from the yarn; I say that because of the colour and the micron count of the extruding fibers.

This yarn is very soft and lofty; it is stable and has an excellent hand. While knitting, it was light and flexible. It did not exhibit luster but did have a slight halo effect and would make excellent warm wearable garments such as mittens, gloves, hats, scarves and excellent shawls.
RAW FIBER SAMPLE 3 Ply

Beaver & Camel Down

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A
HANDSPINNERS YARN

FIBER CONTENT: 3 Ply  60% Beaver Underfur & 40% White Cashmere

PREPARATION METHODS: The white cashmere was a fleece I purchased at Olds Fiber Week 2010 which I had dehaired by hand and hand carded in preparation for blending with the beaver fur. The beaver fur was carded numerous times to open the fine fiber before sandwiching portions between layers of cashmere on the hand cards. All fibers were well blended for making punis for spinning.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZZS  ANGLE OF TWIST: 25  WPI: 26  TPI: 8  PLY: 3  COUNT: 21 s

EVALUATION AND CONCLUSION: Blending these two fibers was a real joy to the tactile senses; even though the cashmere was longer they blended beautifully and felt like butter. Drafting the fiber during spinning was very easy and consistent making thin even single for plying. To set the twist I washed the yarn in warm water and mild soap, rinsed the yarn a few times before gently wacking the yarn on the counter a couple of times to bring out the fullness of the yarn before it dried. It did not shed during washing as it did with mink or possum blends.

The resulting three ply yarn was very durable with a wonderfully soft buttery feeling, softer than the camel down blend and about the same softness as the mink/beaver blend. This yarn has exceptional hand and it would knit or crochet into the softest garments to be worn against the skin with virtually no prickle factor. Because it is stable and durable it would make excellent yarns for scarves, shawls, hats, mittens and gloves and I can just imagine that a light camisole or lacy vest would be perfect in this yarn.
RAW FIBER SAMPLE  3 Ply

Beaver & White Cashmere

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 40% Bison Down

PREPARATION METHODS: The bison down was purchased as a carded roving so I carded it again to open the fibers before blending with the beaver fur. The beaver was washed and dehaired by hand before being carded numerous times by itself to open the fine fibers. When I combined the fibers they blended easily and evenly and I carded them numerous times before I made punis to spin from.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZS  ANGLE OF TWIST: 24  WPI: 26  TPI: 7  PLY: 3  COUNT: 26 s

EVALUATION AND CONCLUSION: The bison fiber appeared quite coarse compared to the beaver and I thought the yarn would have an unpleasant hand but it is surprisingly soft and lofty. The fibers drafted very fine and made the singles so fine that the three ply yarn is fine but not fragile. The bison fibers were dusty and dirty so I took extra care when washing the yarn to make sure that it was not only fulled but clean.

This bison fiber had amazing deep crimp or crinkle, similar to wool fibers; this gave the yarn loft and spring. It is soft, warm and light to the touch. Compared to the mink, cotton, camel and cashmere blends I don’t think it was as soft or luxurious, but when compared to the possum it has a more pleasing hand. When the yarn was washed and the bison fibers were clean and the yarn was allowed to bloom it had an amazing soft hand and springy warm feel. This yarn would be knitted or crocheted into garments such as sweaters, scarves, vests, camisoles, hats, mittens or gloves. Also, a light weight lacy shawl or throw would be ideal garments because of the warmth, softness and lack of prickle factor in this yarn.
RAW FIBER SAMPLE 3 Ply
Beaver & Bison Down

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 Ply  60% Beaver Underfur & 40% Yak Down

PREPARATION METHODS: The Yak down was purchased as commercially processed cloud. It was clean and free of guard hairs, and I carded it before blending with the beaver to open the fibers. The beaver was dehaired by hand before it was weighed and carded numerous times to open the fibers before I blended both fibers by hand carding them together with hand cards and making punis to spin from.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZZS    ANGLE OF TWIST: 21    WPI: 21   TPI: 6   PLY: 3    COUNT: 27 s

EVALUATION AND CONCLUSION: The Yak fiber was a real joy to work with because it was clean and free of guard hairs; it needed little preparation before blending with the beaver. It blended very quickly and evenly during hand carding and drafted easily and evenly from the punis to make a consistent yarn. Because both yak and beaver are very short fibers I had to be very careful when drafting to have enough twist all the time and not to draw too fast so I would not lose the yarn into the orifice of the spinning wheel.

The three ply yarn was finished by fulling it in hot and cold water to allow for two functions to the yarn; one to make it bloom into a soft round yarn and second to make it strong and durable. The resulting yarn is wonderfully soft and strong; it has a lovely plump look and would make an excellent yarn for knitting warm garments worn next to the skin as there would be no prickle factor. I believe it would also make an excellent outer wear sweater coat as it would be light and warm. This 3 ply yarn, because of it properties, will knit up into smaller garments such as scarves, hats, mittens, tams, vests and warm shawls. Woven, this yarn would make excellent lap rugs and throws giving warmth, softness and durability.
RAW FIBER SAMPLE  3 Ply
Beaver & Yak Down

KNITTED SWATCH

SINGLE SAMPLE

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EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 40% Qiviut

PREPARATION METHODS: The qiviut was from Greenland, it was raw and needed to be dehaired by hand and cleaned of skin flakes and small vegetation and debris. There were various types of guard hairs to be removed leaving only about 50% as usable down fibers which I washed before carding to open the fibers. The beaver under fur was unusual this time because it was from pelts that were sheared with large commercial shears. They tended to float up the coarse guard hairs and chew up the fine fur fibers. This beaver fiber was poorly dehaired by commercial dehair equipment leaving much of the guard hairs mixed with finely cut up pieces of fur.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZZS  ANGLE OF TWIST: 20  WPI: 19  TPI: 5  PLY: 3  COUNT: 26 s

EVALUATION AND CONCLUSION: This blend was totally different to draft and spin mostly because it was from commercially dehaired beaver fiber. The dehair equipment mixed short pieces of guard hairs and fur rather than removing them. Therefore, I did spend a great deal of time dehairing by hand but the result was still not satisfactory. The qiviut also contained bits of skin flakes so the punis drafted small clumps of fiber, this resulted in poor quality yarns that shed heavily during washing and fulling. The yarn is very soft and lofty but contains short guard hairs which cause a prickle sensation. I could see during knitting of the swatches that the yarn appeared bare from the loss of fine fibers during the washing. The yarn was still stable because of the fulling and it knitted into a lovely soft swatch. It would make warm soft mittens, gloves and garments where warmth is important but slight prickle is not an issue.
RAW FIBER SAMPLE 3 Ply

Beaver & Qivuit

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 40% Paco-vicuna

PREPARATION METHODS: The beaver under fur was blended with the paco-vicuna fiber on hand cards by first laying a fine layer of paco-vicuna roving across the cards with the beaver fur over that before adding another layer of paco-vicuna. I hand carded the fibers numerous times to blend the fibers because the beaver is much shorter than the paco-vicuna. Than all the carded fibers were mixed and recarded into small light airy punis for spinning.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the punis described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZSZ ANGLE OF TWIST: 17 degrees WPI: 26 TPI: 8 PLY: 3 COUNT: 35 s

EVALUATION AND CONCLUSION: The paco-vicuna fiber was very fine (approx. 14-15 microns) making it an interesting match with the fine beaver fiber. However, because of its natural length that was approximately 2.5 - 3 inches it proved to be a challenge to keep the fibers combined during drafting. The paco-vicuna fibers did have some guard hairs that also affected the yarn.

When I was drafting the yarn it was difficult to keep the fine short beaver fibers in the drafting zone along with the longer paco-vicuna fibers. The shorter fibers tended to hold back in the finger area a bit, when this occurred the result was slight clumps in the yarn. I found that the paco-vicuna blend allowed the yarn to be spun very fine with less twist (8tpi) yet the resulting yarn was soft, pliable and durable but slightly uneven in grist.

I finished the yarn by fulling it with a hot water wash with mild soap and a very cold water rinse repeating this process numerous times followed by a good wacking on the counter before allowing the yarn to dry with no tension.

This yarn is very fine, soft, and flexible and would make a wonderful lacy garment where open work would be enhanced because it is not as fuzzy as other beaver blend yarns. I believe the paco-vicuna fibers held in the shorter very fine fibers into the twist of the yarn which resulted in less halo and fuzziness.
RAW FIBER SAMPLES 3 Ply
Beaver & Paco-vicuna

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 40% Angora Rabbit

PREPARATION METHODS: The beaver under fur was blended with the angora using hand cards. Both fibers were carded by themselves first to open the fibers before they were layered on the hand cards for blending. They were blended several times before they were made into soft light rolags (almost a puni) ready for spinning.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the soft rolag described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZSZ ANGLE OF TWIST: 25 WPI: 23 TPI: 7-8 PLY: 3 COUNT: 23 s

EVALUATION AND CONCLUSION: I knew that this would be a difficult fiber to blend because the angora fiber was much longer than the beaver. In fact, it was about 2.5 – 3.5 inches long and contained various lengths of guard hairs. The beaver underfur length was not even one half inch long. I did not wish to cut the fibers to match the beaver length, but may do that in another sample, meantime this sample proved to blend quite well on the cards.

During most of the drafting and spinning the blend was quite cohesive. However, there were many instances when the longer angora fibers drafted into the drafting zone leaving behind the shorter beaver fibers. This shows up in the yarn as thin white areas. The guard hairs presented a problem by causing clumps or fiber jams to occur during drafting and the short fine beaver fibers would get caught up when the guard hairs would bend and cause a snarl. This yarn became very thick and thin, uneven and unattractive.

The micron counts of both fibers are similar, but the lengths were vastly different. Another time I would choose angora fiber that was shorter and dehaired or combed.
RAW FIBER SAMPLE 3 Ply
Beaver & Angora Rabbit

KNITTED SWATCH

SINGLE SAMPLE
EXPLORING THE FORM AND FUNCTION OF BEAVER FUR AS A HANDSPINNERS YARN

FIBER CONTENT: 3 Ply 60% Beaver Underfur & 35% Shetland Lamb/5% Silk Noil Blend

PREPARATION METHODS: The Shetland lamb's wool was previously blended together with 5% silk noil on a drum carder. I hand carded the beaver numerous times before blending these fibers together with hand cards. To blend I laid a fine layer of wool/silk on the hand cards first and then a layer of beaver before covering that with wool/silk again. Making a sandwich. This was then hand carded numerous times for a very good blended small rolag.

SPINNING METHODS: This yarn was spun using the supported long draw method of spinning, from the small rolag described above. My Schacht wheel was set at a ratio of 15.5:1, thus making a single yarn.

TWIST: ZZSZ  ANGLE OF TWIST: 26 degrees  WPI: 20  TPI: 5  PLY: 3  COUNT: 22 s

EVALUATION AND CONCLUSION: The Shetland lamb's wool is very fine and not more than 2 inches long. It was a perfect blend with the short silk noils. The final blend was a combination of 35% Shetland/5% silk noil with 60% beaver. It made a lovely yarn that drafted fairly even with some slubs of silk or shorter beaver fibers. The resulting yarn appeared to be very uneven in grist and this was probably a result of having blended long and short fibers, silk noil slubs and also the fact that the yarn was not fulled but simply wacked.

I finished the yarn with a gentle wash and strong wacking on the counter but I did not attempt to full the yarn because of the wool and silk content. It proved to be strong and durable probably because of the silk and wool content. The yarn shows texture and fine fuzziness, it feels soft and lofty. However, it is not as consistent in the grist as I would have liked for this blend.

This yarn has character, softness, and is durable making it suitable for mittens, gloves, hats, scarves or other garments where warmth and texture are desired.
RAW FIBER SAMPLE 3 Ply

Beaver & Shetland Lamb/silk Noil Blend

KNITTED SWATCH

SINGLE SAMPLE
A Tactile Experience with beaver & Exotic Fiber blends
Beaver + Mink

Beaver + Possum

Beaver + Brown Cotton

Beaver + Silk Noil

Beaver + Camel Down

Beaver + Cashmere
Beaver + Bison Down

Beaver + Yak Down

Beaver + Qiviuk

Beaver + Paco Vicuna

Beaver + Angora

Beaver + Shelland Lamb + Silk Novel Blend
Cost analysis of beaver for project

July 10, 2012, Purchase of three raw, salted and dried beaver hides $50.00
July 24, 2012, Purchase two raw, salted and dried prime beaver pup hides $30.00
Oct 31, 2012, Purchase one tanned and plucked prime beaver hide $155.73
3 hour Commercial Dehair Machine usage courtesy of Twisted Sister Mill $20.00

Totally monetary expense $265.73 for beaver

The cost of other fibers used in the blends was not kept as they were generally fibers from my stash except mink and possum which were especially ordered for this project. Cost of the Possum $12.00, Mink $15.00 plus postage.

Travel time and expenses to Trappers Convention, Fur buyers and trapper locations to study primness and quality of beaver pelts.....priceless!

Countless hours upon hours picking/dehairing by hand the guard hairs from the underfur...absolutely enjoyable and immeasurable!

Cutting the underfur from the raw and tanned hides strip by strip was tedious but for some reason very satisfying.

Learning about beaver fiber meant learning about the animal too.
Exploring the Form and Function of Beaver Fur as a Hand Spinners Yarn

Appendix:


Histogram, Olds College Centre for Innovation – Natural Fiber Centre

Fur Grading Charts, courtesy of Fur Harvesters Association

Castor fiber:

- German: Biber
- French: Castor
- Spanish: Castor

Distribution areas

In the past the beaver was found throughout Europe, Asia and North America. The European beaver is now very rare and is protected by the state authorities. The Canadian variety of beaver found in North America has a larger population. The difference between the varieties is only minor: the Canadian species has a narrower head and its skin is darker in colour.

Description of the fur:

The skin of beaver is from 50 to 100 cm long and light-brown in colour. The guard hairs are straight, and are apparently longer than the fine under-fur fibres. These coarse hairs are lustrous, bark-brown or red-brown in colour and relatively scarce.
The guard hairs of the Canadian form of beaver are dark-brown or black. The coat of the beaver skin is relatively dense. The length of the under-fur fibres is from 6 to 15 mm; the longest guard hairs are from 25 to 55 mm long.

Structure of the hair: The cuticular structure:

The microscopic structure of the skin of the fine fibres, 2000x surface is usually smooth; the hairs follicles are wide with straight edges. The average follicle contains from 15 to 25 fibres in cluster.

The fine fur fibres have a circular cross-section with a diameter of 10 to 15 µm. The cuticular scales are of the cornet-like type with a smooth scale surface and usually crenated scale margins. The fine fur fibres are non-medullated.
The intermediate fibres are very similar in structure to the fine fibres but are longer (from 15 to 30 mm), and their width is from 20 to 25 µm. The cuticular scales are cornet-like, smooth on the surface and usually crenated at the margins. The intermediate fibres are usually non-medullated.

The guard hairs are circular in cross-section of a guard hair, 1000x-section in the lower part, and ellipsoidal in the middle and upper parts of the shaft. The diameter of these fibres is from 25 to 65 µm. The cuticle consists of even tile-like scales with a smooth surface and rippled scale margins. The medullar structure is visible only in some guard hairs; a large proportion of these hairs is non-medullated. The medulla in the coarser guard hairs is wide, unbroken and central symmetrical-shaped. The medulla is of the lumpy type with an amorphous infilling substance.
Castor fiber

Transverse section of a guard hair, 1000x

Longitudinal section of a guard hair, 1000x
Numerical code for beaver skin structure:

Surface of the skin: 1-2-3

Fine fur fibres: 1-5-1-2-4-0-0-0-0-0-10.15-6.15

Intermediate fibres: 1-5-1-2-4-0-0-0-0-20.25-15.25

Guard hairs: 1.2-2-1-2-4.2-1-1-13-8-25.65-25.55

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Furskin Identification

In past years valuable information has been accumulated about micro-morphology of a number of important fur species. This could be used in solving problems with fur skin identification when only a small sample of material is available. Such a situation is currently appearing in zoology, archaeology and criminology. However, when one tries to use this technique, one is usually faced with a considerable amount of time needed to analyze the micro photographs and determine the most probable fur skin type. In this website, we describe the Furskin Identification program for rapid analysis and identification of fur skin species based on its micro-morphology and wide collection of fur skins and their microscopic patterns. The structural features can be described by special code numbers, previously suggested.

The identification of a biological object using a mathematical model was first suggested by Beers and Lockhart for bacterial species. The mathematical basis by which such programs provide identification is derived from a theorem of probabilities. Furskin is the first program created for fur skin identification and for simplification of the procedure which has allowed a very quick and exact comparison of structural patterns and eliminates much of the tedious work associated with the use of the Atlas book.

NUMERICAL MODEL OF ANIMAL HAIRS

Computerized treatment requires transcription of morphological features into alphanumerical shape. In the code system used in the FURSKIN program, each structural feature is represented by a letter of the alphabet. All micro-morphological variants of the feature are described by numbers. The first three letters represent skin surface, shape of upper part of follicles and average number of hairs in a follicle. The following eleven letters represent structural features of three main hair types, particularly fine fibers, intermediate fibers and guard hairs. Therefore, these letters are used three times.

Surface of skin: a - b - c
Fine fibers: d - e - f - g - h - i - j - k - l - m - n
Intermediate fibers: d - e - f - g - h - i - j - k - l - m - n
Guard hairs: d - e - f - g - h - i - j - k - l - m - n

Any individual letter in this scheme describes the following structural pattern:

- a: appearance of skin surface (3 types)
- b: the shape of upper part of follicles (6 types)
- c: number of fibers in follicle (3 types)
- d: the shape of hair cross-section (9 types)
- e: shape of cuticular scales (16 types)
- f: surface of cuticular scales (3 types)
- g: the shape of scale margins (2 types)
- h: size of medulla (4 types)
- i: longitudinal shape of medulla (2 types)
- j: shape of medullar cross-section (4 types)
- k: structure of medulla (16 types)
- l: structure of medullar filling (8 types)
- m: minimal and maximal thickness of fiber shafts (in µm)
- n: extent of hair lengths (in mm)

HOW THE IDENTIFICATION WORKS

The FURSKIN program understands the comparison of structural features of a tested sample with a huge volume of structural data offered by an ensemble of expressive fur skins. The micro-morphological patterns of tested fur skin are placed into a computer and compared by program procedures. For each fur skin species a calculated "score of similarity" is represented by a number of structural differences. All scores are arranged in descending order and results are displayed or printed.

THE EFFECTIVENESS OF THE FURSKIN PROGRAM

The effectiveness was tested by cross-comparison of 134 fur skin species to find the most similar couples. The results in the following table suggest the important diagnostic feature of hair microscopic structure. The minimal number of differences between couples was ten dissimilarities in micro-structural patterns.

<table>
<thead>
<tr>
<th>THE GREATEST SIMILARITY IN MICRO-MORPHOLOGY</th>
<th>NUMBER OF DIFFERENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talpa micrura vs. Tapa europaea</td>
<td>10</td>
</tr>
<tr>
<td>Equus caballus vs. Equus caballus (Hucul variety)</td>
<td>10</td>
</tr>
<tr>
<td>Dama dama vs. Ovis musimon</td>
<td>12</td>
</tr>
<tr>
<td>Rangifer tarandus vs. Cervus elaphus wapiti</td>
<td>13</td>
</tr>
<tr>
<td>Panthera tigris altaica vs. Panthera pardus</td>
<td>13</td>
</tr>
<tr>
<td>Antilope cervicapra vs. Kobus ellipsiprymnus</td>
<td>13</td>
</tr>
<tr>
<td>Martes zibellina vs. Lutreola lutreola</td>
<td>14</td>
</tr>
<tr>
<td>Tamandua tetradactyla vs. Boocercus euryceros</td>
<td>15</td>
</tr>
<tr>
<td>Cynocephalus temminckii vs. Lemur kata</td>
<td>15</td>
</tr>
<tr>
<td>Hylobates lar vs. Ovis aries - Cigaja lamb skin</td>
<td>16</td>
</tr>
<tr>
<td>Cercopithecus mona vs. Hylobates lar</td>
<td>16</td>
</tr>
<tr>
<td>Ovis aries - Cigaja lamb skin vs. Cercopithecus mona</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THE LEAST SIMILARITY OF MICRO-MORPHOLOGY</th>
<th>NUMBER OF DIFFERENCES</th>
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</thead>
<tbody>
<tr>
<td>Capra sibirica vs. Arvicola terrestris</td>
<td>29</td>
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<tr>
<td>Desmana moschata vs. Kobus ellipsiprymnus</td>
<td>29</td>
</tr>
<tr>
<td>Putorius putorius vs. Cryptoprocta ferox</td>
<td>29</td>
</tr>
<tr>
<td>Meles meles vs. Ovis aries - Persian lamb skin</td>
<td>29</td>
</tr>
<tr>
<td>Castor fiber vs. Tamandua tetradactyla</td>
<td>29</td>
</tr>
<tr>
<td>Canis familiaris collie vs. Otocolobus manul</td>
<td>29</td>
</tr>
<tr>
<td>Oryctolagus cuniculus vs. Vulpes vulpes</td>
<td>30</td>
</tr>
<tr>
<td>Sus srofa srofa vs. Giraffa camelopardalis</td>
<td>30</td>
</tr>
<tr>
<td>Alopex lagopus vs. Vulpes vulpes</td>
<td>33</td>
</tr>
<tr>
<td>Antidorcas marsupialis vs. Equus przewalsk</td>
<td>34</td>
</tr>
<tr>
<td>Choleopus didactylus vs. Connochaetes gnou</td>
<td>37</td>
</tr>
<tr>
<td>Dicoytes tajacu vs. Canis familiaris collie</td>
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DISCUSSION

The comparative study with 134 different fur skin species validates the long accepted diagnostic ability of the microscopic method for identification of small samples. Comparison among species discovered an average number of 20 important dissimilarities between most of the species. This demonstrates a high degree of individuality of fur skin micro-morphology. In spite of the range, including over 10,000 micro-photos, the study cannot be considered as fully thorough. More work needs to be done to determine the differences over skin areas, winter and summer coats, between male and female animals, changes induced by maturation and on domesticated animals. It is also important to determine the effect of variability among races. This study should be of a non sustainable range and may be too expensive if compared with its usefulness. On the contrary, owing to this structural variability, different samples of identical species may not have a zero level of dissimilarity. The accessible number of differences eventually would be in the range of dozens.

Copyright © 2011 Furskin Co.
The guard hairs of the Canadian form of the beaver are dark-brown or black. The coat of the beaver is relatively dense. The length of the under-fur fibres is from 6 to 15 mm; the longest guard hairs are from 25 to 55 mm long. The intermediate fibres are very similar in structure to the fine fibres but are longer (from 15 to 30 mm), and their width is from 20 to 25 µm. The cuticular scales are cornet-like, smooth on the surface and crenated at the margins.

Longitudinal section of a guard hair, 1000x

Numerical code for beaver skin structure

Surface of the skin: 1-2-3
in North America has a larger population. The difference between the varieties is only in the surface structure of the skin. The Canadian species has a narrower width of the skin, 100x hairs head and its follicles are wider with skin is darker in colour.

Description of average: the fur follicle contains from 15 to 25 fibres; 50 to 100 cm long and light-brown in colour. The fine fur fibres have a circular cross-section with a diameter of 10 µm. The hairs are straight, and are apparently longer than 15 µm. The cuticular structure is visible only in the cornet-like type with a come guard hair; a smooth scale hairs; a large proportion of these hairs are non-medullated. The medulla in the coarser guard hairs is wide, unbroken and symmetrical-shaped. The medulla is of the lumpy type with an amorphous infilling substance.


Structure of the hair

The cuticular structure The guard hairs are circular in cross- of a guard hair, 2000x The cuticula r structure

The guard hairs are circular in cross-section in the lower part, and ellipsoidal in the middle and upper parts of the shaft. The diameter of these fibres is from 25 to 65 µm. The cuticle consists of even tile-like scales with a smooth surface and rippled scale margins. The medullar structure is visible only in the cornet-like type with a come guard hair; a smooth scale hairs; a large proportion of these hairs are non-medullated. The medulla in the coarser guard hairs is wide, unbroken and symmetrical-shaped. The medulla is of the lumpy type with an amorphous infilling substance.


Structure of the skin of the fine fibre

The skin of the beaver is from 50 to 100 cm long and light-brown in colour. The fine fur fibres have a circular cross-section with a diameter of 10 µm. The hairs are straight, and are apparently longer than 15 µm. The cuticular structure is visible only in the cornet-like type with a come guard hair; a smooth scale hairs; a large proportion of these hairs are non-medullated. The medulla in the coarser guard hairs is wide, unbroken and symmetrical-shaped. The medulla is of the lumpy type with an amorphous infilling substance.
FURSKIN - fur skin identification

The thickness of the medulla:
MIN: 10 µm
MAX: 15 µm

The length of hair:
MIN: 10 mm
MAX: 15 mm

The thickness of the medulla:
MIN: 20 µm
MAX: 25 µm

The length of hair:
MIN: 15 mm
MAX: 25 mm

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01/10/2012
Natural Fibre Centre

Date: 19Sep12
Sample ID: Beaver 1 yr old
Description: ? Brown Bvr Aug2012
Lot/Client: Suri Textiles
Operator: A 18937 MidSide MCR

5% of fibres 5.1 μ above mean.
Curve= 79.5[59] deg/mm

Mean = 11.64 μ
SD = 8.57 μ
CV = 73.6 %
Sample size = 4000
Comfort factor= 98.9 %
Curve number = 958

Along: num= 998 Mn= 11.5[8.3] Sd= 0.54[0.5] Min= 10.9[8.2] b[lob]= 1.72[1.4]% sm[all]= 1.14[0.6]% l[arge]= 0.58[1.3]%
OFDA166:2.14 Cal: D=5.1599*WH -2.98, wV= 1.4683*W+ -0.04, DkFlash= 83.0

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### Natural Fibre Centre

**Date**: 19 Sep 2012  
**Sample ID**: Beaver 1 yr old  
**Description**: ? Brown Bvr Aug 2012  
**Lot/Client**: Suri Textiles  
**Operator**: A 18937 MidSide MCR  
**5% of fibres**: 5.1 u above mean.  
**Curve**: 79.5 [59] deg/mm  
**OFDA Micron Test Report**

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<td>Spin fineness</td>
<td>19.8 u</td>
</tr>
<tr>
<td>Comfort factor</td>
<td>98.9 %</td>
</tr>
<tr>
<td>Curve number</td>
<td>958</td>
</tr>
</tbody>
</table>

**Along**:
- num: 998  
- Mn: 11.5 [8.3]  
- Sd: 0.54 [0.05]  
- Min: 10.9 [8.2]  
- blob: 1.72 [1.4]  
- Sml: 1.14 [0.6]  
- Lge: 0.58 [1.3]  

**OFDA166:2.14**
- Cal: D=5.1599*WH -2.98, DkFlash= 83.0
Beaver - Oval stretching pattern recommended

This is where the trapper makes or loses money depending on how they board the pelt. Always board the pelt 2" to 3" above the size tariff suited to the size of the pelt. The skin boarded at 61" GREEN, if it can be boarded 2" larger and still remain LOOSE on the board would remain in the 1X category. Two beaver pelts of exactly the same quality when boarded differently can easily sell for a $5 - $10 difference. Always remember that a freshly boarded beaver will almost always shrink 2 to 3 inches during the drying process. Both pelts will fall into the large category but the grade of the two could be quite different. An example of this would be as follows:

**SHEARABLE GRADES:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>LG SEL B</td>
<td>$40.00</td>
</tr>
<tr>
<td>LG I-II HVY B</td>
<td>$34.00</td>
</tr>
<tr>
<td>LG I-II SEMI B</td>
<td>$24.00</td>
</tr>
</tbody>
</table>

**NON-SHEARABLE GRADES:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>LG I-II LT B</td>
<td>$17.00</td>
</tr>
</tbody>
</table>

The 56 inch beaver will have a far better chance of falling into one of the shearable grades than one at 59 inches. By boarding your beaver pelts properly, you will be getting the best quality grade possible. You will receive far more shearable grades by boarding your beaver loosely, than the person who stretches it tight. They may gain in size, but the market is demanding a shearable product.

Once you have determined your size, continue to nail the top half of the pelt to the board. Space the nails about 3/4" apart. When the top half is completed, continue to place nails at the same intervals along the bottom half of the pelt, until it has an even shape that follows the pattern on the board. This will help prevent over stretching which reduces the density of the fur and lessens its value.

The leg holes should not be left open because they give the pelt a rough appearance. It is preferred to sew the leg holes, but nailing them closed is also acceptable. After the leg holes have been closed, wash the leather lightly with water and some paper towels or cloth. This will remove blood stains and light grease. The leather will take on a creamy, whitish appearance. Next, lift the pelt up off the nails so the air can circulate under the skin. Many trappers who use boards prefer to do their fleshing after the pelt has been tacked to the board. This should be done before the leg holes are closed.

There are very few select pelts. A grade pattern is established primarily because all the pelts are intersorted. If you have a pelt worth $50.00 you would not expect it to be put with pelts worth $40.00 as the maximum you would realize would be $40.00. This is what necessitates fine grading.

**DRIYING**

It is best to dry beaver pelts slowly. Temperatures of 55° - 65° degrees are desirable. Never put drying pelts near stoves or expose them to sunlight. As the pelt dries, wipe the leather from time to time with a clean cloth. This removes any grease which may run from the leather. A fan directed towards drying pelts will help speed up the drying time without damaging them.

**MARKETING THE BEAVER**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELECT</td>
<td></td>
</tr>
<tr>
<td>I-II HVY XDK</td>
<td>Shearable</td>
</tr>
<tr>
<td>I-II HVY DK</td>
<td></td>
</tr>
<tr>
<td>I-II HVY BRN</td>
<td></td>
</tr>
<tr>
<td>I-II SEMI XDK</td>
<td>Shearable</td>
</tr>
<tr>
<td>I-II SEMI DK</td>
<td></td>
</tr>
<tr>
<td>I-II SEMI BRN</td>
<td></td>
</tr>
<tr>
<td>I-II LT XDK</td>
<td>Non-shearable</td>
</tr>
<tr>
<td>I-II LT DK</td>
<td></td>
</tr>
<tr>
<td>I-II LT BRN</td>
<td></td>
</tr>
<tr>
<td>I-II R/R XDK-DK</td>
<td>Shearable, Red</td>
</tr>
<tr>
<td>I-II R/R BRN</td>
<td>Stained Rumps</td>
</tr>
<tr>
<td>BLACK'S</td>
<td></td>
</tr>
<tr>
<td>GDSL T DGD XDK</td>
<td>Shearable</td>
</tr>
<tr>
<td>GD SLT DGD DK</td>
<td></td>
</tr>
<tr>
<td>GDSL T DGD BRN</td>
<td></td>
</tr>
<tr>
<td>SLT DGD XDK</td>
<td>Shearable, Multiple Holes, Scars</td>
</tr>
<tr>
<td>SLT DGD DK</td>
<td></td>
</tr>
<tr>
<td>SLT DGD BRN</td>
<td></td>
</tr>
<tr>
<td>REG SLT XDK</td>
<td>Non-shearable</td>
</tr>
<tr>
<td>REG SLT DK</td>
<td>Multiple Holes, Scars</td>
</tr>
<tr>
<td>REG SLT BRN</td>
<td></td>
</tr>
<tr>
<td>I'I'S</td>
<td>Early Caught, Blue Leather</td>
</tr>
<tr>
<td>GD DGD</td>
<td>30% Pelt Damage</td>
</tr>
<tr>
<td>IV &amp; DGD</td>
<td>50% Pelt Damage</td>
</tr>
</tbody>
</table>

**PRIMENESS IN BEAVER**

The underfur of the beaver is almost absent in the summer. However, towards fall, these hairs start to grow. The last place on the animal where they finish growing is the back of the neck. In the fall, they are quite short. However a full prime skin will have under fur on the back of the neck, approximately 3/4" long. This is why when grading, the back of the neck is felt. The amount of resistance the hand feels in rubbing the beaver against the grain of the fur, indicates the density of the underfur. When it is very flat, it is called a II or III. As it comes into prime, the hair thickens and it can be classified as I-II HVY, SEMI or LT depending on how thick the fur grows. Once the full length of the hair has been reached, the fur and pelt start to become over prime. The beaver, because of its long stay in the house and sour feed source, has been using its body fat to produce fur and keep warm. Another defect which occurs in the spring is red rings (or rumps). This colour defect is caused by urine which burns and stains the belly fur of the beaver. It starts at the tail and progresses up the flanks. The red stain goes into the underfur causing the beaver to become less valuable for plucking and shearing. This is the reason fall beaver are much more desirable than spring pelts.

**TIP:** Beaver patterns are available at FHA.
Beaver - Open skinned, leg holes closed, cut off ears, trim nose & whiskers off.

Before skinning a beaver first make sure it is dry and clean. If the beaver needs to be dried it is best to lay it on its back on a grate or something similar so that air can circulate around the whole beaver. Putting a fan on the animal will speed up the drying process. Brush the beaver with a fur comb to remove any burrs, mud or mats.

The next step is to remove the feet. Very close to the fringe of fur above the feet on the front legs is the wrist joint. This joint can be felt with the thumb and index finger and one cut across the joint with a sharp knife will sever the foot. To cut off the hind foot, first, bend the foot forward towards the belly of the beaver, bending it fully forward at the heel. With the foot held this way, cut across the cords at the base of the foot and keep cutting all around the foot with it still bent forward. A snap sideways after this cut is finished will usually break the foot free from the leg.

The next step is to slit the pelt from the chin to the tail on the belly side in a straight line. Cut around the vent on both sides. Cut the pelt around the tail being careful not to cut too deep. Cutting deep will sever veins which will cause much bleeding. Leave the tail on as it will give you a place to carry the carcass once skinned.

Slit the pelt from the chin to the tail on the belly side in a straight line.

THE DRYING BOARD

The drying boards are made from a single sheet of 4'x8'x3/4" plywood. Cut the sheet into three pieces measuring 32"x48". The drying board should be marked as shown on our template. This is done on both sides of the board, giving you six stretching surfaces from one sheet of plywood. The pattern templates are available at no cost from Fur Harvesters Auction. Choose the line appropriate to the size of the pelt, and fasten the head and tail to the drying board with the fur side down. The nails which are used to attach the pelt should extend at least 1" above the pelt so that when the nailing of the pelt is complete, it can be raised off the board. This allows the air to circulate between the fur and the board (2" box nails work well). Place one nail behind the nose and one at the tail, and one at the mid-point on each side of the pelt.

IMPORTANT!! The lines on the board should only be used as a guide to give you a consistent uniform shape.

Using a tape measure, measure from the nail at the nose to the tail. Add this to the width measurement. The sum of the two will give you your GREEN size. Refer to size chart:

DRIED PELT SIZE

<table>
<thead>
<tr>
<th>Size</th>
<th>Green Size</th>
<th>Dried Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>3X-2X</td>
<td>Over 65&quot;</td>
<td>Over 165.1cm</td>
</tr>
<tr>
<td>1X</td>
<td>60&quot; to 65&quot;</td>
<td>152.4cm to 165.1cm</td>
</tr>
<tr>
<td>LG</td>
<td>55&quot; to 60&quot;</td>
<td>139.7cm to 152.4cm</td>
</tr>
<tr>
<td>LM</td>
<td>51&quot; to 55&quot;</td>
<td>129.5cm to 139.7cm</td>
</tr>
<tr>
<td>MD</td>
<td>47&quot; to 51&quot;</td>
<td>119.4cm to 129.5cm</td>
</tr>
<tr>
<td>SM</td>
<td>42&quot; to 47&quot;</td>
<td>106.7cm to 119.4cm</td>
</tr>
<tr>
<td>XS</td>
<td>Under 42&quot;</td>
<td>Under 106.7</td>
</tr>
</tbody>
</table>

A beaver pelt will almost always shrink approximately 2" from the time you board it until you take it off. If the skin measures 61" GREEN, it is a 1X, but when it is dry it will most likely be a large size approximately 59" putting it down one size, at the upper limit of the LG size tariff.

Note: Beaver castors, on both males and females, are found on each side and just forward of the vent. These should be removed carefully with a knife or pulled free with the thumb and finger so the sacs are not broken, which would let the oil run out. They should be tied at the cords and hung until dry. The more care used in removing and drying, the more castors are worth. They are used in making scents and perfumes.

The pelt is then skinned back one side at a time to the back. When the legs are reached, do not slit them open but pull them through, pulling the hide off the way you would take off a sock. Be careful with the skinning knife around the legs because the skin is easily cut in these tender places. Skin the head carefully. Cut the ears off close to the skull. Skin around the eyes and nose and the pelt is free from the carcass.

TIP: Use 2 inch box nails when boarding beaver.
The history of felt hat making

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Felt has been used for producing headwear for many centuries and is perhaps the oldest textile material. Archaeological evidence shows that from very early on, people had discovered the tendency for fibres to mat together when warm and damp, many years before they learnt how to spin and weave yarn.

To this day there are three varieties of felt used for hat making. Wool felt, fur felt and Beaver felt. Beaver felt hats date back as far as the 14th Century with the majority of production being based in Holland and Spain. European Beaver skins were first sent to Russia to be used as coat trimmings and then re-imported into Holland as used furs would felt more easily. By the early-mid 1600s the beaver's European breeding grounds became exhausted, after which North America became the main supplier of skins to the trade. The United States also became an important manufacturer of hats although in 1731 England passed a Hat Act that prohibited the export of hats from the USA. In the 18th Century Beaver felt was still the preferred material for headwear, although a mixture of felts, beaver and wool, beaver and fur felt, became increasingly popular for the less expensive hats.

In the late 1800s, the traditional and independent hatters who made the hats they sold in their shops were soon to be replaced by large hat making factories due to the advent of steam power, which made the hatters bow redundant. Many of these factories combined both the felt making process with the production of the finished article. Importing the fur from various overseas sources, fur mainly from Belgium and wool from Australia, they would then put it through various machine processes to arrive at the final felt hood. This would then be blocked into shape, sanded, lined and finished.

In recent years, although the hat has seen a marked revival, many of the traditional hat factories have been faced with closure as a result of cheaper imports from both the Eastern block countries as well as the Far East.

Hat making

Fur felt hats

Fur felt hats are produced most commonly from rabbit fur with some of the better quality hats being made from beaver, although beaver today is exceedingly rare. Hare fur today is also fairly common with a combination of rabbit and fur being more popular.

Beaver

The initial stage in the hat making process would be the plucking of the coarse guard hairs from the beaver pelt, which was then brushed, with a solution of nitrate of mercury. This would raise the scales on the fur shafts so that they would become firmly locked together. This process became known as "carotting" and if carried out in a poorly ventilated room, the mercury fumes could damage the brain, hence the expression "mad as a hatter". The fibres would then be cut from the skin and placed on a bench in a workroom known as the "hurdle". Over the bench would be suspended a hatter's bow, very much like an oversized violin bow and the fibres responded to the vibrations of the bow which was controlled by the craftsmen, separating themselves and becoming evenly distributed until they had formed into a thick but loosely structured mat of material known as the "batt". Several batts would then be shaped into a cone and reduced in size by boiling and then rolled to create a firm dense felt. The hood would then be sent onto the hatter who would mould it to the required shape and then line and finish it.

Hats made from Beaver felt were to see a marked decline in the mid 1800s and gradually became replaced by the silk hat, followed by fur felt hats and wool felt hats.

Rabbit / Hare

Specific breeds of rabbit are preferred with the majority of fur being produced in Belgium. Only the under-fur of the animals is used, as only this fur is suitable for the matting process involved in felt making. The fur, which is removed from the rabbit, is bagged according to the grade of fur and undergoes various mixing refining processes before it is ready to be made into a hood. The fur is then blown, a process which enables the removal of any dirt and clotted fur. The actual process of hat making can now commence.

The initial stage is the production of a cone. This is produced by placing a certain quantity of fur onto the top of the forming chamber (an upright cylindrical compartment - within which is housed a copper cone approximately one metre in height). The cone which is perforated revolves slowly and an exhaust fan beneath it sucks the air and the loose fur in the chamber down onto the revolving cone, creating a matt of loosely
interwoven fibres. The cone is then immersed in a vat of very hot water where the heat of the water shrinks the fibres thus starting the felting process. The fur, which has formed into a loose layer of felt, is then removed from the cone.

At this stage the felt hood is many times larger than the final finished hood. To achieve such a significant reduction in size, the layer of felt is put through the processes of folding, dipping in hot water and then finally it is put through rollers which will squeeze out any of the excess fluid thereby furthering the felting process.

**Hood Blocking**

Felt hoods are generally blocked on wooden blocks. The wood for these blocks tends to come from the American Poplar tree as it has no grain, which if present would show in the blocking process. A hat block is required for every size of hat and for every shape of hat and with the current price at around $200 per block, the creation of a new style of hat represents today a fairly heavy investment.

**Flanging**

Flanging is the term used to describe the forming or creation of the brim. The brim is first ironed flat. It is then cut to the required width, placed on a wooden flange of the necessary shape, ironed and finally dried and pressed.

**Stiffening and sanding**

A stiffener such as shellac is normally always required for the brims and obviously the more stiffener applied the stiffer the brim. Stiffener is often avoided in the crowns of fur felt hoods, although is regularly used in wool felts.

Finally the hat is sanded many times, to create a smooth texture so characteristic of the fine fur felt hats.

Find our stiffener products here.

**Trimming**

The final stage of the hat process is the trimming. This will include the insertion of a leather inner band or similar (like Petersham), the lining of the hat as well as the application of some outer band. The latter, although a relatively simple process can be the most important in terms of the final appearance of the finished hat, very much determining the character of the hat and consequently its potential wearer. The more flamboyant the trim, e.g. feather band or silk band, the more flamboyant and individualistic in style the wearer.

**Wool felt hats**

These are produced from sheep's wool and consequently are significantly coarser in touch in comparison to the soft fur felt. They have in recent years gained in popularity primarily due their competitive price advantage and because of this are particularly favoured as a fashion item. They do not wear as well as fur felts and unlike fur felts have a tendency of losing their shape and shrinking if exposed to rain. The hat making processes involved in producing a wool felt hat are very similar to those used for fur felts, although many of the additional finishing and sanding processes required to produce a fine fur felt are obviously not required.

"Hand felted" Wool felt hats

Hand felting with sheep wool has been around for Centuries but it was around the 1980's when felt making was rediscovered and gained popularity. New techniques were developed by feltmakers all over the world including Polly Sterling, Australia, who created "Nuno felt" which is known as laminated felt in America. May Jacobsen Hvistendahl, Norway, has made a name for herself with seamless felting, Inge Bauer, Germany, uses leather and felt more to make bags, Elina Saari, Finland, has a wonderful playful way of making hats in felt.

There are many more felt makers all over the world who have written books and developed techniques and it has to be noted that the making of those felts are unique yet often very time consuming. Most felted articles are one off's as the maker very seldom would want to reproduce the same twice. The way hats can be moulded and shaped through Hand felting, is not possible with commercial wool felts which are seen as lesser quality by the Millinery industry. Through hand felting the maker is in control of shape, colour, size and design, where as with commercial felt hoods the maker is limited to the material one buys of the shelf.
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