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PERSPECTIVE OPTICS. VISUAL REPRESENTATION TRANSFORMATION THROUGH THE ARTS

Abstract: *Art and architecture, at their finest, serve as social expressions of beauty. Artistic language as a form of human communication in the visual arts is an anticipatory tool of societal changes daring to position art as a reflective mirror of the future. Art functions as an avant-garde communication to architecture, conveying the imagine of humanity in the social dimension. In their coexistence, art has the role of the social language tool while architecture acts as a shelter of cultural complexity.*

With these premises and considering the evolution of art in the last half of century, from Renaissance to present day, the perspective on the role of visual representation has changed from true representation and realism to interpreting symbols in the illusion of graphics. The authors explore the shifts from the humanism of Renaissance to the contemporary rebirth of humanism through science looking at the evolution of representational language of perspective of naturalism, realism, surrealism and the optical illusions in context of the art and science relationship.

The study explores representation techniques such as Leonardo da Vinci's atmospheric perspective, Albrecht Dürer's painting in perspective, Johann Wolfgang von Goethe's Colour and Light Theory, René Magritte's surrealism, anamorphisms, Salvador Dali's melting landscapes, Maurits Cornelis Escher's graphical optical illusion. The investigation of these techniques contributes to understanding the role of perspective in representation and to reflecting on the importance of the scientific language in the visual arts.

Key words: *atmospheric perspective, painting in perspective, light and colour theory, anamorphism, optical illusion*

1. INTRODUCTION

The paper discusses the connection between humanity, art and architecture exploring a distinctive problematic. The authors are identifying the communication methods in representation of art and architecture by integrating the science of perspective. The study endeavour is to grasp the anticipatory dimensions of architecture representation in bringing together both art and science. Moreover, the inquiry has the purpose to underline the role of architecture in human evolution in intertwining art and science as its creational DNA. So, attempting to give sense to the human dimension through architecture representation, both evolutionary and creational.

The research findings will be applied in the field of Perspective and in teaching Perspective methods to architecture students. Moreover, the present study can open new research topics that can be explored through didactic projects.

The research methods are based on literature review, study cases and analysis. Therefore, the first stage is to identify the theoretical context and set up a background of the subject, the second stage to select and analyse study cases, while in the third step the conclusions are formulated based on theoretical and practical works.

The main questions guiding the study are

- How is our visual sense enabling a new perspective on the reality around us?
- How much the connections with the known can alter the visual perception into illusions?
- How are the illusions contributing to enhancing our perception of the world through the optical sense.

2. THEORETICAL CONTEXT

The visual sense is a gateway to understanding the environment. Moreover, it is an instrument of matching the new information with one's understanding of reality.

The information that we receive every day, and we consider nurturing and therefore continues the path of analysis, filtering and then allowing it to contribute to our systems of knowledge might be subject to illusions. Therefore, if the means of information is visual and the channel of receiving the information is optical, we are facing the optical illusions. Many times, the optical illusions are themselves messages, compounds of information, signs from a certain context of time and space communicating data (traits, characteristics). Perspective has been a technique in visual representation providing tools to enhance communication techniques in art. Architecture, by bringing together the science of perspective and art, has developed the communication between space and people.

In Biology scientists consider three types of optic categories: perspective distortion to form an illusion, visual manipulation to intimidate or mislead the viewer, sensory manipulations that inactivate sensory systems. Illusions of size, shape, that draw the attention of receivers, involving movement are visual illusions altering receiver's perspective. Manipulation of receiver behaviours are manipulated through exploiting, startling and intimidating receivers. The receiver sensory systems are disrupted through sensory disruptions, overstimulation, or inactivation of receiver sensory systems. [4]

Neuroscientist consider" the brain is constructing several representations, and the one that is commonly used for the purpose of shape perception generates distortions inasmuch as it must satisfy a number of conflicting constraints, such as the constraint of producing a stable shape despite the changing perspectives produced by eye movements". Shape and movement distortions are influencing the forming of illusions differently. Visual memory, short term or iconic, as well as abstract representation are involved in topographic and shape understanding, in terms of movement velocity and clarity of the shape. [7]

In Cyberspace the confusion generated by the duality of physical and virtual reality generate cybersickness due to perception of movement through the senses, visual and motion. [3] Previous studies have shown [5] that individuals take ownership of the virtual instance in the virtual reality. The incongruence of visual and motor senses diminished or increased, maintaining, or dismantling the illusion if the motor senses were confusions, the physical reality experienced by the physical body did not match the virtual environment.

The optical illusions are techniques speculating perception biases to construct different outcomes than the material reality. Subjective curvature defined by Helmholtz in Handbuch der physiologishen Optik 1896, Zollner's lines, Fraser's spiral, Muller-Lyer illusion estimating relative line lengths, the Ponzo Illusion [8] are examples of how the visual sense can influence the perception on the reality through a bidimensional image. The bidimensional images are speculating tridimensional characteristics therefore the eye adjusts the perception to the representational intention. Often, the information in front being adjusted to match perception. Therefore, cognitive and perception are in dissonance and the observer is challenged to mediate and harmonize between the reality and the perception, thus creating an illusion of a perceived reality.

2.1 Atmospheric perspective

Linear perspective in paintings introduced by Masaccio in the 15th century ("Holy Trinity", Santa Maria Novella, Florence, Italy, 1427-28) succeeded in amplifying the space through optical illusions created through linear perspective. Atmospheric perspective makes use of the linear perspective specific to architecture representation of spaces and buildings and applies its principles to nature representation, particularly landscapes. In atmospheric perspective the representation is more accurate and truthful to reality transposing distance to depth and clarity to colour and detail. So, landscape is represented through shapes applying the rules of proximity and information. The closer, the clearer, more detailed, dens and lighten, while the farther, blurred, transparent and dark. This way atmospheric perspective aims at representing the experience of the world from ones perception.

Leonardo da Vinci paintings connect humanity and nature, with the human at the centre or the support illustrated the techniques of atmospheric perspective. "The last Supper" or "Monalisa" artworks illustrate the atmospheric perspective of Leonardo da Vinci. The backgrounds are landscapes, while in the foreground there are the people capturing the viewers' attention. Leonardo da Vinci aimed for a natural representation therefore through his techniques „sfumato", blending colours with transparent layers, and „chiaroscuro", transitioning from light to dark, paintings feel more natural, the transition between the colours and elements being smoother creating the illusions of tridimensional forms. The deep studies of anatomy have a great contribution to Leonardo da Vinci's paintings in grasping emotions through movement and micromovement. The viewer is involved as an observer.

Figure 1 "The last Supper", Leonardo da Vinci, 1498, Milan, Mural painting 460 x 880 cm, Milan, at the Santa Maria delle Grazia Church (dining). [10]

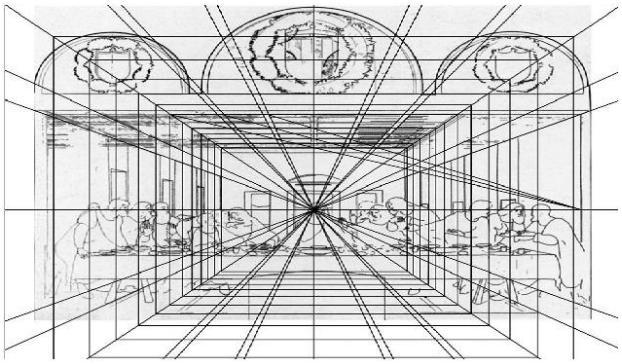

Figure 2 "The last Supper", Leonardo da Vinci, perspective analysis. [10]

Later light and shadow became more important in painting. For example, in Baroque Rembrandt highlighted human traits in his paintings and brought to light the character of the represented figures. Rembrandt, 17th century genius, created believable, alive characters through his paintings of light, colour and shadow. The dynamic in the Renaissance paintings achieved by captured movement transformed in dramatic Baroque artwork through emotion and deep communication with the viewer who is captivate in a dialog of interpretation of the painting. The detailing and accuracy are discarded in virtue of emotion depth calling for the viewer empathy.

For example in Van Eyck's 15th century painting "The Arnolfini marriage", in the foreground, the mirror on the wall shows an accurate reflection of a greeting, the painter greeting the viewer in his painting, in the imagined world, rather than in the real studio. From the Renaissance, the painter communicates directly with the

observer, not being just a medium, but a source of creativity. Here we bring into discussion Albrecht Dürer (between the 14th and 15th centuries) and his paintings in perspective capturing the essence of humanity starting with his own. Leon Batista Alberti and Leonardo da Vinci were preoccupied by perspective representation. After the geometric grid system, the perspectograph of Albrecht Dürer is a mechanism invented by the artist to create accurate representations of object on a canvas rendering the precise dimensions, proportions, and scale for appropriate perception of the observer.

Figure 1 ”The Arnolfini marriage”, Jan van Eyck, 1434, 82.2 × 60 cm, Room 28, National Gallery, London, UK [11]

2.2 Colour and Light Theory

Colour is directly related to light and darkness, as well as the light and shadow. There is the encounter between what we see and what we know, while the image of the world and the image of our consciousness are inseparable. Darkness as absence of light, therefore colour s the encounter between light and its absence. So, colour is a surrogate for the absence of light. Colour is alive together with nature and the universe reflecting the perpetual birth, the cycle of life.

Goethe’s theory of colour and light is founded by the fact that colour is a gateway to envision the world without judgement of prejudice, by appealing to the senses.

The harmonic colour wheel with the green base, on one side the colour yellow and the blue on the other. The top of the wheel is magenta. ”Light is visible when it meets resistance”. Johann Wolfgang von Goethe states ”The ear is mute, the lips are deaf. But the eye senses and speaks. In it the world is reflected from without, and man from within.” From Goethe’s words one can grasp that the eye is the gateway between the man and the world, it’s not only an organ in the organism with a function. Through vision and the eyesight it unravels to the whole body and to the mind a world of sensory experience sending information about the environment. Moreover, the senses disclose the environment through the intrinsic lenses, triggering the visual sense to transform and perceive something more than the cognitive perception allows. [9]

2.3 Anamorphism

René Magritte’s contribution to surrealism by introducing a new way of looking at art, anamorphisms, mirroring, reflection and self-reflections that in essence have the same idea as Salvador Dali’s melting landscapes, the idea of time dilution, space as an overlapping of life sequence, reality and fantasy, known and unknown. If one invites the viewer into the painting of the painter, the other opens his mind to the observer.

Salvador Dali’s contributed to Surrealism through a process of ordering the chaos of confusion by undermining reality. The artist forges uncanny connection between unrelated things with the purpose of triggering new paths for creation. Salvador Dali’s most famous painting, ”The persistence of memory”, inspired by the characteristics of Camembert depicts three pocket watches showing different times, a distorted portrait in a landscape of a beach with cliffs in the background. [6] The painting with the melting objects triggered by the softness of the cheese forges a new understanding of the perception of time. His distorted portrait indicating passage of the physical time, altering body through growth, loosing track of time in a summer day when only the shadows of the sunset remind of the passing of time, getting lost in owns dreams, thought processes that are only linked in one’s mind through time and space. Only the space of human mind can host and bring together unrelated things that otherwise are not contemporary or coexistent in space and time.

Figure 2 ”The persistence of memory”, 1931, 24.1 x 33 cm, Salvador Dali, MoMA, [6]

In a way ”The persistence of memory” is a self-portrait depicting a state of mind projected in a landscape of childhood, a juxtaposition, later defined by Foucault, as heterotopic space, conscious and unconscious, awareness and unknown are merging in the same moment. The artist juxtaposes symbols, layers, experiences only to ”cultivate self-induced psychotic hallucinations in order to create art”, taking plunges into unconscious only to take invite the viewer into a leap into the unknown. [6]

Salvator Dali's leap into unconscious is a step forward from the reflection and mirroring of Rene Magritte.

2.4 Graphic optical illusions

Maurits Escher graphical optical illusions fall into a few cathegories: regular division of plane, unlimited spaces, special rings and spirals, mirror images, inversion, polyhedrons, relativities, conflict flat-spatial and impossible buildings. In his work, Escher explored the world of graphics creating optical illusions that challenge the perception of the viewer because the graphics are at the border between abstraction and real representation. The use of symbols and geometry merge organically into a fantastic world of graphic illusion. Geometry and symbol come together to display a hidden world that the viewer is invited to decode and read. Using a black and white graphic either with graphite (side-grained wood) or ink (black art technique of the mezzotint) Escher plays with the foreground and background by using depth and contrast of light or the symmetry. Whitin the regular division of plane, Escher uncovers his secret in achieving a glide reflection: "Anyone who wishes to achieve symmetry on a flat surface must take account of three fundamental principles of crystallography: repeated shifting (translation); turning about axes (rotation) and gliding mirror image (reflexion)." [2, p.7]

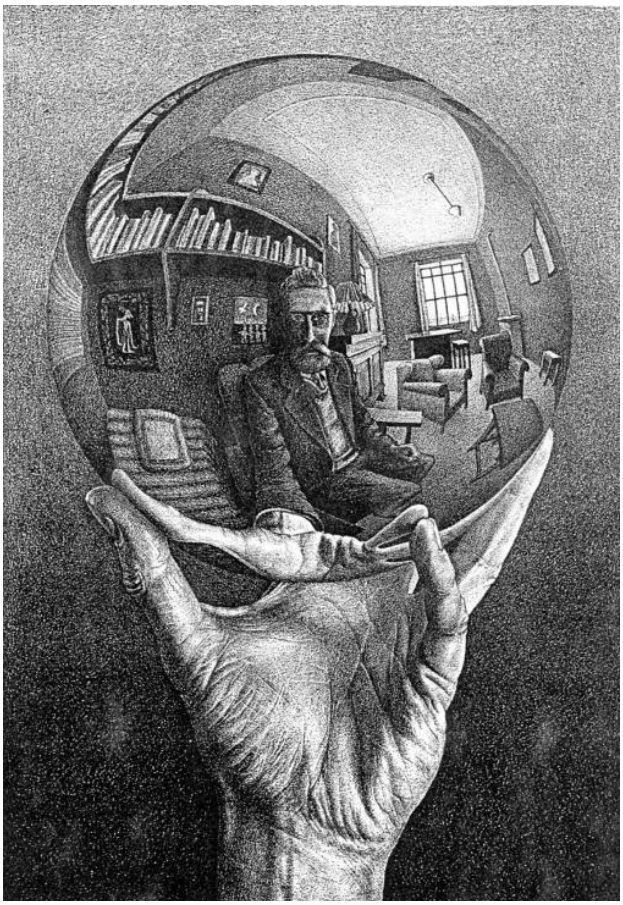

Figure 3 Maurits Escher, "Hand with reflecting globe" [2]

In his graphic Escher has figures as a background with a specific function: "Our eyes are accustomed to fixing upon a specific object. The moment this happens everything round about becomes reduced to background." [2, p.7] In this stage the form and contrast are developed, one can notice the infinite number by reduction of size figures reaching a "limit of infinite smallness" [2, p.9]. Every picture is a story by "transition from flat to spatial and vice versa" either by individuals coming alive, either by losing themselves in the community [2, p.10]. Figures repeat themselves in different forms and contribute to the complexity and the difficulty of the representation.

3. PERCEPTION MAGIC

A painting interpretation is dependent of the connection between the creator and the observer. Their relationship based on the systems they are part of determine the message communicated by the relationship. Culture, systems of belief, sensory capacities influence and trigger or enable ways in which we see the world and therefore our representation and interpretation of the world and its image. Scientific methods, such as perspective or colour theory brings together and forms common ground for universal perception.

3.1 Observer dynamics – still or in movement

For the artist Olafur Eliasson the circle is a resource in his art work integrating circular shapes and movion in his projects. The "Circular Show" is recurrent in constant play with the light, colour, human visual perception and perception of scale. Reflection, depth, and materials are embodied in the circle, bidimensional, tridimensional or multipled. The obsession for the circle, light and colour is transformed into space through architecture projects. Vertical Panorama Pavilion from 2022 (Carneros Estate vineyards, California), artist Olafur Eliasson and architect Sebastian Behman create a new space under a multicoloured canopy. Rainbow panorama, 2011 (ARoS Aarhus Kunstmuseum, Denmark) is a space to transfer into other dimensions, with the illusion of living in a rainbow, a space that changes colour with the moments of the day, amplifying the natural light colour, while the city is perceived in a perpetual changing panorama.

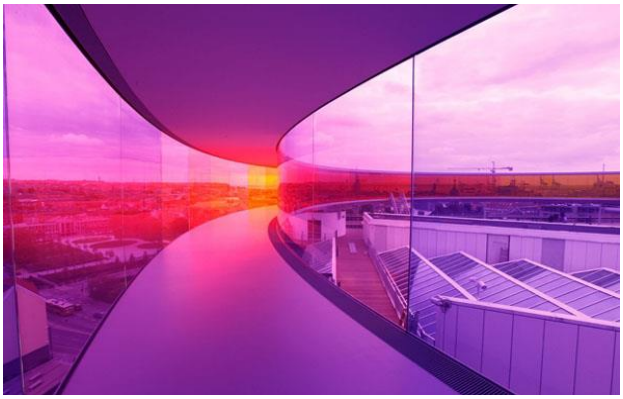

Figure 4 Olafur Eliasson, "Rainbow", ARoS Aarhus Kunstmuseum, Denmark, 2006. [12]

3.2 Context – static and dynamic

Ames "window of illusion" (based on the "Heer circle illusion") and "the room of illusion" is based on the bidimensional planes and tridimensional spaces built in

perspective. A window is built as in perspective, trapezoidal, with two vertical sides parallel, and the other sides, that should have been parallel, they are congruent. In the case of Ames "window of illusion "when rotating along a vertical axis, the window seems to pendulate back and forth or rotating, while the direction of rotation is confusing because of the trapezoidal shape of the window, built as in the perspective representation. The illusions generated by the perception alterations because the longer vertical sides are perceived to be in front.
"The room of illusion" is built with vertical walls, at different angles, while the floor and the ceiling are sloping. Therefore, closeness and scale are distorted.

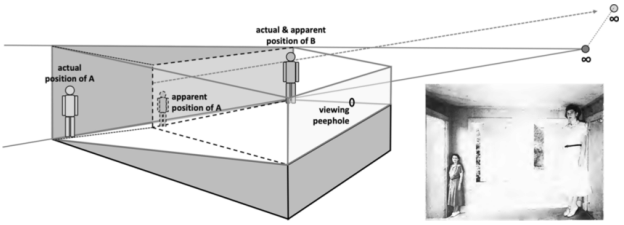

Figure 5 3-dimensional projective inference generates the Ames Room Illusion.[13]

4. CONCLUSIONS

The perspective techniques applied in paintings illustrate the tools artists had to communicate efficiently the main ideas of their times. Moreover, the visionaries of the time speculated representational techniques as hooks for public attention, opening gates to people's hearts and to activate emotion through their subtle symbols.
Optical illusion is the drop of magic in representation of the world through art and science, blending techniques and tools to spark communication between the creator and the observer. The observer thus evolves being gradually engaged from a simple viewer to being part of the creative act.
Vivid memories of one's experiences are represented with drawing tools to express the sensorial experience and to transmit emotion. Visual illusion has an important role in opening the way to different pockets of reality, even to fantastic realms having the role to enrich perception and trigger imagination.
Optical illusion are often gateways into other realms, worlds as perceived by the artists that dare to express through art their own perceptions on the world and open gateways to their inside world.

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