ISSN: 2454-9940

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

E-Mail :
editor.ijasem@gmail.com
editor@ijasem.org

www.ijasem.org

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN2454-9940
www.ijsem.org
Vol 9, Issuse. 3 July 2018

Sandcastles of Symmetry: Unveiling the Hidden Math in Sona Drawings

Mrs V. Sandhya Rani M.Sc. (Mathematics); B.Ed.*1, Mr. P. Srinivas Rao, M.Sc. (Mathematics) *2

Mrs. Mayuri Odela, M.Sc. (Mathematics); B.Ed *3

Abstract

Sona is a mesmerizing art form practiced by the Chokwe people of eastern Angola and neighboring regions. It involves creating intricate geometric patterns and drawings in the sand, using only a finger or stick. These impermanent masterpieces, often erased by the wind or washed away by the tide, serve as a powerful form of storytelling, cultural expression, and knowledge transmission Born of a single finger's caress, Sona weaves complex patterns – circles chasing squares, spirals echoing triangles. These are not mere doodles; they are ancestral myths etched in grains, proverbs whispered on the breeze. Elders narrate creation tales, while children's laughter trails celestial dances in the ever-shifting canvas. But Sona is a mistress of transience. The tide whispers its claim as the sun dips, stretching shadows across the sands. Each wave laps at the shore, erasing stories one grain at a time. Yet, dawn unveils a blank canvas, expectant and fresh. Sona is more than sand drawings; it's a living tapestry woven from stories, impermanence, and cultural memory. Its intricate whispers resonate from the Angolan shores, inviting us to embrace the fleeting, celebrate the moment, and find timeless beauty in the ever-shifting sands.

Introduction:

Born from a single finger's touch, Sona transcends mere drawings. It's a symphony of geometry, where circles chase squares, and triangles echo spirals. These intricate patterns are not just aesthetically pleasing; they are potent symbols, each line resonating with ancestral myths, cultural values, and forgotten stories. Elders become storytellers, narrating tales of creation and migration as their fingers glide across the sand. Proverbs and fables form in swirling patterns, their wisdom imprinted on the ever-shifting canvas. Children, giggling along the shore, join the dance, tracing constellations and celestial stories in the fleeting artwork.

*1. Lecturer, Dept. of Mathematics, Siva Sivani Degree College, Kompally, Sec'Bad- 100

*2. HOD, Dept. of Mathematics, Siva Sivani Degree College, Kompally, Sec'Bad- 100

*3. Lecturer, Dept. of Mathematics, Siva Sivani Degree College, Kompally, Sec'Bad- 100

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN2454-9940
www.ijsem.org
Vol 9, Issuse. 3 July 2018

Key characteristics of Sona:

- Geometric patterns: Sona drawings are characterized by their complex and interwoven geometric patterns, often featuring circles, squares, triangles, and spirals. These patterns hold symbolic meaning, representing various aspects of Chokwe cosmology, history, and social life.
- Storytelling: Sona is not just about creating beautiful visuals; it's also about telling stories. The artist traces the patterns in the sand while narrating folktales, proverbs, or historical accounts. The patterns serve as visual aids, helping the audience remember the story and its deeper meaning.
- Ephemerality: One of the defining features of Sona is its impermanent nature. The sand drawings are meant to be temporary, existing only for the moment of creation before being washed away or erased. This impermanence adds a layer of poignancy and beauty to the art form, reminding us of the fleeting nature of life and the importance of living in the present moment.
- Cultural significance: Sona plays a vital role in Chokwe culture. It is used to educate and entertain younger generations, transmit cultural knowledge and values, and strengthen community bonds. The practice is often passed down through initiation rites, ensuring its continuity for future generations.

Sona's appeal beyond its cultural context:

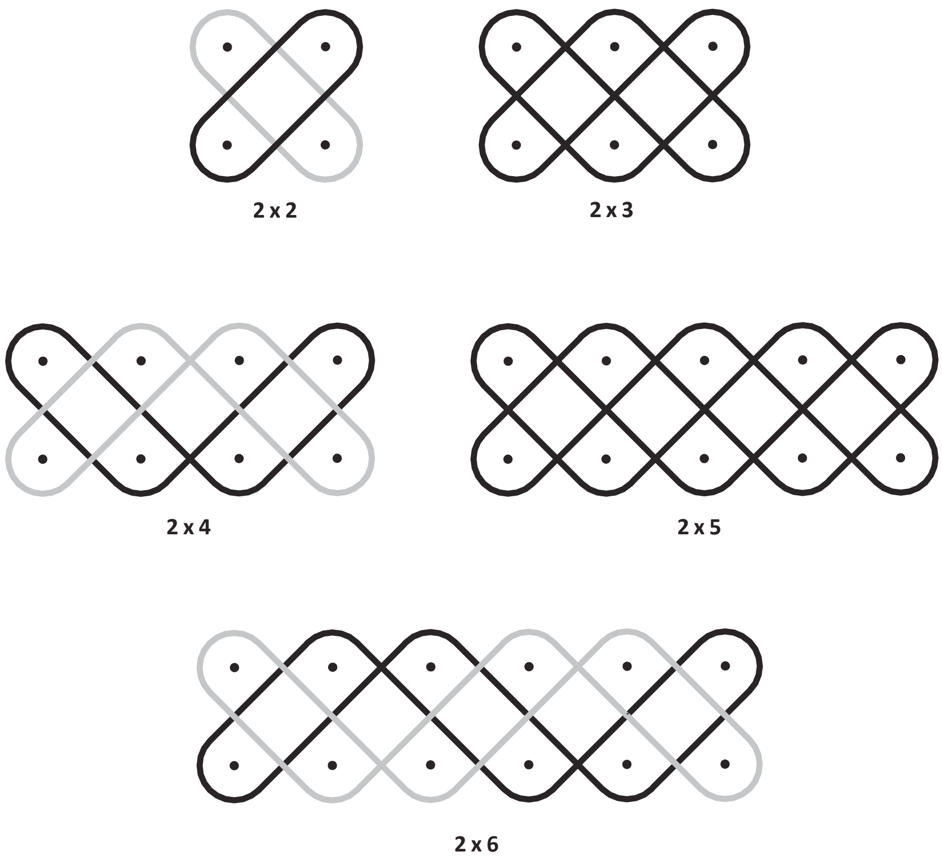
- Mathematical intrigue: The complex geometric patterns of Sona have also caught the attention of mathematicians and educators. The drawings have been found to embody mathematical concepts such as symmetry, tessellations, and graph theory, making them a valuable tool for teaching math in an engaging and culturally relevant way.
- Artistic inspiration: Sona's intricate patterns and ephemeral nature have also inspired artists and designers around the world. The art form has been adapted for various media, including paintings, sculptures, and even digital animations.

Sona is more than just sand drawings; it's a window into the rich culture and traditions of the Chokwe people. Its ephemeral beauty, captivating storytelling, and mathematical complexity make it a truly unique and fascinating art form.

How many Lines?

The smaller turtle required three closed lines to draw, whereas the lioness and the antelope could be drawn with just one. This may have shocked you. The dimensions of the array of points you begin with determine how many closed lines you must draw for each drawing. For instance, a 3 x 5 array can be used to draw a newborn lion with just one closed line. However, you'll discover that to finish creating a larger lioness with a 3 x 9 array, you'll need three different closed lines.

Many adults and children in Angola, Ghana, the Congo, and other African nations can quickly determine the number of closed lines required to create a design when they observe the assortment of dots. They can quickly inform you that two closed lines are required to create a sona painting using a 4 x 6 array if you inquire how many are needed. When you show them a 5 x 7 array, they immediately decide that a single closed line is sufficient.



Determination of Closed Lines

How can you determine the number of closed lines required for the drawing by looking at a set of dots? You will need to conduct some experimentation to investigate this question. Use arrays based on two rows to begin. Create two-by-two, two-by-three, two-by-four, two-by-five, and two-by-six arrays of dots. How can you determine the number of closed lines required for the drawing by looking at a set of dots? You will need to conduct some experimentation to investigate this question. Use arrays based on two rows to begin. Create arrays of two by two, two-by-three, two-by-four, two-by-five, and two-by

Now spend some time investigating three-row arrays. What pattern, if any, can you identify for them?

Here, the pattern is distinct. If there are three or six points in each row, you will need three closed lines to draw the figure if there are three rows. However, only one closed line is required if each row contains four or

ISSN2454-9940
www.ijsem.org
Vol 9, Issuse. 3 July 2018

five points. Now experiment a little with four-row arrays.

Once more, the pattern is different. The 4 x 3 and 4 x 5 arrays contain

It only takes one closed queue Two lines are required for arrays that are 4 x 2 and 4 x 6. For the 4 x 4 array, four closed lines are required. It appears that there is a distinct rule for every array size. Nevertheless, that is untrue. There's a method to estimate how many closed lines a pattern will require, however there are many patterns.

Utilize your prior knowledge to help you solve the challenge. You begin with two numbers for each array: the number of rows and the number of columns. You need to determine a third number—the number of closed lines required to complete the drawing—from these first two figures. How are you going to solve this?

NO OF ROWS	**NO OF COLUMNS**	**NO OF CLOSED LINES**
2	**2**	**2**
1	**3**	**1**
3	6	3

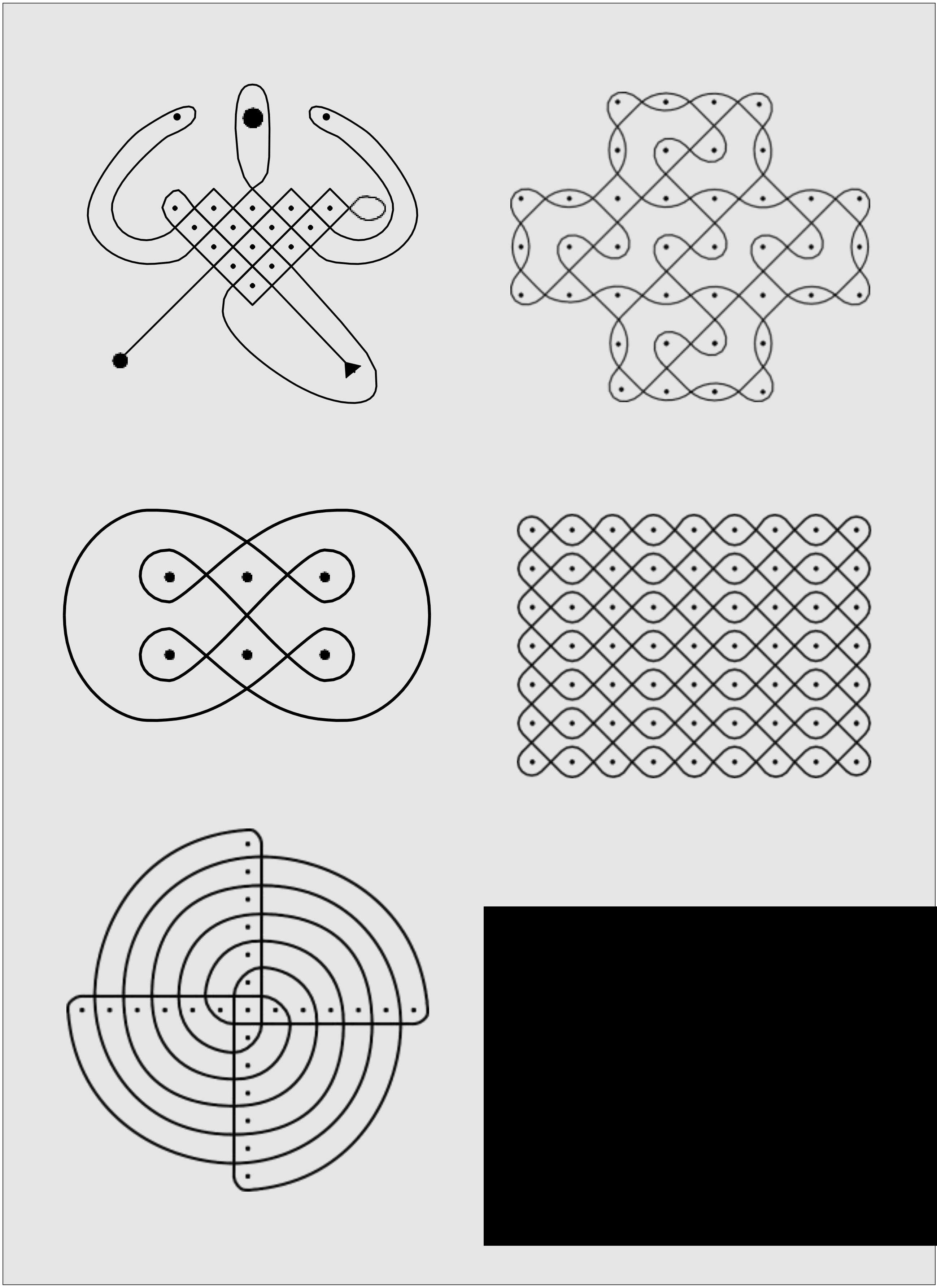
Mathematical Correlation

There are numerous methods in mathematics to obtain one number from two others. You can discover the lowest common multiple of the two, for instance, or add or remove the first two numbers. You can also multiply or divide the numbers. Numerous alternative methods exist that you might undoubtedly think of to derive a number from two other numbers.

Making a table is frequently useful when you have multiple groups of three numbers and are attempting to determine the rule that unites them. Create a table using the arrays you have experience with. As indicated above, arrange your table in three columns: Number of Rows, Number of Columns, and Number of Closed Lines.

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN2454-9940
www.ijsem.org
Vol 9, Issuse. 3 July 2018



ISSN2454-9940
www.ijsem.org
Vol 9, Issuse. 3 July 2018

Making Connections

Currently, attempt to determine a mathematical correlation among the values in the third column of your values in the first and second columns of the table. A relationship, or rule, that holds for each entry in your table is what you're searching for. Is the third figure the total of the first two? Is it the way they differ from each other? Is the regulation more intricate?

Don't give up if you don't see a rule after some time. In many math and scientific projects, you have to examine a set of data until you find a pattern that was present from the beginning. Continue attempting! You'll be rewarded for your efforts with the epiphany of discovery.

Have you figured out the pattern? This is it: The largest number that splits evenly into the first two numbers is the third one. In other words, the greatest common divisor of the array's row and column counts equals the number of closed lines.

For instance, three closed lines are needed to fill a 3 x 6 array since three is the greatest common divisor of three and six. Since 3 and 5 have a greatest common divisor of 1, you may conclude that a 3 x 5 drawing requires just one closed line. What is the largest divisor that divides 2 and 4? Does that align with your table's results?

Acknowledging Connections

Paulus Gerdes was the one who created this exercise.

Creating Links

• Are there any photo albums kept by your family? Are there any family lore stories that accompany the images? How were such stories taught to you? Imagine what would transpire a century from now if one of your descendants happened to glance at those albums. Do you suppose they'll be familiar with such tales as well? How?

• When you were younger, you most likely learned a lot of fairy stories. Inquire of individuals from various regions of the world about the stories they were taught as children. Do they tell stories similar to the ones you tell?

• Stories are often used to teach people a lesson or make a point. What lessons have you taken away from the tales, adages, and fables you

References

1. Gerdes, P. (2007). Drawings from Angola: Living mathematics. Springer. (Focuses on the mathematical aspects of Sona patterns)
2. Bazin, M., Beuchamp, G., & Mann, B. J. (2003). Math and science across cultures. Rowman & Littlefield Publishers. (Chapter 5 discusses Sona as an example of ethnomathematics)
3. UNESCO Intangible Cultural Heritage Website. (2008). Sona: Drawings and geometric figures on sand. (Official website with detailed information and resources)
4. Mavinga, J. V. (2012). The ephemeral dance of Sona: Chokwe sand drawings and the meaning of art. Africa: Journal of the International African Institute, 82(4), 506-522. (Academic article

ISSN2454-9940
www.ijsem.org
Vol 9, Issuse. 3 July 2018

analyzing the cultural significance and meaning of Sona)

5. Lanfranchi, G. G. (2010). Chokwe Sona: Art as cultural memory in Angolan sand. African Arts, 43(4), 28-41, 86.** (Explores the role of Sona in transmitting and preserving Chokwe cultural memory)
6. De Boeck, F., & Peltier, R. (2007). From sand to screen: Interactive digital simulations of Chokwe Sona sand drawings. International Journal of Heritage and Computer Applications, 3(4), 266-278.** (Examines the use of digital technology to preserve and promote Sona)
7. Azevedo, J. R. T. M. (2012). Sona in the classroom: Mathematical knowledge and cultural values in sand drawings. The Mathematics Enthusiast, 9(3-4), 296-309.** (Discusses the educational potential of Sona for teaching mathematics and cultural values)
8. Bloss, R. S. (2013). Drawing with sand: The ephemeral art of Chokwe Sona. Art Education, 46(5), 22-29.** (Explores the artistic aspects of Sona and its potential for art education)