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The timeless journey of the Möbius strip: circulation and transposition into different artistic mediums

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Abstract: From the twentieth century up to the present, the Möbius strip has been translated from mathematics into other fields, such as visual arts, design and architecture. Due to the versatility of allegorical and spiritual meanings it can mediate, this surface describing an abstract topological space has been assimilated in various artistic fields and materialities, especially in contemporary art. Thus, the Möbius strip stands out as a binder-motif that becomes a transposable concept with the potential to create new constellations of association and meaning, making connections between various disciplines, such as visual arts, architecture, design, literature, mathematics or psychology.

Keywords: Möbius strip, transposable concept, visual arts, architecture.

The Möbius strip or Möbius band is a looped surface with only one side and only one edge. A pattern of this band can be easily made by taking a rectangular strip of paper, twisting it 180 degrees, and gluing its two ends. One of its properties is that if one traces its entire surface starting from a certain point, it will reach back to the original point. The Möbius band was discovered and described in 1858 by two German mathematicians, August Ferdinand Möbius and Johann Benedict Listing, who worked independently of each other[2]. Various graphic representations of the Möbius band (Fig. 1) made by the former can be found in the second volume of *Gesammelte Werke*[3], published posthumously in

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[2] Jolly Thulaseedas and Robert J. Krawczyk (2003), *Möbius Concepts in Architecture*, in "Meeting Alhambra, ISAMA-BRIDGES Conference Proceedings", ed. Javier Barrallo *et al.*, University of Granada, Granada, p. 353, retrieved from https://archive.bridgesmathart.org/2003/bridges2003-353.html#gsc.tab=0

[3] August F. Möbius (1885), *Gesammelte Werke: Zweiter Band*, ed. Felix Klein, S. Hirzel Verlag, Leipzig, p. 520.

1885. These designs vary according to the number of half-rotations to which the original band is subjected, around its central axis.

Starting from the 20th century to the present, the motif of the Möbius strip has circulated in various artistic fields such as visual arts, music, architecture and design, being reinterpreted and transposed in various mediums, in accordance with the intentions of those who approached it. Accordingly, over time, consistent with the artistic vision and materiality associated with it, this motif ends up being given multiple meanings, beyond or in line with the generally accepted metaphorical meanings that have been assigned to it. In the general sense, the Möbius strip is read to represent notions such as infinity, continuity, unity, as a metaphor for the universe or as a symbol of the derision and constraints associated with human existence.

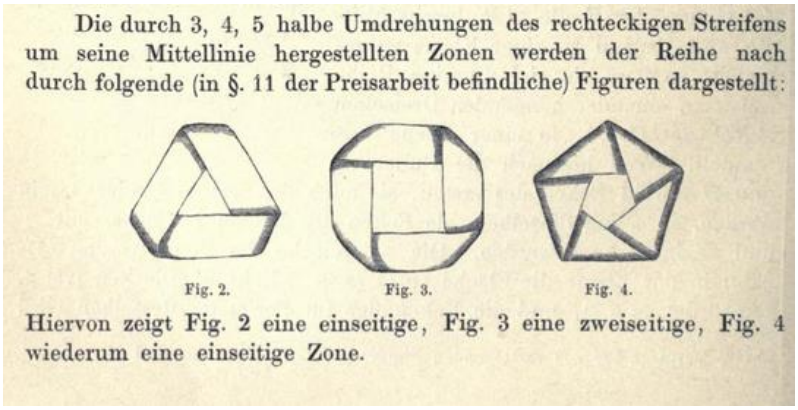
Die durch 3, 4, 5 halbe Umdrehungen des rechteckigen Streifens um seine Mittellinie hergestellten Zonen werden der Reihe nach durch folgende (in §. 11 der Preisarbeit befindliche) Figuren dargestellt:

Fig. 2. Fig. 3. Fig. 4.

Hiervon zeigt Fig. 2 eine einseitige, Fig. 3 eine zweiseitige, Fig. 4 wiederum eine einseitige Zone.

Fig. 1 August F. Möbius, illustrations of the Möbius strip.
Excerpt from Gesammelte Werke: Zweiter Band, 1885

Illustrating several instances of the path taken by the Möbius strip motif in and through different artistic fields, materialized through transposition and assimilation istead of mimetic representation, this motif can be read as a "transposable concept". These concepts, which Rosi Braidotti described as "nomadic notions" weaving a network that connects philosophy to social realities, theoretical speculations to concrete plans, concepts to imaginative figurations"[4], capture the malleability and adaptability of the Möbius strip, understood as a motif that has the potential to create links between different fields such as visual art and mathematics or literature, architecture and design.

Moreover, Michael Schwab states that "the fact that transpositions leap between diverse domains and therefore create connections between different domains suggests a generative capacity not on a line of simple repetition of form,

[4] Rosi Braidotti (2006), *Transpositions: On Nomadic Ethics*, Polity Press, Cambridge, p. 7.

but on one of formal or informal (metaphorical) permutation."[5] Such permutations can be captured by visual art, design or architecture projects, which incorporate in the process of articulation and edification the *Möbius* strip, whose symbolic meanings support and enhance the creative approach.

In his work *Möbius Strip I* (Fig. 2) the Danish-born artist Maurits Cornelis Escher combines the physical properties of the strip with the Ouroboros (Fig. 3), a symbol of ancient mythology frequently found in Egyptian and Greek culture. This is a representation of the serpent or dragon swallowing its own tail, understood as metaphor for the cyclical regenerative transformations of the universe[6], the eternal passage of time that periodically turns upon itself, and the cyclicity of human existence, framed by the natural succession of birth, death and rebirth. In Escher's interpretation, we can identify "three fish"[7] that swallow one another's tails, in turn, the theme of eternal continuity being supported, thus, by the synthetic association of the symbolism specific to the Ouroboros motif with that of the Möbius strip.

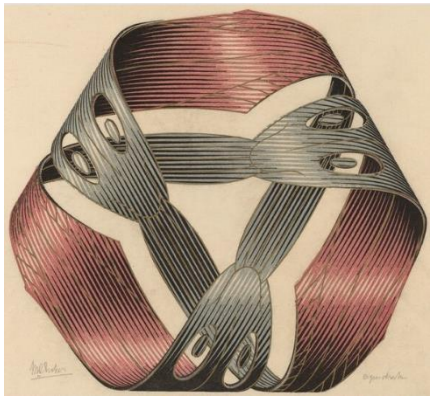

Fig. 2 M. C. Escher, *Möbius Strip I*, woodcut, 30.8 × 31.12 cm, 1961

Fig. 3 Ouroboros, the tomb of Tutankhamon.

Two years later, Escher takes up the same motif in a new work, *Möbius Strip II* (Fig. 4), in which he represents a series of ants walking endlessly one after the other in a continuous loop. Referring to some of his works, including the two designs of the Möbius strip, Escher stated that "the ideas behind them often bear witness to my amazement and wonder at the laws of nature that operate in the world around me"[8]. This attitude led the artist to often refer to

[5] Michael Schwab (2018), *Introduction*, in "Transpositions: Aesthetico-Epistemic Operators in Artistic Research", Leuven University Press, Leuven, p. 15.
[6] Alicia Maravelia (2018), *The Thrill of Time through the Ancient Egyptian Religion and Art: Ouroboros as an Archetype for the Meta-physics of Eternity*, in "The Oriental Studies", 81, p. 5.
[7] Maurits C. Escher (1975), *The Graphic Work of M.C. Escher*, Ballantine Books, New York, p. 11.
[8] *Idem*, p. 6.

abstract notions from the field of mathematics in his practice, in an attempt to interrogate and analyze these natural rules of the universe. From this point of view, works like Möbius Strip I, II can be read as "visual demonstrations"[9] of some abstract notional elements. Thus, in the previously mentioned works, the motif of the Möbius strip becomes a mediator between concept and visual representation, facilitating the transposition of a mathematical idea that refers to the concept of infinity in the artistic medium of woodcut.

In 2015, Canadian artist Andreas von Zadora-Gerlof took over and translated Escher's *Möbius Strip II* from woodcut to kinetic art (Fig. 5). He proposes a monumental sculpture three and a half meters high, using materials such as aluminum, copper and carbon fiber, along with a series of electrical and magnetic mechanisms [10], to allow the nine ants originally imagined by Escher to move along the Möbius band. If in the two-dimensional paper of 1963 they appear to be opposite each other, ambiguously suggesting the existence of two distinct surfaces of the band, one outside and one inside, then in von Zadora-Gerlof's work it becomes obvious that the ants move on the same continuous surface.

Fig. 4 M. C. Escher, *Möbius Strip II*, woodcut, 58.42 × 31.43 cm, 1963

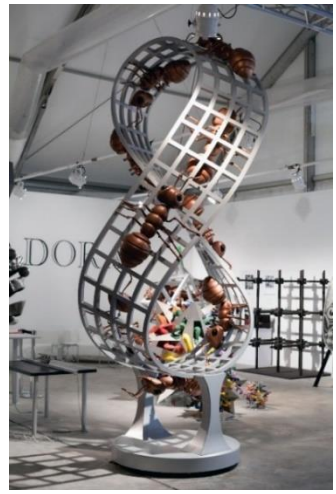

Fig. 5 Zadora's workshop, *Möbius Strip 2*, kinetic sculpture, aluminum, copper and carbon fiber, height: 350 cm, 2014-2015

[9] Jean C. Rush (1979), *On the Appeal of M. C. Escher's Pictures*, in "Leonardo" 12, no. 1 (Winter), p. 49, retrieved from www.muse.jhu.edu/article/598892

[10] Andreas von Zadora-Gerlof, Mobius Strip II, von Zadora, viewed on 18.01.2023, http://vonzadora.com/portfolio/mobius-strip-2/

At a first glance, *Möbius Strip 2* appears to be a mimetic reiteration of Escher's. However, in her PhD thesis entitled "Translation in the Language of Sculpture", published in 2022 at the University of Auckland, Natalie Fae Guy proposes that such a creative transfer, from a two-dimensional medium to a three-dimensional one, can be understood as an act of non-verbal translation between two different artistic areas, accepted as an original in its own right, which does not offer the possibility to faithfully reconstruct the original work based on it, even if it is thematically related to it[11]. Thus, Natalie Fae Guy's research, which uses the categories of intersemiotic translation (between different channels) and intrasemiotic translation (between equivalent channels) structured by Henrik Gottlieb in *Semiotics and translation* (2017), allows the act of translating *Möbius Strip II* from woodcut to sculpture through *Möbius Strip 2* to be read not only as a stand-alone work, but also as an intersemiotic translation specific to artistic fields.

The motif of the Möbius strip has been taken up and translated into the medium of sculptural creation by other artists, such as John Ernest or Tim Hawkinson, each of them having distinct approaches, depending on the particularities of their artistic practices. The former, being passionate about mathematics, included elements specific to it in his works[12], so that part of them are visual representations of abstract mathematical models. His original interpretation of the Möbius strip appeals to the notion of negative space, so that this motif is reinterpreted within the free area of the parallelepipedal shape defining the constructivist *Moebius Strip* sculpture (Fig. 6). Thus, the artist brings to the fore the fact that a property of a mathematical surface can also be represented by means of solid volumetry[13], synthetically associating the field of topology with sculpture.

Another way of transposing the Möbius strip motif in a sculptural context can be identified in the work *Möbius Ship* (Fig. 7) made by Tim Hawkinson in 2006. His artistic practice involves the reconfiguration of ordinary objects into sculptures or novel artistic installations, the artist often addressing themes such as time, repetition, claim, cause and effect[14], and exploring the connections between nature, technology and human perception. Through the *Möbius Ship*

[11] Natalie Fae Guy (2022), *Translation in the Language of Sculpture*, PhD thesis, The University of Auckland, p. 54, retrieved from https://hdl.handle.net/2292/59487
[12] Paul Ernest (2009), *John Ernest, a Mathematical Artist*, in "Philosophy of Mathematics Education Journal" 24, (December) non-paged, retrieved from https://education.exeter.ac.uk/research/centres/stem/publications/pmej/pome24/index.htm
[13] Alan Fowler (2009), *A Rational Aesthetic*, in "Philosophy of Mathematics Education Journal" 24, (December): non-paged, retrieved from https://education.exeter.ac.uk/research/centres/stem/publications/pmej/pome24/index.htm
[14] Jeffrey Kastner (2016), *Tim Hawkinson*, in "Artforum", (May), retrieved from https://www.artforum.com/events/tim-hawkinson-10-218593/

sculpture, Hawkinson associates the symbolism of Möbius strip's infinite loop motif with Captain Ahab's obsession with the white whale, the eponymous character from Herman Melville's novel *Moby Dick*. The ship seems to be perpetually following itself, mirroring how Ahab obsessively pursued his own vision of the whale[15]. The complexity and ingenuity of the structure created by Hawkinson thus becomes a visual metaphor for the events conveyed in the epic work of the American author.

Fig. 6 John Ernest, *Moebius Strip*, sculpture, wood, metal, wood fiber plywood and alkyd paint, 244 × 214 x 58.5 cm, 1971-1972

Fig. 7 Tim Hawkinson, *Mobius Ship*, sculpture, wood, plastic, plexiglas, rope, staples, string, thread, plastic necklaces, glue, 265 x 310 x 130 cm, 2006

Due to the complexity of the symbolic and philosophical meanings associated with it, the motif of the Möbius strip has been transposed and integrated into works of performance art. An eloquent example in this sense is represented by the experimental practices of the artist Lygia Clark, "generally understood as multisensory experiences, whose importance lies in understanding artistic research beyond the visual."[16] Together with Hélio Oiticica and Lygia Pape, she laid the foundations of the neo-concrete art trend in Brazil (1959-1961), which promoted the understanding of art as an experience lived in the everyday, the latter becoming a living canvas that facilitates awareness of the actions: to be, to do or to experiment[17]. Throughout the 1960s, beyond exploring the dichotomies of body-mind, subject-

[15] Elizabeth Schultz (2019), *The New Art of Moby-Dic*k, in "Leviathan" 21, no. 1 (May), p. 31, retrieved from https://doi.org/10.1353/lvn.2019.0001

[16] Suely Rolnik (2007), *The Body's Contagious Memory: Lygia Clark's Return to the Museum*, in "European Institute for Progressive Cultural Politics", (January), retrieved from https://transversal.at/transversal/0507/rolnik/en

[17] Jessica Gogan (2022), *Reading the World Before the Word: Post Neoconcrete Legacies and Decolonial Pedagogie*s, in *"LA ESCUELA"*, 8 June, retrieved from https://laescuela.art/en/campus/library/mappings/reading-the-world-before-the-word-post-neoconcrete-legacies-and-decolonial-pedagogies-jessica-gogan

object and individual-collective, Clark focused on corporeality and human perception in her practice, proposing a series of actions and "relational objects" that could directly engage the audience[18], in a way that synesthetically combines everyday life and artistic experience, the self and the collective. In *Caminhando* (1963) Clark explores these continuously developing relationships between exterior and interior through the Möbius strip. Initially, participants create their own Möbius strip out of paper and glue. They then pierce its surface with scissors, and continue to cut along the strip until its width becomes too thin to continue. Thus, the notion of "choice" is the conceptual basis of *Caminhando*[19], and the artistic act itself is realized through the temporary relationship that is established between the participant and the object. In the work *Diálogo de mãos* (1966) Clark's and Oiticica's hands, engaged in a non-verbal dialogue, are connected to each other by an elastic strip in the shape of a Möbius strip. The bodily closeness and gesture involved in the work explore the paradox of physical proximity[20]. The two human instances try to form connections at a cognitive level through physical touch on the skin, understood as a surface that delineates the self from the outside, through a sensory act that brings them extremely close but does not completely eliminate the psychological barriers specific to communication and perception. In both *Caminhando* and *Diálogo de mãos*, Clark resorts to the symbolic continuity of Möbius strip's surface, between its imagined outer and inner sides, in order to interrogate the potential of experimental art to make connections between self and others, between human and object, between body and mind, taking over elements from psychology and psychoanalysis in her artistic practice.

Fig. 8 Lygia Clark, *Caminhando*, action, paper, glue and scissors, 1963

Fig. 9 Lygia Clark and Hélio Oiticica, *Diálogo de mãos*, performance, elastic bandage, 1996

[18] Christine Marcel (2017), Part 1: *Lygia Clark: At the Border of Art*, in "Post MoMA", 20 June, retrieved from https://post.moma.org/part-1-lygia-clark-at-the-border-of-art/

[19] Lygia Clark, *Caminhando*, in "Lygia Clark portal", viewed on 14.10.2023, retrieved from https://portal.lygiaclark.org.br/acervo/189/caminhando

[20] Daniel Birmbaum (2014), *Lygia Clark*, in "Artforum", October, retrieved from https://www.artforum.com/events/lygia-clark-4-207128/

The motif of the Möbius strip can also be found in the designing stage or even in the volumetric realizations of some architectural projects, both on a small scale - pavilions - and on a monumental scale, when it is taken up within several proposals for socio-cultural buildings. A conclusive example in this regard is the ContemPLAY pavilion, created in 2012 by a team of students from the DRS (Directed Research Studio) at the McGill School of Architecture in Montreal, together with FARMM (Facility for Architectural Research in Media and Mediation). Its constructive composition is based on a series of structural elements of glued laminated wood and steel tubes, which can be described as a whole as a curved space beam. This beam, rotated around its own axis, joins itself, describing a Möbius strip. Aiming to achieve a certain visual effect (a mill of patterns of parallel and rotated lines)[21], the resistance structure of the pavilion is clad with several slats with winding paths, made of wood. Thus, through materiality and volumetric play, the pavilion delimits an ambiguous space, simultaneously perceived as both interior and exterior. This sensation is emphasized by the play of lights and shadows given by the interaction of the sun's rays with the wooden slats.

Fig. 10 The ContemPLAY pavilion, made by students under the guidance of the Directed Research Studio, McGill School of Architecture; Montreal, 880 cm x 670 x 370 cm, 2012

Resorting to the same type of volumetry, the Danish architecture office BIG won the international competition for project proposals for the New National Library in Astana, Kazakhstan, organized in 2009. The architectural project they proposed had to be able to describe a monument "both local and universal, contemporary and timeless, unique and archetypal", as Bjarke Ingels put it [22].Thus, it was decided to merge and redesign familiar geometric and spatial

[21] Alison Furuto (2012), *The ContemPLAY Pavilion / DRS + FARMM*, in "Archdaily", 03 August, retrieved from https://www.archdaily.com/258929/the-contemplay-pavilion-drs-farmm
[22] David Basulto (2009), *National Library in Astana, Kazakhstan/BIG*, in "Archdaily", 26 August, retrieved from https://www.archdaily.com/33238/national-library-in-astana-kazakhstan-big

shapes, such as the circle, rotunda, arch and yurt, which are recomposed into a volumetric ensemble describing the Möbius band.

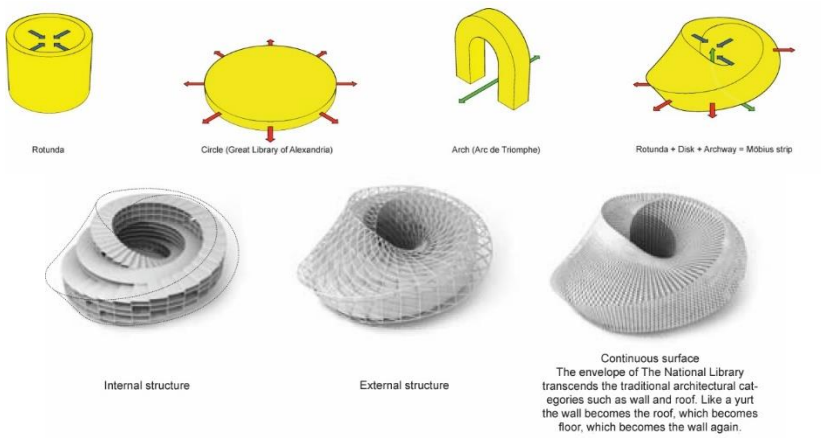

Fig. 11 Conceptual diagrams: National Library from Astana, Kazakhstan; Bjarke Ingels Group: BIG, 2009

In the field of fashion design, Korean-American architect and designer Meejin Yoon proposed in 2004 the *Möbius Dress*, a garment made of a single piece of fabric, designed in a way that no longer uses knots or overlapping stitches and there is no need to establish a certain hierarchy for arranging the material from which it is made. Möbius Dress interrogates the often assumed harsh demarcation between exterior and interior spaces and surfaces, proposing a gradual going through them[23]. Its shape is supported by the human body and the dress relates to it, twisting and turning to form an ever-evolving and changing surface that translates the topological properties of Möbius' band into fashion design.

Fig. 12 Meejin Yoon, Möbius Dress, recycled industrial felt, adjustable sizes, 2004

[23] J. Meejin Yoon and Eric Höweler (2009), *Expanded Practice: Höweler + Yoon Architecture/My Studio*, Princeton Architectural Press, New York, p. 18.

Discovered by mathematician August F. Möbius and graphically illustrated by him in *Gesammelte Werke*, the Möbius strip was adopted as a transposable concept in the sense proposed by Braidotti, and circulated throughout the twentieth century until today as a motif-binder between various artistic fields, such as visual arts, architecture, design, literature, mathematics, psychology. The motif of the Möbius band is distinguished as having a generative capacity specific to transpositions, making formal and informal permutations in the sense described by Schwab. This process of translation and assimilation could materialize both due to the potential plasticity of philosophical concepts associated with it by those who chose to reinterpret and transpose it into their works, as well as the allegorical and spiritual valences that the Möbius band represents, from (a)temporal cyclicality to the cyclical regeneration of the universe and up to the precariousness of human existence.

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Fig. 1 August F. Möbius, illustrations of the Möbius strip.

Excerpt from *Gesammelte Werke: Zweiter* Band, 1885 Source: August F. Möbius. *Gesammelte Werke: Zweiter Band*, Ed. Felix Klein, Leipzig, S. Hirzel, 1885, 520

Fig. 2 M. C. Escher, *Möbius Strip I*, woodcut, 30.8 × 31.12 cm, 1961

Source: https://www.nga.gov/collection/art-object-page.61283.html

Fig. 3 Ouroboros, the tomb of Tutankhamon.. Source: https://en.wikipedia.org/wiki/Ouroboros#/media/File:%C3%84gyptisches_Museum_Kairo_2016-03-29_Tutanchamun_Grabschatz_09.jpg

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Fig. 7 Tim Hawkinson, *Mobius Ship*, sculpture, wood, plastic, plexiglas, rope, staples, string, thread, plastic necklaces, glue, 265 x 310 x 130 cm, 2006 Source: https://collections.discovernewfields.org/artwork/75563

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