Knot News

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Nagem Knots (3) - Skye Sapphire

Pieter van de Griend

Knots, like children, should be gently urged in the direction it is hoped they will follow.
Clifford Ashley [1, p117, #913].

Prologue

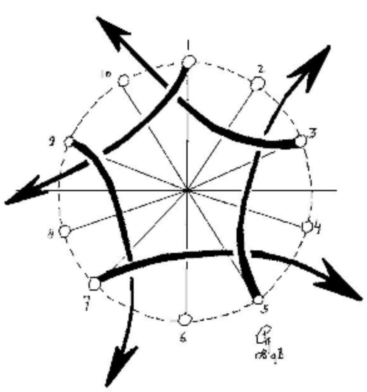
Despite it being a neat little knot, the 8-stranded version of the Little Lump Knot (**LLK**) is a pest. Find this opinion confirmed by making one and taking a critical look at its weave. You will see that its patches differ in shape and size. This criticism holds for most Knob Knots, by the way. Although our LLK's Asymmetric Nested Grid (4/2, 6/0, 8/1) can be made to fit its mouse, it frequently is an unhappy marriage. If your stends leave the mouse at inconvenient latitude you are done – no way will you be able to fix this problem without distorting the weave.

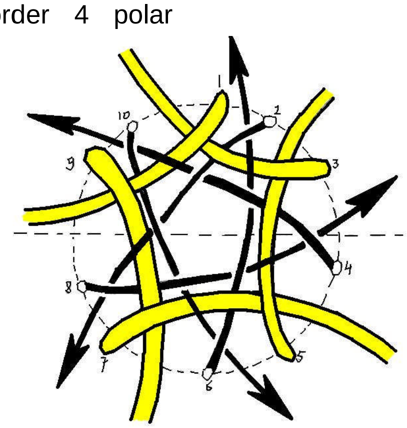
On the other hand, if your LLK mouse turns out to be an excessively fat rat, you'll be too late in discovering that the LLK Equatorial Grid is stretched beyond repair. This kind of problem occurs more often than your intuition is inclined to admit. You can provisionally repair this ugliness in a number of ways. You may either resort to more than 8 strands in your LLK, which will lead to a non-order 4 polar openenness. Or you may choose to insert an interweave padding the Equatorial Grid. Adding weave along the Equator and pushing covering material out to the poles certainly helps, but it is a desperate last-ditch bolt-on to rescue your handiwork. It certainly is seldom accounted for in any initial design. Let us take a closer look at these two cosmetic repair options.

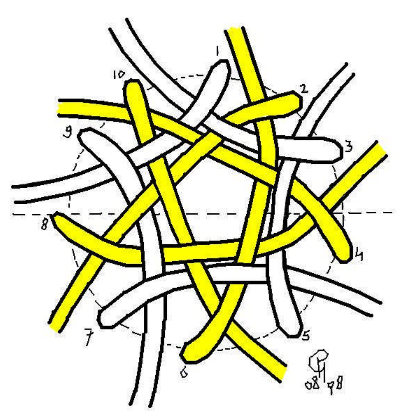
First tentative cosmetic LLK repair

A first approach to solving the ratty LLK-mouse mess lays in adding strands. Having 2 extra strands to create the LLK cover should, theoretically, lead to better coverage. This brings our LLK into a situation reminiscent of #852.

As we have seen in the Nagem Knots' Overture, #852 was a Regular Grid. Its problem was that the Polar Openness, not being 4-valent, had turned into a 5 bighted gap. Making the required 10-stranded Nested Grid Section is illustrated below. There you can see how to create the Polar Cap. I guess this is what Roy found for himself too [2]. Note that we do *not* have a #961 or #964 here. You should undertake an effort to spot the differences!



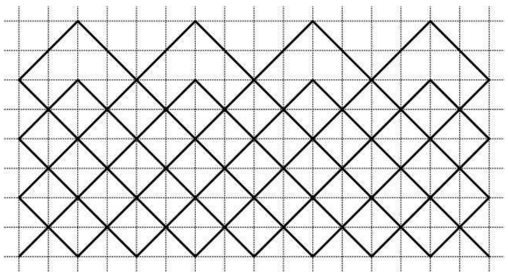




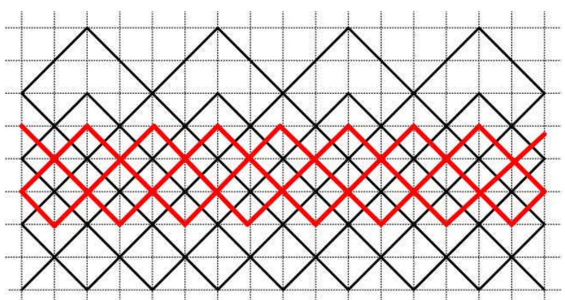
Second tentative cosmetic LLK repair

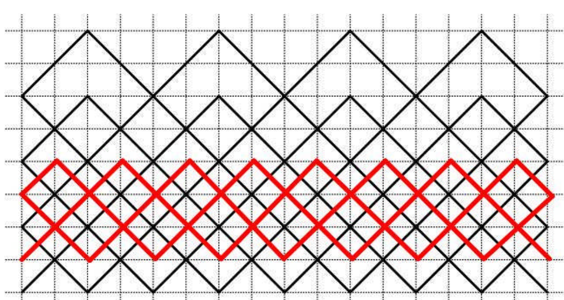
Braiders have long known that a centralized interweave yields neatly curved *narrow* knots and even approximates a mouse [4], [5]. Adding independent interweave causes a local humping of material. Depending on its transversal placement, the resulting bulge of the interweave is positioned.

Pull out the LLK-grid and see what we can do (in theory) to plaster in such a repair along the Equatorial Weave. Here is its bare bone LLK-grid.



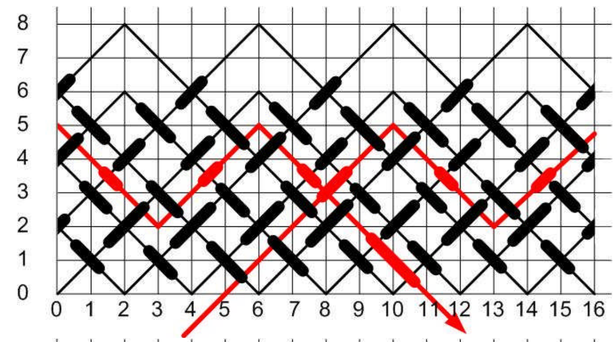
A simple 3-stranded interweave can be located in one of 2 positions. They are shown in the consecutive images below.

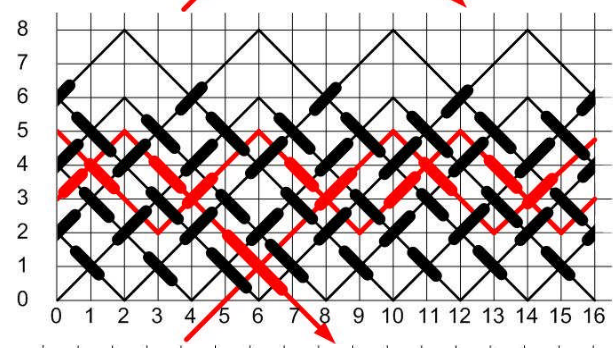


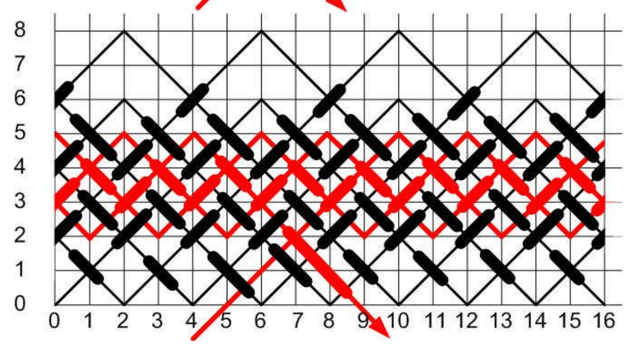


This setup will result in a homogeneous spread of material. There is more material around the equator and less at the Poles. This will partially cure trouble. The most significant observation we can take home is that the nesting number of the Nested Grid is increased *on one rim only*. In both cases the *x*-value increases.

My initial solution to the LLK-patching problem was an interweave, which lead me to the row-coded Diana Knot [3]. Below we show how to obtain it stepwise. This is a typical case of first laying and then splitting the tracks. The structure is such that the stem, exiting the North Pole, can be held in the hand – easing some of this dreadful work. Anyway, below you can see how to make this particular interweave of the first kind. We leave it as an exercise for the reader to bring the other interweave to life and detect the differences.





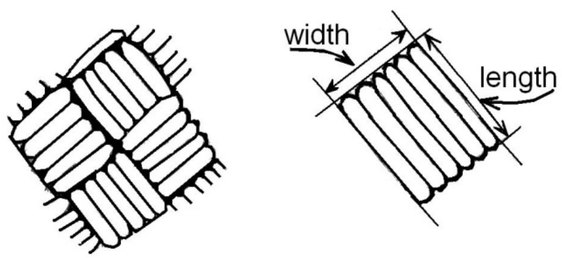


As already noted, the Diana LLK is no longer a Nested Grid of the type we have been discussing so far. Indeed, the Southern Polar Region is a Nested Hemispherical Grid with nesting number *A*=3, but the Northern Polar Rim displays some new type of nesting! We shall return to these matters in the Svalbard Smaragd, the fifth installment of the Nagem Knots series.

Obviously the structural solution, which we are seeking, will be something involving extra strands and bights. Where to add them? Is the choice between more *A*, more *x* or both. We must find out where the curvature is and add (or remove) patches of grid. Let's take a look at these curious patches first.

Perfect Patches

Finding grids to cover a surface can be viewed as a type of tiling problem. Gapping and crunching is something which occurs on, what I propose to call, the **patches** of the weave. In the illustration below patches are illustrated.



The shape and size of patches are the key to a perfect covering. We shall speak of **perfect patches** when they are square, i.e. when the width equals the length. When you are multiplying a knot's trajectory *n* times, we speak of *n*-ply. The ply and *d*, the diameter of the medium with which you are working, determine the perfect patch only relevant dimension, namely *nd*. Now let us see what we can do with our patches.

Engineering Issues

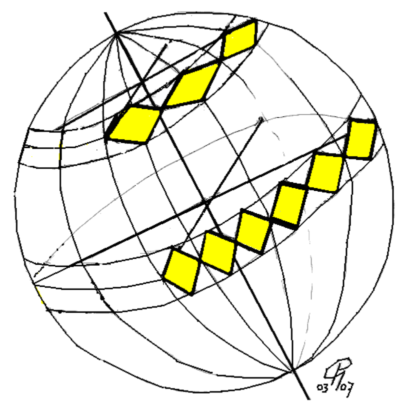
Achieving a tensionless grid on a sphere is obviously an engineering feat. Is it at all possible? Well, as Isambard Brunel (1806-1859) once remarked, "Nothing is impossible for an engineer!" That field of human endeavor inevitably entails calculations and math. Therefore I offer my apologies for the small digression into the quagmire which is to follow. Skip this part if it makes you seasick. Only the final result counts, anyway. The bumpy road leading there may be of less interest – after all.

Try and place perfect patches along the Equator of a sphere of radius r_0. You require a number of bights, denoted by b_0 and which equals

$$b_0 = \frac{2\pi r_0}{nd\sqrt{2}} = \frac{\pi r_0 \sqrt{2}}{nd} \approx 4,43\frac{r_0}{nd}$$

These patches have some problems. The sphere has radius r_0, but the resulting double-layered covering does not. We shall neglect this round-off for the time being by assuming the sphere diameter exceeds the medium's diameter a sufficiently large number of times, i.e $d << r_0$. Also b_0 may not be a multiple of four, which is our polar openness demand. We accept the closest approximation for the Equatorial Grid Length and denote that by b_E. The Polar bight number will usually be four, i.e. $b_P = 4$.

Of course this b_0-value only holds for the so-called great circles of a sphere, i.e. the meridians and the Equator. The closer parallels approach the poles, the stronger their number of bights decreases. Actually this number depends on the cosine of the latitude. At 60 degrees North (or South) the number of bights is half that at the Equator. The illustration below illustrates this.



Let's find the formula yielding perfect patches from the Equator to the Pole. How many bights do we have on such a stretch? Obviously a quarter of the Equatorial Grid Length. The Equator is spread along an arc of 2π radians and requires b_0 patches to be tiled. Therefore we have *s* parallel bight-rings between Equator and Pole, given by

$$s = \frac{\frac{\pi}{2}}{\frac{b_0}{4}} = \frac{4\pi}{2b_0} = \frac{2\pi}{b_0} \in \mathbf{N}$$

So, ideally we have a string of bight numbers declining from b_0 to $b_s = 0$. In reality this will be from b_E to b_P. Indexing our latitude by *i*, we find a radius r_i ideally boasting b_i bights.

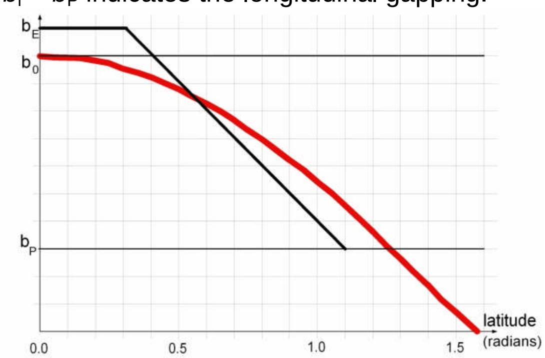
$$r_i = r_0 \cos\left(\frac{i\pi}{2s}\right)$$

The *i*-th bight value b_i can be found by

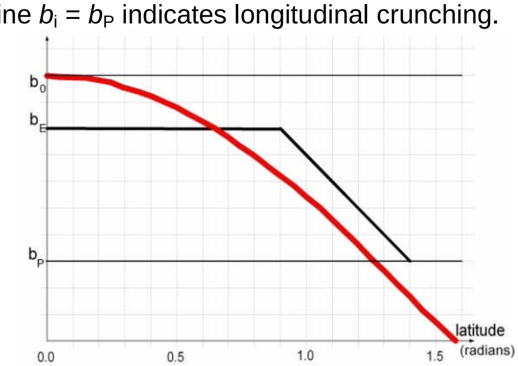
$$b_i \quad = \quad \frac{\pi r_i \sqrt{2}}{nd} = \frac{\pi r_0 \sqrt{2}}{nd} \cos\left(\frac{i\pi}{2s}\right)$$

where $0 \leq i \leq s$ and the angle is measured in radians.

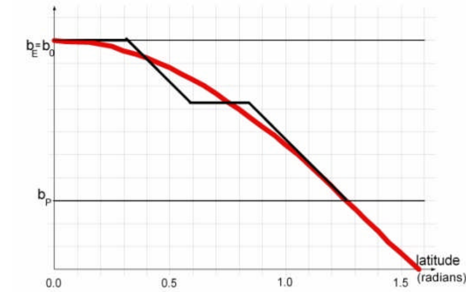
In Rockall Ruby we have seen that Nested Grids emerge as natural sphere covers when B = 4. The question *how well* do they perform remains open. Interesting is to know how much deformation results and which way does it work? In the diagram below b_i is plotted against the latitude. The cosine is the optimum curve. The straight lines are our Nested Grid approximations. At the Equator a real-life Sphere Covering Grid will have b_E bights and at the South Pole b_P bights. The diagram tells you how much surplus of bights you get (causing transversal crunching), depending on the horizontal placement of the straight line for the b_E bights. The b_P bights of the South Pole revenge themselves diagrammatically by the abrupt ending of the sloping line due to the A-section of the Nested Grid. What happens when you increase x? Then the drop into the downward slope will be delayed along the latitude-axis. The straight slope, dipping below the cosine curve results in a bight shortage per latitude (causing transversal gapping). Below the horizontal difference along the line b_i = b_P indicates the longitudinal gapping.

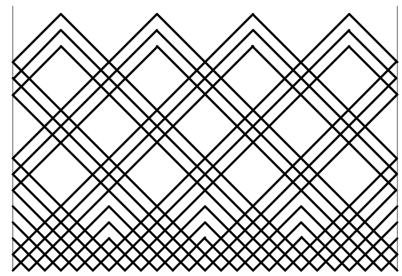


What happens when the Length of the Equatorial Grid b_E is less than b_0? The image may look like what is given below. Now the horizontal difference along the line b_i = b_P indicates longitudinal crunching.



Can we say anything general for the best fit? Well, yes, try and get the straight line-segments to coincide with the slope of the cosine graph and you will have approximated that fit. This will require some broken lines and may look like what is illustrated below. A sample of matching Hemispherical Grid is given next. Note the skew-placement of the creasing.





Designing the Skye Sapphire

How can we put the foregoing knowledge to use when designing the Skye Sapphire? Design depends on requirements. So, lay down demands first and see whether we can create a structure to match.

PSC dimension requirements Of course much depends on the radius and the shape of the mouse which needs to be covered. We make a few assumptions here in that respect. Assume the mouse is spheroid rather than obloid, meaning it is not flattened at the poles. Let us not get over-excited and stick to what we had in Rockall Ruby, a 12-stringer project base. With our perfect patches and medium diameter we can find the radius of our spheroidal mouse. Assume we have a ply-number ranging from 1 to 4 and medium diameter ranging from 1 to 6 millimeters. The table below helps find the approximate mouse-diameter r_0 in millimeters as a function of ply and medium diameter.

r_0 *(mm)*	1-ply	2-ply	3-ply	4-ply
1 mm	3	5	8	11
2 mm	5	11	16	22
3 mm	8	16	24	33
4 mm	11	22	33	43
5 mm	14	27	41	54
6 mm	16	33	49	65

Rim requirements In Rockall Ruby we went for a Hooded rim. In order to highlight the difference we shall now resort to an Asymmetric Nested Grid. The LLK and Rockall Ruby were “stuck” with the order 4 Polar openness on the Hemispherical Grid. Let’s modify that parameter too. We started cosmetic repairs with B=5 earlier in this article, in the mean time we have met an abundance of B=4 samples, so let's cover up the Skye Sapphire with B=3. We have 12 strands. Let's progress in a good tradition, aiming at change, and choose A=4.

Our Equatorial Grid has a bight length of 12. That is a fortunate number with reasonable factors. We have 3/4 and 6/2 as factors of 12. We address 2 demands in one go by immediately fulfilling our rim-parameter demand. It is not always a prerequisite to have an order 4 polar openness. So, we let the South Polar Openness be 3 and the North Polar Rim have 6 nests, each with a nesting number which equals 2.

Coding requirements Making a column coding is less error prone than a row coding (all strands will be making the same crossings per half-cycle, but more challenging than the Casa coding (U1O1). Let us go that way. To me column coding appears better suited for the obloid bodies, because it is easier in accommodating an interweave along the Equatorial Weave. However, we shall not spend too much effort on coding aspects because we shall return to them in later articles. Having all these aspects settled we can focus on the other parts of the architecture.

Note that the **squareness criterium**, which we uncovered in our Rockall Ruby project, informing us that x = 2(A+1), does not tell you anything about *the fit* of the grid. It just helps you find a square grid for B=4. The b_0 value determines the physical fit. For Rockall Ruby we have seen that x = 2(A+1) = 2(3+1) = 8. To comfortably accommodate 3 bands of 2-pass column coding and still get a Square Nested Grid (with some cheating), we require an x-value in the vicinity of 10, as A=4.

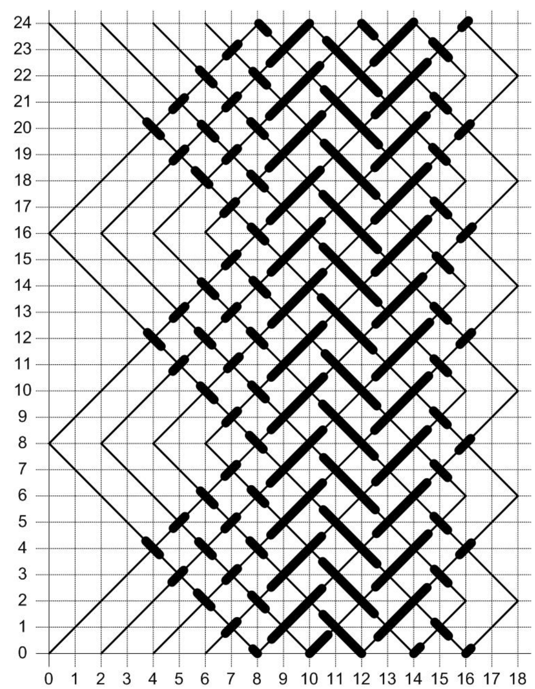
Sweeping all our ramblings into a design, we end up with an Asymmetric Nested Grid (3/4, 10/2, 6/2) with a 2-pass column coding across 3 bands. The complete knot-design is given in the image to the right. Verify that it contains 4 components.

Constructing the Skye Sapphire

Designs seldom tell you anything useful about their construction. Usually you run into their interesting aspects when trying to make the actual knot. In previous Nagem Knots projects we have seen that their construction can be done by sequential singular strand manipulation. That is to say, we pieced the weave together by moving the strands into their approximate final position making the rim and a section of the Equatorial Weave, pulled all somewhat taut and then equipped the thing with a South Polar Cap.

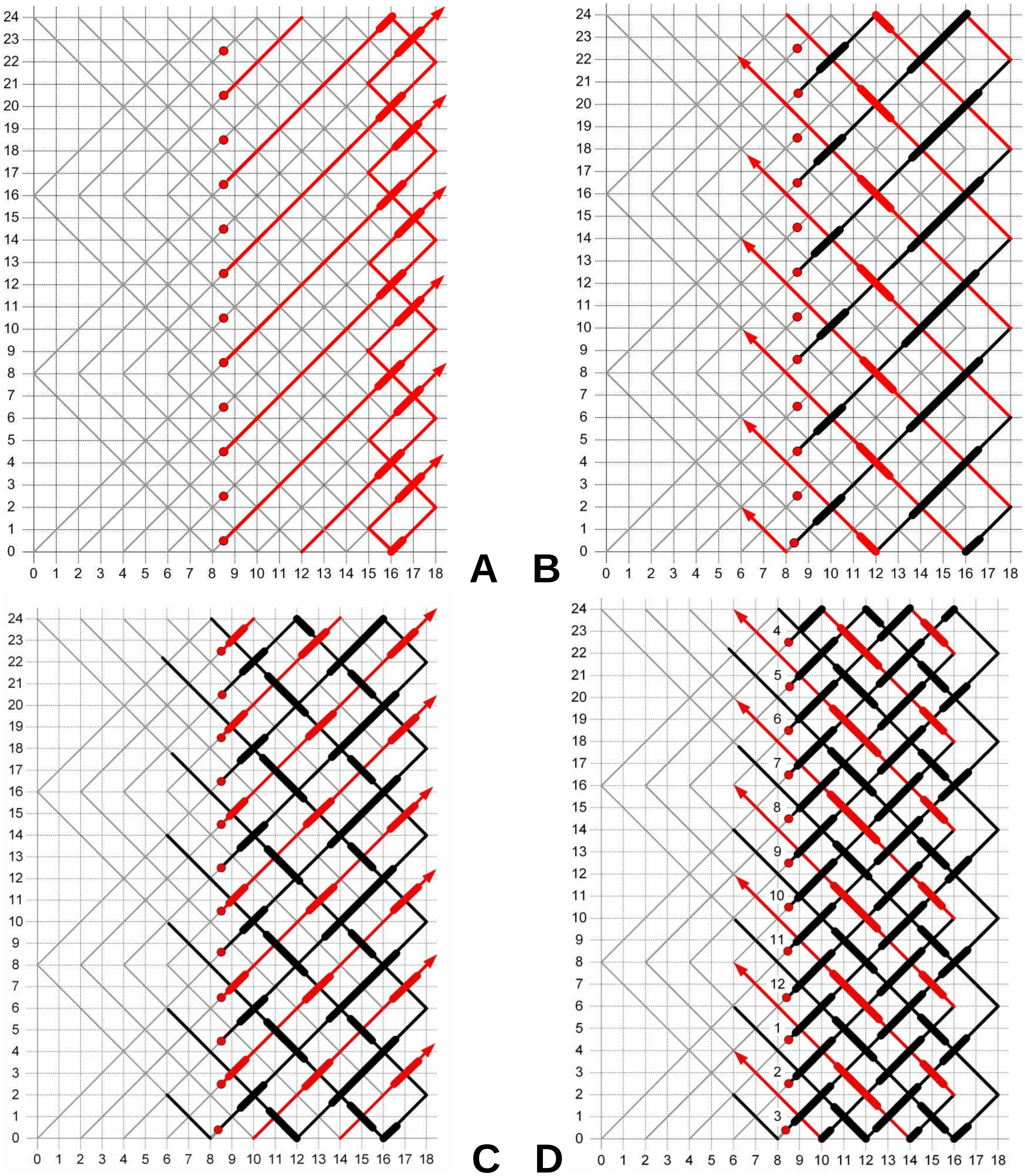
As in all Composite Nagem Knots cases it will be a matter of (symmetrically) positioning the n start-stops of the stends and wends. Where are we going to place them this time? How can we scatter them symmetrically over The Skye Sapphire's Grid? In general we have: the problem on how to create a n-stringer weave? Proceed as follows. Choose n symmetrically positioned locations in the grid/weave to start-stop the construct. In Figs A-D they are indicated by little circles.

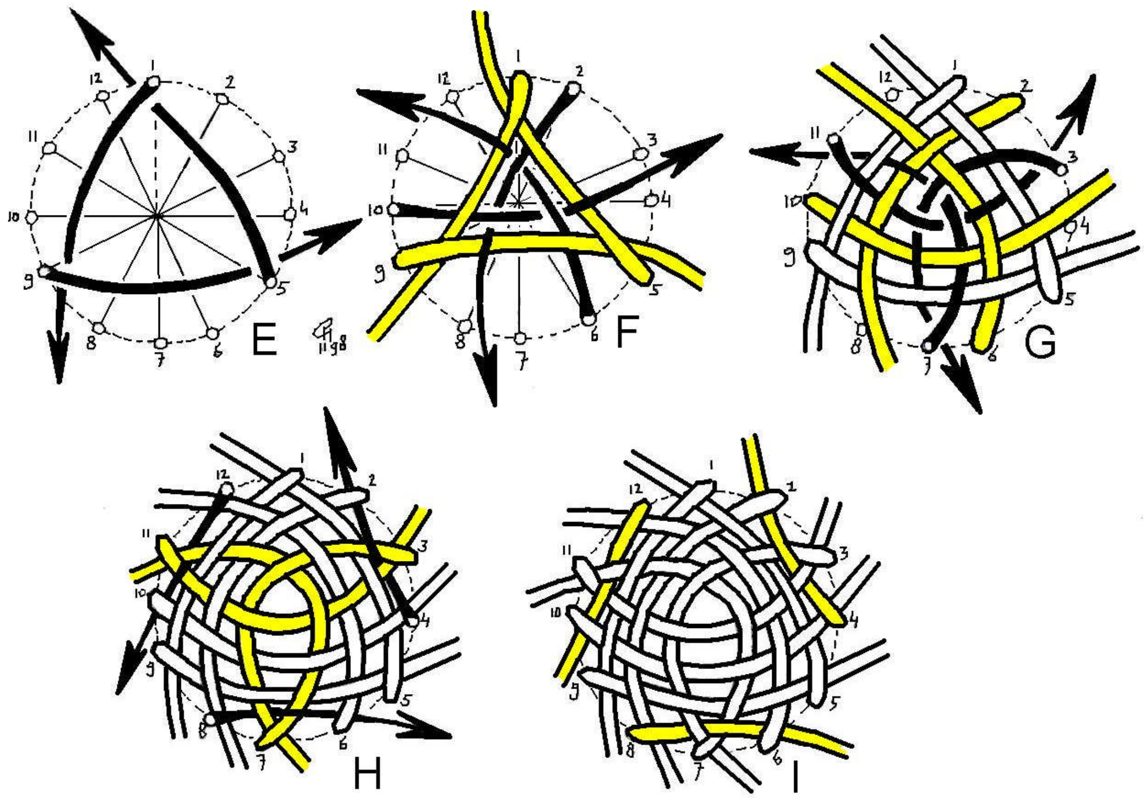
How to make the rim? In this case it comes in 2 stages. Like in all Nagem Knots we choose an easy beginning. All Crowns are in a specific direction (Fig. A and Fig. B). This will partially lock the design at an early stage (tension skeleton). The Equatorial Weave is created in 2 phases. First the inner part of the rim is made (Fig. C). Next the strands move to the completion of the Equatorial Weave (Fig. D).



The Polar Cap (Figs. E–I) Note the difference between the Polar Cap of The Skye Sapphire and that of Rockall Ruby! If you want a challenging exercise, you should unpick your Rockall Ruby's South Polar Cap and smack in this 12-stranded covering.

Note that, so far, we have been looking at Nagem Knots in which we got away with Polar Coverings needing only one set of crossfidarcs. Why is this the case? Because we were not creasing. We shall return to this observation in more detail in the Bontekoe Brilliant and the Svalbard Smaragd project


A
B
C
D



System Tensioning (2)

We re-iterate that the application of tension is an art. Thoughtlessly pulling arbitrary strands will destroy your creation. *System* tension is a method to achieve proper tension-control. Let us investigate aspects which help establish it.

Pinning the PSC-cover to the mouse, by driving nails or needles into strategic opennesses will deprive you from hours of frustrating corrections. On the other hand this technique creates a skeleton forcing the PSC-cover to take proper shape. You can accomplish the same by tensioning those strands which will fixate crucial parts of the structure. During the rim creation we have seen that the 6-stranded initial Crown did this already (Fig. A). The principle can be extended by selecting those strands which will literally tie down the structure before applying the final rounds of tension.

In the Nagem Knot projects so far, a sufficiently helpful first step is to (symmetrically) position the stend-wend linkups of all strands. Next it is a matter of identifying those strands which will help you keep the structure rigid during tension-application. The inner bights, which we laid in Figs. C and D, are good candidates.

Epilogue

We have seen that patches can be tiled tensionless on a spherical body. Selecting proper values for nesting number (*A)* and the number of nests (*B*) in either rim of an Asymmetrical Nested Grid is paramount. The rim with the highest *A*-value is to cover the spherical cap. That means the smaller *A*-value will leave a gap.

Creasing is required to cover a spherical object in a tensionless manner. Placement of creases will be part of The Bontekoe Brilliant Theme, the fourth installment on the Nagem Knot series. There we shall see how designs influence symmetry requirements and vice versa.

References

1. C.W. **Ashley**, *The Ashley Book of Knots*, New York, 1944.
2. R. **Chapman**, *Knot News*, no.36, p5, issn 1554-1843, 2002.
3. P.v.d.**Griend**, "Het Diana Knoopje", *Het Knoopeknauwertje*, issn 1385-4267, no.24, pp15-17, 2000.
4. T. **Simpson**, "Turk's Heads with a built in mouse I", *Knotting Matters*, issn 0959-2881, no.65, pp39-44, Winter 1999.
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BRAID OR NOT BRAID
THK or NOT THK*
[*THK = Turk's Head Knot]

The impetus for putting ideas kept private for over a quarter of a century into an argumentation for publication all began in a www.khww.net forum after giving the reference of Noemi Speiser's in-depth study of braiding, then adding: "…it should make easy the realization that Turk's Head Knots (THK) are not braids."

After that, *de fil en aiguille* ("from thread to needle") I had to put up some reasoned points to defend my view which is: A Turk's Head Knot is NOT a braid. [Braid (US) Plait (UK)]

In **Part One** I offer points, to be examined, telling why I think that a THK is anything but a braid. Turk's Head Knot is a label that should be strictly reserved for what in my perspective is the ORIGINAL BRAND. This type of configuration of cordage has been labeled TH **KNOT**, not TH BRAID; not that this proves anything given the present state of naming nomenclature.

I try in **Part Two** [future issue] to show the simple, regular single strand THK with O1-U1 or U1-O1 crossings, complying with the common divisor rule as being the only "original" brand THK. THK, just as "bowline", is in my opinion a much misused label. *Mis à toutes les sauces* as they say in France, "served with all sort of sauces".

Fallacies that are best avoided and are most often fallen into:

- appeal to the People or bandwagon
- appeal to tradition or common belief
- appeal to authority
- faulty comparison and
- jumping to conclusion,

Just to name a few; in short, faulty or absent reasoning.

Part One: THK ARE NOT BRAIDS
by Charles Hamel

At first I directed the interested person to my web page. http://tinyurl.com/38mrcp

Main points made there were:

- Single strand or multi-strand THK are not braids in their process of construction.
- Even if, once they are finished, they can be, if one accept and except the circularity, mistaken for a braid.
- They can too, when destroyed by cutting, take the appearance of a legitimate braid.

Still that does not make them braid or plait.

Descriptive definition of a braid: Imagine a set of vertical strands equally spaced from each other two by two, suspended by their upper extremities, pulled downward by their own weight. These strands are only allowed to modify their course by going laterally so as to cross one or several of the other strands**.** Never will they go upward or follow a previously set segment of the braid. It is **impossible** for any one of the strands **to cross itself**. No strand may even be along side itself as that is no longer braiding but doubling. When the braiding process is finished the final move is to fix in place the lower extremities of the strands.

As in the defined braid, no strand is ever allowed to cross itself **ABOK #2254** - and other Platted mats - are not quite aptly labeled.
ABOK #2955, **#2958** are "false" braids.

If this general description of a braid is accepted it follows that it must also be accepted that a THK, single or multi-strand, cannot be considered to be a braid.

At the cost of its destruction a THK becomes 'something' indistinguishable from a braid. A discontinuity created in the single strand transforms it into several individualized segments making strands of second order whose disposition in space takes on the visual appearance of braid. A braid shows on both its outer limits small arcs that are akin to the bights of a THK. This common aspect makes it easy to reach the mistaken equation: Braid = THK.

If a THK has to be destroyed to make the "braid inside" appear, it logically shows that the THK is not a braid prior to its destruction.

Application of morphological criteria without due precaution is faulty morphological ordering. This ordering on external appearance is based on a postulation: degree of 'likeness in appearance' is equal to degree of genetic kinship. It is doing phenetics and that is as good as abandoned in biology because it is faulty.

I have yet to meet someone of the 'THK equals braid' persuasion who goes beyond throwing a Jupiterian bolt out of the blue to my brain : "THK are but braids" and who then take no pains to give me a suite of reasoned and articulated argumentation. Having no wish to fall into that pit, I want to build a case backed by logical arguments against the unsurveyed use of the word 'braid' around THK.

For a run of the mill way of expressing notions in an everyday context, it is of no import if someone says that a THK is a braid and yet it is not one really; or says they are not but that indeed they are.

Nonetheless, with this classification of knots in mind, it is not, in fact, a point that should be discarded out of hand nor should it be considered settled by a peremptory statement.

Brian Kidd opposed this argument: "All those criss crosses would represent a form of braiding."

If patterned criss-crossing is the criterion retained to identify something as a braid then it will be necessary (only a few example) to identify as being braids: flat or two dimensional knots such as Prolong Knot **ABOK #2242** or **#2249 to #2251**, **ABOK #2259** Twelve strand Knot. This does not figure in my envelope of possible: in a braid as I conceive it *no strand is ever allowed to cross itself*.

Cambridge (UK) Dictionary: *plait* (braid in American-English) = *to join 3 or more length of material by putting them over each other in a special pattern.*

This is building layers by direct superposition. Each new segment is immediately added to the length of braid already laid. This makes the braid appear in a fully finished state like the road surfacing appears complete behind the self propelled paver engine. Let us have a look at the process by which the structures or the patterns are materialized (there are nuances between the 2 concepts structure/pattern).

I am making use of 3-strand braid and of a 3 lead THK but this is generalize-able to greater numbers of Strand and Lead.

In a braid the collection of strands is worked upon as a group with successive crossings following one another immediately in a very short span of time and space (we will accept the approximation of saying "in a continuous flow").

This proximity in time goes with closeness in space (that is a really important point as will be shown later). Each successive move brings to existence adjacent consecutive crossings. While a THK is worked on in such a manner that spatially neighboring crossings are not made in temporal succession; this temporal succession is disjointed when compared with the spatial one. (We will accept that rather than "continuous" it is a "discrete" process, going 'by step or jump').

BRAID 3 stands algorithm or code	THK 3L 5B O = Over crossing U = Under
1 2 3	Over
\ 1 Over 2 2 1 3:	Over
/ 3 Over 1 2 3 1	U O cross bights
\ 2 Over 3 3 2 1	U O
/ 1 Over 2 3 1 2	U O Wend meet Spart
\ 3 Over 1 1 3 2	
/2 Over 3 1 2 3	

After starting with parallel strands the making of a braid is the repetition of a fixed sequence. A sequence of putting strands upon others without any direct threading In a braid repeating the sequence adds to the existent crossings: **quanti**tative change without **quali**tative change.

No such sequence iteration exists in a THK.

Following the leader into doubling or tripling a same, unique THK does not count. It does not count because it does not change the succession of crossings made, just repeat it. Neither **quali**tative nor **quanti**tative change of crossings is made then. During the making of the THK each added crossing brings **quanti**tative and **quali**tative change.

(Note that 1, 2 , 3 here are 'name' by function 'Nominal' and not 'Order' or 'Interval' or 'Rank'. Take that as a first lesson about distinguishing a structure/pattern from the function it serves).

If that notion of using digits as names distress you please just replace the digits with the name of colors. Just looking at the code should help convince the reader of the existence of a profound difference of intrinsic nature between a braid and a THK.

With this discussion I hope to dispel an almost complete mental blindness to concepts that are different from each other: STRUCTURE vs FUNCTION; PATTERN vs PROCESS.

First point to examine is the existence, of a degree of confusion, or at least of some absence of clear distinction, made between the pattern, which is obtained, and the process through which it is obtained

Some examples taken from ABOK (Chapters: Chain and Crown Sinnets; Plat Sinnet and Decorative Marlinspike) will illustrate:

- **#2960** though aping a braid is not a braid as far as pattern is concerned, *and* is not a braid in process as one of the strand is made to cross itself, which is not admitted in the definition of "braid"

- **#2959** though sporting a braid pattern is not strictly a braid in process as one of the strands is passive and immobile; it is the lateral strands that do the changing of direction.

- **#2868** Monkey Chain, or **#2871** Trumpet Cord, or #**2872**, or #**2873** : though those 'sinnet' fairly mimicry a braid pattern they are not braid in process as their unique strand cross itself

- **#3486** Railroad Sinnet: approaching but not attaining the braid pattern and is not a braid in process anyway.

This should be enough to accept the importance of making a clear distinction between the PATTERN of a knotting and the PROCESS by which it was materialized?

Now others examples introducing another distinction I feel important to make: STRUCTURE and its FUNCTION.

- **#2952** A Round Twist Sinnet: braid pattern but it is one unique strand. Structure is one unique strand, but this strand implements a 3 strand-like function. So I can count it as a braid.

- **#2953** Idem. braid pattern. Structure: single strand. This strand functions as 5 strands that are processed by braiding.

- **#2950** Trumpet or Bugle Cord: braid pattern and braid process; not by a 3 strands structure as it is a unique strand, but this unique strand perform a 3 strands function. I accept it as a braid

I do hope that the distinction between a material STRUCTURE (here one strand) and the FUNCTION that it performs (here functioning as several strands) will be kept in mind as of now.

Commutativity does not always exist between braid and THK. (6 * 3 = 3 * 6, that is commutativity, but you may not have 6 - 3 = 3 - 6 as there is no commutativity in this operation). I mean you cannot take a braid of 3 Strand 21 Bight and make it into a single strand 3 Lead 21 Bight THK. You must leave it as a 3 component strands THK.

To make a braid into a THK that could be made with a single strand you have to make sure the braid is obeying the common divisor rule. This compliance it is not an obligation for braids.
A 3-strand flat braid may be made with 6 or 9 or 12 "bight" but that is impossible for a simple regular single strand THK.
That point alone makes two different types: braid on the one hand and THK on the other.
A flat braid put in a circle and then closed on itself does not automatically become a single line THK. It is possible in some particular cases but mostly it is not as will be seen later. (Part 1 – Drawing 1)

Single line THK, if destroyed by a cut from rim to rim will regenerate phoenix-like as braid looking.
A braid of as much Strand that there were Lead in the THK (By the way LEAD = STRAND = PART = TURN and BIGHT = CROSS = SCALLOP).

Yet the process of its apparition will not have been braiding. I recognize one has to have been present at the making to know that after the fact.

Process, a dynamic phase, is an evanescent moment in time that, after its completion, is not readily accessible to direct observation.

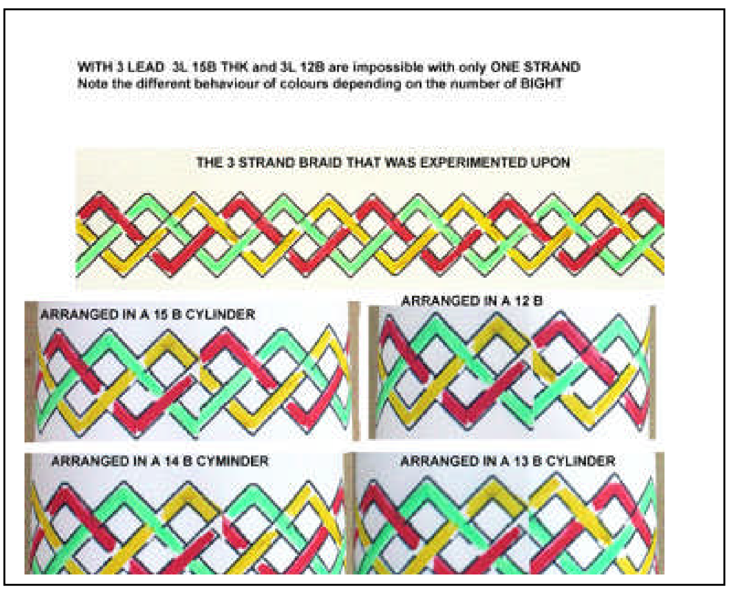
Pattern (or structure) is a "steady-state" or static phase following the end of the process. After the completion of the process and till its destruction it stays readily accessible to direct observation.

I suppose that is one reason why the creed of the equality or equivalence between THK and Braid is so often held as true. Superficial observation makes it believable.
Squarerigger asked: “What is the difference if I make a THK from a single line, doubled and then braided with the third pass (#1381 I think) to form a braid from a THK? Is that not still a THK? The distinction becomes less clear for me.”

It can never be a braid allowing to the definition.

It can be an inter-twining, or an inter-weaving, or an inter-threading. (Nuances should be studied in order to get the right word; weaving does not seem to apply as process here).
It can never be a THK according to what I put in the diagnosis flow charts (Part Two)

I did my best with this illustration (Part 1 – Drawing 1) to make it easy to ascertain that:



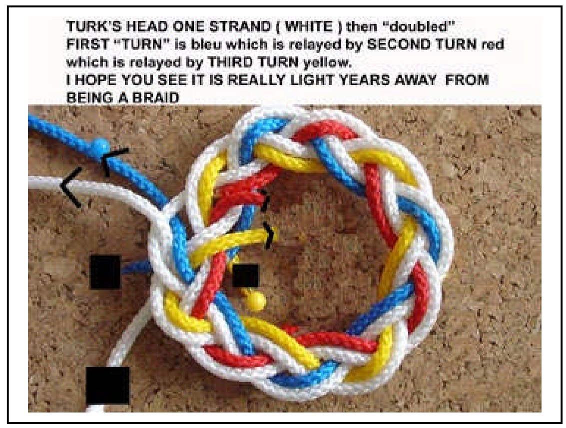
When put into a circular form (cylinder of revolution) a braid does have several types of behavior, some of them being illustrated. Only one type of behavior (13B and 14B in the particular case of this illustration) among those several types is comparable with a THK made with as much strands/lines (here 3) as there are in the braid.
Compulsory condition: this THK <u>can be done</u> with <u>a single</u> length of cordage.

Analyze the way color meet color and observe the number of Bight in each case.

Do your own experimenting.

Illustration (Part 1 – Photo 1) at the top of the next page:
A single line 3L THK in white cordage is doubled it with 3 different colors, changing color each time the one being threaded in has completed one ‘turn’.
(I find TURN much more adapted than LEAD or PART and I hope that it is 'graphically' evident here).

3 Lead THK are special cases on the particular point of the enlargement process but that does not enter into play here.



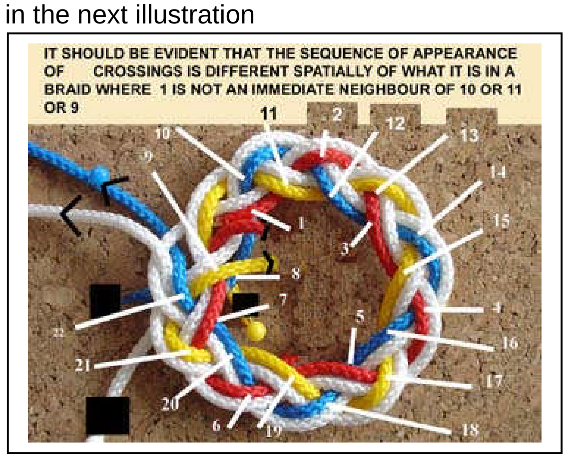
Discarding the white trace and looking only at the colored figure, it is tempting to see a circular Braid.

That is a no-no!

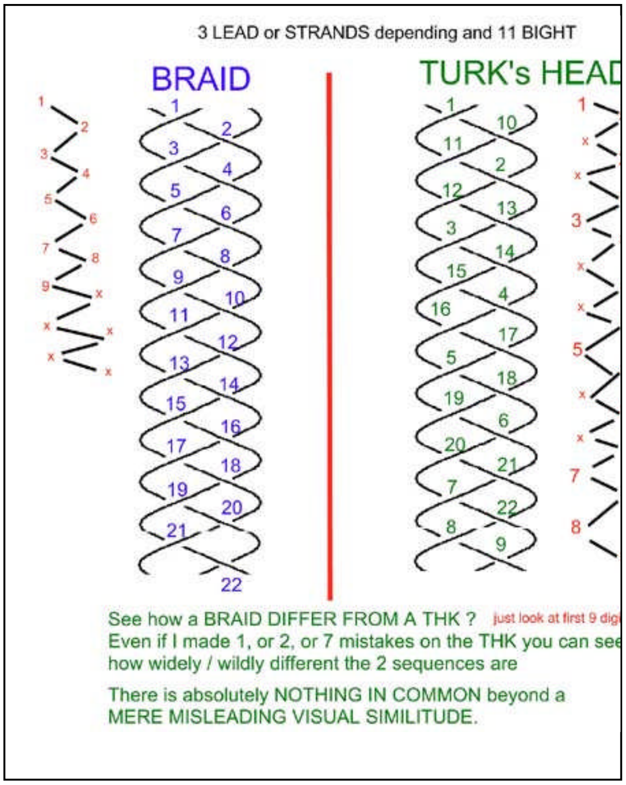
Process applied to thread in the colored lines is not a braiding process: it is threading in and not putting on each other by superposition.

In the next illustration (Part 1 – Photo 2):

I numbered the crossings taking care to follow the order in which they appear when the THK is being materialized.
This is the sequence used for comparison purpose in the next illustration



It should be evident by now that the braiding process and the making of a THK are indeed 'incomparable' one with the other.
Comparison is not possible at a level deeper than mere visual outward appearance.



Examine the order in which the crossings appear in the dynamic phase, in the process: this point alone suffice to make the final structures (static phase) : Braid, THK, quite different one from the other if one resist being mislead by the external appearance of the pattern seen without analyze of the way crossings are put in there. (Part 1 – Drawing 2)

Spatial position of the crossings and their time sequence of apparition:

--- Braid = **Time proximity plus spatial closeness**:
'continuous flowing', without any 'jump' in the sequence.

--- THK = **Time proximity with spatial remoteness**:

This remark about crossing sequences is not a moot theoretical point, it does have practical implications. This is what makes it easy to understand why it is so simple to 'enlarge' the length of a braid: the steady sequence of apparition of the crossings, ordered both in time and space, can be continued' without any difficulty.

It does not have to obey to any particular rule as far as the Bight / Strand ratio is concerned.
One may add to Bight without having to add to Strand. Nor have one to use any other process than the one implemented to make the first length of braid that is now being lengthened.

This also shows why THK to be 'enlarged' demands the mastery of more 'know how'.
Enlarging a THK you very well may end with your knickers in a knot as Australians put it.
Adding to Bight imply adding to Lead and vice versa, and that in a precise ratio. This entails that a particular process be known and applied.

If the final Lead/Bight ratio or its inverse (R or 1/R) is an integer then there is a common divisor and either the THK cannot be a single strand one or it is an 'irregular' one. Therefore it cannot be a true "ORIGINAL" brand THK. One exception is the 3L THK family which accept to have bights added without having to pay in leads added.

We are at the end of this first part: someone will almost surely have already uttered: So what?

If that empty reaction is of no consequence in the everyday life of a knot tyer or a braider, if pushed in the technical discussion it will leads to "jargon" that will be strictly endemic to small groups. Others, not in the know, will be shut out just by lack of common ground enabling them to partake to the exchanges.

It is compulsory in order for any communication to be successful to built an <u>explicit common ground</u> based as far as possible on objective argumentation with fallacies weeded out and not founded on habit, usage, hand-down tradition left unexamined. <u>Beware of implicit common ground</u>.

When we are attempting to transmit our enthusiasm and our knowledge about knotting I think advisable for a given volume (quantity) to put as much signal as possible (quality information to be turned into knowledge) and as little as possible of noise .
Noise = unexamined and unguarded way of expressing a state of mind left encumbered with belief, creed, prejudice, fallacies instead of examined and validated knowledge.

(Part 1 – Drawing 3) **CONCLUSION**

TURK'S HEAD KNOTS ARE NOT BRAIDS FROM WHICH, BEYOND MERE VISUAL ASPECT, THEY ARE INDEED DIFFERENT

BRAID:
a given pattern + a given process.
During the process phase the pattern 'emerges' continuously and fully 'finished' in the small part already done.

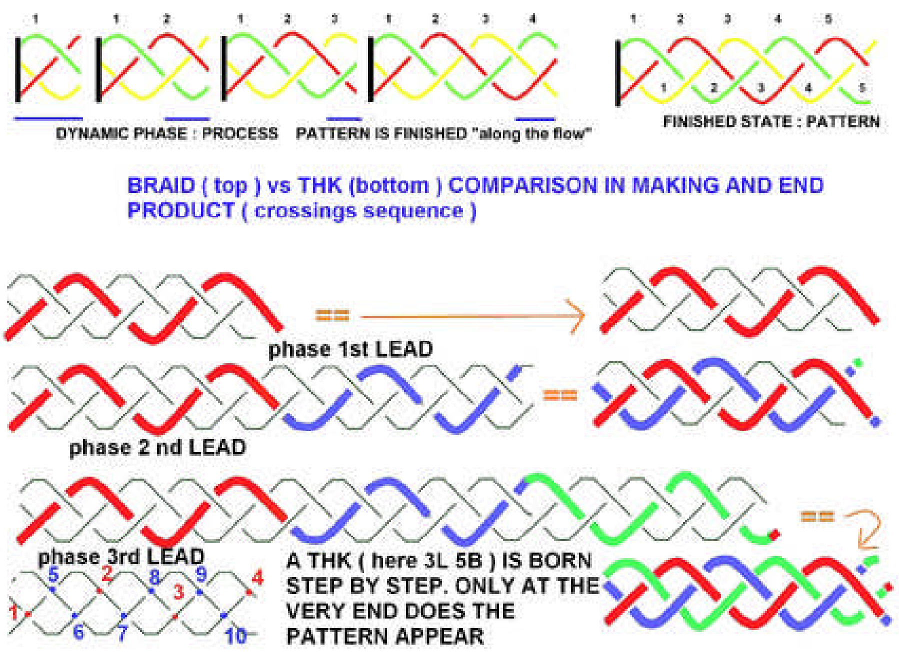
While the process goes on it does not bring any QUALITATIVE change to the braid but only a QUANTITATIVE one (length added).

This is building **layers by direct superposition**.
Each newly made segment is immediately added to the length of braid already laid which makes the braid appear in a fully finished state like the road surfacing appear complete behind the self propelled paver engine.
Even the first meter laid on is a "finished road".

TURK'S HEAD KNOT:
a given pattern that may be strikingly looking alike the one of a braid but is put into existence by a process that is *not* the one used in a braid.
The pattern will emerge as 'finished' only when the dynamic phase, the process, has ended.

All along the way there are QUANTITATIVE AND QUALITATIVE changes brought up.

The THK appears quite progressively by **successive threading** a bit like the latent image on a photographic film treated in the adequate chemical bath appears progressively.
You get the complete image only at the end of the process; you cannot form a judgment about it before the process is at its end.



Vitry-sur-Seine – October 2007.

The Science of Knots Unraveled
by Jeanna Bryner
this article originally appeared in *LiveScience.com*

Tangled telephone cords and electronic cables that come to resemble bird nests can frazzle even the most stoic person. Now researchers have unraveled the mystery behind such knot forms.

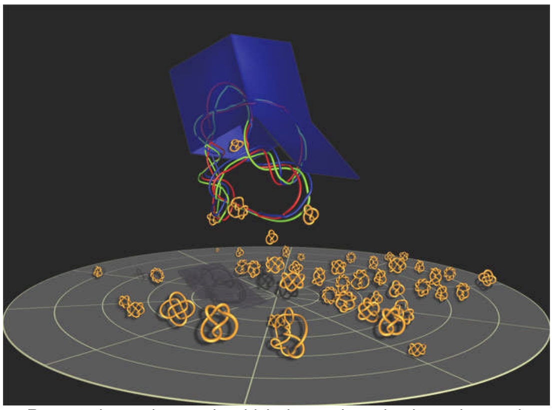
Two physicists used string-tumbling experiments and mathematical models to create a step-by-step recipe for knot formation and determined which factors cause the knottiest knots. Their research, published by the Proceedings of the National Academy of Sciences, sheds light on an everyday phenomenon about which little was known beyond the madness it incites.

"It's a common annoyance of everyday life, that anything that's like a string inevitably seems to get itself into a knot," said the study's senior author Douglas Smith of the University of California, San Diego.

He added, "Very little experimental work had been done to apply knot theory to the analysis and classification of real physical knots."

All Tied Up

Smith and UCSD colleague Dorian Raymer ran a series of homespun experiments in which they dropped a string into a box and tumbled it for 10 seconds (one revolution per second). They repeated the string-dropping more than 3,000 times varying the length and stiffness of the string, box size and tumbling speed.

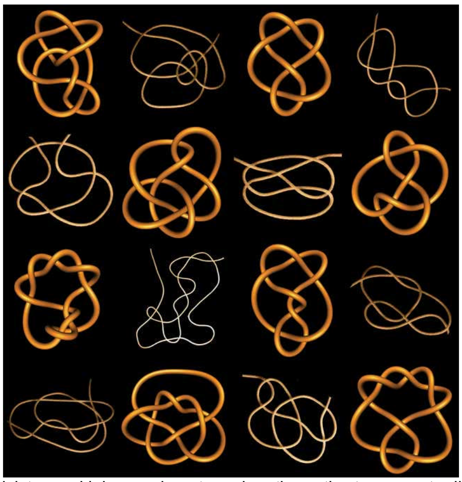


Repeated experiments, in which dropped a string into a box and tumbled it around, revealed how knots form.

Digital photos and video of the tumbling strings revealed: Strings shorter than 1.5 feet (.46 meters) didn't form knots; the likelihood of knotting sharply increased as string length went from 1.5 feet to 5 feet (.46 meters to 1.5 meters); and beyond this length, knotting probability leveled off.

Observations could only go so far. "It is virtually impossible to distinguish different knots just by looking at them," Raymer said.

Raymer developed a computer program to try and mimic their observations. From the model, they created a simplified "lifecycle" of a knot from tidy beginning to titanic tangle. Once dropped, the string formed concentric coils. Next, the string's free end weaved through the coils, with a 50 percent likelihood of crossing under or over the coil and following a path to the left or the right.



Physicists used lab experiments and mathematics to generate digital drawings of knots, which vary in the amount of tangling. The results show how knots form and which factors increase the likelihood of such knots.

Knot Busters

The best knotting came from very flexible, long string contained in a large box. "A highly flexible string placed in a very large container will have a higher probability of becoming knotted than a stiff one that's confined in a small container," Smith told LiveScience.

The researchers suggest that cramped quarters limit the tumbling motion that facilitates the string weaving through the coils. That would explain why knots were less likely to form in smaller compared with larger boxes.

But in real life, most people don't tumble cords and wires on a daily basis. Smith explained that while tumbling is not a requirement for knots to form, some motion is necessary.

"Surprisingly little disturbance or motion is needed," Smith said. "It's quite easy for something to get knotted." Even the act of picking up the phone and placing it back down could be enough jostling to trigger knot formation.

While there is no magical knot buster, Smith advised what all sailors, cowboys, electricians, sewers and knitters know: to avoid tangles, keep a cord or string tied in a small coil so it can't move.

Can anyone help with any details of American Sailmaker's Palm Manufacturers?

by Des Pawson MBE

This article first appeared in *Shavings*, the newsletter of the Early American Industries Association, and is reprinted here by permission of the author.

SAILORS' PALMS.

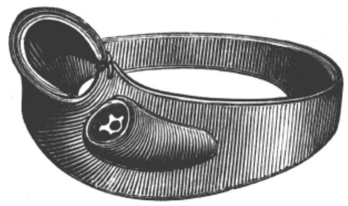


Figure 425.

Number.		Per Dozen.
1	Half Hide Mounted, Seaming, ...	$1.50
2	Full Hide Mounted, Seaming, ...	2.00
3	Brass Mounted, Seaming, ...	2.00
4	Hide and Brass Mounted, Seaming, . . .	2.25
5	Hide Mounted, Seaming, with Buckle, . .	2.50
6	Hide Mounted, Roping, ...	2.25
7	All Hide. Seaming. Extra Stitched, with Buckle,	5.25

SAILMAKERS' EXTRA PALMS.

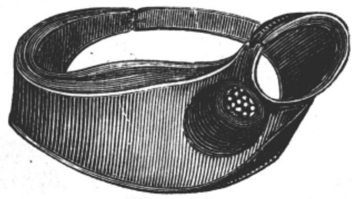


Figure 426.

Number.		Each.
12	Mullen's Pattern Seaming, ...	$2.00
13	Mullen's Pattern Roping, ...	2.50

From Henry B. Newhall Co, Boston: catalogue 1892[i]
Top is a left handed roping palm, the lower a right handed seaming palm.

The palm is the quintessential tool of the sailmaker. It is needed to push the heavy needle through the various layers of canvas that go to make the seams and detailed strengthening parts of the sail.

A sailmaker might wear his palm all day every day sewing many miles in a career. Many sailing ships would carry a sailmaker as a member of the crew, but sailors would be called to help "sails" repair and even make new sails from scratch. They too would need a palm. Palms fall into 2 basic categories, firstly the seaming palm for sewing the seams, whose iron has small indentations; secondly, the roping palm, which has larger indentations on the iron to take larger needles and the leather coming up round the thumb where a turn of the twine is often taken to get an extra pull to tighten the stitches. The roping palm is used for sewing on the boltrope that went round the edge of a sail. There are also the lighter and cheaper palms usually sold as “sailor’s palms”. It is worth noting the big difference between the prices of the various palms; the Sailmakers “Mullen’s seaming palm” is 16 times the price of the “Sailors’ half hide mounted seaming palm”.

Who made these tools? Sometimes the sailmaker, himself, made his own. Ike Manchester Sr., sailmaker of Pananaran, S. Dartmouth, Mass., was well known for the palms he made. I am not certain if he made them for profit or for special gifts. There are examples of his work in Mystic Seaport and New Bedford Whaling Museum.

More frequently, in the 19th and 20th century the sailmaker would purchase his palm, the palm often coming from the same supplier as his needles. Many of the sail needles would have come from Redditch, near Birmingham, England, even today the source of many of the worlds’ sail needles. William Smith & Son, whose needles have always been well regarded, sold [and still sells] many thousands of needles to the United States and still makes a wide range of sailmakers palms. They currently supply 15 styles either right hand [the norm] or left hand, throughout the world.

But what of American palm makers? Janet Mead Cutler writing about her sailmaker father, Alexander Munro Cutler [1852-1943], in “Bent Sails”[ii] speaks of a Mr Hazlitt in Boston, making seaming palms of renown, and Mr Mullins of New York making roping palms. The same source mentions a Mr Kirby, who often lined his palms with patent leather, although it must be pointed out that there was an English maker of sail needles called Kirby.

The Newhall catalogue off 1892[iii] offers *sailmakers extra palms*, “*Mullens pattern seaming $2 each and Mullens pattern roping $2.50 each*,” yet the cheapest sailors seaming palm was only $1.50 per dozen, and the price of even the most expensive sailors roping palm being $2.25 per dozen, with the palm described as “*all hide seaming extra stitched with buckle”* being only $5.25 per dozen. Mr Mullens palms must have been something special, but who was he?

Morss of Boston, about 1908[iv], apart from a range of *“sailors palms”*, offered “*sailmakers palms*” by

“Smiths: seaming $2 & roping $2.50,”

“Read: seaming $1.5 & roping $2”

“Cribby: seaming $3 & roping $4”.

The Topping catalogue of 1916[v] as well as a range of “*sailors palms*”, lists *“sailmakers extra palms”* and calling them “*Navy seaming $2” and “Navy roping $2.50”*

SAILMAKERS' PALMS

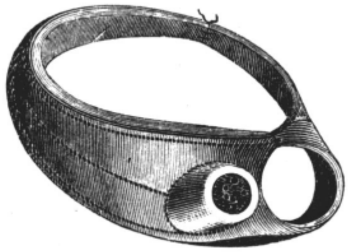


Fig. 806

Seaming, Cribbie or Mullins Pattern, $6.00; Smith's $3.20 each; Weight each, ¼ pound.
Roping, Cribbie or Mullins Pattern; $6.60; Smith's $3.60 each; Weight each, ¼ pound.

SAILORS' PALMS

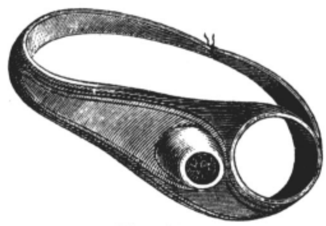


Fig. 807

Size	Price	Description	Weight per dozen
No. 1	$2.90 dozen	Half Hide Mounted, Seaming	1⅝ pounds
No. 2	3.30 "	Full Hide Mounted, Seaming	1¾ "
No. 3	3.40 "	Brass Mounted, Seaming	1⅞ "
No. 4	4.40 "	Hide and Brass Mounted, Seaming	2 "
No. 5	4.40 "	Hide Mounted, Seaming, with Buckle	1 13/16 "
No. 6	11.50 "	All Hide Seaming, Extra Stitched, with Buckle	2 3/16 "
No. 7	11.50 "	All Hide Seaming, Extra Stitched	2⅛ "
No. 8	13.00 "	All Hide Roping, Extra Stitched	2¼ "
No. 9	4.50 "	Common Roping Palm, for Sailors	1¾ "

Left Hand Palms

No. 1	$2.90 dozen	Half Hide Mounted, Seaming	1⅝ pounds
No. 2	3.30 "	Full Hide Mounted, Seaming	1¾ "

From Sunde & d'Evers, Seattle, Catalogue circa 1923[vi]
Both palms are right handed seaming palms.

Sunde & d'Evers Co,of Seattle, about 1923, also offered both a range of "*sailors palms*" and *"sailmakers palms".* This time they are described as "*Cribbie or Mullins pattern seaming $6 Smiths $3.20, Cribbie or Mullins pattern roping $6 Smiths $3.60"* each palm.

So who was Hazlitt, Mullens/Mullins, Cribby/Cribbie, and who was Read? Was Kirby American or British?

There is a left handed seaming palm in the collection of Mystic seaport with a faint make that appears to be J.G. OUTWOOD, Maker BOSTON. I have also been told of an Atwood from Boston perhaps the same people. Does anyone know anything about them? There are some palms marked HENRY ROGERS Sons & Co[vii] at the Fisheries Museum of the Atlantic, Lunenburg, Nova Scotia.

I am told that even as late as 1974 it was possible to buy a custom sized palm from Bainbridge, the sailmakers supply company, but who made them? Can any one help?

Do any members have any ships chandlery catalogues that may shed some light? Does anyone have any American sailmakers palms in their collection or do they know of any palm makers? Please contact me. In fact I would be happy to share my researches in to the tools of the rope and canvas trades with anyone who has a similar interest.

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[i] Henry B. Newhall Co: Heavy Hardware , Building & Railroad Supplies, Malleable & Gray Iron Castings, Awning & Sailmakers' Hardware ,Ship Chandlery and Wire New York and Boston, 1892. page 179
[ii] Mead, Janet Cutler: Bent Sails, Mail It Inc Cincinnati, Ohio 1962.page 5
[iii] Henry B. Newhall Co: Heavy Hardware , Building & Railroad Supplies,Malleable & Gray Iron Castings, Awning & Sailmakers' Hardware ,Ship Chandlery and Wire New York and Boston, 1892. page 179
[iv] A.S. Morss Co.: Marine Hardware. Boston, USA. Circa 1908page 174
[v] Topping Brothers: Catalogue 11. New York, USA.1916 page 249
[vi] Sunde & d'Evers Co.: Catalogue Seattle, USA. Circa 1923 Page 285 this catalogue is almost certainly Wilcox Crittenden & Co Inc. Catalogue 110 with a differing cover.
[vii] Ref MG10

From the Editor

For a long while I had settled on 8 pages as a workable, practical length for the *Knot News*. It was a good choice for postage (it only took one stamp) and it didn't pose too many problems in filling up the pages. There was the occasional time when we went over this limit, but you will always have the exception in any case. Now that we have changed to sending our newsletter through cyberspace (to those that want it delivered that way) the length of the newsletter has grown because of the lowered cost and the ease of delivery. After some discussion, it was decided (for now) to hold the *Knot News* at 16 pages and to limit each article to (more or less) 8 pages. This compels the writer to be concise and keeps the reader from getting bored.

As you can see, this issue has slipped past even these expanded limits, though this is not a reason for me to complain. These authors have been exceedingly generous with their time and talents in helping to make the *Knot News* what it is. This flood of material eases my job considerably with the hardest choice being whether to publish a piece now or later. By all means, please, keep it coming.

I would also like to mention that these authors have asked me time and again if I have any responses to past articles or if I know what would be of interest to members for future articles. To both questions I must always respond that I just do not know. Not much feedback makes its way back to me. If you ever have any comments, rebuttals, additions, observations or questions about anything discussed in *Knot News*, please feel free to contact either myself or the author directly, we are always hoping to hear from you. That goes for the future articles too – let us know what you would like to see in upcoming issues.

To finish I want to wish everyone a Happy Holidays and we hope that there will be more knots for you in the New Year!