Drawing Lines with Light in Holographic Space

Yin-Ren Chang
Imaging & Displays Research Group, Faculty of Technology, De Montfort University
1.32d Room, Queens Building, Gateway, Leicester LE1 9BH, UK
E-mail: yinrenchang@yahoo.com.tw

Martin Richardson
2.27 Room, Queens Building, Gateway, Leicester LE1 9BH, UK
E-mail: mrichardson@dmu.ac.uk

Abstract. This paper explores the dynamic and expressive possibilities of holographic art through a comparison of art history and technical media such as photography, film and holographic technologies. Examples of modern art and creative expression of time and motions are examined using the early 20th century art movement, Cubism, where subjects are portrayed to be seen simultaneously from different angles. Folding space is represented as subject matter as it can depict space from multiple points of time. The paper also investigates the way holographic art has explored time and space. The lenticular lens-based media reveal a more subjective poetic art in the form of the lyrical images and messages as spectators pass through time, or walk along with the piece of work through an interactive process. It is argued that photographic practice is another example of artistic representation in the form of aesthetic medium of time movement and as such shares a common ground with other dynamic expression that require time based interaction.

Keywords: Holographic Art, Cubism, Motions.

1. Introduction
The theme of time has dominated aesthetic consideration in fine art. This is of course invisible but it sets boundaries and the ultimate challenge for artists is in developing, depicting and exploring methods to visualise quantifying rates of its change, not only as a visual abstract concept, but to also as the narrative of human condition.

The invention of photography made visual statements became more accessible for ordinary people; tourists can take pictures to illustrate vivid experiences from their point of view. Light is a compulsory element to create an image exposure on a frame of film, the developing process could be regarded as a novel technique that reveals very personal artistic perspectives, reproducing flakes of reality as the image creator experiences the world and time.

Stereographic based practices such as anaglyph, lenticular and holography offer a new dimension of visual art. That expedition into new forms of expression and aesthetic effects in time and space constitutes one of the most fascinating adventures in the history of art. This paper will trace the links between cubism and photographic artwork and then connect these to the theme of time and movement. This will involve an examination of depicting methodologies and representations.

This Research aims to explore the interaction between space, time, movement and visual perception by using three-dimensional representation tools such as anaglyph, lenticular and holographic technologies. It identifies potential associations between spatial imaging, perception, artistic interpretation and interaction. These practices will be a key for gaining an in-depth understanding to develop knowledge within the context of art.
2. Depicting Time
Following the advent of new technologies since the Industrial Revolution, people found that they could reach and connect the world quicker and broader than before. The invention of photography offered opportunities to make visual recordings more available and accessible for ordinary people. The concept of emerging techniques has had a tendency to lead artists into looking for new ways of communication in visual languages, similar to other new technologies that were crossing the geographical restrictions and bring people to explore diversity through world.

In the early of 20th-century, cubism launched its distinguished abstract style of modern art and introduced new ways of seeing. Cubists questioned the belief that art should be reproduced from natural and also challenged the traditional techniques such as perspective, light shadow, proportion, modelling and foreshortening.

This new way of seeing required a fresh concept of artistic representation. Cubist painters reduced the detailed description of objects and fractured the natural forms into semi-geometric shapes. They depict the simplified object from a multiple or contrasting viewpoints or fold space in this way they can portray the object at different angles and motions at the same time, according to the Heilbrunn Timeline of Art History [1]. The satisfactory results showed on their 2-D canvas, a single object can be seen from multiple perspectives in time.

Cubist painting responded to the innovative technology development; also captured this era’s unique characteristics and transform it into a novel visual language. The artistic expression in painting and photography showed unexpected similarities between the manual visual statement and the mechanical visual statement. In near-monochromatic colour tone (e.g. browns, greys or blacks), objects be transformed to a series of overlapping plans, and the iconic artistic expression not only to represent cubist’s aesthetic concept, but also could be found the analogous features of photographic works such as Muybridge’s photographic works.

Eadweard Muybridge (1830-1904), made pioneering experiments, photographing motion which used multiple cameras and improved the development of the shutter to capture motion in stop-action photographs. Previous failed work was attributed to the lack of a fast shutter. “Woman walking downstairs”, one of his remarkable works, viewers could distinguish the whole activity as separate movements through each frame. After this cooperated research programme with University of Pennsylvania, a portfolio “Animal Locomotion” has been published in 1887.

Muybridge’s experimental photographic studies are recognised as an influential development on artistic creative practices and captured body movements by representing consecutive still images. These black and white photographs influenced Cubist’s, who tried to simplify the colour description, in order to emphasise the fracturing geometrical objects in motions or seen from multitude viewpoints [2].

![Figure 1-“Woman walking downstairs” (part), 1887, Eadweard Muybridge.](image)
Let’s compare it to 1912, Marcel Duchamp presented his distinguished oil painting of perpetual motion, “Nude Descending a Staircase (No. 2)”. He responded Muybridge’s photographic works, depicted fracturing body forms through successive images of movement in near-monochromatic gold and beige tones to represent a nude female in motions. This mechanistic style has successful signified the idea of visualised time movement, also showing the inspirational links with Muybridge’s photographs and films on the analogy of visual narration, according to the website of Metropolitan Museum of Art [3].

Figure 2-“Nude Descending a Staircase (No. 2)” (left), 1912, Marcel Duchamp.

Figure 3-“A nude descends a staircase” (right), 1942, Gjon Mili.

A communication has been created between oil painting and photography, each medium has its unique artistic representation, but also expanding the potential possibility after blending their visual languages. Through Duchamp and Muybridge’s work, Gjon Mili has developed a series of investigational works to successfully capture a sequence of action in one photograph by using stroboscopic instruments [4].

Following this emerging unique technology, holography made a strong dynamic visual statement to illustrate the movement. Jacques Desbiens’s computer-generated hologram, “The Broken Window” (2006), the motion of a scroll painting from unrolling to expanding; a branch breaks through the window from behind, which brings allows the viewer to experience a new visual effect when they move from left to right, depicting a new narrative possibility connecting time and space [5].

Figure 4-“The Broken Window”, 2006, Jacques Desbiens.
3. Holographic artistic expression

Dieter Jung (2006) has described holographic art as being based on a technical medium, but its diversity and attractive vitality catch the attention of artists, leading them to transform vivid experimental imaginations into the “real virtual space”, “shimmering with reflections of truth, fiction and fantasy” [6].

“A new sense of the notion of information has been constructed around the photographic image. The photograph is a thin slice of space as well as time”, stated by Susan Sontag (1977) [7]. Compared with painting and photography the natural characteristics of medium, holographic technologies, these three-dimensional image recording mediums could offer multiple dimensions in 2-D materials for artistic representation as well as bring profound experience to audiences through its interactive display.

Setsuko Ishii (2006) has suggested that holographic art demands new forms of artistic expression and also has classified the characteristics of visual effects into three categories: “realistic three-dimensional image reconstruction”, “viewing area constraints” and “colour of light”. Based on these potential competences and relating the findings of artistic interpretation in cubism and photography, a series of creative artworks, which explore the dynamic, expressive, possibility of holographic art, as well as demonstrating the potential of spatial imaging as applied to the pictorial image [8].

3.1 Lenticular in art practice with still life

Figure 6- a) “Fly away”. b) Enlarged details view.

Figure 6-“Fly away”, 2011. a) Main part, which gives an idea about the working environment in which it was created; b) Enlarged details from the original source, a very strong sense of the semi-fracturing movement continues with the construct.

One of the outstanding characters of lenticulars is the representation of the three-dimensional image. This studio shoot was set-up with a digital camera, artificial lighting, tripod and rail. A sequence of digital photographic shots of the still life has been made utilizing the movement of the rail system, capturing a multitude of viewpoints. Twenty-five frames have been collected, after the process of interlacing and lamination a view through the lens represents the image of three-dimensional reconstruction.

It is interesting to observe that the interlaced image has delivered a strong graphic statement as it displays without lens. A numbers of semi-fracturing objects form from different perspective when seen through consecutive recordings, these familiar narrative methods could relate to cubism artworks. Moreover, this visual effect has not come from artists’ fantasy, that visual effect is the resultant form of computer graphic processing.
3.2 Lenticular in art practice with human motions

Original recorded (Fig. 7) by digital camera filming and editing before processing in Photoshop to create multiple layers. These consecutive frames show a man in motion. This process before interlacing is a vital creative step to check motion and flow. An excited finding shows the connection between photographic techniques and computer software, delivering movement within the still image.

![Figure 7- "Passing" displayed in sequential format.](image)

Passing (Fig. 8) was generated from 25 frames; a man just walking past the camera. However, his figure has vanished after the interlacing process because of fast movement. This unexpected result strongly points out that “time” is still a key factor of image recording. The relation of motion speed and camera shutter could be defined as a key factor as the interplay between light and shadow.

![Figure 8- "Passing" displayed in interlaced format.](image)
3.3 Anaglyph in art practice

Anaglyph offers stereoscopic (three-dimensional) effect by focusing each eye’s image through applying filters of different colours, usually chromatically opposite (such as red and cyan.) It is explained that Red-Cyan glasses became very popular as 3-D movies became more and more accessible. However, what could be seen in the image as the viewer wears the glasses in a wrong way (right eye in red; left eye in cyan)? Can people visit an exhibition, but perceive two versions at the same time? To imagine it, people wear a pair of red glasses to visit an exhibition, and turning back revisit the same images but only wearing cyan glasses that is fascinating! In “Good evening” (Fig. 9) there are two versions, viewers need to try on the glasses in both ways, the background may confuse viewers by its three-dimensional array paradox (pseudoscopic view).

![Figure 9-“Good evening”](image)

Flip canvas (Fig. 10) refers to the concept of a multitude of viewpoints and traditional perspective law, using a mirror effect to recreate a composition; vanishing points locate the lower centre of this picture. The first glance with naked eyes, a convincing space was rebuilt. However, the reality only existed under the red-cyan world; people can see truth behind the sense through the specialised glasses when closing each eye alternatively.

![Figure 10-“Flip canvas”](image)
4. Summary
Moholy-Nagy identified photography is a form of artistic expression, which shared a similar tendency with other creative forms. The main influential factors are dependent on “present technical, scientific sociological trends and their relationships. As these relationships are not obvious to everyone it will be necessary to make an analysis of this statement and show by examples what its meaning is” [9]. It shows the importance of understanding the potentialities of materials, in order to distinguish their unique characteristics of being and how artists reflect their perspective of contemporary tendency by using such medium of artistic expression.

“A space inside other space, a shape inside other shape” says Isabel Azevedo (2012) [10]. In holographic arts practitioner possess an extraordinary instrument for reproduction/recreation. Art can be perceived by exploring multiple layers of meanings. Experiencing and interacting dynamic three-dimensional artwork will help the audience to experience the full concept of an artwork.

Reference
[1] REWALD, S (2004) Cubism [WWW] The Metropolitan Museum of Art. Available from: http://www.metmuseum.org/toah/hd/cube/hd_cube.htm [Accessed 15/06/2012].
[2] MUYBRIDGE, EADWEAR (1955) The human figure in motion. New York: Dover Publications Inc.
[3] REWALD, S (2004) Marcel Duchamp (1887–1968) [WWW] The Metropolitan Museum of Art. Available from: http://www.metmuseum.org/toah/hd/duch/hd_duch.htm [Accessed 15/06/2012].
[4] LIFE (2012) It’s About Time: Gjon Mili’s Stroboscopic Portraits [WWW] Life. Available from: http://life.time.com/photographers/its-about-time-gjon-milis-stroboscopic-portraits/ [Accessed 15/06/2012].
[5] DESBIENS, J. (2009) The perspectives of synthetic holography [WWW] I. Jacques. Available from: http://www.i-jacques.com/Text/Perspectives%20of%20synthetic%20holography-JacquesDesbiens-ISDH09.pdf [Accessed 15/06/2012].
[6] JUNG, D. (2006) As I see it-The absence of darkness. In: Proceedings of the 7th International Symposium on Display Holography, Wales, July 2006. London: River Valley Technologies, pp. 120-122.
[7] SONTAG, S. (1979) On photography. London: erquin Book.
[8] ISHII. S. (2006) Artistic Representation with Holography [WWW] Scipress. Available from: http://www.scipress.org/journals/forma/pdf/2101/21010081.pdf [Accessed 15/06/2012].
[9] KOSTELANETZ, R. and MOHOLY-NAGY, L. (eds.) (1970) Moholy-Nagy. London: Allen Lane.
[10] AZEVEDO, I., RICHARDSON, M. and BERNARDO, L.M. (2012) Across Light: Through Colour. In: Proceedings of the SPIE Photonics West , San Francisco, January 2012.

Image
Figure 1 MUYBRIDGE, E. (1887) Woman walking down stairs. [Photography]. In: MUYBRIDGE, E. (1955). The human figure in motion. New York: Dover Publications Inc.
Figure 2 THE METROPOLITAN MUSEUM OF ART (2004) Nude Descending a Staircase (No. 2) [Online image]. Available from: http://www.metmuseum.org/toah/hd/duch/hd_duch.htm
Figure 3 LIFE (1942) A nude descends a staircase [Online image]. Available from: http://life.time.com/photographers/its-about-time-gjon-milis-stroboscopic-portraits/#7
Figure 4 I.JACQUES (2006) The Broken Window [Online image]. Available from: http://www.i-jacques.com/Text/Perspectives%20of%20synthetic%20holography-JacquesDesbiens-ISDH09.pdf