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African dance rattle capsules from Cameroon to Madagascar, from Somalia to Mozambique: Plaiting a symmetric, nonahedral shape

Abstract

The following paper presents examples of dance rattles from several parts of Africa: from Cameroon in the West-Central Africa, from Somalia and Kenya in Eastern Africa, and from Madagascar and Mozambique in Southern Africa. The capsules of these rattles are plaited in a similar way. They display a nonahedral shape (nine faces) and each capsule is made from only one strip of a leaf. A plaited capsule can be understood as an alternating knot, precisely as knot 9_{40} in the international knot table. The paper shows how to weave a strip of cardboard paper to produce the nonahedral shape.

Leg rattle composed of pods (Botswana)
Photograph 1

African dances

Africa is very rich in its cultural diversity and unity. Dances belong to the common heritage of the continent. Frequently dancers wear rattles or shakers wrapped around the arm, wrist, waist, knee, leg or ankle. The rattles provide a rhythmic background to music during the dance. They may consist of a chain of capsules formed by pods, fruits, or nuts. Photograph 1 presents an example of a rattle made of pods used by Naro dancers in the Central Kalahari (Botswana). The capsules may also be woven (plaited or braided) from palm leaf strips with small seeds inside each of them. These capsules or compartments are strung together on one or two cords. Photograph 2 presents a dance rattle from Cameroon, produced before 1967, kept at the Music and Theater Museum in Stockholm, Sweden.

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Dance rattle from Cameroon
Photograph 2

The particular, approximately polyhedral shape of the capsules of this dance rattle from Cameroon will be analysed in the paper.

Various polyhedral shapes

In a recent paper I analyse the **octahedral** shape of the plaited capsules of a Nuer dance rattle from South Sudan and show how one can produce the octahedral shape by plaiting the capsule with a single strip of cardboard paper (Gerdes 2012). Earlier I discussed and explored, in the book *Geometry from Africa* (Gerdes 1999, pp. 148-153), the **decahedral** shape of the plaited capsules of the '**bamboyo**' rattle that is produced and used among the Bassari in the border region of Senegal and Guinea. Each of the '**bamboyo**' capsules is made from only a single palm leaf strip too.

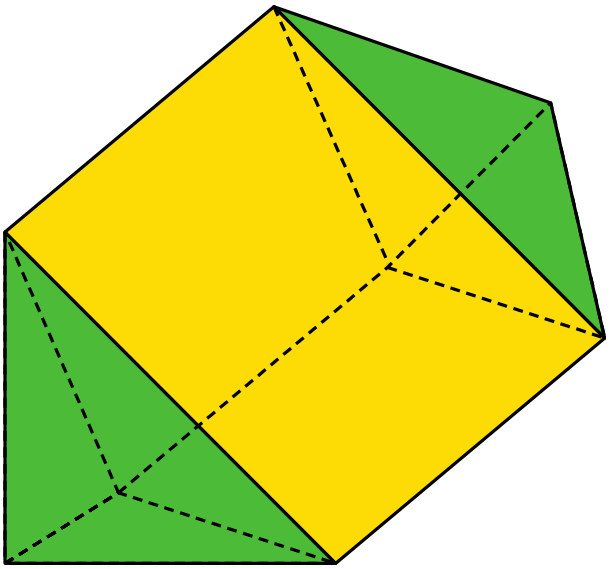
In the book *Otthava: Making Baskets and Doing Geometry in the Makhuwa Culture in the Northeast of Mozambique* (Gerdes 2010, 2012, pp. 153-189) and in the papers (Gerdes 2004, 2005) I analyse the shape of the '**nirrosula**' rattle capsules. Photograph 3 presents part of a '**nirrosula**' rattle produced in the 1940s and kept at the National Ethnological Museum in Nampula (Mozambique). Once again, each capsule is plaited (over-one-under-one) using one single pam leaf strip.

The capsules of the dance rattle from Cameroon are woven in exactly the same manner as those of the '**nirrosula**' rattle. Their shape is, approximately, **nonahedral**.

Various capsules of a ‘nirrosula’ dance rattle (Mozambique)
Photograph 3

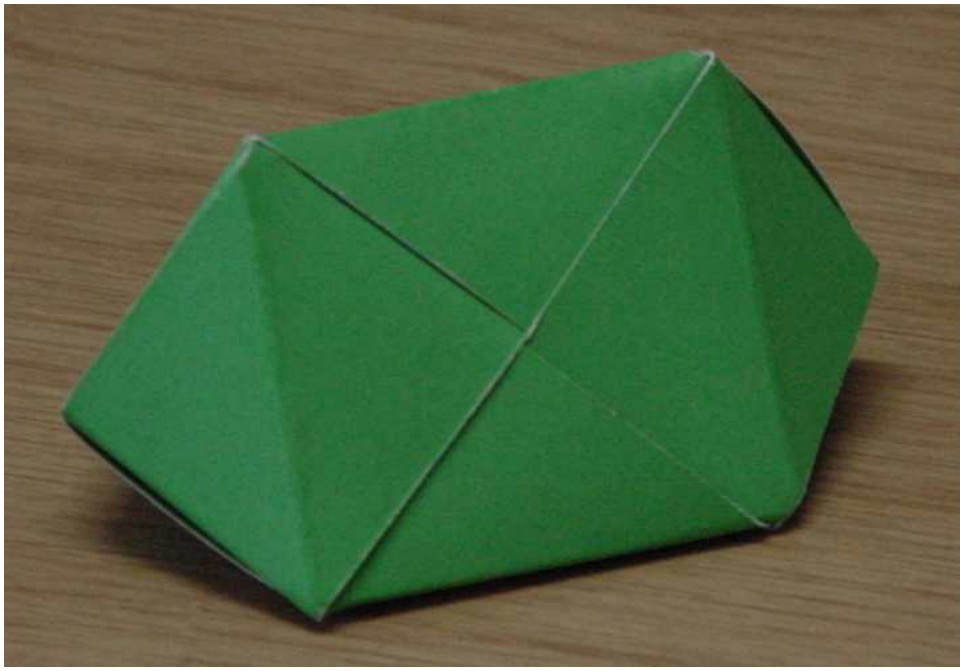
Nonahedral shape

The capsules of the rattle capsules from Cameroon and the Makhuwa in Northeast Mozambique present a threefold rotational symmetry. When the faces are flattened, a nonahedral shape appears (see Figure 1). The central (yellow) part is that of a triangular prism: three faces are congruent squares and the top and base are congruent equilateral triangles. At the top and base there are two wedges or cubical caps. The faces of each wedge are three congruent isosceles right triangles and an equilateral triangle.



Nonahedral shape of a Makhuwa rattle capsule
Figure 1

Photograph 4 shows a nonahedral capsule made out of a strip of cardboard paper.



Plaited nonahedron made out of one strip of cardboard paper
Photograph 4

By introducing first some fold lines (see Figure 2), the plaiting of the cardboard capsule is facilitated. Photograph 5 shows how to start the weaving by superposing partially the triangles A and B.

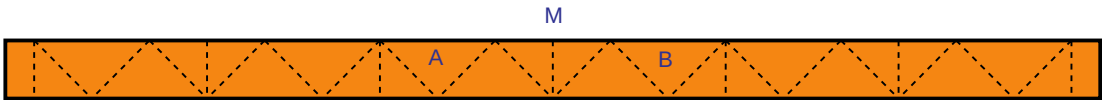
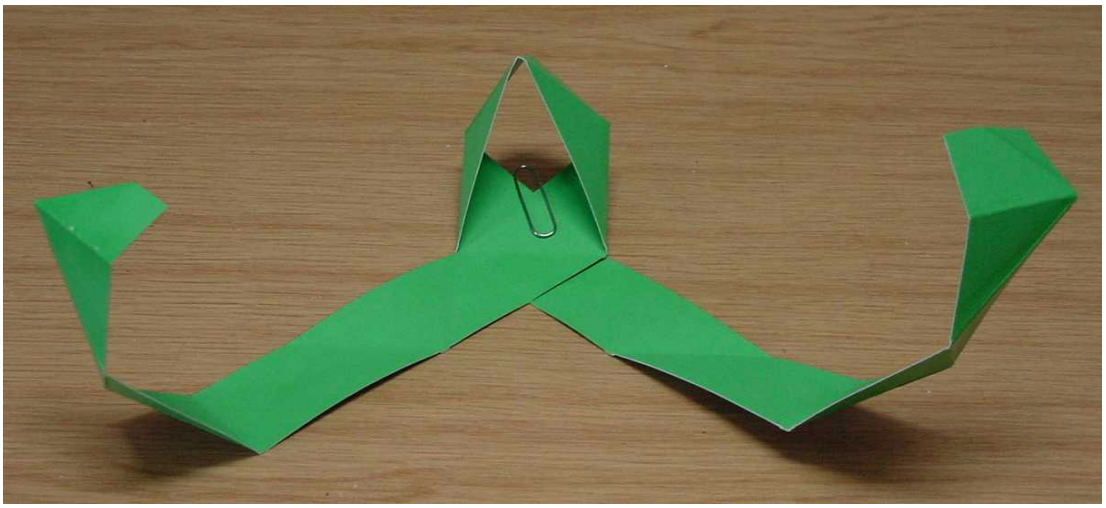


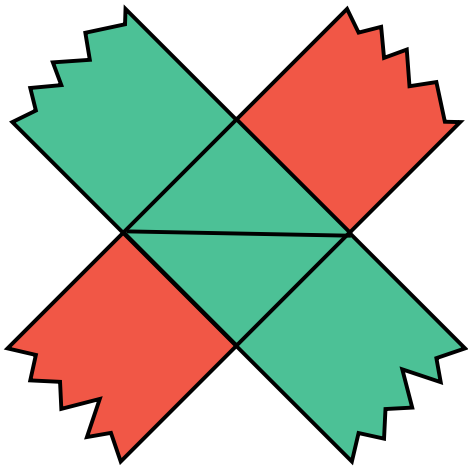
Figure 2



Starting to weave
Photograph 5

Alternating knot representation

The surface of a plaited nonahedron consists of nine squares folded along one of their diagonals. These diagonals are the edges of the triangular prism. Each folded square is a crossing where one part of the strip passes over another part (see Figure 3).



A crossing
Figure 3

We may represent a crossing as an ‘open’ X as in Figure 4, that indicates clearly which part of the strip passes over the other part, as observed from the outside.

Representation of a crossing
Figure 4

Now we may look for a representation of the plaited nonahedron in the plane that reflects its threefold rotational symmetry. Let us start with the three crossings at the top. They may be represented around an equilateral triangle (see Figure 5).

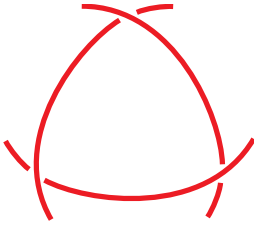
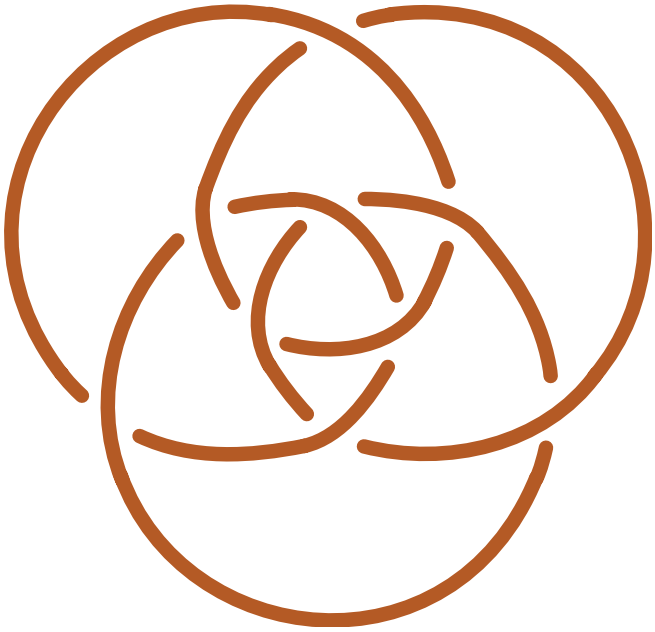


Figure 5

Around these three top crossings, we may draw the three crossings of the middle layer and then the final three crossings at the base layer of the plaited nonahedron. Finally we may join the loose ends (Figure 6).



Alternating knot representation of a nonahedral Makhuwa capsule
Figure 6

In this way we arrived at an alternating knot representation for the plaited nonahedron. The representation shows that the plaiting structure of our nonahedron corresponds to knot 9_{40} in the international knot table. '9' not because of the 9 faces but because of the 9 crossings. The representation illustrates clearly the threefold symmetry of the plaited nonahedron.

Other instances of the plaited nonahedron [2]

In (Gerdes 2007, 2010, 2012, p. 185) I refer to a drawing in (Somjee 1993, p. 45) that suggests (see Photograph 6), that rattle capsules similar to the Makhuwa '**nirrosula**' and the Cameroonian one, are made in Kenya.

Kenyan rattle capsule
Photograph 6

[2] Figure 3 in (Dias 1986) presents another '**nirrosula**' or similar dance rattle from Mozambique, kept at the Anthropological Museum of the University of Coimbra, Portugal (Inventory number: MIAC Moç nº 384).

Several rattles collected in 1934-35 by Diana Powell-Cotton among the Mashan Guli in then Italian Somaliland are either chains of plaited nonahedral capsules, as the ones kept at the British Museum (London, UK; Image AN1217982001) and the Pitt Rivers Museum at the University of Oxford (see Photograph 7) or small rattles composed by only one plaited nonahedral capsule, as the ones kept at the Pitt Rivers Museum (PRM 000078483, PRM 000078581, PRM 000080116) (see the example in Photograph 8). The single capsule rattle was tied to the leg for the *n'sewe* dance.

Mashan Guli rattle from Somalia
Photograph 7

Single capsule rattle from the Mashan Guli (Somalia)
Photograph 8

Photographs 9 and 10 present two 19th century dance rattles from the island of Madagascar. They are kept at the 'Musée du quai Branly' and the 'Cité de la Musique' in Paris, France, respectively. The second has four plaited nonahedral rattle capsules at its top.

Rattle from Madagascar (1882)
Photograph 9

Rattle from Madagascar (19th century)
Photograph 10

All examples of plaited nonahedral rattle capsules presented so far are historic specimens found in museums in Mozambique or in the former colonial metropolis. Very surprisingly, when I visited the annual Mozambican Trade Fair in Marracuene, 30 km north of Maputo, on August 29, 2012, I saw for the first time plaited polyhedral capsules that were recently made. Photograph 11 displays a necklace from a village Guludo on the coast of the Cabo Delgado Province in the Northeast of the country. The language spoken in this coastal area is Mwani.

Nonahedral capsules alternate with dried fruits. The capsules are rather 'rounded-off' as they are woven with three superimposed layers of palm leaf strip. The top yellow strip has a smaller width than the underlying natural coloured strip, giving rise to a special colour effect. Photograph 12 presents one of the capsules in close-up.

Much smaller capsules appear on a placemat from the same village (see Photograph 13) with a height of 15 to 20 mm, whereas the biggest capsules on the necklace have a height of 50 mm. This time, each of them is made from only one layer of palm leaf strip. As the strip is relatively thin, the polyhedral shape of the capsules becomes more salient.

Necklace from Guludo (Cabo Delgado, Northeast Mozambique)
Photograph 11

Close-up
Photograph 12

Placemat from Guludo with nonahedral capsules
Photograph 13

Origins?

As nonahedral, plaited capsules may be observed on historical specimens of dance rattles from Cameroon, Kenya, Madagascar, Mozambique, and Somalia, this way to plait such a capsule may have been invented centuries ago. Once or several times…

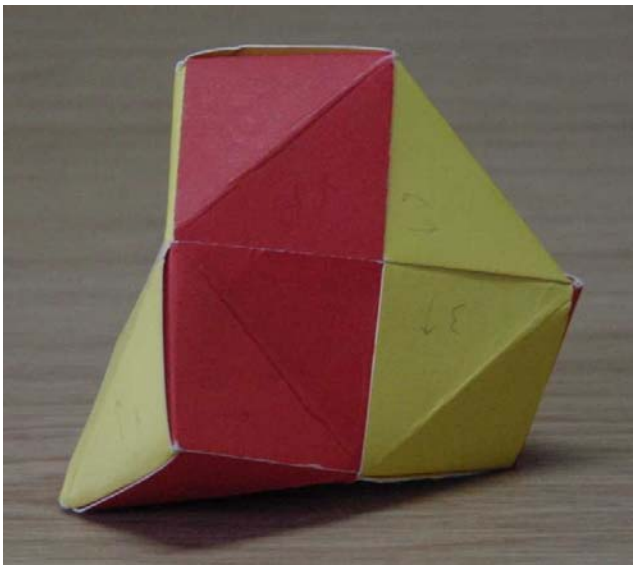
The only examples from outside Africa, where nonahedral shapes are plaited in a similar fashion, I have observed so far, come from the Philippines (Cf. Nocheseda 2009). Photographs 14 and 15 present images of '**palaspas**' plaiting, where the '**nirrosula**' shape appears. It has probably an independent origin.

First example of 'Palaspas' plaiting from the Philippines
Photograph 14

Second example of ‘Palaspas’ plaiting from the Philippines
Photograph 15

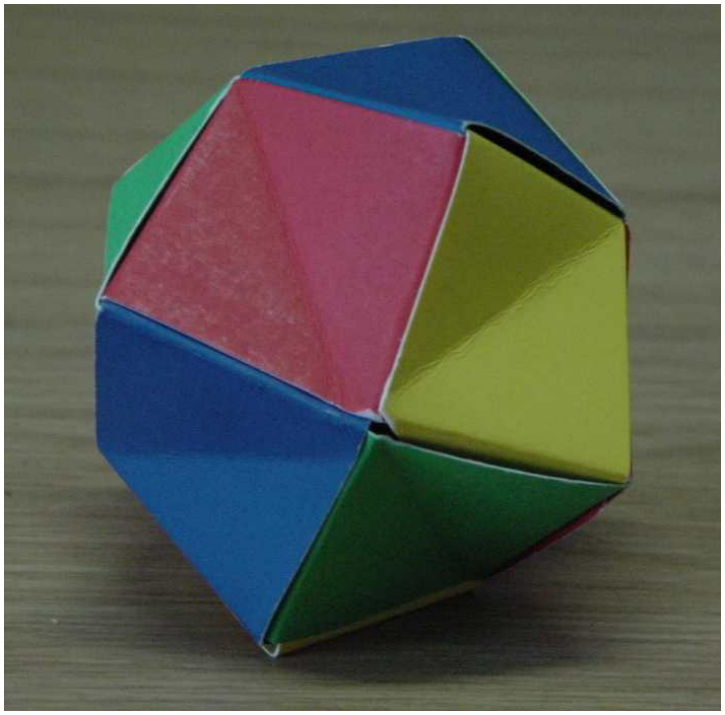
Educational exploration

The chapter on the ‘**nirrosula**’ in the already cited *Otthava* book (Gerdes 2007, 2010, 2012), and the papers (Gerdes 2005, 2008) present various examples of a mathematical-educational exploration of the plaiting of the nonahedral shape. Inspired by its plaiting, other plaitable shapes may be found, like the twin-‘**marrosula**’ [3] and the stellated octahedron illustrated in Photographs 16 and 17.



Twin-‘**marrosula**’
Photograph 16

[3] The plural of ‘**nirrosula**’ is ‘**marrosula**’ in the Makhuwa language.



Stellated octahedron
Photograph 17

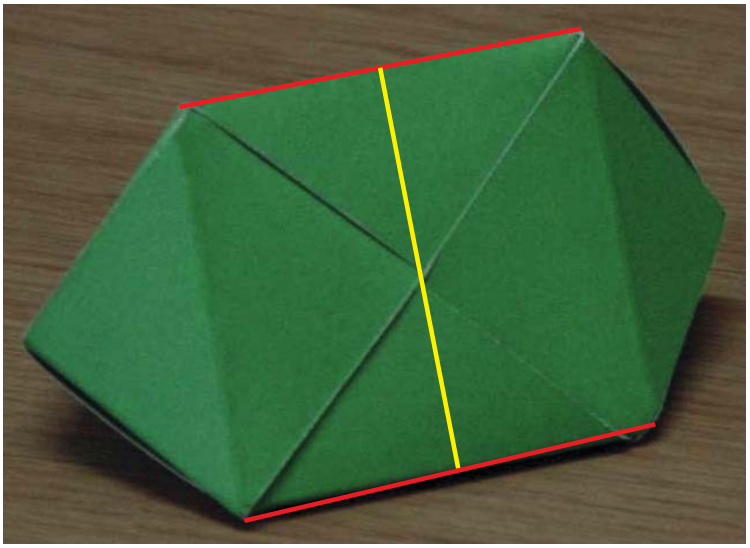
They can be woven with two and four strips, respectively.

Photograph 18 shows a doctoral student taking part in a course I taught in 2011 at the University of São Paulo (Brazil) on exploring mathematical ideas from Africa. He just finished plaiting a nonahedral '**nirrosula**'.

Plaiting the nonahedron at the University of São Paulo
Photograph 18

Another polyhedron corresponding to the same alternating knot

Consider the three edges of the triangular prism section of a plaited nonahedron. The two edges that are visible in Photograph 19 are coloured red. They correspond to the diagonals of three folded squares. What will happen if instead of folding along these three diagonals, one folds each of the squares along the other diagonal? Halves of two diagonals are coloured yellow in Photograph 19.



Plaited nonahedron
Photograph 19

The result is a plaited dodecahedron (see Photograph 20): (a compound of) two interpenetrating cubes.

A plaited dodecahedron
Photograph 20

This interesting plaited dodecahedral shape has threefold, rotational symmetry and three symmetry planes. It corresponds to the same alternating knot 9_{40} as the original '**nirrosula**' shape.

Final comments

Comparative studies of plaited rattle capsules and other basketry products are easier in 2012 than before, as more and more collections of historic-ethnographic specimens in European and North-American museums are becoming accessible as photographs on the internet, for instance, through the 'Europeana' project of musical instruments.

The author prepares further studies on other polyhedral shapes of African dance rattle capsules. Their shapes are different from the octahedral, nonahedral, and decahedral shapes referred to in the present paper.

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Nocheseda, Elmer I. (2009), *Palaspas: an appreciation of palm leaf art in the Philippines*, Ateneo de Manila University Press, Manila, 328 pp.

Somjee, Sultan (1993), *Material Culture of Kenya*, East African Publishers, Nairobi.

Sources of illustrations

Photographs

1 The Africa Image Library, Photo ID: BO-CK-san-08-0080 (Ariadne van Zandenberg, 2008) (reproduced a detail of the photograph)

2 Musik & Teatermuseet, Stockholm, Sweden: Inventory number F538

3 Detail of Photograph 6.1 in *Otthava* (Gerdes 2007, 2010, 2012)

4 Photograph 6.2a in *Otthava* (Gerdes 2007, 2010, 2012)

5 Photograph 6.5b in *Otthava* (Gerdes 2007, 2010, 2012)

6 Drawing in (Sonjee 1993, p. 45)

7 Pitt Rivers Museum, Oxford, UK: Number 000078291

8 Pitt Rivers Museum, Oxford, UK: Number 000080116

9 Musée du quai Branly, Paris, France: Inventory number 71.1882.63.4

10 Cité de la Musique, Paris, France: Inventory number E.01458

11 New photograph by Paulus Gerdes, 2012

12 New photograph by Paulus Gerdes, 2012

13 New photograph by Paulus Gerdes, 2012

14 Photograph by Elmer I. Nocheseda, 2007 (http://www.flickr.com/photos/elmer_ng_pateros/1315252359/)

15 Photograph by Elmer I. Nocheseda, 2007 http://www.flickr.com/photos/elmer_ng_pateros/1262232797/

16 Photograph 6.13 in *Otthava* (Gerdes 2007, 2010, 2012)

17 Photograph 6.15 in *Otthava* (Gerdes 2007, 2010, 2012)

18 New photograph by Paulus Gerdes, 2011

19 New photograph by Paulus Gerdes, 2012

20 New photograph by Paulus Gerdes, 2012

Figures

All figures were drawn by the author.

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