Diptych View on The Spiral

Françoise Beck-Pieterhons and Jacques Beck
Plastician Artists
Chemin des Baraques 10
B-1410 Waterloo, Belgium
E-mail: pomenou@gmail.com

Abstract

Two short papers are linked here by the relationship of their authors, lay people in mathematics, and by a same mathematical object that inspired them independently in creating a couple of works. The first author's passion for animals, even down to the humble shell displaying the particularly beautiful spiral shape that is a manifestation of mathematics in nature, informs her art in Part I. In Part II the second author reasserts the value of the past while embracing technology as a path to excellence and beauty. Relevant stakes, challenges and opportunities are illus - trated by the enlargement of a previous spiral-shaped hand made work shown at Bridges 2011 using a promising technology still in infancy.

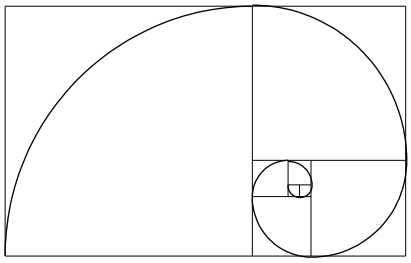

Figure 1: **a** - *Inspiring Sea Tranquility* **b** - *The Fibonacci Spiral* **c** - *Original and Enlarged Works*

Introduction

A two-dimensional spiral can be described using polar coordinates, where the radius r is a continuous monotonic function of angle θ. Perhaps among all types of spirals, the logarithmic spiral $r = a \cdot e^{b\theta}$ is the most interesting because approximations of this are found in nature.

The Fibonacci spiral is logarithmic and uses the Fibonacci numbers in order to wind the curve around a fixed point at a continuously increasing rate as it passes through certain vertices that are generated from a sequence of Fibonacci rectangles. Figure 1b presents construction of the Fibonacci spiral, which is based on a series of rectangles whose sides are consecutive Fibonacci numbers.

Part I. The Spiral: An Inspiration from Nature

The Spiral is a wonderful connection between mathematics and art. Such a mathematical object offers its shape throughout the universe. Indeed, like everybody, ever as I was a child I could distinguish this simple yet intriguing geometrical figure. I loved drawing it with finger and pencil, as I recognized spirals reflected in the natural world around me. No wonder it had to strike my mind later, when I was looking for painting projects.

But spirals in nature weren't included in my university years in either Brussels or Italy, my common knowledge of the subject was rather shallow and certainly so in a mathematical sense. Hence badly in need of documentation, deciding to tap the technology at hand, I readily got overwhelmed by the magic Internet search window swirling out an abundant wealth of information. Suddenly feeling like the Man who for the very first time entered a place where no other human being ever came before, I discovered loads of exciting material both on the spiral figure itself in its numerous mathematical variations and its recurrent place in the World at large, and in Nature in particular. Much more than I could swallow: from tiny plants to tornadoes, to the cosmos, and … to the animals. I appreciate their purity, their integrity and frequently their physical external perfection. Animals that have spirals in their overall shape often live in the sea, another world that fascinates me.

So I started what became an in-all-directions bibliographic written report [1]. I selected a drawing I had made representing a common North Sea whelk that we call a *bulot* in Belgium, scientifically known as *Buccinum undatum Linnaeus* [2], after Linné, considered a father of modern ecology, who was among the first to precisely establish a scientific classification of, by now, the some 80.000 different species of shells.

The 3-D shell in my work at the Bridges art show (Fig.1a), as its larger cousin, the conch (Fig.2a), easily can be morphed (here with 3D-XplorMath) to another much more common shell, the *snail shell* [4]. I borrowed images of this reference (Fig.2b) and from the given applet (Fig.2c) to invite readers to play with said applet and enjoy the way mathematical simulations vividly can render evolutionary evidence around the spiral concept.

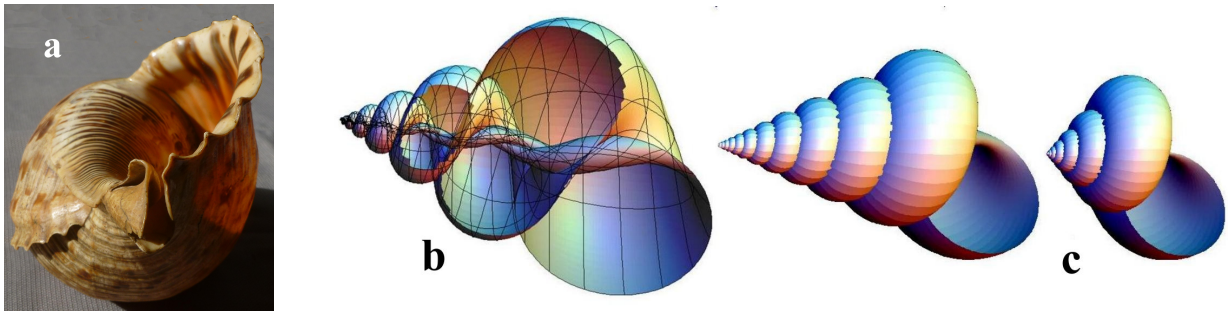

Figure 2: **a** - *'Charonia tritonis tritonis' – axial view* **b** - *Whelk or conch model* **c** - *morphing to snail*
(courtesy by Morgon family, Levie, Corsica)

Let me finish by sharing another discovery this study brought me to: we're in the midst, it seems to appear lately, of a complete overhaul of the above mentioned longstanding classification of shells triggered by recent advances in biology at the DNA level, itself a double spiral [5] which is another captivating swirling knowledge 'spiral' to check out once in a while indeed …

Part II. Manual Force and Technology Applied with Wisdom to Create Beauty

To know the world is not to reduce it to a system, it is to become intensely aware of it.
Andre Malraux. The Voices of Silence (1951)

The Legacy of Our Ancestors Meets the State of the Art

While evoking the memory of our fathers, I like to emphasize the individual memory, that of a gesture ever repeated and yet always different to reach, not an automatic, but a conscious control, which brings the result to completion. It remembers those humble unknown men and women who, throughout history, despite too many unfortunate losses, some due to excessive mechanization, have perpetuated their knowledge, invented and perfected techniques, know-how and proficient use of their tools.

Mechanization, when well-suited to our needs and correctly used, certainly saves us time, but is time always money? Man often no longer enjoys the present, he consumes it. Regrettably what is true for the body is, in many cases, also true about the spirit. Considerable services in all fields by powerful computer technologies alas, have two sides like every coin. Many microchips have led to an intellectual itch, and at the same time to a profound amnesia of basic things in favor of gadgets: reading maps, carrying out simple mental calculations become great feats. Wisdom is thus a key.

A 3D Printing Case as an Example

We just mentioned mathematics already (loss of calculus skills) ☺ … Learning to learn wisely rather than nurture Pavlovian reflexes is here shown in the learning curve to master a novel technology. Excellence in using technology is of a similar nature than excellence in using traditional hand-held tools. The Bridges Exhibits abound in works whose very existence stems from perfectly mastered novel techniques.

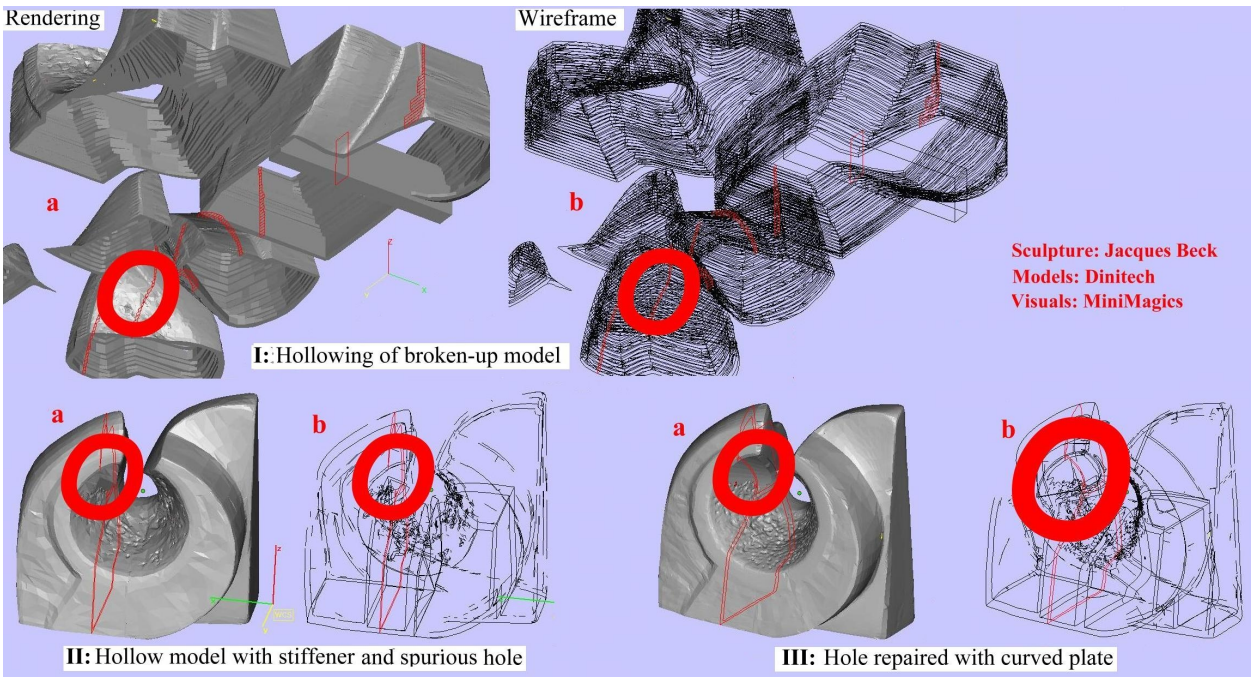

Figure 3: *Computer model of the artwork that shows the damaged and repaired part of the piece*

To realize such a curve in stone an artist needs to adjust his points of view from a two dimensional object to a three dimensional creation. A small hand-made artwork was presented at the 2011 Bridges Coimbra, Portugal [9]. This small artwork, which is located by the foot of the artist in the photograph (Fig.1c), needed to be enlarged in a proper way using considerable traditional hand-working. The goal was to not only the enlarged artwork can convey a sense of growth but also be properly stable and balanced.

An emerging creative 3D-printing technology [8] applied to large objects in stone-like materials, that are filled with lightweight foam, will eventually constitute an elegant solution to multiply the possibilities of my Multicsculpture concept. Here too, wisdom will be needed to turn it into Beauty. This first realization is a complex case where the needed new 'gestures' toward excellence are still in infancy.

The numerical model of the stone original obtained by 3D scanning and broken up in parts underwent a successful computerized hollowing process (Fig.3Ia,b here displayed using Materialise's MiniMagics [10]) needed for diminishing the weight of the final enlarged copy. During the parts assembling and the introduction of internal stiffening panels, a hole appeared inadvertently in a portion of the conical face (Fig.3IIa,b, see inside of loops) and got repaired by the introduction of a doubly curved triangle (Fig.3IIIa,b). It is during the physical translation of the now routinely satisfactory computer modeling into reality that the sprinkling process of hardening liquid on the successive layers of powder couldn't be tuned yet to a sufficient control, resulting in an overall thickening of the expected shape.

An Interesting Point Emerged from the Struggle with the New

Awaiting for the learning curve to bring this promising technology into a new fully respectful craft, let's conclude that a considerable manual rework by traditional chiseling got unexpected beauty on a different shape enhanced by the typical visual layering perception given by the 3D printing process as a welcome byproduct.

Acknowledgments and Copyrights

Gratitude is due to each other, Samuel Verbiese, Eric Laysell, Riccardo Dini (Dinitech) and last but not least to the referees and reviewers who provided much appreciated suggestions on math contents and English language. The Multisculpture concept is deposited at the BOIP (www.bmb-bbm.org).

References (on-line links are as of May 3rd 2012)

Part I:

[1] Françoise Beck-Pieterhons, *Survey on the Spiral,* 2012, attachment to this paper on Conference CD.
[2] http://en.wikipedia.org/wiki/Buccinum_undatum.
[3] http://gallery.bridgesmathart.org/exhibitions/2012-bridges-conference/fbeck.
[4] Traudel Karcher, http://virtualmathmuseum.org/Surface/snailshell/snailshell.html.
[5] http://en.wikipedia.org/wiki/Gastropod.

Part II:

[6] Jacques Beck, *Multisculpture or Polymorphic Sculpture : A Different Approach to Sculpture to Challenge and Nurture Reflection : Both in the Sculptor and in the Viewer*, Proc. Bridges 2010 Conference, Pécs, Hungary. And: http://gallery.bridgesmathart.org/single-artist?uid=jafrapo.
[7] Jacques Beck, *The Art of Manual Stone Carving as a Leap to its Virtual Future*, Proc. Bridges 2011.
[8] Rinus Roelofs, http://www.rhinojungle.com/profiles/blogs/concrete-3d-printed-sculpture and Dinitech, www.dinitech.com.
[9] Jacques Beck, *The Others of Me or The Alternate Emotions,* Catalog Bridges 2011.
[10] MiniMagics: http://software.materialise.com/minimagics.