Hypercylindrical Art

Ion Bica

MacEwan University, Edmonton, AB, Canada; bicai@macewan.ca

Abstract

Every form and shape that surrounds us has a purpose, and mathematics helps in understanding it. Mathematics provides a source of abstract forms, i.e., mathematical structures, which are deliberately emptied of any content and therefore adaptable to any content. Art History is a testimony of great artists who adapted abstract mathematical forms, giving them artistic content. The article was inspired by a piece of art that I purchased of a talented emerging Ecuadorian artist, Tanya Zevallos. Her "Cylindrical Abstract Construction #124" artwork inspired me to look at the mathematical perspective that she gave in her art and construct further abstract aesthetics using cylinders.

"Cylindrical Abstract Construction #124" by Tanya Zevallos

I was happy to buy a print of Tanya Zevallos' original art, Figure 1 (personal photo taken of the print), entitled "Cylindrical Abstract Construction #124" [7]. Her art inspired me greatly in the way, by my interpretation,

Figure 1: *"Cylindrical Abstract Construction #124" by Tanya Zevallos. An aesthetic view of a hypercylinder.*

she described a hypercylinder. An artist does not tell us what we should feel about their art or what we should see in their art. They convey their creativity in the medium where they produce their artwork, and its aesthetics will be in the eyes of the beholder. When I look at a piece of art, I must see beyond its title and descriptions given by art experts. A work of art must engage me regardless of its title and what experts say about it. Tanya Zevallos' "Cylindrical Abstract Construction #124" engaged me and therefore inspired me to dive deeply into what I perceived she is relaying in front of me, i.e., a beautiful image of a hypercylinder. Her "Cylindrical Abstract Construction #124" convinced me that she adapted an "empty of content" mathematical structure to artistic content, and therefore giving that mathematical structure a purpose. Art is very personal and subjective, but it is an integral part of the human condition.

Perspectives Used in the "Cylindrical Abstract Construction #124"

Figure 2 shows the top and the side views of a cylinder. The cylinder considered is a right circular cylinder, which intuitively it can be understood as a solid of revolution of a rectangle about one of its axes. Taking the two surfaces, the top view and the side view surfaces, and distorting them (i.e., giving them perspective), we obtain the pictures in Figure 3. By placing them to each other as shown in Figure 4, we expand the cylinder

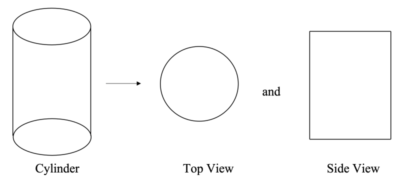


Figure 2: *Top and side views of a cylinder.*

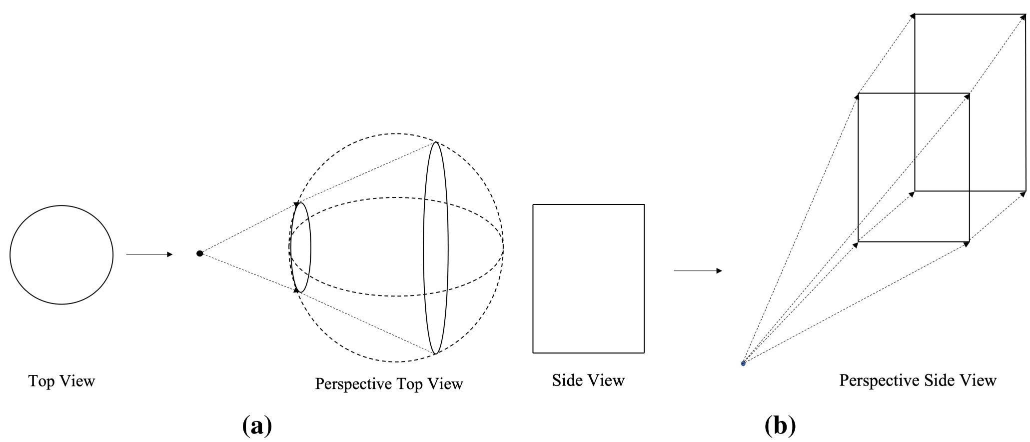


Figure 3: *Perspective views: (a) distorted top view, (b) distorted side view.*

from Figure 2. The eye is beguiled to perceive the higher dimensionality of the new object created in Figure 4, i.e., the birth of a hypercylinder. I was drawn to believe that the artist, Tanya Zevallos, was in search for the

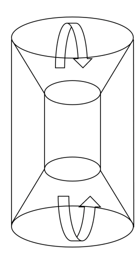


Figure 4: *Hypercylinder.*

higher dimension for the cylinder concept. The hypercylinder in Figure 4 is the result of rational deduction based on perspective view. The perspective of the top view from Figure 3, Figure 3a, can be understood on the following rational grounds

- A point is part of an infinite set that describes a circle.
- A circle is part of an infinite set that describes a sphere.

The perspective of the side view from Figure 3, Figure 3b, can be understood on the following rational grounds

- A point is part of an infinite set that describes a line.
- A line is part of an infinite set that describes a plane.
- A plane is part of an infinite set that describes a volume.

To get more insight into the rational statements described above, we start with how we can define abstractly a cylinder. Given a fixed-line and a circle, the set of all tangents to the circle (the circle is 2-dimensional curving into 3-space) parallel to the fixed-line forms a cylinder tangent to the circle, i.e., the set creates a cylindrical surface tangent to the circle. Then, Tanya Zevallos' hypercylinder can be understood as follows: given a fixed-line and a hypersphere (3-dimensional surface curving into 4-space), the set of all tangent lines to the hypersphere that are parallel to the fixed-line forms a hypercylinder tangent to the hypersphere, i.e., the set creates a cylindrical hypersurface tangent to the hypersphere.

In art history, the two decades between 1890 and 1910 were considered the golden era for higher-dimension mathematical objects in art [5]. For example, the British mathematician Charles Howard Hinton had innovative ways to explain hypersurfaces. Hinton's visualization of a hypercube [5] resembles the visualization of the hypercylinder in Figure 4.

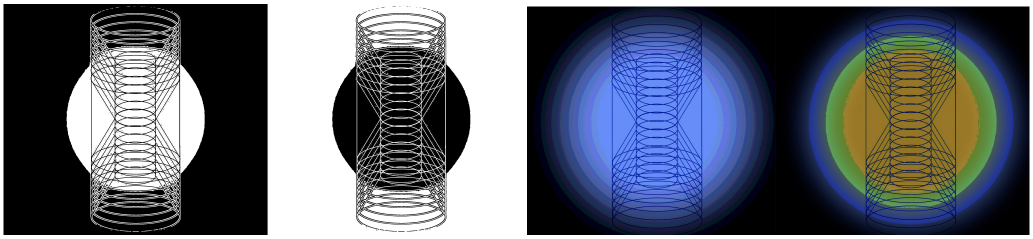
Another example of renowned mathematicians who studied hypersurfaces was the British mathematician William Kingdon Clifford, with his renowned Clifford algebra (geometric algebra) [4]. His torus, "Clifford torus," is obtained through a stereographic projection of a hypercylinder.

In his book for the general audience "Relativity" [3] Einstein reveals his view of the universe as shaped as a hypercylinder whose length was determined by the total number and composition of the forms of manifestation of energy (matter, field, radiation, vacuum) in this cylinder. The time (the fourth dimension) in this model was directed from the endless past to the endless future. Einstein explained Minkowski's 4-dimensional space, where physical phenomena are "naturally four-dimensional in the space-time sense."

Thus, the preoccupation of understanding the structure of a hypercylinder was and will be a scholar's preoccupation, regardless of their background, scientist or artist, or simply curious minds about the high-dimensionality concept.

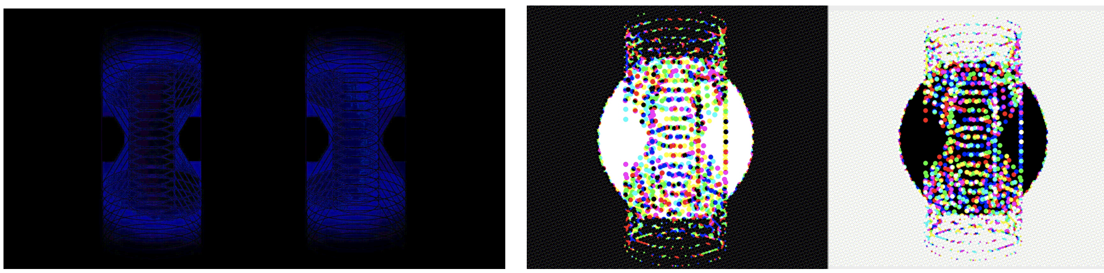
Inspired Original Art Using Hypercylinders

This section is simply an original artistic reflection on the hypercylinders inspired by Tanya Zevallos' artwork. At the same time, my thinking on these hypercylinders is influenced by the paintings of Mark Rothko (1903-1970) [6] who was a leading figure in Abstract Expressionism, Figures 6a & 6b, and Victor Vasarely (1906-1997) [1] who was a pioneer in the Op Art (i.e., established nickname for Optical art), Figures 5a & 5b. For example, Figure 5a was inspired from Vasarely's composition "Supernovae" [6]. The composition in this figure depicts how I feel, personally, about my own higher dimensional state in the scheme of things. As well for example, Figure 6a is strongly influenced by Rothko's composition "Black on Maroon" [6] a composition that I find it, personally, "haunting." In Figure 6b, the agitated repetition of disks and lines, like pixelated "confetti" in space, has the characteristics of many compositions of Vasarely.



(a) *Hyper Yin and Yang.* **(b)** *Hyperise.*

Figure 5: *Personal artistic view on hypercylinders.*



(a) *Midnight Blue.* **(b)** *Confetti.*

Figure 6: *Personal artistic view on hypercylinders.*

Summary and Conclusions

In this article, I realized the following main goals

- I acknowledged the artwork of Tanya Zevallos who succeeded in giving an artistic meaning of an empty of content mathematical structure and therefore giving that mathematical structure a purpose.
- I gave an intuitive mathematical description of the object I admired in Tanya Zevallos' artwork.
- Inspired by Tanya Zevallos' artwork and the paintings of Mark Rothko and Victor Vasarely, I created my original artistic view through the Figures 5-6.

Here I intended to mainly capture the attention of the visual artists who follow the endeavours of the Bridges Organization. I am a mathematician with research contributions in differential equations and mathematical modelling. Yet, mathematics in art, music, architecture, and culture is vital for me as it helps improve my imagination. And why am I interested in enhancing my imagination through art, music, architecture, and culture? Because I believe in "Imagination is the highest form of research" [2].

References

[1] T. Aknai and J. Sárkány. "Vasarely Múzeum." Janus Pannonius M*ú*zeum, P*é*cs, 2000.

[2] A. Einstein. https://quotessayings.net/quotes/imagination-is-the-highest-form-of-research-2216964.html.

[3] A. Einstein. "Relativity." 15th ed, Three Rivers Press, New York, 1952.

[4] S. G. Franchini, F. Sorbello and G. Vassallo. "A brief introduction to Clifford algebra." 2010.

[5] M. Kaku. "Hyperspace." Doubleday Press, New York, 1995.

[6] S. Wilson, "Tate Gallery, An Illustrated Companion." Tate Gallery Publishing, 1997, pp. 216-229.

[7] T. Zevallos. "Cylindrical Abstract Construction #124." 2021. https://www.saatchiart.com/art/Painting-Cylindrical-Abstract-Construction-124/467318/8199724/view.