

THE ORIGINS
OF INVENTION:

*A STUDY OF INDUSTRY AMONG
PRIMITIVE PEOPLES.*

BY

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WITH ILLUSTRATIONS

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CHAPTER VII.

THE TEXTILE INDUSTRY.

“ Who can find a virtuous woman? for her price is far above rubies.
She seeketh wool and flax, and worketh willingly with her hands.
She layeth her hand to the spindle, and her hands hold the distaff.”

Proverbs of Solomon.

THE Apaches call the Navajos spiders, in allusion to their beautiful weaving; and on the breasts of skeletons in the mounds of Tennessee have been found shell gorgets upon which spiders are engraved.¹ It is not known that the person whose skeleton was there entombed had been really a weaver, but copper implements wrapped in coarse cloth were found hard by, and on much of the pottery exhumed from the Tennessee graves are marks of basketry. There is no objection to calling the spider gorget the trade badge of the dead one.

The textile art is older than the human species. For not only spiders and many caterpillars drew out extremely fine threads, but birds wove nests long before man's advent on earth. And, most significant of all, in tropical lands especially, trees and plants fabricated cloth, which men have worn from time immemorial, and on it they have also preserved their thoughts. There is no reason to doubt that the very first women were weavers of a crude kind, and that the textile art has been with us always in one form or another.

¹ For illustration of spider on shell gorget, see Holmes in *Third An. Rep. Bur. Ethnol.*, p. 466, fig. 141.

This department of industry is to be studied in its materials, in the tools and processes employed, in its products as to their form and use. Without committing ourselves to any theory of evolution in the art, it will be convenient to notice first the various types of bark cloth, basketry, and matting as not involving the spindle. Then the textile art proper may be considered under the topics of yarn, thread and braid, weaving, looping, netting, and embroidery. All of this will serve to show that the savage has not been idle in the development of fibres.

Mela says that the Germans were clothed in winter only with the *sagum* (a kind of poncho), or with the bark of trees.¹ It is difficult to understand what is meant by this phrase. The Germans lived too far north to be successful in making their shirts from the bast, or inner bark, of trees indigenous to Northern Europe. The Aryan race as a whole are not known to have clothed themselves thus. The bast of temperate zone plants, hemp, flax, cedar, has a fibre that shreds easily into filaments which may be spun.

Bark cloth may be seen in any museum from Central and South America, from Africa and from Polynesia. The art of pounding the bast, or inner bark of a tree, whose fibrous strands do not lie parallel, as in textile plants, but are interlaced intricately, is of very wide extent racially. Three out of the five great types of mankind practice it—the African, the Negroid, and the Malayo-Polynesian. The cloth, so called, manufactured in this way is quite durable, and much more expeditiously made than any produced by weaving.

In Polynesia the bast of the paper mulberry and of the breadfruit is chiefly used. The process involves several discoveries and inventions worthy of notice. The outer rind was scraped off with a shell; the inner bark was then slightly beaten and allowed to ferment, or was macerated in water. Upon a long, smooth log the bast was then beaten with a heavy mallet of *Casuarina* wood. This mallet was

¹ Mela, *De Situ Orbis*, vol. iii. p. 3.

square in cross section, and each side grooved—one with very coarse, the opposite with fine ridges ; a third side was sometimes plain, a fourth cut into checker patterns. Each of these sides was useful in spreading out the texture, removing the pulpy matter, and giving the appearance of textile work. The cloth was dried and bleached in the sun. For colouring a variety of vegetable dyes were used. Nature supplied the pattern. The natives selected some of the most delicate and beautiful ferns or the hibiscus flowers. When the dye was prepared the leaf or flower is laid carefully on the dye. As soon as the surface was covered with the colouring matter the stained leaf or flower was fixed on the cloth and pressed regularly down. Many of the patterns were printed on in regular designs, worked out on a surface of palm leaf with little bits of stem sewed on in geometric figures. The stronger kinds of cloth were covered with a brown or black varnish, which made the texture tougher, and also water-proof.¹

For colouring their bark or tapa cloth, the natives of the Society Islands used a variety of vegetable dyes. Among them the bark of the *Casuarina* and *Aleurites*, giving a dark red or chocolate colour. Brilliant red was prepared by mixing the milky juice of the berry of *Ficus prolixa* with the leaves of a species of *Cordia*. When prepared the dye was absorbed on the fibres of a kind of rush and dried for use. When covered with a varnish of gum it retained its brightness until the garment was worn out. Yellow was prepared from the inner bark of the root of *Morinda citrifolia*. An infusion of the bark in water was made, and the cloth soaked therein and then dried in the sun.²

The tapa beating of the Hawaiians is minutely described in a catalogue of the Bishop Museum in Honolulu. The material is the bark of the paper mulberry (*Broussonetia papyrifera*), but half a dozen other plants are occasionally

¹ Ellis, *Polynes. Res.*, vol. i. pp. 178-185, giving a detailed and excellent account of tapa beating.

² Ellis, *op. cit.*, vol. i. p. 182.

substituted. The apparatus consisted of a log or anvil, a series of mallets, calabashes of water and of mucilage, dye stuffs, and tools or stamps for decorating. The anvil was a log of hard wood, about six feet long, hewn to a flat surface three inches wide at top, and hollowed longitudinally underneath. This was supported on two stones. Of clubs there was a variety ; round for the first beating, and flat for the finishing. Ornamented beaters had longitudinal grooves cut at varying distances apart on the four sides, and in others these parallels were cut by other grooves at right angles, or undulating patterns were engraved. From scions of the paper mulberry the bark was stripped in lengths of about six feet, and two inches wide. These strips were dried until the sap was wholly evaporated, and they were then stored for future use, either with the outer bark still on or after this had been removed by scraping on a smooth board with a plate of shell or of bone.

When to be used the strips were soaked in water and beaten with the round club on a smooth stone until the fibres were felted together. The strips were then soaked again and beaten on the log, strip was welded to strip until sheets of a surface 125 square feet was obtained. The peculiar "water marks" to be seen in tapa were given by the patterns carved on the decorated beaters. The colouring of the tapa was effected in various ways. Previously pulped material of various colours was beaten in, or the fabric was dyed after it was beaten. When the pigments were to be applied locally they were ground in oil in a stone mortar and applied by cords, by pens, by brushes, and by dies. Waterproof kapa or tapa was saturated with the oil of the cocoanut.

The Hawaiians excelled all other peoples in the world in their bark cloths. This remark applies to the fineness of the product, the diversity of lines beaten into the texture, and to the variety of ornamentation added to the surface. Many of the varieties have special names, and a

Cf. Brigham, Cat. Bishop Museum, Honolulu, 1892, p. 23.

collection of them all would fill an enormous album, giving one page to each.

The bark cloth of Africa and of Tropical America are much simpler in construction than that of Polynesia. In neither of the continents is there any overlaying or uniting of pieces. Each garment is made, so to speak, of the whole piece. "The Warraus of Guiana make the *lap* and the *queyu*, the breech clout and the 'fig leaf' apron, of the inner bark of the *Lecythis ollaria*, which is beaten until it is comparatively soft, and of the texture of thick rough cloth."¹ All over the Andes the tribes use this bark cloth as a body on which they sew feathers, teeth, beetles' wings, bones, and other decorative objects.

In making the African varieties a piece of bark about six feet long, and as wide as possible, is detached from the trunk of a tree. The outside rind is pared off with a lance-head used with two hands, like a cooper's drawing knife. The bark is then laid upon a beam or wood, on which it is hammered with a mallet grooved in fine cuts, so that the repeated blows stamp the bark with lines somewhat resembling corduroy. This cloth turns brown by exposure, and is dyed or ornamented in black with water from iron springs. Uganda is celebrated for this curious production."²

By the general term "basketry" is meant all kinds of woven vessels in which the materials are not spun. But there is also a large class of flat textiles, made up precisely after the same fashions as basketry, commonly designated "matting." Basketry and matting together constitute a most important division of savage invention. They are the one art that is more beautiful among the uncivilised. Enlightened nations express their æsthetic conceptions in lace and cloths and embroideries, the savage woman gives vent to her sense of beauty in basketry.³

¹ Im Thurn, *Indians of British Guiana*, London, 1883, p. 194.

² Sir Samuel W. Baker, *Ismailia*, New York, 1875, pp. 328, 350.

³ For a minute description of all the styles of savage basketry see the author's paper in *Smithsonian Report*, 1883, part ii., pp. 291-306, pl. 1.-lxiv.

To the unobservant, a basket is a basket, and that is all there is about it. But to the technographer the materials, methods, and products of this art form an excellent guide to peoples or tribes. Almost every type of basketry is confined to a single tribe, or to a very restricted area. From a textile point of view baskets are divided into two great classes—the woven and the sewed or stitched—and it will be necessary to look with a little care at each to comprehend how much original human thought has been bestowed upon this industry, both in very ancient times and in our own.

The most simple form of woven basketry can be seen in the work of the Algonkian and Iroquoian Indians of the Eastern United States, made of thin strips or splints of ash, beech, oak, or hickory, all of uniform thickness and width, and forming a rude warp and woof like the threads in common Manchester cotton stuff.

Improvement on this very plain style, seen to perfection in the cedar-bark stuffs of North-west America, may be made by varying some of the strips or splints in width and colouring a portion of them. This would give the beautiful Polynesian palm and pandanus ware, a great deal found in America, besides much of the mat-work the world over.

The next step, the next patent we should say, consisted in carrying the weft splints over and then under two or more warp splints at a time. Beautiful examples of this are to be found in Guiana and Northern South America, and it is exquisitely done in African matting. The Salishan tribes of Washington make thin, narrow splints of birchwood, from

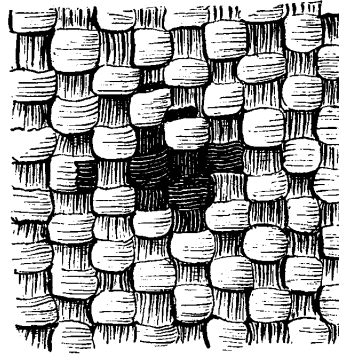


FIG. 42.—Plain Weaving in Cedar Bark, coast of British Columbia.

which to weave their wallets for holding fish ; while the Cherokees, Choctaws, and other Southern Indians of the United States employed the split cane dyed in two colours. But they all understood the overlapping, producing a diagonal or diaper pattern.

Still keeping within the limits of plain weaving, there is a quite different effect, called wicker-work, which one may see, in some material, in any market-house in the world. It seems to be the universal heritage from savagery.

This work consists in using a rigid warp and a flexible weft as in corded silk weaving. The Moki Indians of the Pueblo of Oraibi gather the twigs of the "grease bush" and strip off the rough bark. This yields filaments only a few inches long, but by colouring these and weaving them in and out over a warp of twigs the Moki produce a basket-tray which is highly prized by collectors ; but the manipulation is precisely similar to that in our coal and oyster

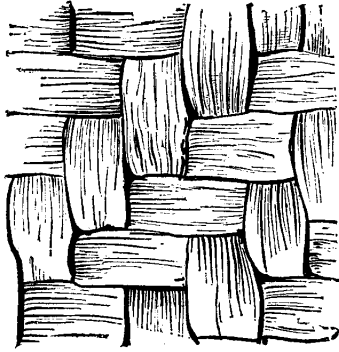


FIG. 43.—Diagonal Weaving, common in many American tribes.

baskets and the old-fashioned farm crates, or the wicker-work around a demijohn. The Zuñi Indians make their peach-baskets in a similar fashion, and there is little doubt that they and the Moki were instructed by the same teachers.

It is a fact worthy of attention here that this one Moki Pueblo of Oraibi in North-eastern Arizona is the only spot west of the Rocky Mountains where this wicker-work is practised. The people belong to the Shoshonean stock, who, outside this Pueblo, practise another style. In fact, the Oraibi Indians make two kinds of baskets essentially different from those of their blood kindred, the Utes, and they do not weave the Ute basket at all.

There is a style of woven basketry that a patent examiner might declare to be derived from the wicker just described. Indeed, it is a kind of double wicker. But its stitch or mesh is found on the oldest pottery, in very ancient graves, and in the Kilima-Njaro country, as well as all over America. The most simple and rudimentary specimen of

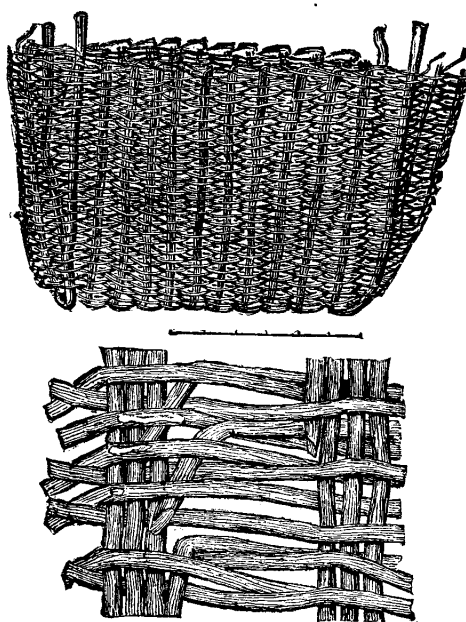


FIG. 44.—Wicker Basket of the coarsest type. Zuñi Indians, with detail. (*U. S. Nat. Museum.*)

this type is the wattling fence, in which two pieces of brush are woven among a row of stakes and twisted into a two-ply rope at the same time. In basketry this is called twined-weaving. Two weft fillets or twigs are carried along at the same time between the warp elements, only they alternate in passing each other above and below so as to make a twine. If all the warp sticks were pulled out, these two

weft strands would be twined together, as in a two-ply thread, continuously from beginning to end.

If the elements are whole, or split osier or other twigs, the work will be open and strong, as in the Pacific Coast large basket. If the elements are fine root, or grass, or bast, or spun thread, or yarn, the work will be fine and close, like cloth, and will hold water.

The Eskimo of the Peninsula of Alaska and the Aleuts produce most dainty ware in this stitch from the stem of the *Elymus*, while their coarser work resembles so closely

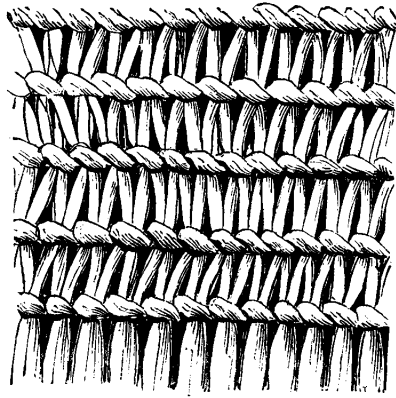


FIG. 45.—Aleutian Basketry, showing twined weaving on split warp filaments.

specimens brought home by Dr. W. E. Abbott from Kilima-Njaro that only an expert would detect the difference by the material employed. From the Mandingo country also rigid baskets are in the same style.

The North American Indians, living wherever the *Apocynum cannabinum* grew, made soft pliable sacks or wallets in this stitch, and impressions of it

are found on pottery fragments from the Atlantic states, and robes of turkey down and of rabbit skin in the same pattern come from the cliff dwellings. But the most exquisite productions in this stitch are to be seen on the West Coast of the United States, from Mount St. Elias to the Bay of San Francisco, where it suddenly gives place to a variety entirely different in structure.

The Tlingit ware about Sitka may be taken as the best representative of twined basketry. It is made of the roots of the spruce, carefully cleaned and split. Those who have

seen the operation say that the women use no other tool than a mussel-shell and no other gauge than their thumbnail to secure uniformity in the splints. This is almost incredible, so regular do the surfaces of the best pieces of basketry appear. The warp is set up with a view to the size and form of the wallet to be made. The weft splints are then twined between the warp splints and pushed as close home as possible, producing a watertight structure. Bands and lines of ornament are produced by means of dyed splints. When two strands of different colours are worked together the alternate appearance and disappearance of each one gives a spotted line, and the management of the succeeding lines with respect to this one gives the artiste an unlimited resource of decoration.

But this is not the end of her tether. An inspection of a piece of this ware will show that every stitch in the weaving is double, one part being outside, the other inside, the warp splint. It is possible, therefore, by means of coloured grasses and bark to embroider the outside of the vessel without affecting the inside, and this indeed is done in such manner as to produce most wonderful effects.

The tribes of Vancouver Island and of Cape Flattery vary from this style somewhat, in that they have three sets of elements; but two are rigid and only one is flexed in weaving. The process is exactly that of wire bird-cages. An upright series of fillets form the warp, a second piece is carried around inside and coiled against the warp, and the third is wrapped around the other two spirally at every point where the coiled piece intersects one of the warp pieces. This gives to the outside the same appearance as is to be seen on the back of a watch. By using different coloured grasses, geometric patterns of great variety and beauty are produced.

In all the range of basketry there is none other so pretty as that of the northern tribes of South America, made nowadays by men. The beauty of the work lies in its extreme chasteness of design and colour. The body is done

in splints of the reed-like stem of maranta (*Itchnosiphon*). These are very uniform in size and are woven in diaper and diagonal fashion, the brownish or amber-colour of the wood being variegated with simple but very decorative geometric figures in black. There are multitudes of tribes in other parts of the world who make finer baskets and put more work upon them, but for chaste beauty those of this region excel.

The Andamanese basket is made of the rattan or cane of the country. The stalks are cut into lengths of about four

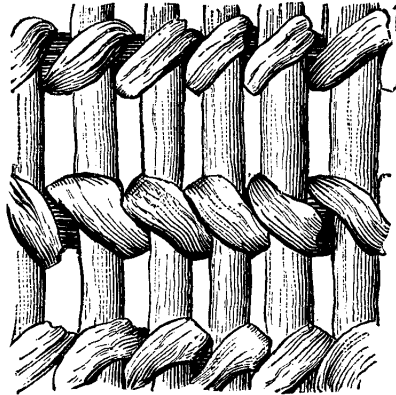


FIG. 46.—Detail of "Birdcage" Stitch in Basketry, Vancouver Island. (*U. S. Nat. Museum.*)

feet, the cuticle is peeled off and divided into narrow strips of uniform width, and the remainder is split up into convenient pieces. The style of weaving is similar to the American. The maker gives a "kick" to the bottom of his basket by scooping a hole in the ground, pressing the framework into it with his heel until he has proceeded far enough, the frame sticks are

then reversed and the work goes on to completion. The rims are finished off with a piece of *Uvaria micrantha*, and the handles made of the bark of *Melochia velutina*.¹

The second class of basketry work is the coiled or sewed ware. Its affinities are not with weaving at all, but with sewing. The savages, in making garments of skin, whip two edges together, as carpet-sewers do, by means of sinew thread. That is, the sewing progresses in a continuous spiral of thread.

¹ Man, *ut supra*, p. 162.

After this fashion the peoples of the Far East, of every stock in Africa, and in all parts of America make coiled basketry, the material each time modifying the method of working and the appearance. The best idea of this class of work can be gathered from the simplest examples, the first patents, to use the modern phrase. These may be seen in Further India or in North-western Canada among the Athapascans. The elements are a stiff root or rod for the fundamental coil, and a soft splint or strip of the same material for the sewing. In making her basket, the woman starts in the centre of the bottom, coiling the rod and wrapping it as she proceeds with the split root or rattan, so as to bind it to the preceding turn, drawing her splint between the spirals. When the rod comes to an end, she neatly splices the end to that of a new one and proceeds as before, carefully concealing the joint. When the splint is exhausted, the end is tucked in behind the spiral and another one started in the same manner, but so carefully joined as to defy detection. The Siamese do not decorate ware of this kind, and much of the spruce-root coiled ware from Canada and Alaska is severely plain. But further south in British Columbia and Washington, bits of birch-bark, straw, or quill are doubled over the splint on the outside of the basket and the two ends concealed under succeeding stitches so as to give an imbricated effect in many colours. Nothing in basketry could be more beautiful, and when it is remembered that every stitch is covered by one of these loops, some conception may be formed of the immense number in a single piece.

Now, to vary the foregoing, some tribes insert a strip of tough material between the coiled rods and reeve the sewing splint between this and the preceding coil. This makes a water-tight joint ; so ware of this sort is commonly used for boiling food by means of hot stones. The Eskimo use a small wisp of grass for a rod. The Oregon Indians use osier and *rhus*, and the California tribes, who make the most beautiful ware in the world, employ *Vilfa*, *scirbus*, *salix*,

and pine-roots. All their basket botany has not been made out.

The wonderful uniformity of the coil and the sewing splint in the California basketry is not due to the possession of delicate machinery for dressing the material. Delicate machinery was devised to make things cheap. Knack and a strong thumb-nail achieve the result. A bone awl is the needle, a true eye, a genuine pride in her work, and a skilful hand do the rest. Patience indeed has her perfect work, for there is one of these beautiful baskets in the

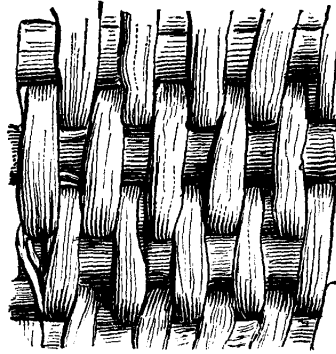


FIG. 47.—Detail of Coiled Basketry, South-western United States. (*U. S. Nat. Museum.*)

United States National Museum which employed a Hupa woman every spare moment during three years to finish it. In the Moki Pueblos, all over Middle America, and throughout Africa, finely stripped yucca or palm-leaf is used in sewing, but the method is the same. Decoration is effected by dyeing portions of the strips used in sewing, by employing the front and the back of certain leaves alternately and by choosing straws and leaves and other sections of plants of different colours. Maidenhair fern, martynia pods, rushes, grass stems, fibre soaked in muddy water, and all sorts of expedients are resorted to in order to produce the greatest embellishment.

A variety of stitch is carried out in the spiral sewing by taking a half-turn around the splint or fillet at each round between the coils. This is seen not only on pretty Japanese lunch baskets, but also on the fish-baskets made of rushes by the Fuegians. They are the only American savages who employ this style of basket-work.

“The Panamint squaws, in Death’s Valley, California,”

says Coville, "make their basketry at the cost of a great deal of time, care, and skill. The materials are the year-old shoots of tough willow (*Salix lasiandra*) and aromatic sumac (*Rhus trilobata*), the horn of the mature pods of the unicorn plant (*Martynia proboscidea*), and the long red roots of the tree yucca (*Yucca brevifolia*). These give three colours, the red, the black, and the white. Sumac and willow are thus prepared. The bark is removed from the fresh shoots by biting it loose at the end and tearing it off. The woody portion is scraped to remove inequalities, and is then allowed to dry. These slender pieces are for the warp or foundation. The weft splints are prepared from the same plants. A squaw selects a fresh shoot, breaks off the too slender upper portion, and bites one end so that it starts to split into three nearly equal parts. Holding one of these parts in her teeth, and one in either hand, she pulls them apart, guiding the splits with her fingers so dexterously that the whole shoot is divided into three equal even portions. Taking one of these, by a similar process she splits off the pith and the adjacent less flexible tissue from the inner face, and the bark from the outer, leaving a pliant, strong, flat strip of young willow or sumac wood. The weaving of the basket is begun at the bottom with two layers of warp twigs fastened by their middles at right angles. The free ends are bent upward, and in and out between them the splints are woven. [Mr. Coville fails to notice that the twined style of weaving is followed.] The free ends are bent upward and concealed in the weaving. As the basket widens new warp twigs are inserted. Ornamentation is produced by retaining the back, or by staining them, and by varying the manipulation in the weaving. A squaw commonly occupies an entire month constructing one basket."¹

The Panamints make their pot baskets and plates as follows: they are built up with willow and sumac strands as above described, but narrower and of finer quality.

¹ Coville, *Am. Anthropol.*, Washington, 1892, vol. v. p. 358.

Similar strands of martynia pods, and the long-jointed, slender stems of a native grass (*Epicampes rigens*) are also needed. The grass is particularly adapted to the use from its firm texture and the fact that the portion above the uppermost joint is very often eighteen inches long.

Starting from a central point, a bundle of two or three grass stems and one very slender withe are sewn by a willow splint to the part already finished. At the proper point the bundle is drawn more tightly, so that the remainder of the spiral forms the sides of the basket. The punctures for the sewing are now made with an iron awl, but the aboriginal tool is a stout horny cactus spine from the devil's pincushion (*Echinocactus polycephalus*), set in a head of hard pitch. The grass stems, when the stitches are drawn tightly, make a perfect packing, and the basket when finished is watertight. Patterns are produced by substituting strands of martynia pod for willow in the sewing.¹

Mr. Coville is here describing the method of making coiled basketry. If the sewing takes place always on the outer edge of the finished part of the coil, the work will be flat like a mat. But these textile artistes understood narrowing, by sewing always a little above the outer edge making the tour a little shorter. The consequence is a bowl, a jar, or a pot, just as the maker wills. I have elsewhere described minutely the cleverness with which these savage women secure a water-tight vessel, light and strong.

Mat-making, hat-plaiting, and all such work as does not require a loom, is in the nature of basketry. The Chilkat Indians of Alaska weave a ceremonial blanket of cedar bark, and wool from the mountain goat. These are covered with totemic devices in yellow, black, and white. But there is no shuttle employed. The warp threads are set up in a frame, and the weft is wrought in by twined work, after the manner of a tapestry worker. It is, in fact, the Tlingit twined basketry in pliant material. All over the

¹ Coville, *op cit.*, p. 359.

North American continent cloth and matting were thus produced.

Hand-weaving, without the aid of loom or frame of any kind, was perfected among the Polynesians. Besides the beaten or tapa cloth they made robes and sleeping mats, with or without fringe or pile from the bark of the hibiscus and *Phormium tenax*. The bark was peeled from young shoots in strips four or five feet long. These were scraped with a shell and dried. From these ribands split the mats were woven, the work commencing at one corner, and a fabric nine feet long and four feet wide being wrought by the fingers of the workman alone. These were of a beautiful white colour, and were worn only by men.¹

The so-called Panama hats and similar work from Africa, though looking like the work of a loom, are produced by hand. Either in Mexico or in Africa the natives may be seen seated on the ground with the split filaments at their sides working away almost unconsciously, and scarcely looking at what they are doing. The method of drawing the working filaments alternately above and below what may be called the warp is ingenious. Each filament is doubled near the point of working, and the nimble fingers place one warp strand above and one below as the loop is drawn along so dexterously that the eye can with difficulty follow the operation.

The true textile art begins, however, with spinning or the making of yarn. This involves the separation of the fibrous tissue from starchy and other foreign matter, and the twisting of the fibre so as to make a strong yarn. Or it involves the removal of hair or wool from animals, and subjecting them to the same operation.

In its beneficial results this art is surpassed by none other invented by savages. When one considers the millions of flying spindles now whirling in all the factories of the world, he does not wonder that the Fates or controllers of human destiny were worshipped in the form of three

¹ Ellis, *Polynes. Researches*, London, vol. i. p. 186.

very plain women, one making yarn, the second spinning it out, the third with the fatal shears. It is easy to believe that the first yarn was twisted between the palms of the hands or on the thigh by means of the palm. The cobbler, in untwisting his thread, keeps alive the latter process. But the spindle is a very old device. The simplest form in use to-day is a stick or rod of wood. The one who used it sat on the ground with legs extended. The yarn was fastened by one end to the middle of the stick. The spinner held the bunch of fibre in the left hand, and rolled the stick along on the thigh quickly with the right hand, catching and carrying it back to the groin, where it stopped twirling. The spun yarn was wound on the stick as soon as it was sufficiently twisted, and this made a sort of fly-wheel.

It was a very easy step in advance to put some weighty object upon this stick, inventing thereby the spindle-whorl. And if the spinner wished to get up and walk around, it would be necessary to have a spindle-stick with a hook or notch on the upper end. Stick, whorl, notch—that is all there is in spinning. All further inventions were for the purpose of doing the work faster and finer. Indeed, in Finland the spinning-wheel is nothing more than a large spindle laid horizontally, and worked in two upright sticks that serve for bearings.

Every region of the earth has its own string. The Arctic peoples prepare thread and twine of sinew, some of them as fine as our best cotton, only very much stronger. The Japanese make excellent string of the mulberry paper, and the Chinese, as well as many peoples south of them, use bamboo splints, while the silkworm goddess is the patroness of the Far East. All over the Pacific Islands the coir, or prepared fibre from the outer husk of the cocoanut, is the staple from which string is made, not by twisting, but chiefly by braiding. This braided coir serves every conceivable purpose. Houses, boats, and implements are tied, not nailed or rivetted together. Its preparation occupies

the leisure of men and women, and great rolls of black and brown sennit, for that is the native name, may be seen in museums. In Mexico and South America the pita fibre and cotton furnish the principal staples, but all over temperate North America the *Apocynum cannabinum*, or Indian hemp, was made into yarn and twine, and woven into cloth. The hair of ruminants and of the dog easily lent itself to the spindle, and among some tribes skins with the fur on were cut into very thin strips, and these were twisted and woven into blankets. Bast from trees is frequently twisted into a kind of single ply twine, and used even for bow strings.

Sinew dressing is a textile art. The long and tough bundles of sinew are removed from the legs of the larger mammals, very carefully cleaned of any flesh or fat and dried. At convenient seasons these bundles are shredded just as men and women pick oakum. This shredded sinew is used without further preparation for seizing or wrapping thousands of things together. For instance, when a savage would firmly attach the feathers to an arrowshaft, he takes the shaft under his left arm with the nock end in his left hand. He then puts a shred of sinew in his mouth, while he lays on his feathers carefully. As soon as the sinew shred is thoroughly softened, the wrapping is neatly done by holding the shred tight with the right hand and revolving the shaft with the left. At both ends the shred is tucked under and rubbed down so as to render the fastening invisible.

This shredded sinew answers another purpose, namely, for strengthening the backs of bows. A quantity of this material is well moistened and mixed with animal or fish glue, and little by little built up on the back of a wooden bow previously prepared. This is so neatly done as to resemble the bark of the wood, and must be very carefully managed to avoid overstraining the wood backward in drying, and to give at the same time the elasticity demanded. Some of these bows will do terrible execution.

The sinew, when very finely shredded and combed out, makes an excellent yarn or thread or cord. The eastern Eskimo very seldom twist the sinew except for bow strings, but the western Eskimo are extremely clever in its management. They have invented a kind of swift which enables the spinner to run out a much longer filament than can be done by hand. The spindle is seldom used in sinew twisting. For bowstrings and cord where strength is needed, the North American Indian had no substitute for this.

The shredded cedar and willow bark and some grasses of the Pacific coast of America make excellent twine for nets, fishing lines, or domestic use. The hackling is done with a very dull bone knife in the shape of a kitchen chopper, and in some cases the filaments are quite short. The twining is done altogether with the fingers, and very skilfully, after the manner of twisting a whip-cracker. The woman holds the twined part in her left hand between thumb and forefinger, and presses her middle finger against the ball of the thumb to hold a strand, while with her right hand she gives the other strands a few turns. She deftly turns the strand, passes it to the middle finger of the left hand to hold, at the same time seizes the other strand, gives that a turn or two, twining the two strands each time. It is said that Sicilian women make twine for chair bottoms in the same way from rushes.

The basket-makers of Guiana are men, but the spinning and weaving, with slight exceptions, are done by women. The string is of three kinds of fibre—cotton, tibusiri (*Mauritia flexuosa* fibre), and crowia (*Bromelia* and *Ananassa* fibre). Cotton is grown and spun by almost all Indians, but especially by the Arecunas. The fibre having been picked and freed from the seeds is pulled out into a long, uneven loose band, and this is wound around the right wrist. One end is attached to the end of a common spindle and the thread is carefully drawn out and twisted and wound about the spindle shaft. In making twine two or three of these spindles are used, as in common twine. The gathering of

tibisiri is a unique process. The young leaf spike furnishes the fibre. Each leaf or spike is taken singly, a sharp dexterous rub at the top separates the outer skin, and the whole is then torn off. It is further prepared by boiling, drying in the sun, and twisting into strings by means of the palm of the hand and the thigh, after the manner of the cobbler. The fibre from a dozen spikes is sufficient to make a large hammock.

The crowia fibre is thus obtained. A noose or slip-knot is passed over the end of a leaf tightly, the other end of the string being attached to a tree. The Indian then takes the point of the leaf in his hand and forces the fibrous portion through the noose by a sudden and strong pull. The green skin and soft matter are removed by the loop. The fibre is then washed and dried in the sun. The crowia is also twisted on the thigh by means of the palm of the hand. Mr. im Thurn explains the existence of thigh-twisting and spindle-twisting in the same area by the statement that the latter is confined mostly to Carib tribes, and that the thigh-twisting is probably the aboriginal method, and that subsequently the stocks had borrowed customs from one another.¹

These Indians construct their hammocks by netting the tibisiri fibre after the manner of an old-fashioned silk purse. The square wooden frame on which they are made lies on the ground, and the whole is netted of one continuous string. The Caribs weave their cotton hammocks in a frame. After setting up the warp, they weave at intervals or braid bands across with three shuttles, taking up the warp strands alternately in the plait. The work on these is done by women, from the planting to the finishing off in the loom, but the "scale lines are put on by the men."

The Andamanese cordmaker uses the bark fibres of trees and shrubs for material. For harpoon lines and turtle nets he resorts to the *Melochia velutina*, removes the bark, and with a Cyrena shell scrapes the cellular integument until the fibre which it encloses is laid bare. These are then placed

¹ Cf. im Thurn, *Indians of British Guiana*, London, 1883, pp. 283-290.

in the sun to dry. When ready for use the ropemaker ties several of the filaments to his toe and winds another strand round them spirally, adding fresh lengths when needed. When about thirty yards have been made, a large portion of yarn is wound around the kutegbo, or reel made of two cross sticks. The operator then seats himself, stretches his legs apart, places a stick or cane between his two big toes, and over it passes his reel. His yarn or fibre is placed at his right side and drawn behind his neck and over his left shoulder as he proceeds. The man converts himself thus into a kind of ropewalk.

The women of this race also make a less durable twine for fishing-nets and sleeping mats. And bowstrings are manufactured by twisting fibre on the thigh. Even in net-making the finger is used as a mesh stick, though the netting-needle of bamboo is in vogue. No sewing, as we understand the word, is to be seen. In repairing their dug-out canoes they bore holes above and below the crack and reeve strips of cane through these, filling the interstices with wax of the black honeycomb.

Dr. Faurot says that among the idle men about the village on the island of Kamarane, south of Arabia, may be seen some walking about and spinning. The spindle consists of a shaft and a whorl on top, the latter pierced near the outer border and having an eyelet extending above the centre. The spinner holds the thread high up with the left hand, and with the right palm sets the spindle whirling by striking the palm against the edge of the whorl.¹ Livingstone observed the same implement in Africa, and in the first volume of his explorations refers to a figure of Wilkinson's. In the Egyptian group women are doing the spinning, one twirling as just described, a second is rubbing the shaft against her thigh, as a shoemaker does now, and a third is using both palms, having suspended the thread from the fork of a tree.

¹ Dr. L. Faurot, *Rev. d'Ethnog.*, Paris, 1887, vol. vi. p. 435. Compare with Tibetan spindles, Rockhill, *Smithson. Rep.*, 1892.



ZUNI WOMAN WEAVING BLANKET. (*Photo in U.S. Nat. Museum.*)

Livingstone says that the markets or sleeping-places of Angola are well supplied with provisions by great numbers of women, every one of whom is seen spinning cotton with a spindle and distaff. A woman is scarcely seen going to the fields, though she may have a pot on her head, a child on her back, and the hoe over her shoulder, but she is employed in this way.¹

Among the Mendi negroes on the Niger, the men do the heavy work and clear the bush, they also weave, sew, and make their own clothing. The women till the ground, fetch water, go fishing, prepare and cook food. They spin cotton thread, dye it, and make mats.²

The Polynesian race, as well as the negroid peoples of Oceanica, make a braided cord from the husk of the coconut. In Samoa, the sennit is braided chiefly by the men. They sit at their ease in their houses and work away very rapidly. At political meetings also, where many hours are spent in formal palaver and speechifying, the old men take their work with them.³

Loom-weaving is a savage invention. In the Mexican Codices a mother is pictured giving instruction to her daughter in the art of weaving.⁴ The warp is fastened to sticks at either end and the alternate threads are lifted and depressed by means of a very simple harness. The Africans also had looms, as well as the Polynesians, involving in a primitive way the parts and the processes of our more pretentious machines. One of the latter, however, will do the work of one hundred savage women, and a well-equipped factory would weave more cloth in a day than ten thousand African experts.

The simplest form of weaving is a plain checker in which the same kind of thread is both warp and woof, and both

¹ Livingstone, *Travels, &c., in South Africa*, New York, 1858, p. 433, with drawing copied from Wilkinson's *Ancient Egyptians*.

² Garrett, *Proc. Roy. Geog. Soc.*, London, 1892, p. 436.

³ Turner, *Samoa*, London, 1884, p. 170.

⁴ Bancroft, *Native Races*, New York, vol. ii. p. 484, with authorities.

are drawn equally tight so as to appear on either side. As before mentioned, this is a very common style of basket-making, but it is not so easy to manage in a rude loom, as we shall see. In many parts of the world, savages set up frames, very much like the old-fashioned quilting frames, only of very rude sticks laid parallel on the ground or fastened to some stable objects just as far apart as the fabric is to be long. In a continuous long spiral they wind the warp yarn backward and forward around these two sticks until the warp is as wide as the blanket or other fabric is to be. The threads are thus adjusted at equal distances on the sticks above and below. A long rod is then laid against the warp, and by means of a continuous yarn this harness is made fast to the warp threads farthest from it, the back threads, if the loom is standing. This can be done by simply winding the yarn round the stick and passing it between the front warp fillets and around the back ones, as a hurdle or heald, until every back thread is attached to the harness stick. The yarn of the weft is wound on a long stick by wrapping it around one end once or twice, carrying it to the other end, wrapping it there and so on, backward and forward until enough is wound. The weaving consists in drawing the harness stick toward the weaver, which pulls the back set of warp threads forward between the other or front set. The primitive shuttle is then passed between the two sets of warps, the end of the yarn having been fastened to the outside warp, and enough yarn unwound to go across. With the two hands this first weft fillet is drawn taut, any inequalities adjusted with a pointed bone or stick, and then it is driven home by a wooden sword, lightly if the texture is to be plain, with some force if it is to have a corded appearance. The sword is then withdrawn, the harness stick slackened, the back set of warp threads forced into their places by the sword and another weft thread carried across. This constitutes the action of the most primitive loom. There is no machinery of much importance in savagery, so we must not look for flying shuttles of the

most primitive sort. But the harness does become more complicated. However, so long as there are no true heddles the weaving must necessarily be of the plainest kind. Different colours are easily introduced into this work by having sets of bobbins or reels for each colour and drawing them through the requisite number of stitches each time. The apparatus cannot be set for such performance, but the weaver must carry her pattern in her mind and count properly at each turn. Stripes are easily made, but geometric patterns require great skill and close attention. A curious harness is found among the North American Pueblos and in Finland. It consists of a number of small wooden rods, or heddles, made into a rack by lashing their ends to two parallel rods, after the manner of a ladder, only the rounds are so close together as just to allow the warp thread to pass freely from one cross-bar to the other. The small rods or heddles are all perforated in the middle to form the eyes or "mails." When the warp is set up, threads are passed through the "mails" and between the rods. This enables the weaver to push, or "shred" one half of the warp threads past the other half quickly. It also allows the weaver to "darn" the weft thread through the warp threads that are uppermost and create geometric figures and diaper effects *ad libitum*. The Chinese have a large block of wood with saw cuts inclined so as to throw the warp up and down in weaving the Canton matting.

In the African grass and palm fibre looms a harness is made by a single set of heddles acting precisely as do the perforated rods in the Zuñi belt-weaving.¹ In the manufacture of the garters worn in their ceremonial dances the Pueblo Indians turn their bodies into a very convenient stretching frame. The woman sits on the ground with legs extended, and holds one of the warp bars with her two great toes while the other rests against her stomach, and is made fast to a belt passing around her back. By moving her toes

¹ Matthews, "Navajo Weavers," *Third An. Rep. Bur. Ethnol.*, Washington, 1884, pp. 371-391, pl. xxxiv.-xxxviii., figs. 42-59.

outward and straightening her legs she gets all the tension she desires, and can relax it instantly.

The first attempt at weaving cloth in a long piece, afterwards to be cut up, finds its counterpart in the cotton looms of Liberia and other portions of West Africa. The warp is measured off by driving stakes in the ground and walking around them with the thread as often as there are to be filaments in the narrow cloth. Sometimes it is necessary to go around the house or the whole group of structures. The warp is held taut by a large stone, and the narrow strips are afterwards sewn together. It is not here affirmed that this is altogether a native art, but native processes have survived in it sufficiently to make the study instructive.

A style of weaving controlled largely by the abundance of cat-tail and other great rushlike stems remains to be described. A number of the stalks laid parallel and very close together were joined by sewing at short distances a cord of native hemp straight through the whole series. The slender wing-bones of birds served as needles, and a double crease following the lines of the uniting threads gave an ornamental effect to the surface. This style is described in Smith's *History of Virginia*, and examples of the work with all the apparatus were sent to the United States National Museum by Mr. Willoughby from Washington State.

Plain sewing among the lowest peoples is an affair of the skin dresser. They do not, as has been said, make cloth in long pieces to be cut up and sewed into garments and other useful things. This being the fact, the best tailors ought to be sought in the Arctic regions. And this is true as any one knows who has examined the garments of caribou skin, of seal-skin, of the pelts of the little fur-bearing animals, of the intestines of the larger mammals, wrought by the Siberians and the Eskimo.

Parkas or blouses, trowsers or boots, are cut out with stone or metal knives. The edges of the parts are whipped together with sinews so as to be water-tight. Bits of

different coloured fur are inserted for ornamentation, and, frequently, to save every scrap, the sempstress will have a hundred pieces of skin in a single garment. Her needle is a tough bit of bone working like an awl, and her sinew is drawn through with a true needle made of bird bone. Her thimble is a bit of tough seal hide drawn over the end of the forefinger, though in modern times they imitate in ivory the white woman's thimble. Lighter goods, such as the intestines of seals and the more delicate skins are run together by a basting stitch of wonderful uniformity, and bits of feather are caught between the parts of the seam for ornament. As far south in America as the country of the loom weaver and the bark-cloth beater, sewing women abounded. Especially in modern times were they skilful and active in the buffalo country, where they constructed by hundreds the huge teepees or tents as well as the clothing of their tribes. Indeed, the whole work of skin-dressing and manufacturing devolved on them.

Netting among savages is difficult to study because there is much dispute as to whether it has been introduced among them ; but any one who has examined the knots of Polynesians, of Eskimo, of the ancient Peruvians, has no difficulty in believing savage textile artisans capable of making any kind of nets. The costly feather cloaks of Hawaii are founded upon nets, the quill of the feathers being caught systematically into the knot of each mesh. In a collection of Eskimo objects will be seen netting needles, shuttles, bobbins, spacers for meshes of all sizes and materials, wound with twine and babiche, or fine raw-hide string.

Net-making for salmon in Polynesia was an affair of state. "The salmon net is seldom possessed by any but the principal chiefs ; it is sometimes forty fathoms long and twelve or more feet deep. As is customary on all occasions of public work, the proprietor of the net required the other chiefs to assist in the preparation. Before he began two large pigs were killed and baked. When taken from the oven they were cut up and the governor's messenger sent

with a piece to every chief. If it was accepted, the chief agreed to perform the part assigned him. The cord was about a quarter of an inch in diameter, and made with the tough bark of the maté (*Ficus prolixa*), which, next to the romaha, or flax, is considered more durable than any other vegetable substance. The cord was twisted with the hand

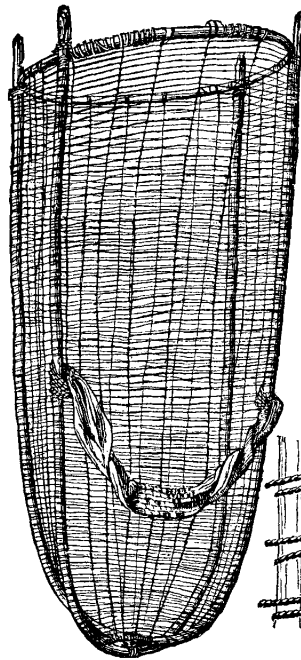


FIG. 49.—Mohave Burden Basket, wove simply wrapped about the warp threads. Compare Andaman patterns.

across the knee, in two or three strands or threads. The meshes were about four inches square, made with a needle not unlike those employed by European workmen. As the parties brought in their portions the chief and his men joined them together. The floats were dried pieces of hibiscus, and the bottom was hung with smooth stones en-

veloped in pieces of the matted fibre of the cocoanut husk tied together at the ends, and attached to the lower border of the net."¹

Loopwork is a fabric made by the interlocking of loops in a continuous string, like

crocheting. Hammocks are often thus constructed. There are no knots as in netting nor double motion as in knitting, but the loops are drawn through as in spiral basketry, and the row now forming is kept from ravelling by having the next row of loops drawn through it. The best and purest

¹ Ellis, *Polynes. Res.*, London, 1859, vol. i. p. 141.

forms of this work are to be seen in the wallets and open net sacks of the African tribes. The same stitch may now be seen in Central America, and the query is whether the negroes taught the Indians the stitch. When the work is done with a bone needle and a rod for a spacer, the end

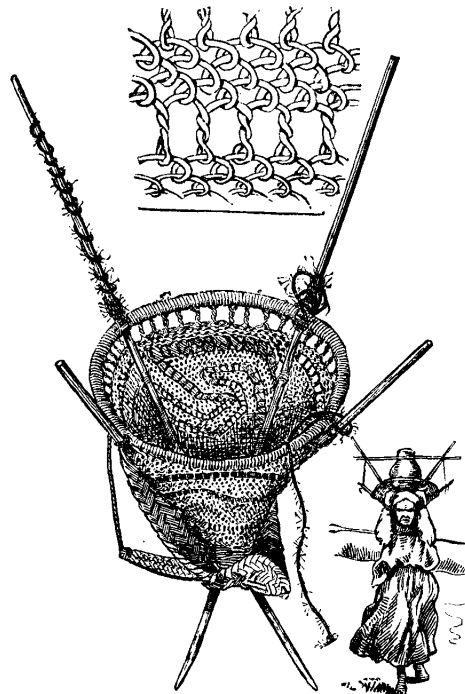


FIG. 50.—Pima Burden Basket, Arizona. Detail showing beginnings of lace making, or loopwork. (*U. S. Nat. Museum.*)

may be drawn through the loops and form a link between looping and netting.

In addition to the weaving of feathers among their cotton fabrics, the ancient Mexicans practised to perfection an art which may be called feather-mosaic. Even in our day attractive examples of this work may be bought in Mexico,

but these bear no comparison with those made by the ancient. To prepare for the feather-painting, the *amanlicā*, or artist, arranged his feathers in small earthen dishes, stretched a piece of cloth on a board before him, and provided himself with a pot of glue and a pair of tweezers. His design was sketched on the cloth, and then the feathers were carefully glued on one at a time with exemplary patience.¹

In Hawaii, feather-hunting was a special vocation, and much labour and patience were spent in catching the birds. Nets and snares were sometimes used, but, more frequently birdlime, composed of the gum of the breadfruit or the viscid milk of the arboreal lobeliads. Hunters are said to have transplanted strange trees to the midst of the forest to excite the birds' curiosity. To obtain a pair of tail feathers of the Koaie (*Phaeton rubricauda*), the hunters climbed the steep palis where the birds nested and plucked the long feathers.²

Embroidery was also a savage art long before the coming of the whites. The surfaces of textiles were covered with beads of shell, with finely stripped and dyed quills of birds and porcupines, with hair of moose and other mammals, not rejecting that from human heads. A little above the lowest savagery, as soon as people became weavers, by omitting weft threads, by splitting warp fillets and changing the parts included in rows of twined weaving, by a figure of eight weaving alternating with skipping of warp threads, by what is technically called "drawn work," and other devices, they established styles of embroidery that are imitated by the most cultured.

Superconstructive features, so important in the decoration of fabrics are the result of devices by which a construction already capable of fulfilling the duties imposed by function has added to it parts intended to enhance beauty, and which

¹ Bancroft, *Native Races*, referring to many authors, chap. ii. p. 488, *seq.* Also Mrs. Zelia Nuttall, in Peabody Museum Papers.

² Brigham, *Cat. Bishop Museum*, Honolulu, 1892, p. 10.

may or may not be of advantage to the fabric.¹ They constitute one of the most widely used and effective resources of the textile decorator, and are added by *sewing or stitching, inserting, drawing, cutting, applying, appending, &c.* These methods of over-laying and added decoration are seen in their perfection among the northern skin-workers. The weaving people of Peru and Mexico had come to this stage of their art, but plain weavers had not. But the clever little Eskimo woman could herring-bone with shredded quill, let in a gore cut from the ankle of the caribon, and cut out parts or "pink" the edges of a garment according to her mind.

In all primitive weaving definite reticulated patterns are produced by variations in the spacings and other relations of the warp and woof. The production of reticulated work is the especial function of netting, knitting, crocheting, and certain varieties of needlework, and a great diversity of relieved results are produced, no figure being too complex, and no form too pronounced to be undertaken by ambitious workmen.²

The decoration of basketry and textiles is, after all, a kind of chess playing. Each stitch is restricted to a definite area, and if the maker has been skilful, the area may be indefinitely small. The decoration of basketry is the development of geometry, producing straight lines on wallets and curved lines on true baskets and jars. These lead on to the creation of triangles and rectangles and polygons of every sort, to herring-bone, chevrons, and frets or meanders, in short, to everything that can be made out of dots and small figures and lines. Basket-making also introduces and keeps before the mind the elements of arithmetic. It would be very difficult to find another savage occupation which exacted so extended a count and such a ready use of figures. The basket-maker must hold in her memory and count in a twinkle any number of stitches, certainly up to twenty.

¹ Holmes, *Sixth An. Rep. Bur. Ethnol.*, pp. 211-232. With many illustrations.

² *Ibid.*, p. 210.

The Zuñi belt-weaver, introducing the same design over and over after an interval of ten or a dozen passes of her shuttle is a tolerably fair mistress of rapid counting.

This primitive counting and geometry laid the foundation for decorations innumerable on other material. The potter has never ceased to copy them though the transfer has been accomplished with the greatest difficulty, and has led to modifications made possible by the softness of the material.

On the other hand, the ambitious basket-weaver, working in extremely fine stitches, and instinctively guessing that a curved figure is only a polygon with infinite number of sides, soars away from right-lined geometry, and attempts animal forms. These animal forms, curtailed and abbreviated, become at first a quaint pictography, which is lost by and by in other geometric forms of a higher order. These are borrowed and multiplied from land to land, and form the stock-in-trade of the designers.

It is of the utmost importance that the stitch in basketry and the mesh in weaving be correctly understood in their relation to art in textile and also in pottery, which, as was seen in Chapter V., is a child of basketry. The one thing sought after by the skilful weaver in savagery is uniformity of dimensions in the stitch. The most cultivated persons have marvelled in looking at a Yuki Indian's or a Congo negro's textile work to see the uniformity of the plaiting or the weaving. Children and young women struggle and struggle on until they acquire the knack, and become old in the pursuit until they attain it. This once learned with any degree of nicety, the young artist is ready for the second lesson, that is, to give variety to the surface by means of shading or by colour. The Panamint Ute woman working with splints of rhus or willow, and with the split pods of *Martynia*, which are jet black, has now the means of branching out into form. But do not forget that the exigencies of her material and of her method preclude the possibility of her ever achieving aught but geometric figures. It is one, two, three in black, and then as many more in

white, and the thing is done. The next time she comes around, the blacks and whites will face opposite colours in the preceding row. That is all there is in it to begin with.

The colouring of textiles, both basketry and weaving, is an ancient art. In the first place, Nature assisted the weaver by supplying brown, black, red, green, yellow filaments in a multitude of shades. The rest is art or invention. Some vegetable substances assume new colours when buried in marshy places. Others are changed in contact with mineral or vegetal or animal substances. The California Indians immerse splints in muddy places, and secure a permanent chocolate brown; but everybody knows that vegetal dyes need the addition of a mordant to make the colouring matter adhere. This part of the art of colouring, however, was worked out in savagery.

The Navajo Indians make their native dyes as follows:

Black.—*Rhus aromatica*, yellow ochre, gum of the piñon (*Pinus edulis*). The sumac leaves and stems are boiled five or six hours. The ochre is finely powdered, and roasted to a light brown colour. It is then mixed with an equal quantity of piñon gum, set on the fire, and stirred until the mass is reduced to a fine black powder. When it has cooled somewhat it is thrown into the decoction of sumac, when it instantly forms a blue-black fluid, the tannic acid of the sumac combining with the sesquioxide of iron in the roasted ochre, the whole enriched by the carbon of the calcined gum.

Yellow.—The flowering tops of *Bigelovia graveolens* are boiled until a decoction of deep yellow is produced. Some almogen (an impure native alum) is heated over the fire and added to the decoction, and the wool is put into the mixture to boil. This produces a tint nearly a lemon yellow.

A second process consists in crushing the fresh root of a plant, as yet undetermined, upon a metate, and in using the almogen as a mordant. The cold paste is rubbed between the hands into the wool.

Red.—A reddish dye is made of the bark of *Alnus incana*, var. *virescens* (Watson), and the bark of the root of *Cercocarpus panifolius*, the mordant being fine juniper ashes.¹

The Lacandons of Guatemala used as dyes, indigo for blue, cochineal for red, and indigo mixed with lemon-juice for black. The Nicaraguans obtained a highly prized purple by pressing the valve of a shell-fish found on the seashore. They take the material to the seaside, and, after obtaining a quantity of fresh colouring matter, dip each thread singly into it, and lay it aside to dry. From the aloe and pita they obtain a very fine thread. Reeds and bark give material for coarser stuff, such as ropes and nets.²

The ancient Mexicans, in preparing dyes and paints, used mineral, vegetal, and animal substances. Of plants, they used the wood, the bark, the leaves, the flowers, the fruits, and many of their dyes have, since the conquest, been introduced throughout the world. Chief among these was the cochineal, *nochiztli*. The flower of the *matlalxihuitl* supplied blue shades; indigo was the sediment of water in which branches of the *xihquilitzahuac* had been soaked; seeds of the *achiottl* boiled in water yielded the red, the French *roucou*; ochre, or *tecozahuatl*, furnished yellow, as did also the plant *xochipalli*, the latter being changed to orange by the use of nitre; other shades were produced by the use of alum; the stones *chimaltzatl* and *tizatalli* being calcined, produced something like Spanish white; black was obtained from a stinking mineral, *tlaliac*, or from the soot of a pine *ocottl*. In mixing paints they used chian-oil, or sometimes the glutinous juice of the *tzauhtli*. The numerous dye woods of the *tierra caliente*, now the chief export from that region, were all employed by the native dyers.³

The oldest books speak of cloth and nets and embroideries

¹ Matthews, *Third An. Rep. Bur. Ethnol.*, p. 376.

² Bancroft, *Native Races*, New York, 1874, vol. i. p. 699.

³ *Ibid.*, vol. ii. p. 487.

and dye stuffs. Indeed, there are some types of hand-work in the textile art that no machinery can be made to imitate. This body of industries, like others of which we have been speaking, seems to have been invented and developed long ago, and when the curtain rises on the drama of written history, the spindle, the distaff, the loom, the needle are there on the stage in place. This chapter relates especially to woman's work throughout. It ought not to depreciate the inventors of the textile art in the eyes of cultivated women when they learn that the delicate stitches and patterns which they employ were invented so long ago by their own sex.¹

¹ Havelock Ellis, *Man and Woman*, London, 1894, Walter Scott ; O. T. Mason, *Woman's Share in Primitive Culture*, London, 1894, Macmillan.