MANIPULATIONS OF THE CIRCLE: AN INTRODUCTION TO TRADITIONAL CLOSED-LOOP STRING FIGURES

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1. Lietzmann (1955), in elaborating on the topology of lines, especially in his chapters on open-ended and closed-loop threads, points out the differences between looped string games and adjacent areas such as; weavings, braids, knittings, crochet work, meshings, wreaths, knots, etc.
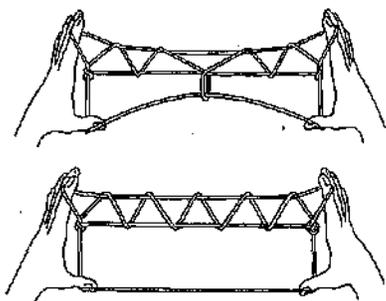

Figure 1. Two terminal patterns of closed-loop string games as played by Alaskan Inuits (Eskimos) in the early 1900s and recorded by G.B.Gordon, after Jayne (1906).

A PASTIME INHERITED

Manual dexterity games using pliable loops of string have been recorded by ethnographers worldwide and in all climate zones. Be it fibrous cord, silk twine or leather thong - the medium is astonishingly simple: an endless sling (in topological terms a circle) obtained by knotting, splicing or tying together the ends of a two meter string[1].

The making of yarn and rope belongs to humanity's most ancient technical accomplishments. Twisted or braided cordage was used for equipping early foragers, hunters and fishermen with essentials: carrying nets, snaring traps, fishing nets, etc. Very early in prehistory - so can be assumed - artfully slung figures from endless loop of string were invented by primitive man as a mere pastime enjoyment or for ceremonial-ritual purposes. The enormous variety of such string figures inherited by the twentieth century, with their intricate slingings, laced intersections and convoluted line patterns together with the corresponding processes of their construction, can be considered the collective result of many anonymous individuals in uncounted human generations patiently practicing, perfecting and exploring further - with many a random discovery along the way.

The multitude of different string figures in this tradition is astounding. Dickey (1928) talks already about more than 700 recorded. But many such patterns and their constructive movements could well have been lost as a consequence of relative late interest in the subject. Recording of this form of cultural heritage started only three generations ago. Hornell (1927), in his attempt to uncover traditional string figures in Samoa and Fiji, mentions not only the reluctance of natives to share their skills due to fear of ridicule for indulgence in a pastime which the white man may consider childish, but also the blight of missionary influence upon old customs (meaning, in its extreme, suppression by being banned). Disappearing indigenous string games - important manifestations of human ingenuity - are just one more example of rapid deterioration of native culture caused by a dominating Western civilization.

These games consist of placing the loop of string over the hands and manipulating it with the fingers in various ways to generate a distinct figure in two or three dimensions. Although players mainly use their hands, they sometimes also rely on their teeth, knees or toes for help. The manipulations are typically performed

bilaterally and, for practical purposes, symmetrically, although exceptions exist. The resulting patterns can be plain or complex. Similarly, the forming process utilized can be simple or complicated. But a simple sequence of manipulations does not necessarily also lead to a simple result. So it is possible that a complex process will lead to a final pattern which is surprisingly simple and vice versa. Also, certain string figures can be accomplished with different processes.

In some regions (such as Polynesia and the North-American Pacific NW) string games were often accompanied by specific recitations or traditional chants. And almost always string patterns were named after objects of daily environment or the spiritual world. Such associations were borrowed from animate or inanimate nature (humans, body parts, animals - quadrupeds, birds, reptiles, fish, crustaceans, insects, ... - plants, celestial bodies, weather, landscape, etc.) or were related to artifacts (tools, fences, ladders, clothing, shelter, hunting/fishing implements, transportation devices such as boat or sled, ...). Some figures discern basic geometric shapes or represent motion (transit, flow, dance, athletic contest). Occasionally, personalities of tribal history or mythological figures are symbolized, too. Naming of patterns, however, is inconsistent and possibly changing repeatedly with cultural diffusion, because names of identical string patterns often vary with the geographic area of their documenting.

"TAKING OFF"

The common string figure game of Eurasia relies on two players alternately picking up and "taking off" the string pattern from the partner's hands and transforming it into a new one. If one player has generated a figure, the other seizes this string work with the fingers of both hands and takes it over. Each such sequential action yields a new figure - a total of eight (Figure 2). This game is so well known to children in Asia and Europe, that a step-by-step verbal description of its procedural sequence should not be necessary beyond the pictorial presentation of its intermediate steps and its progressing results[2]. It is enjoyed from Japan to Ireland and from Algeria to Lappland, is uncomplicated and easy to learn. Although the actual sequence of individual figures can be varied, their number is definitely restricted to eight and the game, therefore, provides little incentive for innovation.

2. These and most of the following drawings in Figures 3-15 are after M.C.Betts, used first by Jayne (1906). They were, where necessary, improved for additional clarity. See also Ball (1920), Kattenstidt (1936) and Holden (1983).

Table 1. Some basic ordering criteria affecting the theoretical variety of closed-loop string games. Technical details of diverse opening movements and types of intermediate steps are not considered. Examples covered in this article fall into the heavy framed categories.

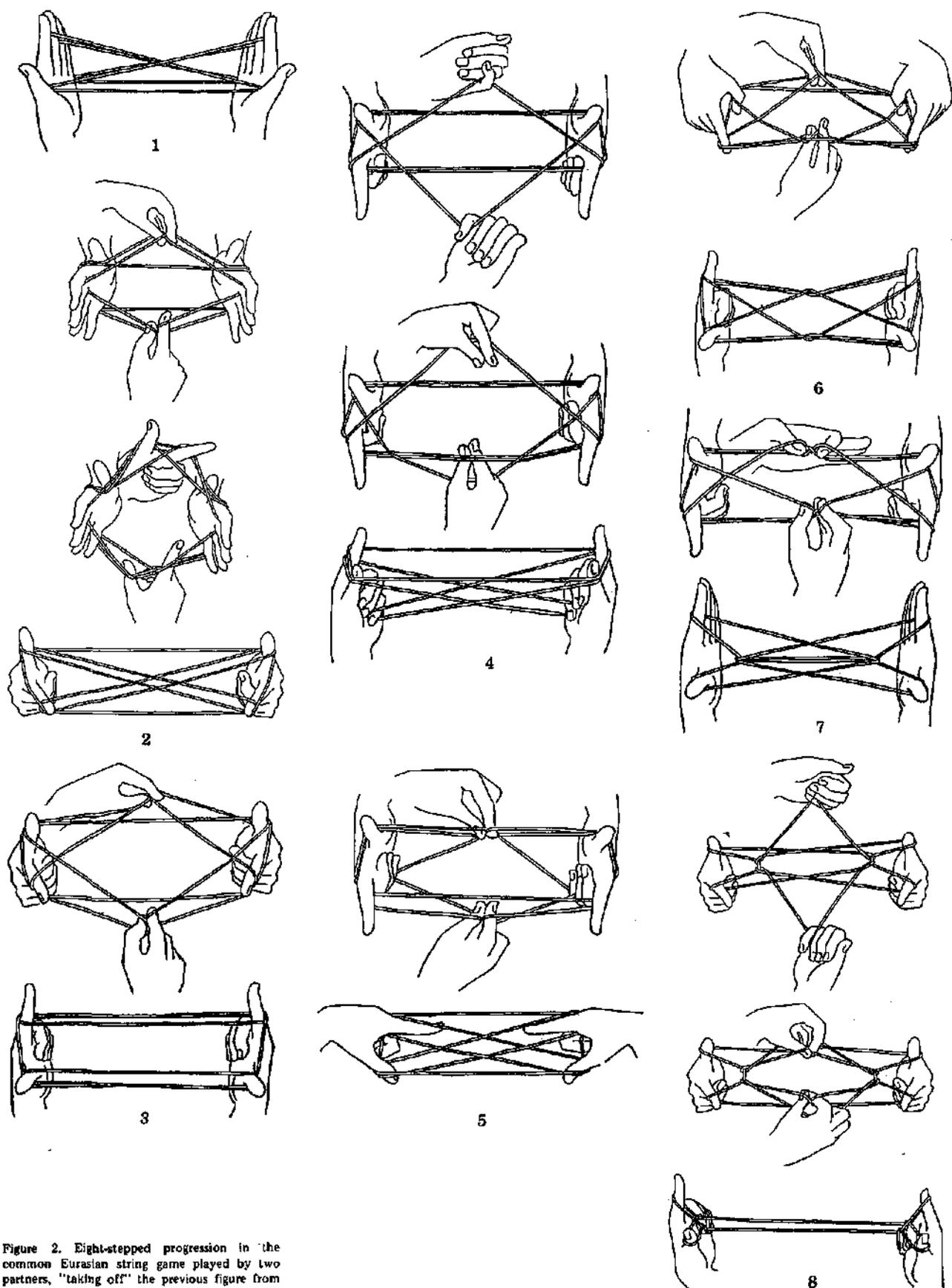| Game Element	Properties							Theoretical Cumulative Variety
Medium	single loop of string	extra long loop of string	two loops of string	more than two loops of string				4
Player	single person	two persons	more than two persons					12
Forming Process	known	unknown						24
	use of hands	use of hands and teeth	use of hands, teeth and additional limb					72
	one specific process	one process with alternative short cuts	alternative processes					216
	start with "opening A"	start with "opening B"	other starting positions					648
	symmetrical operations	asymmetrical operations	both					1,944
	less than 5 sequential steps	6-9 steps	10 or more steps					5,832
	traditionally with recitation	traditionally with chanting	without accompaniment					17,496
Result	stationary (without known sequent figures)	progressive (with series of figures)						34,992
	static	dynamic						69,984
	symmetrical	asymmetrical						139,968
	2-dimensional	3-dimensional						279,936
	string figure	string trick catch slip						839,808
Recorded Origin	Africa	America	Asia	Australia/ Oceania	Europe	multiple origin	invented new	5,878,656

Figure 2. Eight-stepped progression in the common Eurasian string game played by two partners, "taking off" the previous figure from the other player's fingers in alternation

SOLITARY STRING GAMES

String games from Pacific Oceania, Native American populations and from the Arctic are formally more interesting. They can be played alone and rarely - only to assist in especially complex operations - is another person needed. Moreover, these non-Eurasian string games are played not only by the young; their practice is traditionally also enjoyed by adults, men as well as women.

To introduce the reader to some extent to this alternative approach to manipulation of looped string, twelve examples from the impressive accumulation of such games are presented here. They are selected from the impressive accumulation of string figures learned by ethnographers from Native North Americans, Pacific Islanders and Inuits (Eskimos). It is hoped that their step-by-step description will induce at least the more inquisitive among the readers to experience such ancient pastime by practicing on their own and exploring further.

Uniform description method

In presenting this selection of non-Eurasian string games a consistent terminology and method of description are followed[3].

The forming process is subdivided in sequential steps./ These intermediate steps and the resulting final string figure are presented from the player's point of view./ If both hands perform symmetrical operations, the drawings may show the beginning of an operation with one hand and its end with the other./ The verbal description distinguishes palm and back of a hand, tips and base of fingers, as well as their palmar and back side./ Usual position of hands is with fingers upward and palms facing each other./ All string games begin with an opening, in which the loop of string is arranged on the hands held in their usual position in such a way that secondary loops connect opposite fingers./ The finger loops are named from the digits of their hands on which they are placed (thus: left little finger loop, right thumb loop, etc.)./ Finger loops held by adjacent fingers simultaneously get multiple designations accordingly./ If a finger loop is transferred to another finger, its designation changes./ Each finger loop has a near and a far string according to its position on the near or further away side as seen by the player (thus: right far index string, left near middle finger string, etc.)./ If fingers carry several loops, their position relative to the finger tip is noted. With the finger tip always "up", we can relate to upper or lower loops (eg., an upper far ring finger string)./ Similarly, movements can be upward or downward, from above or below, over or under a string - always in relation to the (upward) finger tips./ When string lies across the palm of the hand it is accordingly referred to as a palmar string. If it lies on the hand's back, it is called a dorsal string.

These simple rules for description of the constructive process form the base for a precise notation of all possible string positions and their manipulation. The recreation of the string figures selected from the non-Eurasian group which are described in the following can, therefore, be attempted and mastered without problems even by beginners - provided that the instructions are followed meticulously[4].

Opening A

Since many of the documented string games from the Oceanic/American group have identical introductory steps, their common beginning *Opening A* should be presented first. (*Opening B*, a symmetrical version, starting with the opposite hand, is much rarer and will not be enumerated here).
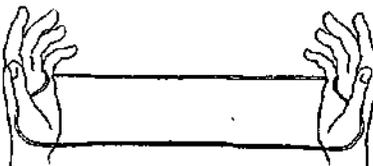
1. Put the thumbs and little fingers into loop of string from below, separate hands and bring into normal position (Figure 3.1).
2. Bring hands together, put right index under left palmar string and left index under right palmar string (Figure 3.2). Tighten strings by separating hands(Figure 3.3).

Selected Examples

W' (Omaha, Native North American)

3. A nomenclature for systematic description of string games was first introduced by Rivers and Haddon (1902). Although the basic principles of it are adhered to here, it was modified to make it easier to understand by ordinary readers.

4. The description of sequential constructive movements largely follows Jayne (1906), but is shortened whenever possible. Variations of the forming process and non-essential commentary are omitted in the interest of brevity. Most of the string figures presented here - and their intermediate steps - can therefore also be found in a more exhaustive description in Jayne's respectable work, namely: W: 204-208; M: 209-211; *Crow's Feet/The Leashing of Lochiel's Dogs:* 116-121; *Two Diamonds:* 28-30; *Carrying Wood:* 66-69; *Door:* 12-16; *Two Chiefs:* 188-192; *Ten Men:* 150-156; *Lightning:* 216-219; *Mouth:* 282-286; *Rib Cage:* 308-314; For *Siberian House* see: Ball (1920) 46-47.
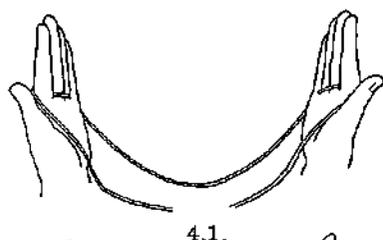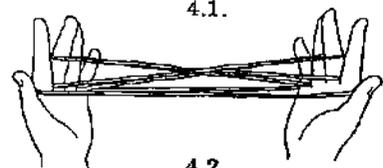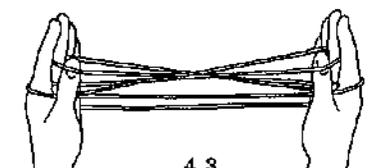

3.1.
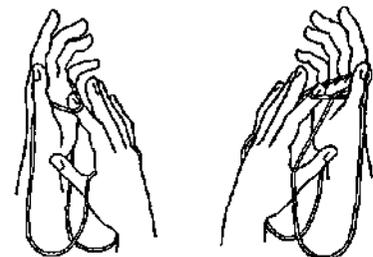
3.2.
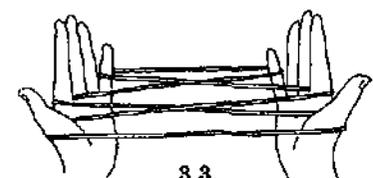
3.3.

Figure 3. *Opening A* - the start of many non-Eurasian string games.

4.1.

4.2.

4.3.

4.4.

4.5.

4.6.

Figure 4. Formative steps for the *W* string figure (Omaha).

Figure 5. Formative steps for the *M* string figure (Omaha).

Figure 6. Final string pattern of *Siberian House* (Inuit).
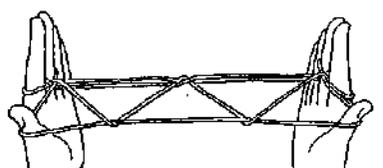
1. Put index fingers and little fingers into loop of string from below, separate hands and bring into normal position (Figure 4.1).

2. Pick up, from below, palmar strings with opposite middle fingers (Figure 4.2).

3. Moving thumbs away from you over the two strings of the index loop, take up from below on the thumb backs the near middle finger string (Figure 4.3) and return thumbs to their position. Release the little finger loops and separate hands.

4. Shift the little fingers toward you over both the far middle finger string and the far index string, and take up from below on the little finger backs the near index string (Figure 4.4). Return little fingers to their position. Release loops from the thumbs and pull strings tight.

5. Move thumbs away from you and, pressing down both the far index string and the near middle finger string, take up from below on the thumb backs the far middle finger string (Figure 4.5). Release the little finger loops and spread thumbs off the other fingers (Figure 4.6). The *W* appears.

'M' (Omaha, Native North American)

1. Put thumbs and ring fingers into loop of string from below (Figure 5.1).

2. Pick up from below palmar strings with opposite index fingers (Figure 5.2).

3. Moving the little fingers toward you over the ring finger loop, take up from below on the backs of the little fingers the far index string (Figure 5.3) and return little fingers to their position. Release thumb loops and separate hands.

4. Shift thumbs away from you over both the near index string and the near ring finger string and take up from below on the thumb backs the far ring finger string (Figure 5.4). Return thumbs to their position and release little finger loops.

5. Move little fingers toward you over both the near ring finger string and the far index string, take up from below on the backs of the little fingers the near index string (Figure 5.5) and return the little fingers to their position. Release thumb loops and spread off little fingers from the other fingers (Figure 5.6). The *M* becomes evident.

Siberian House (Yupic Eskimo, Alaska)

1. *Opening A* (Figure 3).

2. Turning the palms toward you, insert the four fingers of each hand from above into the corresponding thumb loops, throw the near thumb string over the closed fists to the back of the hands and return hands to their usual position.

3. With each thumb push the near dorsal string away from you under all the other strings, pick up with the thumb backs the far dorsal string and return thumbs to their position.

4. With thumb and index finger of the right hand carefully lift up left dorsal loop and let it drop beyond the finger tips on the left palmar side. Perform corresponding movement on the right hand, letting drop the right dorsal loop on the palmar side. Turning palms toward you, extend strings with the *Siberian House* pattern (Figure 6).
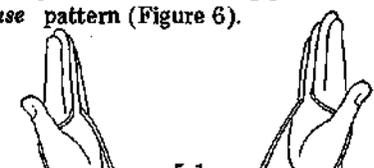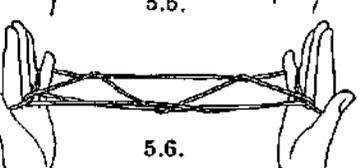

5.1.
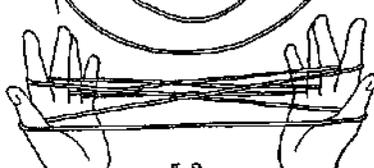
5.2.
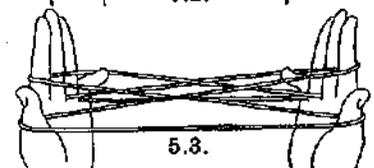
5.3.

5.4.

5.5.

5.6.
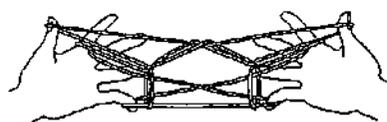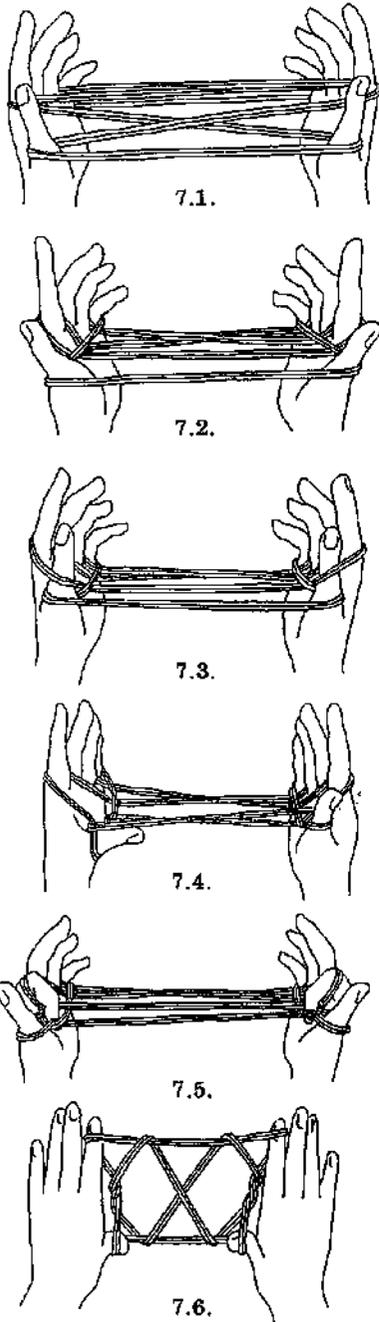
Two Diamonds   (Osage, Native North American)

1. *Opening A* (Figure 3), however, in the recorded version with string doubled and used like a single loop of string (Figure 7.1).

2. Release loops from thumbs.

3. Bend thumbs away from you over the index loops and the near little finger strings, pick up from below with thumb backs the far little finger string and return thumbs to their position (Figure 7.2).

4. Insert thumbs from below into adjacent index loops close to the index, between finger and palmar strings (Figure 7.3).

5. Turn each thumb downward against each other (Figure 7.4 left) and, after releasing the lower thumb loop, return thumbs to their position (Figure 7.4 right).

6. Insert each index from above into the string triangle which has formed in front of each thumb between palmar string and thumb loop (Figure 7.5), turn the palms downward and away from you and release the little finger loops. Spread thumbs off the index fingers to extend figure. *Two Diamonds* emerge (Figure 7.6).

Crow's Feet   (Cherokee, Native North American; but of considerable geographic distribution - from Africa to Northern Europe - and known under different names, among others "The Leashing of Lochiel's Dogs")

1. *Opening A* (Figure 3).

2. Turning the palms toward you, cover all strings except the near thumb string with each four fingers by forming fists (Figure 8. 1 left). Turn each hand down and then upward toward you (Figure 8.1 right) under the near thumb string. Bring hands into usual position (Figure 8.2).

3. With thumb and index of the right hand lift the left index loop and transfer it on the left thumb (Figure 8.3). Similarly, with the left thumb and index finger transfer the right index loop on the right thumb.

7.1.

7.2.

7.3.

7.4.

7.5.

7.6.

Figure 7. Formative steps leading to the *Two Diamonds* string figure (Osage).
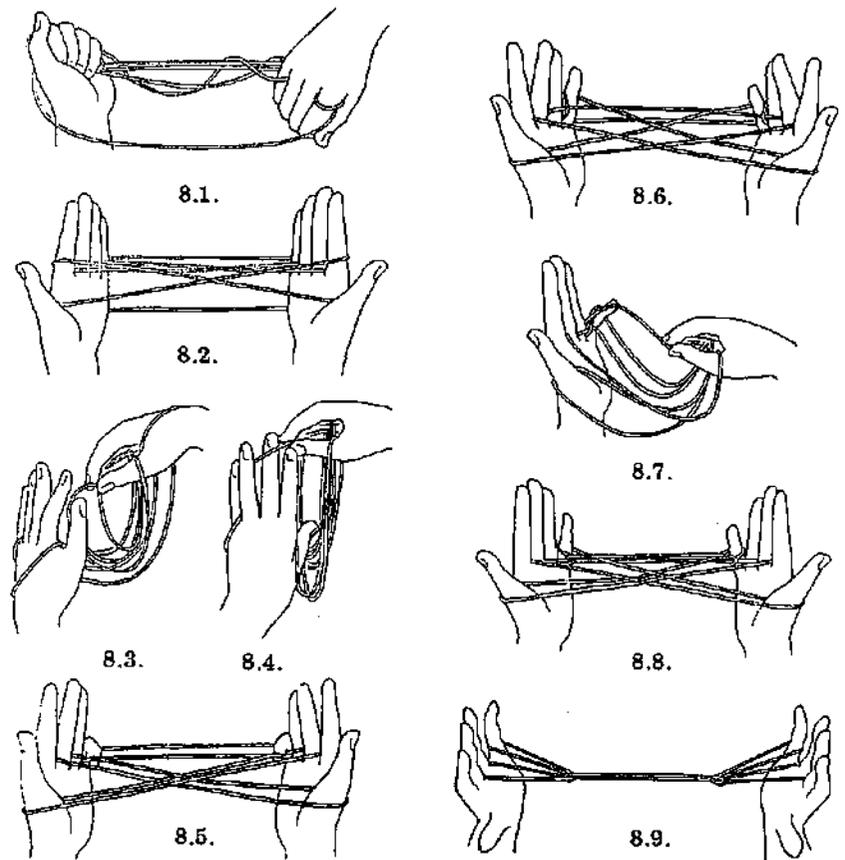
8.1.

8.2.

8.3.   8.4.

8.5.

8.6.

8.7.

8.8.

8.9.

Figure 8. Forming process for *Crow's Feet* (Cherokee). Widely known, though under different names.

4. Use thumb and index of the right hand to carefully lift up the string on the back of the left hand and put the loop on the left middle finger (Figure 8.4). Similarly, use left thumb and index to carefully transfer the string on the back of the right hand onto the right middle finger. Move hands apart.

5. Turning the palms slightly inward, bend little fingers down over the far middle finger string, take up from below on their backs the near little finger string (Figure 8.5) and return little fingers to their normal position (Figure 8.6).

6. With thumb and index of the right hand carefully lift up the lower left far little finger string (the one running straight across), bring it over the left little finger tip and let it fall on the palmar side (Figure 8.7). With the left thumb and index carefully transfer the lower right far little finger string beyond the tip of that finger and drop it on the palmar side. Separate hands (Figure 8.8).

7. By releasing the thumb loops and moving hands apart, the *Crow's Feet* appear or, one can say, the middle and little fingers of each hand, the "dogs", are "leashed" by loops to two central straight strings (Figure 8.9).

Carrying Wood   (Navajo and Zuni, Native North American)

1. *Opening A* (Figure 3).

2. Put thumb and index tips of each hand together, bend these finger pairs away from you over the far index string, take up from below the near little finger strings and return the finger pair to the usual position (Figure 9.1). Separate the finger tips and release the little finger loop (Figure 9.2).

3. Using the right thumb and index, carefully lift the left lower thumb loop over the upper (the one common to both thumb and index) and off the thumb to release it on the palm side (Figure 9.3). Again with the right thumb and index, carefully lift the left lower index loop over the upper (the one common to both thumb and index) and off the index to release it on the palm side, too. Perform the same operations on the right hand, using the left thumb and index: lift the lower right thumb loop over the upper loop and off the thumb to be dropped on the palmar side and lift the lower index loop over the upper loop and off the index to be also released on the palmar side (Figure 9.4). The hands hold now one loop each common to thumb and index. Both loops in turn carry - between thumb and index - a central double loop consisting of 4 strings (2 upper and 2 lower ones).

4. Bend the thumbs away from you to push down the near upper central string (the one going straight across) (Figure 9.5), let the thumb loops slip off, turn the palms away from you and tension the figure *Carrying Wood* between index fingers and thumbs (Figure 9.6). The two parallel center strings represent the carrying band used to transport the wood, which in turn is represented by the rest of the figure.
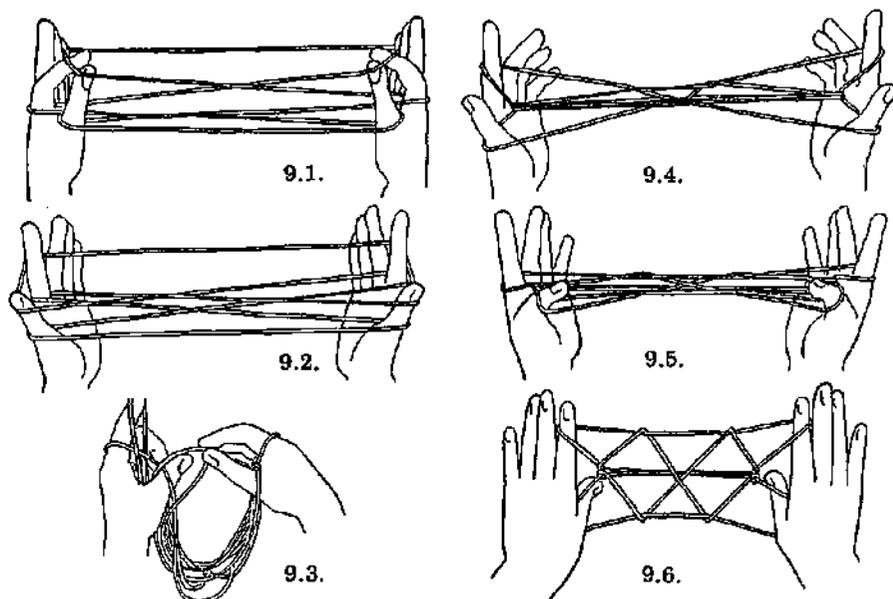

9.1. 9.4. 9.2. 9.5. 9.3. 9.6.

Figure 9. Formative steps for the string figure *Carrying Wood* (Navajo and Zuni).

10.1.

10.2.

10.3.

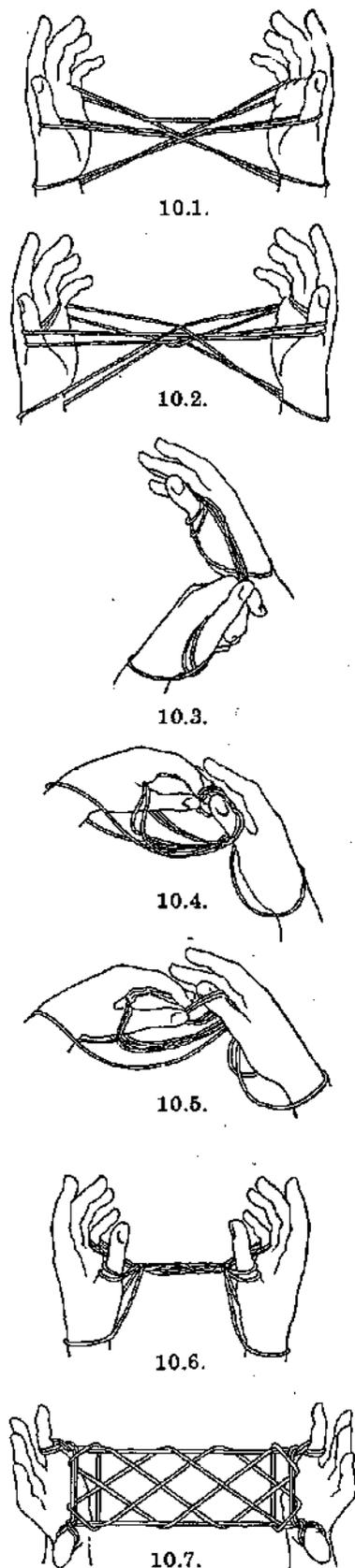10.4.

10.5.

10.6.

10.7.

Figure 10. Process in forming the *Door* string figure (Apache, Navajo and Pueblos).

Door (Apache, Navajo, Zuni, Pueblos - Native North American)

1. *Opening A* (Figure 3).
2. Using the right thumb and index, lift the left index loop off the finger and over the left hand and let it drop down on the left wrist. In the same way, using the left thumb and index, transfer the right index loop to the right wrist (Figure 10.1).
3. Using the right thumb and index, first pick up the left near little finger string (not the entire loop) close to that finger, pull it toward you and place it over the left thumb; then pick up the left far thumb string close to the left thumb and place it over the left little finger. Using the left thumb and index, repeat both operations on the right hand: right near little finger string over right thumb, right far thumb string over little finger (Figure 10.2).
4. With the left hand grasp firmly all strings between the hands and, in a left-to-right movement, place this group of strings between right thumb and index on the back of the right hand (Figure 10.3) and release. Next, using the left thumb and index, pick up the two loops of the right thumb and lift them above the tip of the thumb without releasing them (Figure 10.4), let the collection of strings slip from the back of the right hand to the palmar side and reposition the two thumb loops unchanged on the right thumb (Figure 10.5). Tighten strings by separating hands. With the help of the right hand repeat both operations on the left hand: placing first the bundle of strings on the back of the left hand, lifting the two left thumb loops and moving the string bundle to the palmar side before replacing the two left thumb loops. There are now a loop on each wrist and one twisted double loop each on the thumbs and the little fingers (Figure 10.6).
5. With the right thumb and index transfer the loop on the back of the left wrist over the finger tips to the palmar side. Repeat the operation on the other hand, lifting up the right wrist loop and dropping it on the palmar side.
6. Rub palms together briefly, if you want, and pull figure tight to let the *Door* - or gate - pattern appear (Figure 10.7).

Two Chiefs   (Western Caroline Islands, Pacific)

1. Insert thumbs and little fingers from below into crossed loop of string. Proceed with *Opening A* (Figure 3.2).
2. With the thumb backs take up from below the near index string and return thumbs to their position (Figure 11.1).
3. Using the left thumb and index, lift the right lower near thumb string over the right upper near thumb string off the thumb and release on the palmar side. With right thumb and index, in like manner, lift left lower near thumb string over left upper near thumb string over tip of left thumb (Figure 11.2) and release on palmar side.
4. Bend little fingers down toward you and pick up from below with back of little fingers the far index string (Figure 11.3 right). Return little fingers to their position (Figure 11.3 left).
5. Using the left thumb and index, lift the right lower far little finger string over the upper right far little finger string and over the tip of the right little finger to release it on the palmar side (Figure 11.4). Repeat the operation on the left hand, using right thumb and index to lift left lower far little finger string over the tip of that finger and letting it drop. Separate hands (Figure 11.5).
6. Release the index finger loops.
7. Bringing hands close together, transfer the left little finger loop on the right little finger and the left thumb loop on the right thumb (Figure 11.6).
8. Turning the right palm toward you, insert the left thumb toward you into both loops hanging from the right little finger (Figure 11.7) and withdraw right little finger. Return hands to their usual position, but let the strings hang loosely between them (Figure 11.8) and have the thumb loops clearly separated in upper and lower positions. Bend fingers and press down the lower thumb strings against each palm (Figure 11.9 right). With the back tip of each index take up from below the upper far thumb string and secure its position by loosely pressing the thumbs against the index fingers (Figure 11.9 left). Turning the palms away from you, the figure can be tightened to show the *Two Chiefs*   (Figure 11.10).

Figure 11. Forming process for the string figure *Two Chiefs* (West Caroline Islands).

11.1. 11.4. 11.8. 11.2. 11.5. 11.9. 11.3. 11.6. 11.7. 11.10.

12.1.

12.2.

12.3.

12.4.
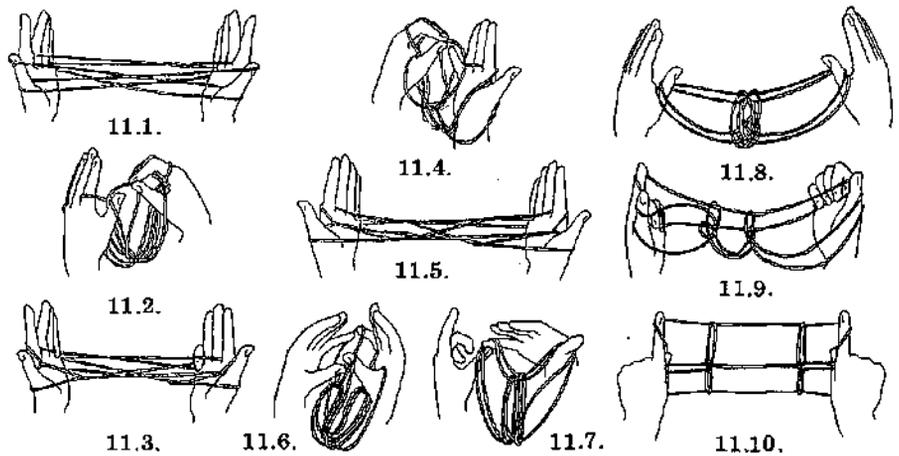
Ten Men (Caroline Islands, Pacific. Also found in NE Australia)

1. *Opening A* (Figure 3).
2. Using your teeth, draw the far little finger string toward you over all other strings (Figure 12.1). Bend left index over left string of this teeth loop and take up from below with back of left index the right string of the teeth loop and return left index to its position. Pick up from below with back of right index the left string of the teeth loop and return index to its position (Figure 12.2). Release loop held by the teeth and tighten string by separating hands (Figure 12.3).
3. Release thumb loops and separate hands.
4. Pass thumbs under the index loops to pick up on their backs the near little finger string and return thumbs to their position (Figure 12.4).
5. Moving thumbs up over the low near index string, insert them from below into each upper index loop and draw thumbs toward you to enlarge these loops, now passing around both index and thumb (Figure 12.5).
6. Using left thumb and index, pick up right lower near thumb string close to the right thumb, lift it past the upper right thumb loop and the tip of the right thumb (Figure 12.6) and let it drop on the palmar side. In like manner, with the right thumb and index, lift up the left lower near thumb string to release it beyond the left thumb tip on the palmar side (Figure 12.7). Separate hands (Figure 12.8).
7. Withdraw each index from the loop common to both thumb and index (Figure 12.9 left).
8. Transfer thumb loops on index fingers by inserting index fingers from below into the thumb loops (Figure 12.9 right) and withdrawing thumbs (Figure 12.10).
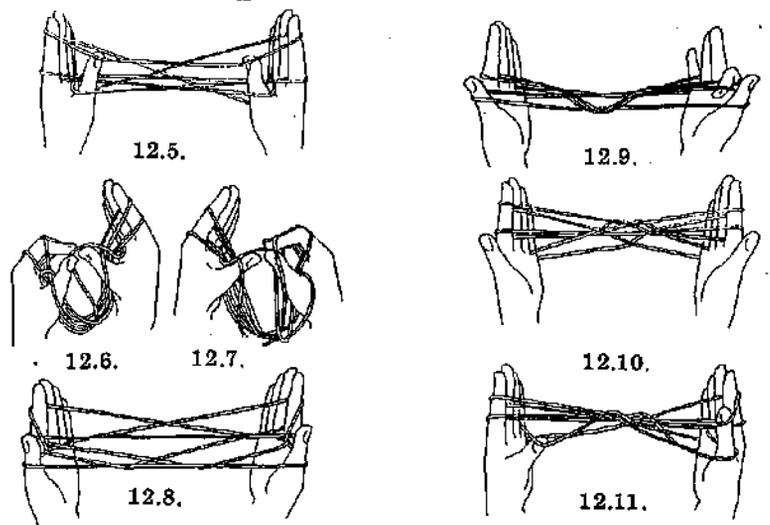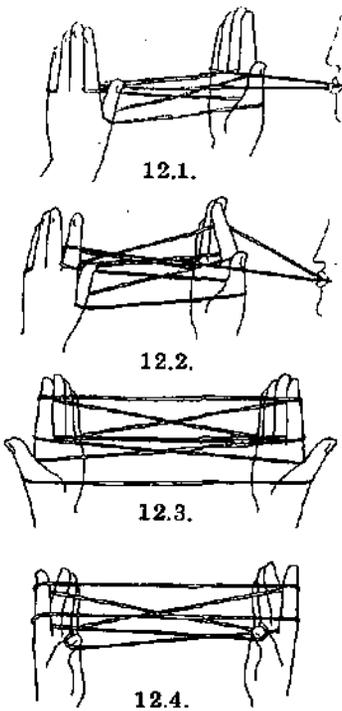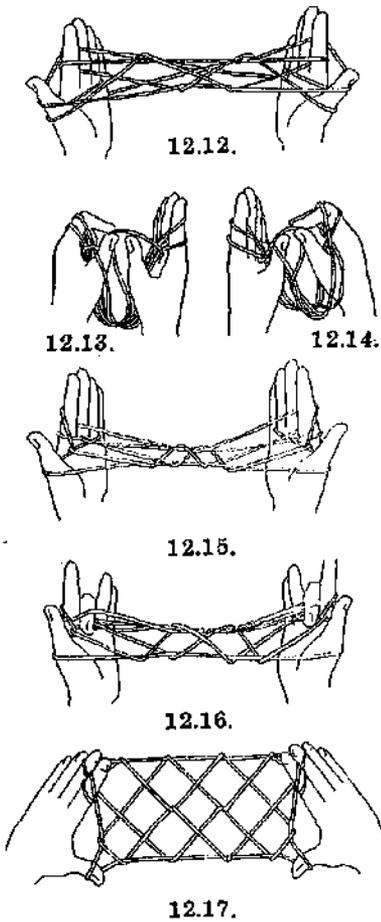9. Repeat step 4 (Figure 12.11 left).

12.5. 12.9. 12.6. 12.7. 12.10. 12.8. 12.11.

Figure 12. Formative steps leading to the *Ten Men* string pattern (Caroline Islands and NE Australia).

12.12.

12.13.   12.14.

12.15.

12.16.

12.17.

10. Repeat step 5 (Figure 12.11 right and Figure 12.12).

11. Repeat step 6 (Figure 12.13-15).

12. Bend middle fingers over far index strings to take up on their backs, from below, the lower near index string (the one extending from index to index) (Figure 12.16); return middle fingers to their position.

13. Release the little finger loops and, turning palms away from you and holding the index and middle fingers close together while the thumbs are spread off, the figure *Ten Men*   (represented by the pattern's multiple "x"s) appears between the hands (Figure 12.17).

Lightning ' (Navajo and Pueblos, Native North American)

1. *Seize string with thumb and index of both hands in a small interval, letting the* majority of the string hang down as large loop. Form a small hanging sling by moving right pick up point behind left one (Figure 13.1). Insert index fingers from behind toward you into this small hanging sling (Figure 13.2), insert thumbs away from you into large hanging loop while turning index fingers outward and upward (Figure 13.3) and separate hands with palms facing away from you (Figure 13.4). Then turn hands into usual position(Figure 13.5).

2. Bend thumbs away from you over the near index string, pick up from below the far index strings and return thumbs to their position (Figure 13.6).

3. Move middle fingers toward you over the near index string and take up from below on the back of the middle fingers the far thumb string (Figure 13.7 left). Return middle fingers to their position (Figure 13.7 right).

4. Bending the ring fingers toward you over the far middle finger string, pick up from below with the back of the ring fingers the near index string (Figure 13.8 left) and return ring fingers to their position (Figure 13.8 right).

5. Bend little fingers over the far ring finger string and pick up from below with the backs of the little fingers the far middle finger string (figure 13.9 left) before returning little fingers to their position (Figure 13.9 right).

6. Bring hands into usual position. The strings between the little fingers should be taut and all fingers kept in close contact to prevent slipping of the strings (the result will depend upon this precaution). Remove thumbs from their loops (Figure 13.10) and swing the resulting hanging loops away from you over the twisted little finger strings (Figure 13.11).

7. Insert thumbs from below into the small triangular spaces between the twisted little finger strings and the little fingers, take up with the thumb backs the far ring finger string and return thumbs to their position. The *Lightning*   pattern (Figure 13.12) appears very suddenly, provided that the four fingers of each hand were holding the strings well in their position.
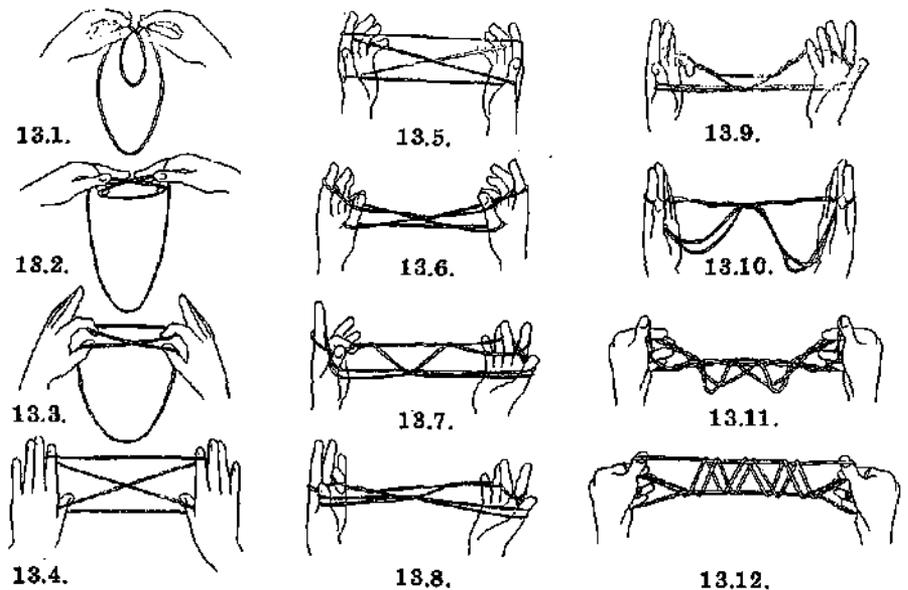
13.1.

13.2.

13.3.

13.4.

13.5.

13.6.

13.7.

13.8.

13.9.

13.10.

13.11.

13.12.

Figure 13. Forming process leading to the *Lightning* string pattern (Navajo and Pueblos).

14.1.

14.2.

14.3.

14.4.

Mouth (Topec Eskimo, Alaska)

1. Insert both thumbs and little fingers from below into the loop of string and bring hands in usual position (Figure 3.1).

2. Put the right index from above behind the left palm string and pick it up with back of index while turning the right index away and upward (Figure 14.1) in bringing it back to its position. Bend down left index to take up with its back from below the left near little finger string. With the left index back in its position (Figure 14.2), release the little finger loops (Figure 14.3).

3. Turning the palms toward you, put little, ring and middle fingers of each hand from below into index loop, close these fingers to hold the near index string against each palm (Figure 14.4 left). Loosen each middle finger, insert from above into thumb loop, pull the far thumb string away from you and secure it by pressing each middle finger against the bent ring fingers (Figure 14.4 right).

4. Bend index fingers with their loops carefully toward you above the near thumb string (Figure 14.5 left) and, by backward and upward movement, pick up on back of index fingers this near thumb string while letting the original index loops slip off (Figure 14.5 right).

5. Release thumb loops and the strings held down by the middle fingers (Figure 14.6).

6. By inserting the middle fingers from above into the index loops (Figure 14.7 left) and withdrawing the index fingers while straightening the middle fingers, the index loops are trasferred to the middle fingers (Figure 14.7 right).

7. Bringing the finger tips of both hands together, transfer the right middle finger loop (without twisting) on the left middle finger. Likewise, hang the right ring/little finger loop on the left ring/little finger pair (Figure 14.8). Then insert the four fingers of the right hand (with palm facing you) into the two loops hanging from the left ring/little finger pair (Figure 14.9), close the four fingers and pull both loops off the left hand. Insert the left thumb away from you (from below) into the two loops hanging from the left middle finger, withdraw the left ring finger, insert the four fingers of the left hand from above into the two left thumb loops and secure both loops by closing the four fingers. Tighten string figure by separating fists. By rotating the fists symmetrically the *Mouth* can be opened or closed. This dynamic effect can be amplified by using the thumbs (Figure 14.10).
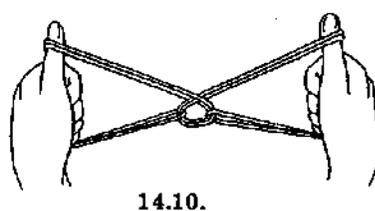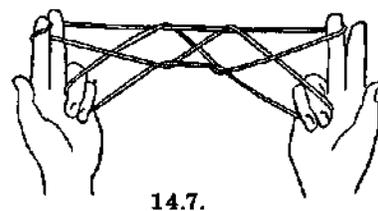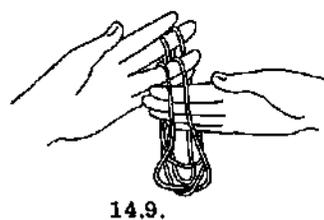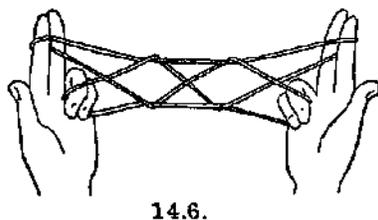

14.5.

14.8.

14.6.

14.9.

14.7.

14.10.
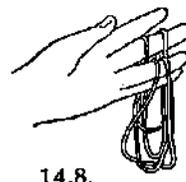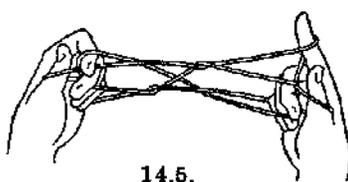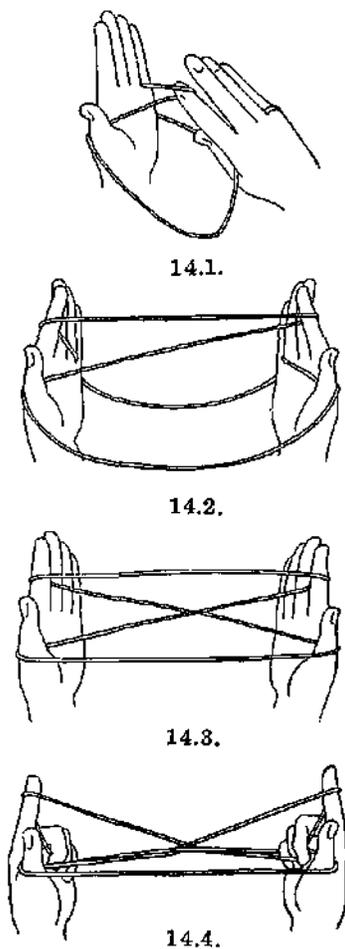
Figure 14. Formative steps for the string figure
Mouth (Inuit).

15.1.

15.2.

15.3.

15.4.

15.5.

Rib Cage (Topec Eskimo, Alaska)

1. Insert thumbs, middle fingers and little fingers from below into loop of string (Figure 15.1).
2. With the back of the right index take up from below the left palmar index string (Figure 15.2). Repeat on the other hand by taking up with the back of the left index (and between the strings of the right index loop) the right palmar index string. Separate hands.
3. With the back of the right ring finger take up from below the left palmar ring finger string (Figure 15.3). In like manner take up with the back of the left ring finger (and between the strings of the right ring finger loop) the right palmar ring finger string. Separate hands. Each finger carries now one loop (Figure 15.4).
4. Insert the thumbs from below into the adjacent index loops (Figure 15.5) and spread thumb toward you. Using the teeth, lift the original thumb loops - one at a time - over the loop common to both thumb and index, and drop them beyond the thumb tips on the palmar side (Figure 15.6).
5. Move each thumb away from you over the far thumb string and index loop, take up from below on each thumb back the near middle finger string and return thumbs to their position (Figure 15.7). Then, using the teeth, lift, in turn, each lower thumb loop over the upper thumb loop and drop it beyond the thumb tip on the palmar side (Figure 15.8).
6. Move each thumb away from you over the loops of thumb, index and middle fingers, take up from below with each thumb back the near ring finger string and return thumbs to their position (Figure 15.9). Again using the teeth, lift, in turn, each lower thumb loop over the upper one and drop it beyond the tip of the thumb on the palmar side (Figure 15.10).
7. Move each thumb away from you over the loops of thumb, index, middle and ring fingers, take up from below with each thumb back the near little finger string and return thumbs to their position (Figure 15.11). With the teeth lift each lower thumb loop over the upper one and drop it beyond the thumb tip on the palmar side (Figure 15.12).
8. Move each thumb away from you over all strings except the far little finger string which is taken up from below on the back of the thumbs and brought toward you with the return of the thumbs (Figure 15.13). Using the teeth once more, lift, in sequence, each lower thumb loop over the upper and let it drop beyond the tip of the thumb on the palmar side (Figure 15.14).
9. Transfer the thumb loops to the little fingers by inserting the little fingers, bent toward you, from above into the thumb loops, taking up with the little finger backs the near thumb strings (Figure 15.15 right) and returning the little fingers to their position while withdrawing the thumbs (Figure 15.15 left).
10. Using the teeth, pull the center of the nearest straight string (usually hanging loose) toward you and extend, at the same time, the figure *Rib Cage* by separating the hands with their fingers spread. The loop held by the teeth can be released when its strings are held between the tips of the extended thumbs instead (Figure 15.16).
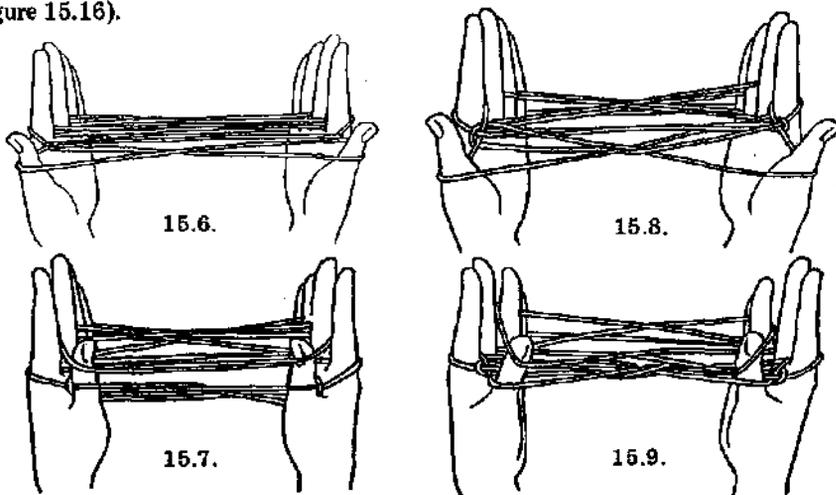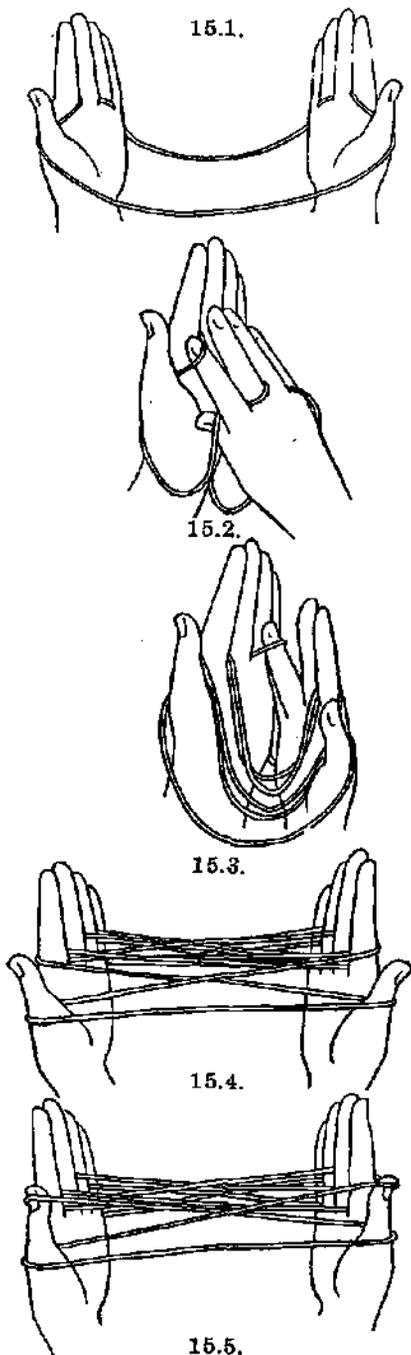

15.6.

15.8.

15.7.

15.9.

Figure 15. Process steps in forming the *Rib Cage* string figure (Inuit).

5. Many more string figure games can be found in: Ball (1920/1971), Dickey (1928/1985), Hornell (1927/1971), Jayne (1906/1962) and Kattenstidt (1936).

6. Culin (1899) preserved such terminal string loop figures from Hawaii without their operational steps. Roth (1902) published 74 string patterns obtained from several tribes in NE Australia also in their final form only. Jayne (1906) published 15 remarkable string figures from Nauru, collected and mounted on paper by E.Stephen, inhabitant of this Micronesian Island in the Pacific.

15.10.

15.11.

15.12.

15.13.

15.14.

15.15.

15.16.
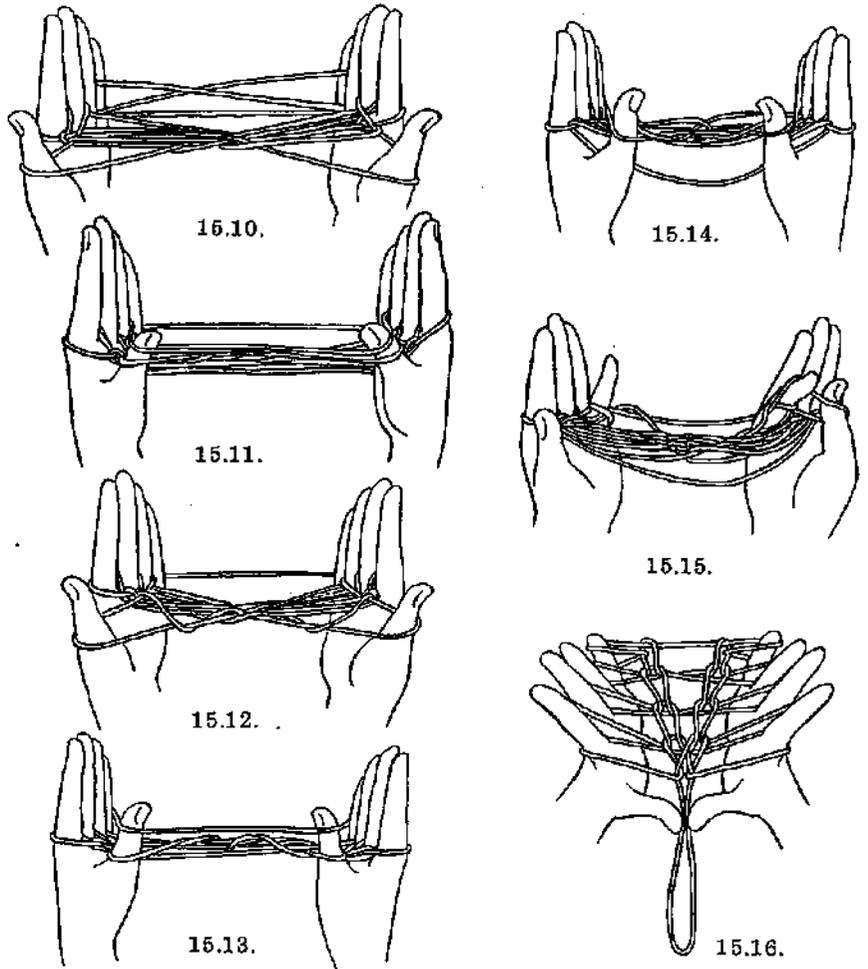
STRING FIGURES WITH UNKOWN FORMING PROCESSES

The above examples of string figures were - like many others - recorded complete, as product and process[5]. A considerable number of string patterns, however, were documented by ethnographers only in their end result, with their forming method remaining unknown. The advanced skill and finesse that must have been employed to generate some of those collected specimens of string figure is obvious, especially when extra long loops of string were used. Among the examples presented here from Hawaii (Figure 16), Micronesia (Figure 17) and North East Australia (Figure 18), the ones from the Micronesian Island of Nauru are the most intricate and formally of utmost appeal[6].
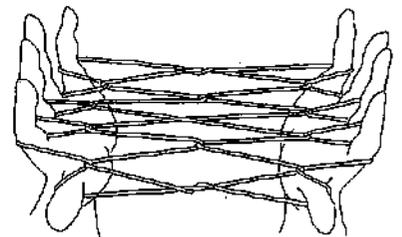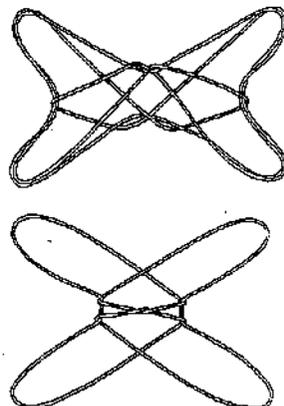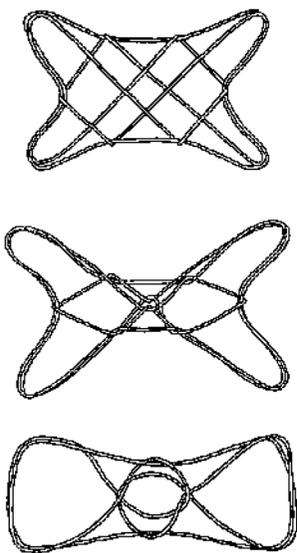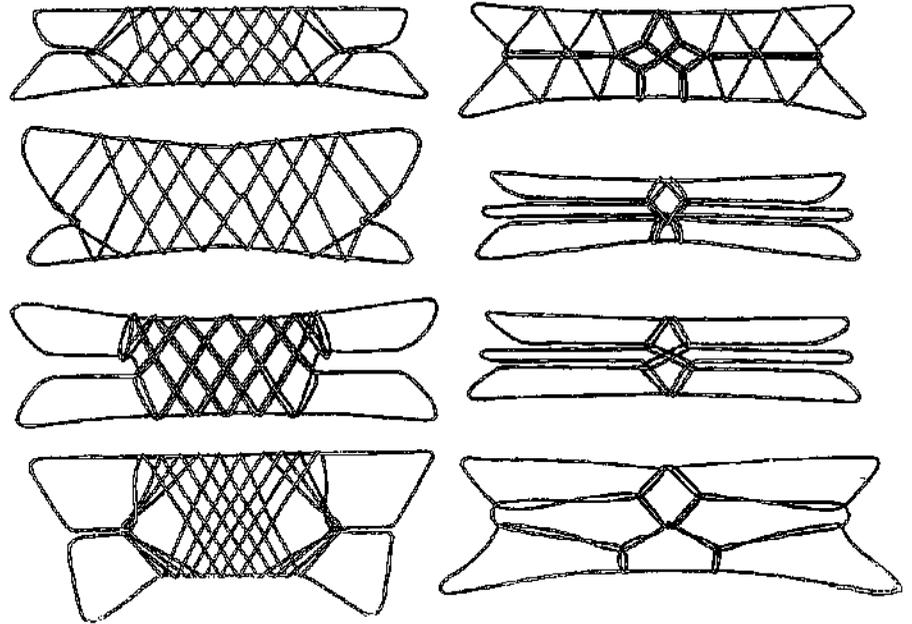

Figure 16. Seven string figures from Hawaii with forming process unknown, collected by S.Culin before 1900.

Figure 17: Eight string patterns with unknown forming process from Micronesia (Nauru). Four represent mats (17.1), four others human figures (17.2).

OUTLOOK

The string game figures passed on to us by tradition constitute relics of an age old repertoire of forms comprised, probably, of a greater abundance of figures than what happens to be documented. With interest in recording this multi-cultural heritage starting so late, many string patterns and their forming processes can safely be assumed to be lost.

By creatively playing with loops of string in trial-and-error approaches, ancient *homo ludens* invented - over long stretches of time - these orderly tangles of lines with their profound visual appeal. With the graphic tools available as of recent, especially computers as design aid, modern *homo ludens* should be in a good position to explore the geometric possibilities of such games. Constraints are simple, for a start: the topological circle and the anatomy and kinetics of a pair of human hands. Step-by-step approaches with defined rules would permit the systematic search for patterns of all complexities. Ancient lost string figures could (unknowingly) be recovered and new ones invented.

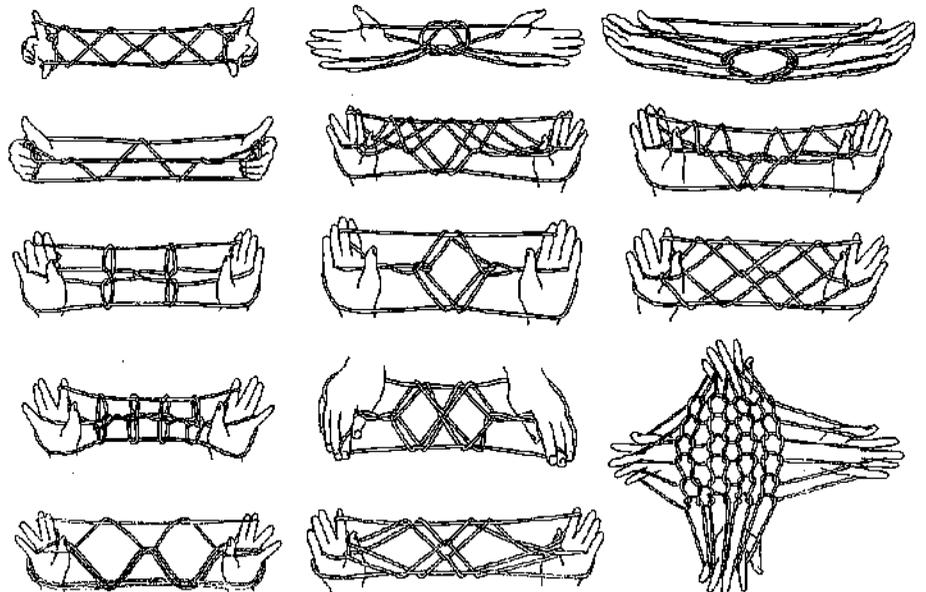Figure 18. Fourteen string figures without recorded forming movements from NE Australia, documented from the spectator's point of view by W.E.Roth around 1900. They represent *Rats* (18.1 and 18.9), *Canoe* (18.2), *Cranes* (18.3), *Four Boys* (18.4), *Coconuts* (18.5), *Sun Clouded over* (18.6), *Setting Sun* (18.7), *Star* (18.8), *Fish* (18.10 and 18.13), *Crocodile Egg* (18.11), *Pouch* (18.12) and *Tortoise Shell* (18.14).

Computer graphics could also be used as an analytic tool to re-determine the successive constructive movements necessary for string patterns now only documented in their final stage.

The inherited string games of Eskimos, Native Americans, Polynesians and Australian Aborigines should be transferable into any cultural setting. Being easy to learn and teachable without difficulty, their pedagogic and therapeutic importance lies in the development of manual dexterity and hand/brain coordination. They also sharpen the recognition of closed linear patterns and their inherent logic as, for instance, found in Celtic ornaments or the decorative art and carvings of the Papuas. The playing of string patterns, as a relaxing pastime, should not only provide a good setting for quiet contemplation, but also a possibility for entertainment and competition. Most patterns, after a short period of learning and practice, can be generated in seconds. Who is the fastest? And who wins the speed record, if two players, each using only one hand, play the same string figure together? Even more demanding on the players' skills would be the simultaneous step-by-step generation of two figures by two players who use two loops of string and pair their hands accordingly. Could more than two persons play together in this way, forming a circle? And why couldn't the ten fingers be replaced by ten people and the string by a more substantial rope?

The technical utilization of the large variety of string figures should deserve exploration. Could they provide models for endless circulation paths or pipe systems with many over - and undercrossings (rail tracks, vehicular lanes, pedestrian pathways, running courses, race tracks, cavernous passages, ducts for gas or liquids, or circuits for electricity or light)? Could they be used for structural purposes? In building technology, could we imagine a structural cable system which, by forming an endless loop, is able to balance its stresses automatically?

Formation games with an unpretentious loop of string as medium fell into inordinate disuse. What prevents us from reconsidering their usefulness today? Are they irrevocably out of date? Should we really continue to regard them as obsolete? Or can they be seen as catalysts for innovative applications in design, architecture and environmental planning instead? Questions - anticipating answers ...

ÇEMBERİN DOĞURGANLIĞI

ÖZET

Uçları birleştirilmiş (sonsuz) bir sicimle oynanan el becerisine dayalı oyunlar etnograflar tarafından tüm dünyada gözlenmiş ve belgelenmiştir. Topolojik gösterimi daire olan halka durumundaki sicimden ustaca ortaya çıkarılan figürler tarih öncesi insanı tarafından hoş vakit geçirmek veya tören ve ayin amacıyla yaratıldı. Yirminci yüzyıla miras kalan bu tür sicim figürlerinin çok çeşitli olması sayısız kuşaklardan nice adı bilinmeyen kişilerin sabırlı uygulama, geliştirme ve araştırmaları ile bu arada yapılan birçok rastlantısal buluşun ortak sonucudur.

Değişik sicim figürlerinden saptamaların sayısının 700 den fazla olduğu söylenmektedir. Bu kültürel mirasa ilginin yalnızca üç kuşak önce başlamış olmasından dolayı daha birçok figürün ve yapılış süreçlerinin unutulduğu olasıdır. Batı medeniyetinin etkisi ile yerel kültürlerin hızla yok oluşu da yerel sicim oyunlarının kaybolmasına yol açmıştır.

Oyun, sicimden elde edilen halkanın eller üzerine geçirilmesi ve parmaklarla şekillendirilerek iki veya üç boyutlu bir figürün elde edilmesinden başka birşey değildir. Eller dışında bazen dişler, dizler ve ayak baş parmakları da kullanılır.

Şekillendirme süreci basit veya karmaşıktır; ancak karmaşık bir süreç beklenmeyecek basitlikte bir sonuca götürdüğü gibi, tersi de olabilmektedir. Bazı bölgelerde sicim oyunlarına belli tekerlemeler ya da geleneksel şarkılarla eşlik edilmekteydi. Genellikle ortaya çıkan figürlere günlük çevreden bilinen canlı veya cansız, doğal veya insan yapısı nesneler ile tinsel dünyaya ilişkin isimler verilmekteydi. Bazı figürler temel geometrik şekilleri belirtmekte veya çeşitli devinimleri temsil etmekteydiler. Bu arada toplumun geçmişinden önemli kişiler veya mitolojik figürler de simgeleştirilmekteydi. Ancak bu isimlendirmeler her yerde aynı değildir. Figürlerin adlarının kültürlerin yayılmaları sırasında sürekli değiştiği adlarının bölgelere göre farklılaşmasından anlaşılmaktadır.

Avrupa ve Asya'da çocuklar arasında da yaygın olarak bilinen oyun türü iki oyuncunun sırayla birbirlerinin ellerinden yaptıklarını alıp başka bir şekillendirmeye dönüştürmeleridir. Bu oyun, yapılış sıralarının değişmesi dışında, toplam sekiz figürle sınırlıdır.

Pasifik Okyanusu'nda, Amerika'nın yerli nüfusu arasında ve Kutuplarda görülen sicim oyunları oluşturdukları biçimler açısından daha ilginçtir. Tek kişi tarafından oynanabilen bu oyunlar nadiren başka birinin yardımını gerektirir. Yalnızca çocukların değil kadın ve erkek erişkinlerin de geleneksel olarak oynadıkları oyunlardır. Bu oyunların yoğun sayıdaki figürleri arasından oniki örnek yapım, süreçleri adım adım açıklanarak sunulmaktadır(Resim 14-15).Meraklı okuyucular açıklamaları dikkatle izlerse bu figürleri rahatlıkla yapabilirler. Pasifik Okyanusu ve Amerika'dan belgelenmiş sicim oyunlarının birçoğunun başlangıç adımları aynıdır. Onun için ilk önce yaygın bir başlangıç adımı alan *A Açılışı* sunulmaktadır (Resim 3).

Örnek olarak verilen figürler diğer birçokları gibi süreci ve sonucuyla bütün olarak belgelenmiştir. Önemli sayıda figürün yapım yöntemi ise bilinmemekte ve yalnızca elde edilen son şekilleri belgelenmektedir(Resim 16-18).

Özellikle, tasarımda kullanılan bilgisayarlar gibi yeni çizge araçlarına sahip olan çağdaş *homo ludens*, atalarının sınama-yanılma yolu ile yarattığı bu oyunların geometrik olanaklarını araştırabilecek konumdadır. Kaybolmuş eski figürler bulunabilir ve yenileri yaratılabilir. Yalnızca son şekilleri ile belgelenmiş figürlerin yapım süreçleri bilgisayar yardımı ile çözümlenip bulunabilir.

Geçmişten miras kalan bu oyunlar herhangi bir kültürel ortama aktarılabilir. El becerisi ve düşünme ile el arasındaki uyumun geliştirilmesi yönünden eğitici *ve tedavi edici önemleri vardır. Süsleme sanatlarında görülen kapalı çizgisel* desenler ve bunların arkasındaki mantığı kavramayı da güçlendirebilirler. Dinlendirici bir vakit geçirme unsuru olmaları dışında eğlenme ve yarışma için de olanaklar yaratabilirler (figürleri yapmada hız yarışları, parmakların yerini kişilerin alması gibi).

Elde edilen figürlerin teknik kullanımları da araştırılmaya değer. Alt üst geçişli sonsuz dolaşım yolları veya boru hattı sistemleri ve yapılarda strüktürel araçlar için model oluşturabilirler.

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