Storytelling in Africa as an aid for motivating art students for mathematics

Dirk Huylebrouck
Department for Architecture Sint-Lucas Brussels
Huylebrouck@gmail.com

Presentation at the 4th ELIA Teachers' Academy
NATFA, Sofia, July 2009

Storytelling in Africa as an aid for motivating art students for mathematics

The Congolese Ishango rod is the oldest object of interest to mathematicians. It was discovered in the 1950s, by Belgian archaeologist Jean de Heinzelin (de Heinzelin, 1962), but was only put in the public exposition in 2001, after the author's intervention. A second Ishango rod, of which de Heinzelin had written a paper on his death bed in 1998, was unveiled by the author during a conference in 2007 (Huylebrouck, 2008). It received considerable attention in the press, surprisingly, because one can wonder why the eventual mathematical nature of some African designs seems so difficult to accept. In today's multicultural societies, teaching the mathematical nature of African art seems a necessity, and maybe a 'story telling' approach can help to bridge the gap between the artistic, mathematical and multicultural worlds (Joseph, 1992).

Introduction: (in)correctness of story telling

The tradition of the reciting long stories, from generation to generation, exists from time immemorial in some regions in Africa. Their content is subject of critique, because the courtiers who told these stories often preferred to please the sovereign or the Western visitor instead of telling the true factual history (Rowe, 1995). For instance, there is the story among the Dogon about the star Sirius, of how they knew that it is a double star long before the arrival of the Europeans and without telescopes, but the authenticity of this story is doubtful. Clearly untrue are some additions on maps 'following Ptolemy', such as comments about one-eyed people, called 'monoculi'.

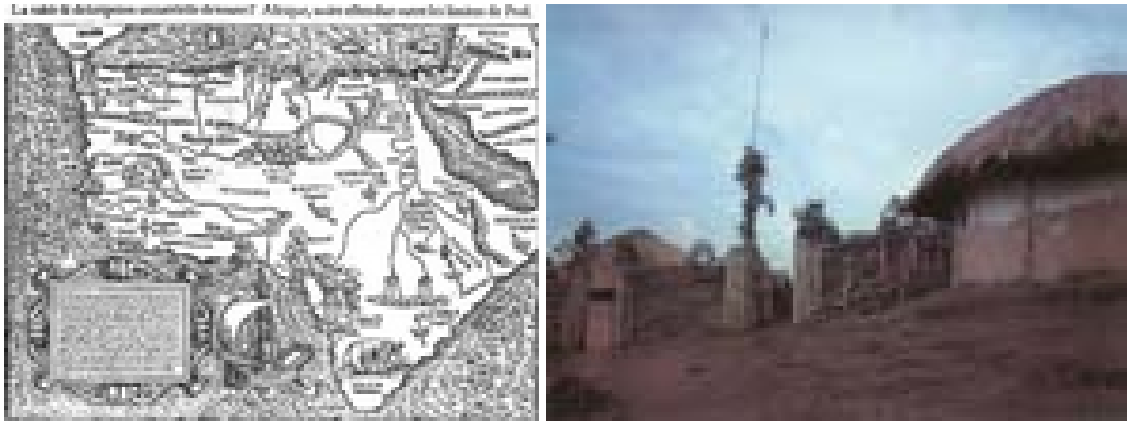

Fig. 1: A map 'following Ptolemy' (left) and a setting where stories where told (right)

On the other hand, the correctness of these oral traditions can sometimes be verified accurately when solar eclipses or comets are mentioned. For instance, there is a story from Rwanda about a solar eclipse or 'ibwirakabiri', during the first months after the accession to the throne of King Mibambwe III Sentabyo. Belgian astronomer Jean Meeus was kind enough to make maps of solar eclipses that could have occurred in Rwanda around the time the King ascended to throne. In combination with the context and the estimations of the ages of persons, it turned out the middle part of the 18de century was an approximation for dating the event.

Teaching and story telling

In Africa before colonisation, education was traditionally done in gatherings around the fire. One of the stories relates how a 'teacher' asked a youngster to grasp a star from the heavens, as an exercise during a kind of ritual for the so-called 'Lyangombe'. In another riddle 'the Death' asked someone to bring cattle that were neither cows nor bulls. Similar stories exist in the West, where the answer often is 'bring an ox', but the more subtle African answer is: 'ask the Death to come neither at daylight nor at night'.

Other tales require fantasy based on an interest in 'scientific issues'. This may come as a surprise for art students, who often have rather romantic prejudices about the black continent. There is, for instance, this shortened anecdote about King Yuhi III Mazimpaka, *'He-who-sorted-quarrels'*.

Once upon a time, when the King sat among his courtiers, he heard a rumbling sound, far away, as if it were a thunder:

- 'Was not that the thunder?' the monarch shouted, 'did not you hear that too?'

- 'No', answered the onlookers.
The King turned his head to the sky and saw a small pirogue flying through the sky, so far above the ground the human eye could hardly see it. He was the only one to observe it, because he had a clairvoyant soul.
-'But do not you see a large ship in the sky?' he yelled at his devotees.
- 'We don't see a thing', the latter answered, 'and we hear even less'.
Mazimpaka let the 'biru' continue, because they were the confirmed magicians at the court. […]
The King, becoming increasingly sad, went on:
- 'I am tired of your mockeries and suspicions; your grandchildren will prove what I confirm. They too will not believe it at first. Their amazement will not be less than yours. You all, my subjects, my magicians, my sorcerers, my children, you will know that this ship, when it will come over our country, will not be prevented from landing. […] I predict our great-grandchildren will use this ship and that it will allow them to travel over a frightening lake. At that time, you will remember me.'

Western 'specialists' gave different rather amusing interpretations of this story.

Mathematics and stories

The common African sand drawings called 'sona' are of mathematical natural: when Ludwig Wittgenstein was asked for an example of what mathematics really was about, he referred to those sand graphs. In Africa, the drawing often was accompanied by narrating stories, about life and death, or about a heritage when a chief passed away. The graphs are modern versions of Leonard Euler's puzzles, who wondered how to cross the seven bridges of Konigsberg, thus inventing modern graph theory.

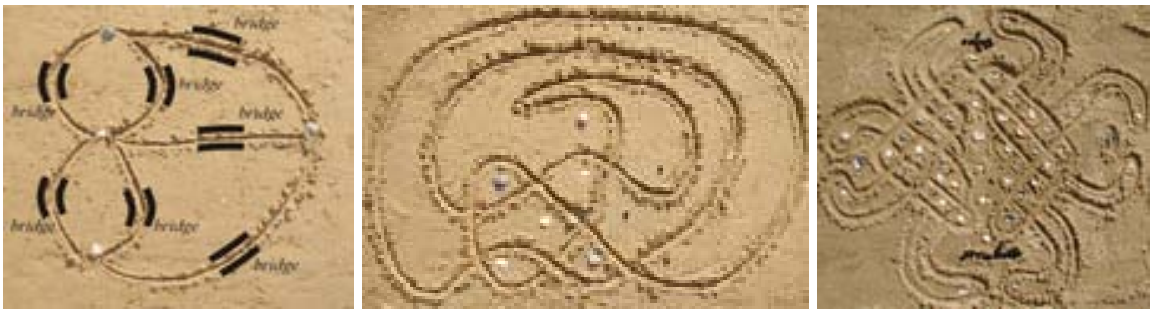

Fig.2: Euler's graph in sand (left), a morning ceremony graph (middle), and a 'graph of life' (right).

Different cultures around the world make such drawings in the sand, with a finger or with a twig, with or without lifting it, and lines full of twists and turns the mythical character. Sometimes symbols are added to clarify the purpose of the drawing. It shows that not only dance, music or dramatic expressions were sources of inspiration for rituals, but mathematical schemes as well. Paulus Gerdes wrote numerous books about them (and about the mathematics of woven baskets too!). His booklet for Brazilian street children proposed to draw them back to school and the study of mathematics by teaching these sand drawings (Gerdes, 1990).

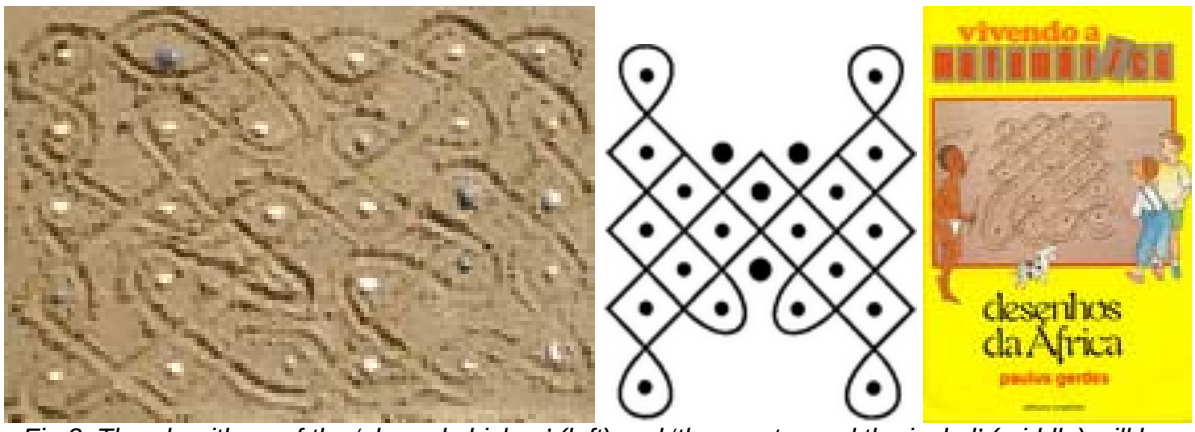

Fig.3: The algorithms of the 'chased chicken' (left) and 'the rooster and the jackal' (middle) will be executed during the talk; they are based on a book by Paulus Gerdes (right).

For instance, here is the story to be told when drawing the 'sona' of *'The Rooster and the Jackal'*:
The rooster Kanga and the jackal Mukuza wanted to marry the same woman. Both contacted her father with a proposal of marriage. He asked for payment in advance and they immediately agreed. Suddenly, there ran a rumour that the promised woman had died. Kanga started to cry inconsolably, whereas Mukuza only regretted having lost his advanced payment. Then the father, who intentionally had spread the rumour to see who would be worthy of his daughter, gave her to the rooster who had demonstrated his sincerity.
G. and T. Celis wondered why geometric non-figurative drawings enjoyed such a strong preference above figurative representations (Huylebrouck, 2004). They observed this in an isolated part in the Southeast of Rwanda. It was difficult to access and thus it was believed that most paintings were original traditional concepts, and not the consequence of the ever-progressing acculturation. The phenomenon of decorating huts by these so-called 'imigongo' seemed go back for about three hundred years in times. The legend relates how the tradition of decorating walls of huts was introduced by the notable Kakira ka Kimenyi, who was legendary for his 'purity' (mathematics = 'the pure science'!).

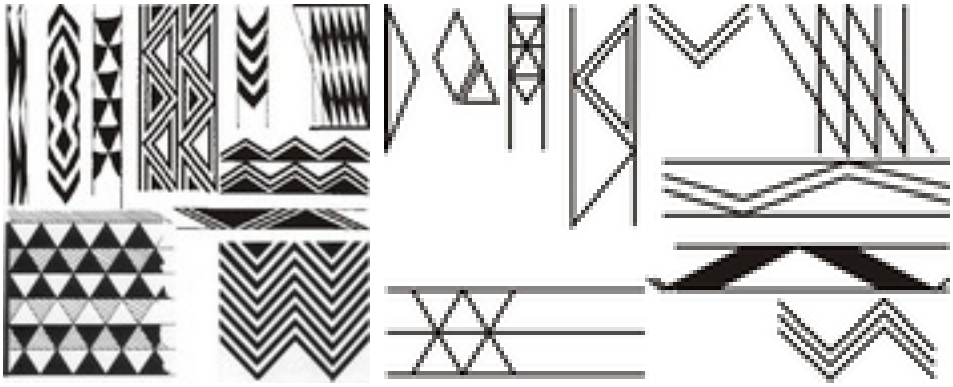

Fig.4: Traditional imigongo from Rwanda (left) and their 'explanation' (right).

Celis noticed all of the patterns they came across were combinations of a few elementary constructions. Only the vertical and horizontal directions, together with three skew lines and their symmetric directions with respect to a vertical axis suffice to form all motives. With these 8 directions, the 'imigongo' can be reduced to a few cases. A coincidence was that these geometric observations led to the rejection of certain recent drawings as unoriginal because they did not follow the prescribed rules. Others used the Kakira rules to program a computer such that traditionally correct patterns are created when designing fabrics.

A modern tale: '2001: A Space Odyssey'

The Ishango rod is an artifact that was found near a Congolese village called 'Ishango' by the Belgian archaeologist Jean de Heinzelin de Braucourt. This occurred more than 50 years ago when the Democratic Republic of Congo was a Belgian colony. The discoverer brought the petrified bone to the Royal Institute for Natural Sciences of Belgium (RINSB) in Brussels where it has remained ever since. The rod has three columns of clearly distinguishable fine groups of carvings. One column shows scratches in the following order: 3, 6 ; 4, 8 ; 10, 5 ; 5, 7. These numbers sum to 48. The first two pairs could indicate the operation of doubling. The other two columns show the groupings 11, 21, 19, 9 and 11, 13, 17, 19 respectively; that is 10+1, 20+1, 20-1, 10-1 and the prime numbers between 10 and 20. In his report on the excavations at Ishango, de Heinzelin advanced the hypothesis that the rod was evidence of some kind of arithmetical game. Despite the undeniably yet mysterious logic of the carvings, the rod remained for a long time nothing more than a singular artifact from the heart of Africa and for half a century the 22,000 years old rod was kept on the 19th floor of the museum, out of sight of the regular museum visitor.

The knowledge of African mathematics has increased greatly since the 1950s, and the emerging discipline of 'ethno-mathematics' established the hypothesis the Ishango rod is the oldest mathematically significant object ever found. And thus, in 2001, after half a century in a dusty drawer

on the 19th floor of the Brussels' RINSB, the Ishango rod descended to the main hall of the associated museum. In 2007, a second rod would confirm the established hypotheses.

Fig. 5: The location of Ishango (left); the Ishango showcase of the Brussels' RBINS (right).

The year 2001 when the Ishango rod first went on display was also the year of the Belgian Presidency of the European Community and thus a year of 'new expectations'. The year 2001 is also associated with Stanley Kubrick's movie '2001, A Space Odyssey' (Clarke, 1968). Its opening scène is well known: a human ancestor throws a bone, his first discovery of a tool, into space where it changes into a space ship. Kubrick has often been regarded as visionary in his movies, and gradually over time the idea of realising one of his visions by actually carrying the Ishango rod into space was conceived as a tribute to this metaphor.

Fig.6: Images from '2001: A Space Odyssey', reprinted with permission of Turner Co.

Nevertheless, both have to obey the obligatory rules of human decision making. The Belgian space mission of November 2002 was initially called 'Bel Odyssey' with a deliberate allusion to 'Space Odyssey (as well as to Bel-gium), but politics intervened: the name was changed into 'OdISSea', while the $10cm^3$ reserved for the rod were replaced by a nun's embroidery. Instead of listening to Strauss' opus 'Also Sprach Zarathustra', the astronauts enjoyed a song by Helmut Lotti, Belgium's Elvis Presley imitator. However, the movie '2001' has a sequel, entitled '2010: The Year We Make Contact' and this opens the door to another Ishango Odyssey attempt!

Fig. 7: Images referring to the theatre show "Africa+".

References

A.C. Clarke, *2001: A Space Odyssey*, based on the screenplay by Stanley Kubrick and A. C. Clarke, The New American Library, Inc. New York, 1968.
J. de Heinzelin de Braucourt, *Ishango*, Scientific American, 206-6, June, 105-116, 1962.
P. Gerdes, Vivendo a Matemática - Desenhos da África, Editora Scipione (Brasil), 1990.
D. Huylebrouck ed., *Ishango, 22000 and 50 years later: the cradle of mathematics?,* Conference proceedings, Royal Flemish Academy of Belgium, Brussels, Belgium, 2008.
D. Huylebrouck, *Africa and mathematics* (in Dutch, translated in French), VUBPress, Brussels, Belgium, 2004-2008.
G.G. Joseph, *The Crest of the Peacock: Non-European Roots of Mathematics*, Penguin Books, London, 1992.
W. F. Rowe, *School Daze: A Critical Review of the 'African-American Baseline Essays' for Science and Mathematics*, The Skeptical Inquirer, Sept.-Oct, 1995.