Knots as Processes in Art and Mathematics

Bojana Ginn
MFA Candidate 2012, Savannah College of Art and Design
1280 Peachtree Street (Art Center Way and 15th St.) • Atlanta, GA, 30309 • USA
bginn@mindspring.com

Abstract

Analysis of reality in both math and art follow certain processes and methods. In this paper, I will show the correlation between the exploration of knotted structures in my art with the research of mathematicians Radmila Sazdanovic from the University of Pensylvania, co-author of the book *LinKnot - Knot Theory by Computer,* and the work of L.G. Meredith and David F. Snyder from Texas State University, *Knots as Processes: a New Kind of Invariant*.

Introduction

In order to understand the meaning of knotted structures in my art, it is important to analyze the meaning of line in my work. I see line as a carrier of information. This understanding is influenced by the experiences of line and line-looking objects in everyday life. Lines on roads divide traffic into lanes, inform with their shape, and point as an arrow. Less than a decade ago, telephone cables transported our voices. We still see power lines conveying electricity: simple and black on the outside, alive and active in the inside. Our Internet lines (cables) are used to transport letters, documents, photographs. In biology, our genetic information has a curly-line-form placed inside of chromatids. In medical diagnostic technology, lines of EKG or EEG inform us of the nature of pulsations in our hearts and brains. Lines in seismographs educate us about the movements of the Earth. Examples are numerous. The forms of wavy line and knot-like structures are at the base of my wire sculptures. If line is information, then knots are events: by bending, breaking and manipulating line, we create a story, an event. To sculpt is to analyze, to ask what happened, or what is happening; to discover/reveal the mechanism, to elevate the event to the level of happening (Figure 1).

Figure 1: *Knotted Evolution, Wire and Wool, 60x50x40 Inches, Bojana Ginn, 2011*

Knots as Processes

In the research concerning one variable polynomials with integer coefficients in the work of R. Sazdanovic, lines are organized into diagrams for categorification. The diagrams were motivated by Temperley-Lieb algebra, which is related to braid group and knot theory. When these lines cross each others' paths, when they intertwine, they influence each other and change. This moment of contact, or impact, at the place where two entities collide, the place where the drawing is made, is highly metaphorical and can be applied to numerous examples in our life. Interactions with people, things, and ideas constantly affect us and carve us into who we are. On a larger scale, the interaction of genetic information with environmental changes is at the base of evolution.

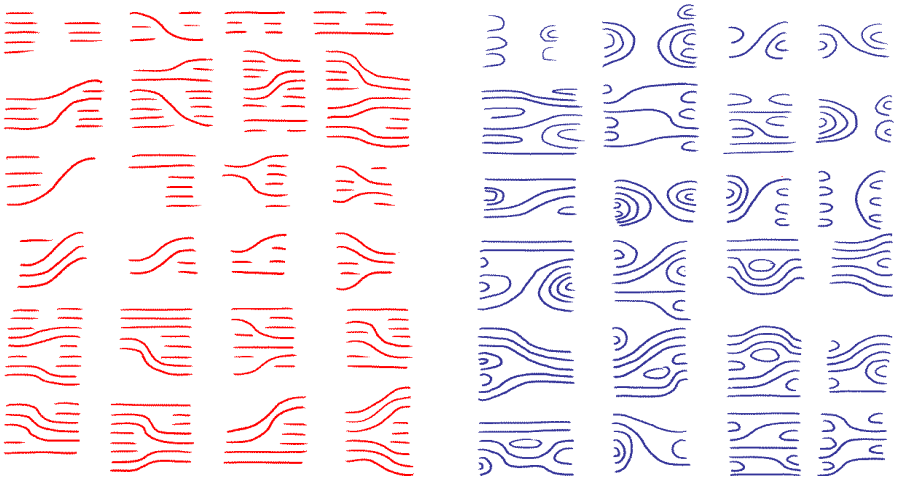

Figure 2: *Diagrams for categorification of one variable polynomials with integer coefficients, Radmila Sazdanovic, 2010*

The place where lines are crossed is the place that defines the knot, as graphically described by Reidemeister moves (Figure 3a). With the simple act of wire twisting, the artist determines the character of a knot (Figure 3b).

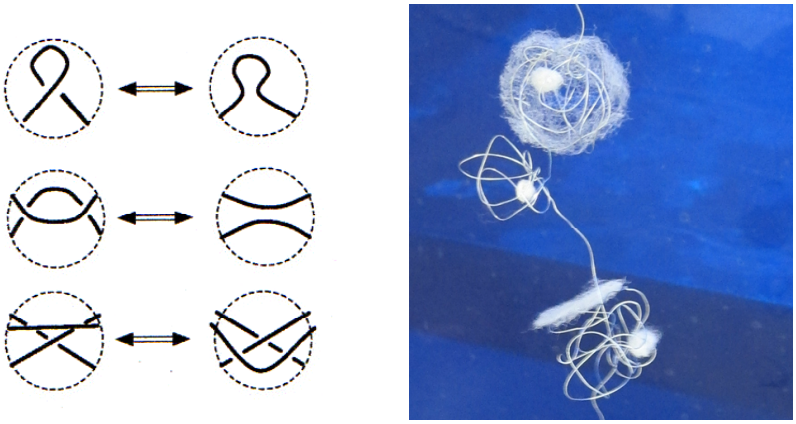

Figure 3: *(a) The three Reidemeister moves; (b) MiliKnots, 5x2x2 Inches, Bojana Ginn, 2011*

Knots can be transformed into braids and the other way around (Figure 4):

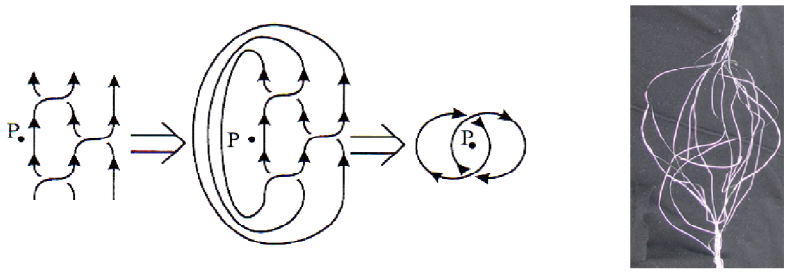

Figure 4: *(a) The closure of a braid. P. D. Bangert, Braid Theory; (b) Multihelix, Detail, 10x5x5 Inches, Bojana Ginn, 2011*

Knots can also be observed as processes (Figures 5 and 6):

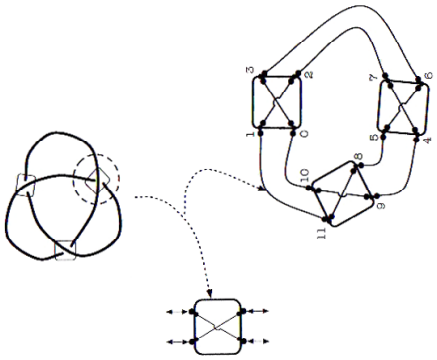

Figure 5: *The trefoil knot as process, Knots as Processes: a New Kind of Invariant by L.G. Meredith and David F. Snyder*

Figure 6: *Three Steps: Wire, Shadow, Drawing, 12x8x4 Inches, Bojana Ginn, 2011*

The installation *Three Steps: Wire, Shadow and Drawing*, is a creative response to conversations with Radmila Sazdanovic and my interpretation of *Knots as Processes: a New Kind of Invariant* by L.G. Meredith and D.F. Snyder. The steps in decoding knotted structures in mathematics are parallel to the processes of translating drawing through different mediums and dimensions. **Step 1**. Through the use of wire, drawing is situated as a knot inside space. **Step 2**.

The physical wire-knot cast an immaterial shadow, which was translated into a two-dimensional image by the use of graphite. **Step 3**. The graphite drawing is ultimately brought to life through imagination, and through pigments of pencil and watercolor. The installation *Inspired by Math* (Figure 7), containing one knotted structure and one painting is created by the multiple application of the three step methodology. Just as in the work *Three Steps*, this installation talks about the way through which scientific methods perceive reality. In scientific experiment, three-dimensional phenomena are analyzed and described through two-dimensional means: numbers and graphs. By using these graphs and numbers, models of reality are made. What is fascinating is that based on these models scientists can predict outcomes of our interactions with the physical world with extremely high precision! Is this logic applicable in art? Absolutely! As "meaning" floats from 3D drawing into its immaterial shadow and into a pigment on canvas, discrepancies between dimensions are automatically adjusted and the reverse process seems to be equally possible: on canvas, pigment entangles with shadows out of which the structure evolves.

Figure 7: *Inspired by Math, Mixed Media Installation, 36x48x26 Inches, Bojana Ginn, 2012*

References:

[1] Meredith, L.G., Snyder, David F., "Knots as Processes: A New Kind of Invariant." (2010), http://arxiv.org/pdf/1009.2107v1

[2] Jablan, S., Sazdanovic, R., 'LinKnot: Knot Theory by Computer', World Scientific Edition 'Knots and Everything' 21 (2007) pp.500 ISBN 978-981-277-223-7

[3] Khovanov, M., Sazadanovic, R., Categorifications of the Polynomial Ring, http://arxiv.org/abs/1101.0293