Article

Ornamental Sign Language in the First Order Tracery Belts

Modris Tenisons* & Dainis Zeps†

Abstract

We consider ornamental sign language of first order where principles of sieve displacement, of asymmetric building blocks as base of ornament symmetry, color exchangeability and side equivalence principles work. The generic aspects of sieve and genesis of ornamental pattern and ornament sign in it are discussed. The hemiolia principle for ornamental genesis is introduced. The discoverer of most of these principles were artist Modris Tenisons [4, 5, 6, 7 (refs. 23, 24), 8 (ref. 65)]. Here we apply systematical research using simplest mathematical arguments. We come to conclusions that mathematical argument in arising ornament is of much more significance than simply symmetries in it as in image. We are after to inquire how ornament arises from global aspects intertwinned with these local. We raise argument of sign's origin from code rather from image, and its eventual impact on research of ornamental patterns, and on research of human prehension of sign and its connection with consciousness.

Key words: binary coding, binary matrices, ornaments, asymmetry, sign coding, sieve in ornamental pattern, first order complexity, hemiolia principle

1. Introduction

Ornaments and ornamental patterns are part of both historical and cultural richness of different nations. What message they convey? Can such question be justified scientifically? Either, has such question legible meaning what concerns exact sciences? In order to answer such and similar questions we must study them. In this article we study mathematically one type of ornament pattern found, e.g., in ornamental belts of Baltic coutries: for that reason we introduce notion *first order complexity ornamental sign language*.

Latvian national ornamental tracery belts, or, simpler, ornamental belts are sufficiently rich area to study [4,8,9,10]. The best known example is belt of Lielvarde (little town in Latvia) [4,9,10], that has attracted enormous interest of different researchers, maybe less from side of mathematicians. Possible reason for that may be the fact that this type of belts has very complicate ornamental tracery. Nevertheless there are some sufficiently rich patterns of belts that are much simpler, e.g., belt of Nica (small rural district in Latvia) (see 1.pict.)[3]. Just this type of belts we are going to study in this article.

In this article we systematize the many years experience of Modris Tenisons in the area of the research of Latvian ornamental belts [4, 5, 6, 7 (refs. 23, 24), 8 (ref. 65)]. Next to experience of Latvian artist and ornamentalistic researcher Modris Tenisons, we come accross with researchers

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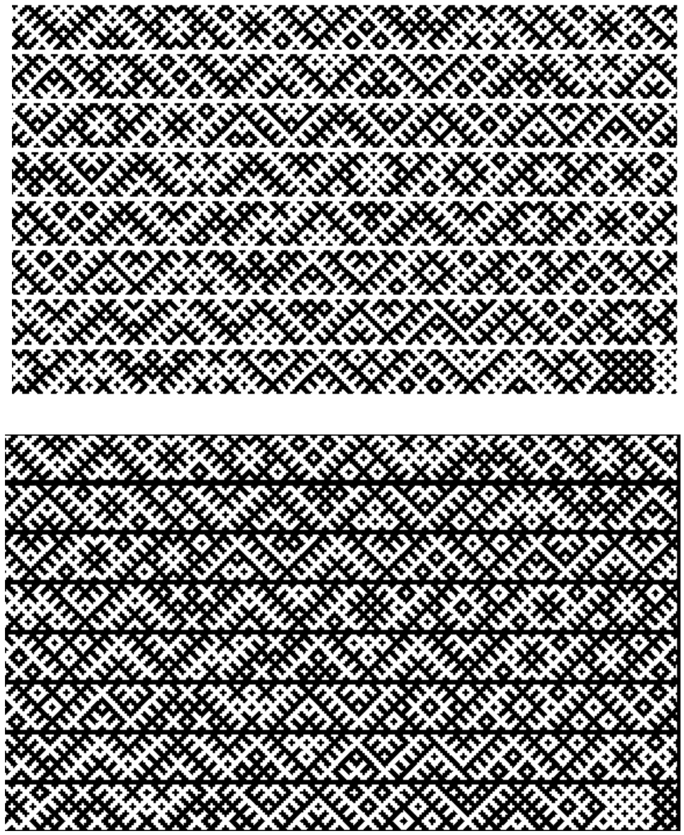
from other Baltic countries, namely, Lithuanian researcher Vytautas Tumėnas [7,8,9] and Estonian researcher Tõnis Vint [10].



Picture 1. Belt of Nica [3] in two settings. The ornamental tracery should be read linearly from left upper corner to the right lower corner. See in appendix binary code of this belt. Length of code 751 rows. Image of the belt here created by computer program. In lower part belt of Nica with opposite coloring. The one of main principles in the first order ornamental tracery is that both colors are as if in equilibrium what concerns amount of elments in it both globaly and locally.

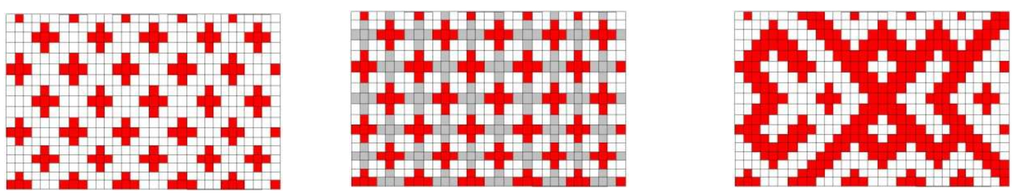
2. The principle of removal of sieve in the first order belt and the code of the ornamental belt

Analyzing different kinds of ornamental belts Modris Tenisons came to persuasion that there may be distinguished one type of belts that may be called *first order belts*. The ornament in these belts may be divided into two parts, scilicet, the part of the sieve, and the part of the code. We research in this article just this type of belts called *first order belts*. The language of ornamental signs used in theses belts we call *first order complexity ornamental sign language*.

First order belts are characterized by property that there can be *removed sieve* in them leaving code alone. The principle of sieve removal or separation and coding in this sieve has been described in the article of Modris Tenisons and Armands Strazds [3]. The principle has been fixed also by patent of Modris Tenisons [4].

If ornamental tracery in belt such as Nica belt is considered as two colored squared pattern, where checks in it has two colors, then there is the part that doesn't change, and the changing part. The permanent part is called *sieve*, and the changing part – *code part*. The sieve consists from two dual parts, where each is lattice of *cross elements* that is called *cross lattice*. Each cross element consists from five checks, naturally forming sign of cross. See two dual cross lattices in picture 3 in the middle, where cross elements of cross lattices are correspondingly of red and grey colors. The changing part, that we call *code part*, consists from $2 * 2$ checks, where each stands for one code unit. Ornamental tracery is built filling (coloring) filling places of codes with color of one or other cross lattices. More precisely, assuming code to be *binary code* consisting from *zeros* and *units*, choosing by coding for zeros one color of cross lattice and for units other color of code lattice we get ornament as image of *ornamental code*. On the spot we get first fundamental property, videlicet, there arise eventually two traceries from one fixed ornamental code, interchanging color either of code or cross elements. We have as if four choices here but further we would see that opposite coloring of all ornamental pattern didn't give other ornament. For coding it would mean that opposite code, i.e., interchanging units and zeros, doesn't give other ornamental pattern for human prehension, though mathematically does. In the pict. 3 we see ornamental pattern with six code places in one row. We would say that this is the *belt of breadth six* as is Nica belt. We consider in this article only ornamental traceries and belts of breadth six, which is in way minimal nontrivial belt but sufficiently complex and problematic as represented by Nica belt.

In the example in pict. 3. ornamental code by fixing only half due to symmetry might be 011,010,100, 010, 011, 011,010,011,010,100 or in octal number system, 3242332324.



Picture 3. Pattern of ornamental trasery on right that is coded in the sieve that stands on the left. In the middle picture sieve is divided into two dual parts, cross lattices, where each is colored distinctly, red and grey resp. Places for coding are clearly seen as $2 * 2$ check elements, respectively in white.

3. Hemiolia principle – one and a half principle in ornament genesis

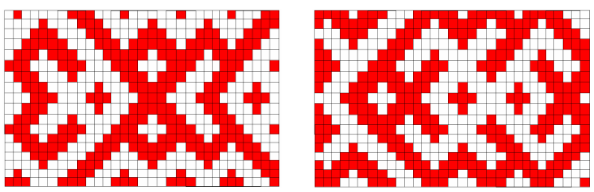
We may try to specify sieve and part of code by some generic aspect with some inquiry where from it could arise. Let us suggest in background of sieve be tracery of checkerboard with $3 * 3$ checks, and code being as if displacement of this background with shrinking of scale by $2/3$ at the same time, namely, the shifted squares are $2 * 2$ checks. By this approach we have as if two grounds for ornament to be enacted, scilicet, non changing background with $3 * 3$ checks and changing by code ground with $2 * 2$ checks. To see this in picture 3 in middle, imagine grey (or red) places in be $3 * 3$ squares where corners are overlapped or partly covered with 4 places of codes, $2 * 2$ squares, where white places have shrinked by scale $2/3$. In this play of enacting ornamental tracery some places respond as if belonging to one background part, say, red, but some to other – say, white.

We see that here ratio 3/2 plays a decisive role. The ratio is significant in some mystical teachings. We call this principle of arising ornament from 3^2 volume parts of background and 2^2 volume parts of code as if interplaying between themselves that we describe here *hemiolia principle*. In Greek ἡμιολία – one and a half.

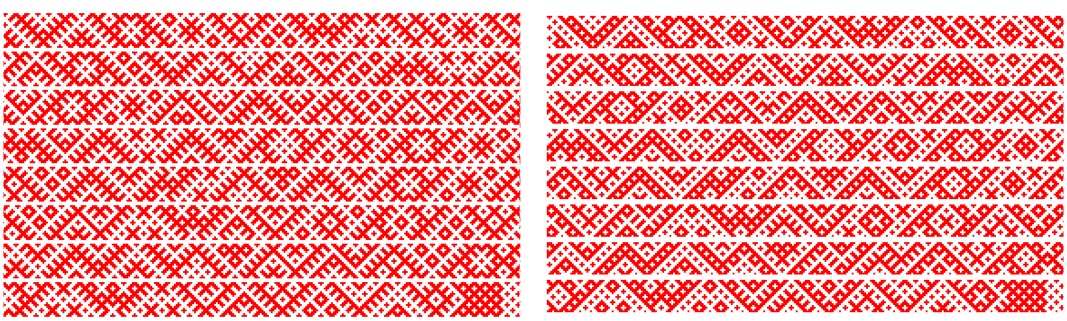
4. Sieve displacement

The notion of sieve displacement arises by observing that displacing sieve by three checks or, what is the same, displacement of code by one row gives other ornament pattern that is equivalent of change of colors of cross lattices. Thus, if we add empty code line in the ornament coding, we get quite new ornamental pattern that what we were to obtain by sieve displacement.

Mathematically the things we consider here are almost trivial, but they effect on human imagination not in the least sense in trivial manner. The consideration in this direction is given below. Moreover, let us bear in mind that ornamental belts' weavers who are directly connected with these belts, because just they are who have invented them, don't know these simple facts as clearly as they stand in mathematical setting and nevertheless they are able to obtain miracles in literal sense like in case of Nica belt, not even to speak about belt of Lielvarde.



Picture 4. Two ornament patterns from the same ornamental code. We may say that one is obtained by other using sieve displacement. We can see that we can't fix the difference by "mathematically non equipped eye" as some simple trick. Neither did most prolific masters as weavers of the most wonderful belts, who only "knew" the rule by some "instrumental" sense that they couldn't formulate directly.



Picture 5. The belt of Nica in two variations. On the right sieve displacement is performed by adding empty code row at the beginning giving another pattern of Nica belt tracery. Visual effect is such as if we had quite another sample of Nica belt.

In pict. 4 we see two ornament patterns from the same ornamental code. We may say that one is obtained by other using the sieve displacement. We can see that we can't fix the difference by "mathematically non equipped eye" as some simple trick. Neither did most prolific masters as weavers of the most wonderful belts, who only "knew" the rule by some "instrumental" sense that couldn't formulate directly.

The sieve removal and sieve displacement Modris Tenisons discovered in the late seventies of previous century. The discovery is fixed in patent as intellectual game [5].

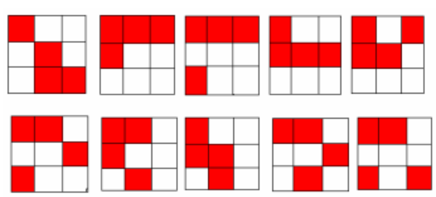
5. Creation of ornamental tracery from asymmetric elements

Modris Tenisons has developed idea that first order belt code should be built from asymmetric elements, i.e., that in the base of symmetric ornamental tracery stands asymmetry. In order to illustrate this idea, let us characterize type of ornamental belt that is built from asymmetric $3 * 3$ elements that are called *seeds of chaos*.

Let us consider element – $3 * 3$ two-colored matrix where four checks are painted out asymmetrically with respect to middle row, middle column and both diagonals. How many such elements exist that are not equal with respect to named already symmetric transformations? It turns out that – ten, see pict. 6. This simple but not trivial mathematical fact we formulate as theorem of Modris Tenisons.

Theorem 1 (Modris Tenisons). There are exactly 10 $3 * 3$ binary matrices with four units that are without automorphisms and not isomorphic with respect to reflections versus middle row, middle column and both diagonals.

Proof. Theorem may be checked by direct enumeration. It is important to notice that all mentioned reflections are considered with respect both asymmetry (non automorphisms) and non isomorphism. See in picture 6 all these 10 possible matrices where units are designated by red checks and zeros by white checks.



Picture 6. Ten asymmetric $3 * 3$ elements named by M. Tenisons *seeds of chaos*. Each of them characterize equivalence class of eight elements – matrices which are asymmetric versus vertical and horizontal and diagonal reflections. Together there are 80 such elements because their asymmetry doesn't allow the number of elements to „break down" due to symmetries. To compare with, symmetric such elements are 46 in 12 equivalence classes. Factorization as simple as in case of asymmetry is "broken down" by two extra symmetric elements that are symmetric versus all allowed symmetries, i.e., 12 doesn't divide 46.

The next theorem is very relevant for the building of ornamental traceries in the first order belts.

Theorem 2 There are exactly 80 $3 * 3$ binary matrices with 4 units that are without automorphisms with respect to reflections versus middle row and middle column and both diagonals.

Proof This theorem differs from previous that condition of non isomorphism is removed. Because elements are asymmetric in the mentioned sense they factorize in 10 classes of equivalence where each class has $2^3 = 8$ elements. Altogether we get $10 * 2^3 = 80$ matrices.

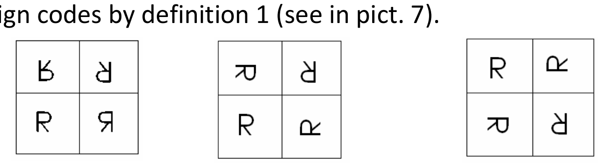
Let us try to get this number 80 without reference to previous theorem. In total we have $\binom{9}{4} = 126$ binary matrices with 4 units. Let us subtract the symmetric ones. We have symmetric matrices with respect to middle row 12, accordingly, with no unit in middle row – 3, and with two units – 9. This number should be multiplied by 4. Two matrices were with all units in all corners, and no unit in corners. These came in the count with repetition because of excessive symmetry, thus they we should re-subtract. Thus, we get $126 - 4 * 12 + 2 = 80$. ■

Let us try to build ornamental tracery from these asymmetric elements we call *seeds of chaos* that are in total 80 factorized in 10 clases of equivalence. Let us first try to count how many ornamental signs we may build in the most simple ornamental tracery from these asymmetric elements.

Definition 1 Let us call *first level ornamental sign code* or, simpler, *ornamental sign code* or *sign code* $2 * 2$ element that is built from 4 asymmetric $3 * 3$ elements which are symmetric either with respect to vertical and horizontal reflection, or with respect to rotation of $3 * 3$ element, all versus center of $2 * 2$ element, (see. pict. 7).

Definition 2 Let us say that two sign codes are equivalent if they are $2 * 2$ elements reflection of first and second row.

Definition 2 introduces simple principle of right and left side symmetry in the belt, namely, belt is readable from both sides equally. This principle has more deep methodological meaning in the making distinction between human prehension and mathematical, see below.
Let us consider allowed sign codes by definition 1 (see in pict. 7).



Picture 7. Illustration of definition 1. Let us put in place of symbol „R" whatever asymmetric $3 * 3$ element with whatever orientation. On left, $2 * 2$ element show how code of sign may be built using reflections of $3 * 3$ element. On the right in two pictures code of sign is built using two possible rotations of $3 * 3$ element. Two depicted cases by definition 2 are dealt as equivalent. This equivalence doesn't affect first way of building of code of sign because code in this case is already symmetric with respect to vertical reflection.

Theorem 3 (Modris Tenisons) There are 120 nonequivalent codes of signs.

Proof Let us show that only 120 different codes of signs can be built with allowed operations by definitions 1 and 2.

Let us consider the way to build code of sign using definition 1 where asymmetric element $3*3$ should be symmetric with respect to vertical and horizontal reflections, (see pict. 7 left side). In place of asymmetric element $3*3$ we can place 80 elements according theorem 2, which all should give different codes of signs. We get 80 codes of sign.

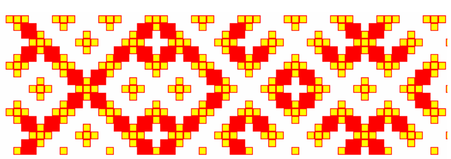
Let us consider second way of how to build code of sign by rotation (see pict. 7 middle and right side). There similarly we get 80 codes of sign, but half of these codes would be symmetric with respect to vertical reflection and according definition 2 should be excluded as being equivalent. In the result we get only 40 non equivalent codes of signs. Together we get 120 codes of sign as stated by theorem. Other ways of building code of sign we do not have. Thus, theorem is proved.

6. The doubling of ornamental signs by displacement of sieve

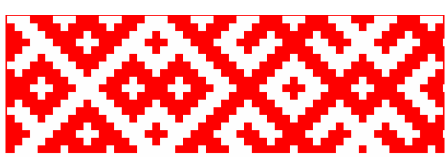
We already considered sieve displacement that gives another ornamental tracery. As we saw sieve consists from two dual lattices of cross elements that may be merged into one by displacement by three checks. Let one lattice be one color and another in second color: putting code in color one we get one ornamental tracery, and other color would give other. The same may be attained by displacement of sieve, that could be performed, say, by entering empty line of code. But this consideration gives us way to build from one code of sign two different ornamental signs. This gives us right for next theorem.

Theorem 4 (Modris Tenisons). 120 non equivalent codes of sign give 240 distinct ornament signs using sieve displacement.

Proof If signs are divided into two classes with respect to sieve configuration, then no sign from one class may be equal with sign from other class, because the sieve itself plays decisive role: sieve in one class is as if displaced versus other class. This argument is sufficient for theorem to be proved. See pict. 9 for illustration.



Picture. 8. Sieve displacement with respect to the same code. Sign „Fish" or "*zivtiņa*".



Picture 9. Changing colors in ornamental tracery we get another one. However this change does not effect to the same extent than by sieve displacement: we may discern previous ornamental tracery by our imagination. Actually the ornamental tracery is invariant with respect to color change whatsoever and to color interchange ditto.

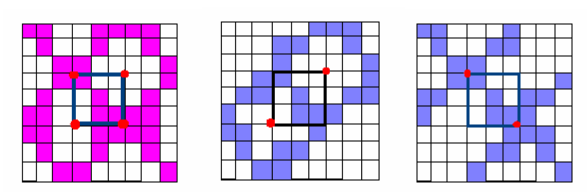
Pictures 9 and 10 show that sieve displacement and color interchange work in different way in ornament building.

Actually we could introduce one more feasibility to double number of codes of signs, scilicet, in place of asymmetric code allowing to be its dual element, namely, asymmetric $3 * 3$ element with five units. But this would lead to some disbalance of colors or brightness of colors in ornamental tracery, scilicet, 5-unit elements would give more colored tracery that 4-unit elements and coming them alternately would give place to disbalance of brightness of ornament. Thus, here we see where pure mathematical argument may come in conflict with some artistic principle and human prehension: mathematics would say that we may have 480 sign codes whereas artistic principles would force us to refrain only to 240 sign codes.

7. The principle of the opening of field information

Modris Tenisons came to building ornament signs in little different way, namely, using principle of the opening of field of information. Let us try to formalize his approach, using systematic argument.

Let us first consider a little different proof to theorem 3. Let us consider pict.8 on the left where we use reflection of $3 * 3$ elements in four diagonal corners. Let us do this in two directions, vertical and horizontal getting in this way 8 ways to build code of sign by use of reflection. Similarly let us do rotation of $3 * 3$ element according schema in pict.8 on right: we do rotation in each corner getting 4 codes of signs. Except, two pictures are to be used to escape overlap. Together we get 12 schemata that for 10 asymmetric elements should give 120 different codes of signs. In this way we didn't use even definition 2. Why? It turns out that performance of rotation only in one direction is equivalent with use of definition 2 that introduces equivalence of left and right sides of ornamental tracery. Allowing rotation in both directions would result in getting repetition of codes that definition 2 excludes.

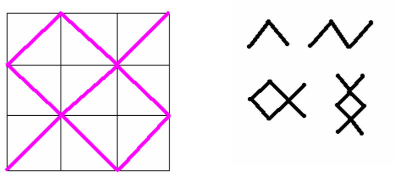


Picture 9. Example of building code of sign. On left one asymmetric element gives four codes of sign, correspondingly in each corners of asymmetric element in the center. In picture in center and on right from the same asymmetric element we get codes of sign by twos in two pictures because in one picture codes would overlap. Clearly is seen principle of double overlap by rotation symmetry.

Let us try to follow idea of Modris Tenisons about opening of the field of information. If in place of asymmetric elements we had symmetric, then the number of different elements would be less because every symmetry tends to reduce corresponding number at least by 2. Some analogy may be the fact that $3 * 3$ symmetric elements with five zeros are 12 classes of equivalence that do not factorize as simple as in case of asymmetry, namely, number of all matrices is 46. Two exceedingly symmetric matrices, with units in corners and no unit in corner, breaks down simplicity of count, say, $12 * 4 = 48$.

Let us try to reason how Modris Tenisons does it in his *workshops of ornament creation* (see [1]). Let us take asymmetric element and open it in all direction with reflections, filling corner squares too as in pict. 9. Going on with such „opening" *we wouldn't get new information* because of repetitions. If in place of asymmetric element we had taken something symmetric we didn't get even this amount of information, but we had already repetitions. Speaking informally, information for us is that that *do not repeat*. But, let us imagine in place of what we see are dimensions in hyperspace: repetitions there would mean no information already directly. In place of information here we might use term – *access to information,* and quantity – *degrees of freedom*, and that would give us full justification for use of these notions in way Modris Tenisons do.

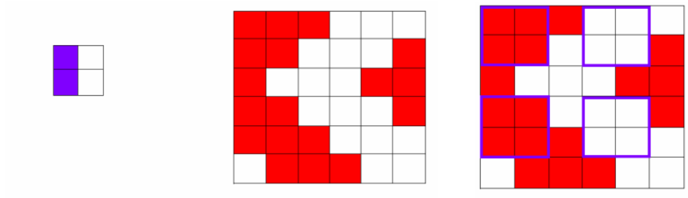
Let us consider how many unrepeatable information we might get. We have 10 equivalence classes of asymmetric elements and 80 elements. Informally we might say that theorem 3 counts number of information or degrees of freedom in the generation of code of first level.



Picture 9. $3 * 3$ field where each of them is $3 * 3$ matrix for building code of sign where with slash is depicted imaginable asymmetric $3 * 3$ element. Such slashes in the language of building of signs may denote their generic element that artists are used to. On right examples of such sign buildings: the sign of Māra ("Māras zīme") that arises from union of two opposite, masculine and feminine, elements; „eternity"; „fish sign"; „crayfish sign" or „cancer". See other examples in [7,8,9]. All these signs except last may be placed in this $9 * 9$ field of code. The slash works as if variable that may have assigned 80 possible values. For example, we may form 80 samples of „Māras zīme", etc.

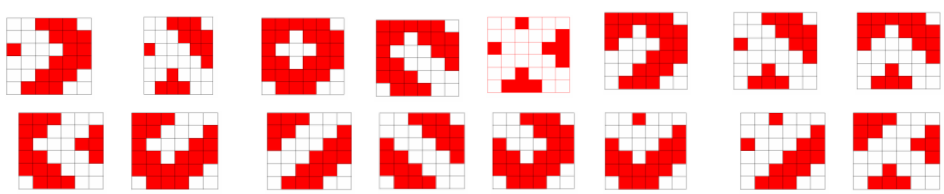
8. Sign language alphabet

Let us consider simple idea how from sieve displacement and ornament coding we may come to sign alphabet in first order (complexity) belts. Two following rows in code in case when ornament code width is, say, six may be divided into two following rows of code as binary field $6 * 2$ that may be divided into 3 $2 * 2$ binary fields. Each such field may be considered as letter in 16 sign alphabet. For binary codes it would be too trivial step without much use. In case these binary fields "work" together with sieve, they make 16 signs for ornamnetal sign language alphabet. Actually we get two such possible alphabets using sieve displacement. Every belt of width 6 may be cut into such square elements standing for ornamental sign alphabet letters because we should get invariantly only 16 such alphabet letters by simple binary code argument.



Picture 9. Illustration how alphabet arises from simple binary code. On left example of two binary columns from two rows – binary matrix $\begin{pmatrix}1 & 0\\1 & 0\end{pmatrix}$. Putting this code into sieve we receive one alphabet letter of sign alphabet, as in pict. in center and right where places of code are marked. Every belt of width 6 may be cut into such square elements standing for ornamental sign alphabet letters because we should get invariantly only 16 such alphabet letters by simple binary code argument.

Modris Tenisons patent [5] actually is for this sign alphabet that in indirect way contains ideas of sieve displacement and ornamental coding.

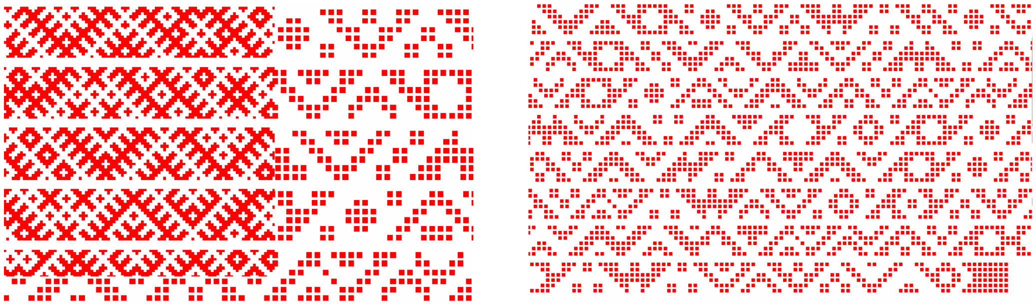


Picture 10. 16 letters of ornamental sign language alphabet. Would this alphabet of Modris Tenisons sufficient to code belt of Nica? ... in sense any first order ornamental pattern may be composed by these squares as puzzle? Mathematically it is trivially if we only notice that this is full binary code in sieve. By sieve displacement we get another such alphabet that is different from this one.

9. The belt of Nica and its investigation

Modris Tenisons has forwarded idea that the belt of Nica is built from asymmetric elements too similarly as we described higher [4]. But it turns out not to be so simple. If we directly search after $3 * 3$ asymmetric elements in the belt of Nica, we do not get them sufficiently many to get complete cover of all the belt. We come to question how the code of belt of Nica is built if we want to stick around idea of Tenisons about asymmetry as basis of symmetry in ornamental tracery of belt?

We may now ask. How weaver may come to belt that is rich as belt of Nica? One interpretation is sufficiently simple. Together with experience by weaving instrumental experience heaps up. Weavers better remember „instrumental" experience than, say, visual, namely, they remember technological and instrumental information how they do anything by weaving rather in some other way. In much simpler case, *exempli gratia*, knitter remembers combinations of stitches rather than anything else. The same but in more complex setting applies for weaver of belts. The belt of Lielvarde shows that this assumed instrumental experience that might be incredibly complex may produce real wonders. Widely used allusion to information from Cosmos in this contex [1] might have some ground though not subject to direct scientific argument up to now.



Picture 10. The code of the belt of Nica and its ornamental tracery.

But what to say with respect to belt of Nica when we want to discover asymmetry in its ornamental tracery? Here we may be forced to attack this question from another side and ask: don't we have to deal here not so much with local code but volume or distributive code? To find distributive function or pieces of holograms if any in the structure of code might be much harder task than code's investigation locally. If so, just distributive function would be real code of belt of Nice, in case we were successful in its discovery. At present first author is working in this direction too.

10. "Belt of Nica teaches us": the aesthetics in belts of first order

First order ornamental belts are convenient object of investigations because we may speak about some level of aesthetics that may be characterizes sufficiently simply by quantitative argument. Firstly, belt is readable equivalently 1) changing colors to opposite; 2) changing sides to opposite (with correction of right side turn argument). Secondly, belts are coded in asymmetric coding. Thirdly, ornamental pattern has balanced color ratio, i.e., already seed of chaos incarnates relation 4:5, and sieve consists from two dual lattices of both colors. Fourth, signs in ornamental patter are inseparable, i.e., sign transforms to other sign, signs overlapping form signs, and so on.

The interchange of colors in ornamental tracery of belts says that belt is readable in both ways equivalently, leaving space for some aesthetic or artistic difference in reference to human psyche. But there is way to read belt in both ways simultaneously, namely, when we see as if belt in both ways. Then we may start to see belt as if border between two colors, namely, we do not see „black on white" or „white on black" but sign as border between both colors. After all that is what we are after: belt is the union of two elements, masculine and feminine. In Latvian tradition this says that belt is the sign of Māra, „Māras zīme". Christian tradition may say „sign of Christ".

Modris Tenisons as artist uses rather different way of expression, saying, what we encounter as aesthetics in Nica belt we must attribute to what belt of Nica teaches us [4]. Thus we must say "*Belt of Nica teaches us*." "Belt of Nica teaches us – In all should prevail simplicy. Belt of Nica teaches us – Nothing excessive. ... Colors should be in equilibrium. ... Belt should be read between colors ... And so on."

What concerns partial equivalence of sides of belt, left and right sides in belt are equivalent in sense they are readable in both ways, but right side remains prevalent over left side as right side (hand) is prevalent over left side (hand) in human nature settings: we discern right and left side as *homines sapientes*, but nature above us might have some indifference against this distinction. This same message we see in mathematics and physics. Lorentz transforms and right and left glove non-interchangeability are guided by the same signature of quaternion [5]. Double cover of $SO(3)$ by $SU(2)$ don't care of prevalence of right over left, but makes space for such prevalence. What we have in case of belts is two dimension case is mostly convenient three dimensional case. It is nice to see that 2-dimensional case leaves over these characteristic two points „left" and „right" of unit circle in complex plane that would be actual for thee-dimensional and higher cases. That we see in ornamental belts incarnated in the principle of partial equivalence of sides of belt.

Picture 11. Piece of ornamental tracery got from one *seed of chaos*.

Picture 12. The belt produced from 10 asymmetric elements, using random number generator to choose different seeds of chaos, according principles explained in this article. How about aesthetics in this example? We don't have that simplicity that in case of Nica belt. Do we lack some more simple aesthetic principle here?

11. Genesis of ornamental pattern: sign from code or *vice versa*

In this article we explain genesis of ornamental sign more from side of code than from side we perceive it as image. Moreover, we may conclude that ornamental code may creep in indirectly in other way too, e.g., via instrumental experience of weaver. Now we may question on more general level asking: how ornamental pattern arise? Via code or as an image? This question is not so redundant, because researchers of ornamental patterns use so much effort to explain where from one or other pattern could arise basically using "image approach"[2,7,8,9], because "code approach" should require some understanding how code generates sign. If code can generate an ornamental pattern as if from itselft, the picture or this type or esearch changes cardinally. New aspect at least comes before researchers – *instrumental experience* as source of producer of ornamental patterns.

12. Belts of higher order and their eventual investigation

We have already mentioned belt of Lielvarde, that is much more complex than, say, belt of Nica. In order to research belt of Lielvarde it isn't sufficient to remove sieve and apply asymmetry on some simple level. Belt of Lielvarde is build as if on several levels, sieve if discernable, is used on several levels, scilicet, at least two, and sieve may have more complex structure than simple pair of dual cross lattices. Nevertheless, Lielvarde belt is produced by human beings, though very skilful masters. How to attack investigation of these belts with exact methods similar we try to use in this article? Our answer is simple enough: we must first research first level belts, then maybe nearest samples that step outside this first level. Moreover, we step as if in new typology of genesis of belts, scilicet, based on arising sign from code rather than as image. To support this approach we must apply new mathematical methods along with these already used in researches as in [2]. Modris Tenisons attributes Lielvardes belt to fifth or even higher level of complexity, but he has no exact means to say what specifically; all this is as if in field of artistic estimation, not in reach of exact scientific criteria. All this shows necessity to do researches and typology of ornamental patterns in gradual way, from simpler to more complex.

Making research in field as complex as of Lielvardes belt researchers face question: is this only problem of artists or, say, researches of Living Ethics? Many speak about information from Cosmos. What is this? Are these things subject to research or only area of religion or mystics? Exact sciences tend to say that they do not want to have anything shared with Living Ethics? But they may have common area of investigations, scilicet, belt of Lielvarde. Now when question has become even more compex we may have for this a new justification: we may ask – Cosmos provide us with visual or instrumental information? See [11].

13. Does there exist first order complexity in nature?

The research of belts is not only recreative entertainment that doesn't have anything in connection with research in nature or mathematics. Question about what is primary – code or image – might be more actual than we assume not only in ornamentalistic but in nature too.

Ornamentalistic plays important role in different areas of science, arts, where these areas may intertwine. We may use language of artists and try to unite with precise language of mathematics similarly as we tried to do in this article. Ornamentalistic would be the branch where without this synthesis were hard to get along. But here may come other areas into touch too, say, physics, biology, psychology. The last is mentioned in very interesting aspect in the movie „The belt of Lielvarde. On hypothesis of Tõnis Vint". Let us take look into message of Tõnis Vint (Estonia) (transl. by D.Z.):

> "Through times and lands signs unite us and tell. For example, these Mexican temple walls hide about world three layers of information: everyday objective, facts about events, and phenomena in nature description. For this last epistemology gifted were only some chosen people. Several notions for one symbol were present also in Chinese tables of I-Cin : heaven – virility, earth – femininity, and parallel notions: heaven – creation father, earth – submission mother, water, moon, danger, fire, light, son, and other meanings.
>
> To son, moon, fire and water our ancients attributed magical signification. In this way geometric ornaments already long ago were used for practical reasons.
>
> American Indians lived in precisely created circles, that afterwards were called medical circles, because, how archeological excavations indicated, in these settlements living Indians of Siu tribe didn't know illnesses. According legend, each child for this tribe had sage or philosophical father specially chosen. Taking away child into wild nature, having explored his character and biophysical features, Indian sage draw individual symbol for boy or girl that served as singular person's code or card. Using these cards youth got acquainted, families united in friendly contacts, and all lived in great friendly family in psychological concordance, and illnesses for harmonic balanced people went past. Using this circle there was possibility to influence human's psyche more directly too."

This was said before year 1980. What we have now? Have we solved problem that was not problem for Indians of Siu tribe? I don't think so? Why? The main problem is about ourselves who consider such evidences as legends that are not much worth for direct research. But why after finding Rosetta Stone there came investigators, and Champollion himself, to decipher the script? The script of Nica doesn't look like script that could be deciphered or deserves to be deciphered? We here maid attempt to show that maybe we heavily err.

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Appendix. Code of the belt of Nica

We add here code of belt of Nica in the table with 8 columns and 100 rows. Code starts from first column and first row and goes down along columns. Table contains 751 code rows.

111000	001100	100001	100111	000110	000011	000011	100111
110001	011001	100001	100111	100011	000111	000011	110011
100011	110011	110011	001110	110001	001111	001110	011001
000111	000111	111111	011100	111000	011100	001100	001100
001110	001100	011100	111000	111100	111100	111000	001100
011100	011100	001100	110000	001110	001111	110011	011001
111000	111111	000111	100011	001111	001111	100011	110011
111000	110011	110011	000011	111100	111100	001111	100111
011100	100001	110001	110000	011100	011100	001111	001100
001110	100001	000000	110000	001111	001111	100011	011100
000111	110011	001100	000011	000111	000111	110011	110011
100011	111111	011110	100011	000011	110011	111000	110011
110001	001110	011110	110000	110001	011001	001100	011100
111000	001100	001100	111000	110000	001100	100110	001100
111000	111000	000000	011100	000011	001100	110011	000111
110001	110011	100011	001110	100011	011001	110011	110011
100011	100011	110011	100111	110000	110011	100100	110001
000111	001100	011000	100111	111000	000111	001001	001100
001100	001100	001100	001110	001100	001100	110011	001100
011100	110001	110110	011100	001110	011001	110011	110001
111111	110011	110011	111000	000011	110011	011001	110011
110011	000111	110011	110001	000011	110011	001100	000110
100001	001110	110110	100011	001110	011001	100111	001100
100001	011100	001100	000111	001100	001100	110011	011000
110011	111001	011001	000111	111000	000111	011001	110001
111111	111001	110011	100011	110011	110011	001100	110001
001110	011100	100100	110001	100011	110001	001101	011000
001100	001110	001100	111000	001111	000000	011011	001100
111000	000111	001100	001100	001111	001100	110110	000110

110011	100011	100100	001110	100011	011110	101100	000011
100011	110001	110011	111111	110011	110011	001100	100001
000000	011000	111001	110011	111000	110011	100110	110000
001100	011000	011100	100001	011100	011110	110011	110000
011110	110001	001110	000000	001110	001100	111001	100001
011110	100011	100111	000000	100111	000000	001100	000011
001100	000111	100111	100001	100111	100011	001110	000110
000000	001100	001110	110011	001110	110011	110011	001100
110001	011100	011100	111111	011100	111000	110011	011110
110011	110000	111000	011100	111000	001100	001110	110011
000111	110000	110011	001100	110001	001110	001100	110011
001100	011100	100110	000111	100011	111111	111000	011110
011100	001100	001100	110011	000110	110011	110011	001100
110011	000111	001100	110001	000110	100001	100011	100001
110011	110011	100110	000000	100011	001100	001100	110011
011100	110001	110011	001100	110001	001100	001100	111111
001100	111100	111000	011110	111000	100001	100011	111111
000111	111100	001100	110011	001100	110011	110011	111111
110011	110001	001110	110011	001110	111111	111000	111111
110001	110011	110011	011110	111111	011100	001100	111111
001100	000110	110011	001100	110011	001100	001110	111111
001100	001100	001110	000000	100001	000111	111111	111111
110001	011001	001100	100011	100001	110011	110011	
110011	110011	111000	110011	110011	110001	100001	
000111	110011	110011	111000	111111	001100	100001	
001111	011001	100011	001100	011100	001100	110011	
011100	001100	001100	001110	001100	110001	111111	
111100	000110	001100	111111	000111	110011	001100	
001111	110011	100011	110011	110011	000111	001100	
001111	110001	110011	100001	110001	001100	111111	
111100	001100	111000	100001	000000	011100	110011	
011100	001100	001100	110011	001100	110011	100001	
001111	100011	100110	111111	011110	110011	100001	
000111	110011	110011	011100	011110	011100	110011	
000011	111000	110011	001100	001100	001100	111111	
110001	111100	100100	000111	000000	000111	011100	
110000	001110	001001	110011	100011	100011	00110	
000011	001111	110011	110001	110011	110001	000111	
000011	111100	110011	000000	111000	011000	000011	
110000	111100	011001	001100	001100	011000	110001	
110001	001111	001100	011110	001110	110001	110000	
000011	001110	000111	011110	110011	100011	000011	
000111	111100	110011	001100	110011	000110	000011	
001100	111000	011001	000000	001110	000110	110000	
011100	110000	001100	100011	001100	100011	110001	
110011	100011	001100	110011	111000	110001	000011	
110011	000011	011011	111000	110011	111000	000111	
001110	110000	110110	001100	100011	011100	001111	
001100	110000	001100	001110	001100	001110	011100	
111000	000011	001100	110011	001100	100111	111100	
110011	100011	100110	110011	100011	100111	001111	
100011	110000	110011	001110	110011	001110	001111	
000000	111000	111000	001100	111000	011100	111100	
001100	001100	111100	111000	001100	111001	011100	
011110	100110	001110	110011	100110	111001	001111	
011110	110011	001111	100011	110011	011100	000111	
001100	110011	111100	001100	110011	001110	000011	
000000	100110	111100	001100	100100	000111	110001	
110001	001100	001111	100011	001001	100011	110000	

110011	111000	001110	110011	110011	110001	000011
000111	110011	111100	111000	110011	011000	000011
001100	100110	111000	011100	011001	011000	110000
011001	001100	110011	001110	001100	110001	110001
110011	001100	100110	100111	000111	100011	000011
110011	100110	001100	100111	000011	000111	000111
011001	110011	001100	001110	110001	001110	001100
001100	111000	100110	011100	110000	011100	011001
000111	001100	110011	111000	000011	111001	110011
110011	001110	111000	110001	000011	111001	110011
011001	111111	011100	100011	110000	001100	011001
001100	110011	001110	000110	110001	001110	001100