



HOLOGRAPHIC ART JARGON HOLOGRAFİK SANAT JARGONU

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Abstract

From the end of the 1960s to the present day, artists have been using different types of holograms as a means of artistic expression. In that process, artists have been using not only the holography jargon obtained by scientists, but also a new jargon created by themselves. In this study; the jargon constituted by artists are examined with samples. A table is also formed to see the jargon created by scientists and used by artists.

To understand and to give meaning to holographic art we should know the holographic art jargon created or used by artists. Constituted holographic art jargon is usually obtained with hybrid words. Generally, the word 'holo' is combined with other word by artists to constitute a new word such as *holomontage*, *holosuret*, *holopainting*, *holopeinture*, *holosculpture*, *holomobile*, *holokinetism*, *holokinetik painting*, *holokinetik sculpture*, *holopoem*, *computer holopoem*, *digital holopoem*, *optical holopoem*, *fractal holopoetry*, *holophotogram* and *holodrawing*. In addition, *hologram portrait*, *pulse hologram portrait*, *composite hologram*, *holographic shadowgram*, *non-hologram*, *luminograms*, *pictorialist holography*, *holographic poem*, *pseudoreflexion hologram*, *holographic interferogram*, *holographic hybrid*, *holographic installation* and *environmental holography* is coined or used by artists to describe holographic artistic works. Holography is an interdisciplinary technique, which is still being developed. Therefore, it is possible to say these words will increase and the time will show us which of them will be used or not used in the future.

Keywords: Holography, hologram, holographic art, types of hologram, terms of holography

Öz

1960'ların sonundan günümüze, sanatçılar farklı hologram çeşitlerini bir sanatsal ifade biçimi olarak kullanmaktadır. Bu süreçte, sanatçılar, sadece bilimciler tarafından elde edilen jargonu değil, aynı zamanda kendilerinin oluşturduğu yeni bir jargonu da kullanmaktadır. Bu çalışmada; sanatçılar tarafından oluşturulan bu jargon örnekleri ile birlikte açıklanmıştır. Ayrıca bilimciler tarafından oluşturulan ve sanatçıların kullandığı jargonu anlamak için bir tablo hazırlanmıştır.

Holografik sanatı anlamak ve anlamlandırmak için sanatçılar tarafından oluşturulan veya kullanılan holografik sanat jargonunu bilmemiz gerekmektedir. Oluşturulan sanat jargonu genellikle melez sözcükler içermektedir. Çoğunlukla 'holo' kelimesi, sanatçılar tarafından yeni bir sözcük türetmek için başka bir sözcükle birleştirilmektedir; *holomontaj*, *holosuret*, *holoresim*, *holoheykel*, *holomobil*, *holokinetizm*, *holokinetik resim*, *holokinetik heykel*, *holoşiir*, *bilgisayar holoşiiri*, *dijital holoşiir*, *optikal holoşiir*, *fraktal holoşiir*, *holofotogram* ve *holoçizim* gibi. Buna ek olarak, *hologram portre*, *atımlı hologram portre*, *bileşik hologram*, *holografik gölgekayıt*, *hologram olmayan*, *luminograms*, *resimsel holografi*, *holografik şiir*, *sahteyansıma hologram*, *holografik interferogram*, *holografik hibrid*, *holografik yerleştirme* ve *çevresel holografi* holografik sanatsal çalışmalarını tanımlamak için sanatçılar tarafından oluşturulmuş veya kullanılmıştır. Holografi, halen geliştirilmeye devam edilen disiplinlerarası bir tekniktir. Bundan dolayı, bu türden sözcüklerin artacağını söylemek mümkündür ve gelecekte hangilerinin kullanılıp kullanılmayacağını zaman gösterecektir.

Anahtar Kelimeler: Holografi, hologram, holografik sanat, hologram çeşitleri, holografi terimleri

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Introduction

British physicist Graham Saxby, who is an important person on holographic researches, says,

To the physicist, a hologram is a recorded of the interaction of two mutually coherent light beams, in the form of a microscopic pattern of interference fringes. To the well-informed lay person, it is a photographic film or plate that has been exposed to laser light and processed so that when illuminated appropriately it produces a three-dimensional image. To the less well informed it is just some kind of three dimensional photograph (Saxby, 1994; 3).

To the artist a hologram is an important artistic medium. Artistic potential of holography was discovered by a small group in the late 1960s and early 1970s. German holography artist Al Razutis, who lives in Canada, writes me;

The 1970's is when art in holography really took off, with exhibitions (of varied mixes of display, science, and art), with an explosion of work done in home-built labs and facilities, with the availability of cheaper He-Ne lasers, that kind of thing" (Razutis, 2014).

However the artistic acceptance and the evaluation of holography as a separate art form is based on the post-1980s (Johnston, 2006) and the jargon of holographic art is based on the early 1970s. From that time until today holographic art jargon has been expanded by scientists, holographers and artists. In this study; firstly, a table is formed to understand the terminology of science, which is created by scientists and holographers, than the jargon of artists is explained with the examples.

Holographic Art Terms and The Contribution of Artists to the Holographic Art Jargon

Holography is a modern imaging technique which was created by the research and applications of numerous physicists, chemists, mathematicians and engineers, and which is still being developed continuously. Therefore, it has many terms containing different disciplines.

Artists have produced a new jargon used in terminology of the other art disciplines. This jargon is generally created in order to describe their own works and commonly 'holo' word has been combined with other word by artists to obtain new hybrid words such as *holomontage*, *holosuret*, *holopainting*, *holopeinture*, *holosculpture*, *holomobile*, *holokinetism*, *holokinetic painting*, *holokinetic sculpture*, *holopoem*, *computer holopoems*, *digital holopoems*, *optical holopoem*, *fractal holopoetry*, *holophotogram* and *holodrawing*. In addition, *hologram portrait*, *pulse hologram portrait*, *composite hologram*, *holographic shadowgram*, *non-hologram*, *luminograms*, *pictorialist holography*, *holographic poem*, *pseudoreflexion hologram*, *holographic interferogram*, *holographic hybrids*, *holographic installation* and *environmental holography* is generated or used by artists to describe holographic artistic works (see the Table 1) (Işık, 2012, 2014-a,b).

Table 1. Holography terms and types of hologram used in holographic art

analog	- using analog recording devices - direct laser light systems (CW or Pulse) - photochemical methods, developing phase, bleaching
Digital	- a mathematical approximation of analog - using digital recording devices - dot-matrix hologram, printing digital hologram - digital screen, computer, CCD array, SLM, scanning etc.
optic and electronic elements	HOE (lenses, mirrors, filters, prisms etc.) HEE (electrons, crystal displays, cameras, computers etc.)
holographic object	- animate or inanimate - material or immaterial - immobile or mobile - sound frequency, microscopic organisms, electrons micro, nano, subatomic particles, human, animal, plant, hologram, film sequences or computergenerated 2D or 3D images
reference and object beams	- single beam, double beam etc. - off-axis or on-axis
copy and multiplication	- analog or digital - broken/cut hologram - hologram's hologram
Laser	- red, blue, green laser - continuous wave laser (to stabile holographic object) - pulse laser (to live and moving holographic object)
color	achromatic, true color, pseudo color, multi color
construction stage	- recording and reconstruction - one-step, two-step, - master, copy, multiplication - hybrid techniques - H1, H2, H3, H4...
dimensions	- thin or thick holograms - small or large-scale holograms - 1D, 2D, 2D/3D, 3D, 3D/4D
parallax	vertical parallax, horizontal parallax, full parallax
axis	- x, y, z (z: holographic depth of field)
angle	360°, 180°, 120°, 45° etc.
directions	up ↔ down left ↔ right front ↔ back
holographic images	- real image, virtual image - pseudoscopic image, orthoscopic image - final image
illumination	- laser light, halogen lamp, led light, ordinary bulb, daylight etc.
holographic depth of field	z axis - real image (space in front of the holographic image recording material, max. 3 m) - virtual image (space in behind the plate, max. 10 m)
types of hologram used in holographic art	- reflection hologram - transmission hologram - denisyuk hologram - white light transmission hologram-WLT - rainbow hologram - pulse laser hologram - multi channel hologram - 360° hologram - holographic stereogram - computer-generated hologram-CGH - digital hologram - dot-matrix hologram
ready-made holographic materials	holographic panel, paper, foil, textile etc. holographic print

Holographic Portrait

It is possible to produce holographic portrait with different types of hologram as *pulse laser transmission hologram portrait*, *pulse laser reflection hologram portrait*, *holographic stereogram portrait*, *computer generated hologram portrait* or *digital hologram portrait etc.* If a portrait done from a live model is desired pulse laser must be used. It is because the fact that the recording of live and animated objects can be taken only with pulse laser. As Holocenter (Center for the Holographic Arts) notes:

A holographic portrait is a unique three-dimensional image that captures the living presence of a person in light. The portraits have a vividness and wealth of detail impossible to obtain with a photograph. A holographic portrait is recorded in a few nanoseconds with a ruby pulse laser on a holographic film. It contains a vast amplitude of information about the person as it captures reflected laser light from every direction and angle. The resulting portrait hangs on a wall with a halogen spotlight illuminating it from above (holocenter.org, 2009).

In 1967, the first-ever pulse hologram portrait was produced by electrical engineer Lawrence D. Siebert (Taylor, 2012). Since that time, many scientists, holographers and artists have produced holographic portraits using with different techniques.

In the 1990s, Harriet Casdin-Silver, who is one of the first holography artists, uses white light transmission hologram techniques to her large-scale (approx.1 m) holographic stereogram portraits besides her pulse hologram portraits. *Alice* (1990) (Fig.1), *Kathryn of Orange* (1992), *Corpse with Tie* (1992), *Ian* (1994) and *Selfportrait* (1999) is the example of her holographic portraits (Ross, 2009 ; gallerynaga.com).

Alphons Schilling (1985), *Boggs* (1987), *Portrait of Keith Haring* (1990s), *Portrait of Rudie Berkhout* (1990s) and *April* (1990s) is the examples of Ana Maria Nicholson, who has worked with the pulse laser in many times. All of them are her pulse laser reflection hologram portraits (Nicholson, 1989 ; anamarianicholson.com).

To British artist Patrick Boyd's *Lucy in a Tin Hat (Dichro Lucy)*, (Fig.2) R. Taylor, who is the president of Forth Dimension Holographic Technologies, says "it is the one of the finest examples of hologram pulsed portraits" (Taylor, 2012). Setsuko Ishii's *Self-portrait* (2000–02) (Fig.3) is also a good example of pulse hologram portrait.



Fig. 1 Harriet Casdin-Silver & Kevin Brown, *Alice*, 1990, transmission hologram, 63.5 x 55.88 cm (bates.edu).

Fig. 2 Patrick Boyd, *Lucy in a Tin Hat*, 1988, reflection hologram, pulse ruby laser, R. Taylor Collection (Taylor, 2012: 3).

Fig. 3 Setsuko Ishii, *Self-portrait*, 2000–02, pulse laser transmission hologram, 50 x 60 cm (Ishii, 2012).

Composite Hologram

This jargon is used to describe "more than one hologram may be juxtaposed or superimposed. Also, they may be added another object in ways." Composite holograms "draw on the principles of collage and assembly as developed in the pictorial arts and they are generally used to create murals and large format compositions. Sometimes for 3D works can be spoken as *holosculpture*" (Leonardo, 2001: 371).

Ana Maria Nicholson created some composite holograms in 1980s-1990s. One of them is *Rudie*, in 1988, two holograms (a face and a hand) were mounted on a surface (Fig.4).

Nicholson's model was an another important holography artist Rudie Berkhout. To her composite holograms Nicholson says,

In an attempt to break the size limitation of reflection holograms and to have a more complex visual space, I have been experimenting in the last few months with composing portraits as diptychs and triptychs, combining two or three different views of a subject into a coherent whole. These views can be images of different parts of the body used either as abstract sculptural elements or as symbolic values related to the central feeling of the composition. (...) The theme of this diptych is the conflict between the desire to trust and the necessity of selfprotection. The wrenching, protective isolation that Rudie feels causes him to retreat so far into the shadows that his portrait becomes a relief sculpted by light and dark. While he remains wary of the viewer, however, his hand breaks through the screen in his desire for contact (Nicholson, 1989: 371).

Ferruccio Fabbri combined his small Denisyuk holograms with old boards of computers in 2012 (Fig.5) (Fabbri, 2014). We can see the other examples of it; Al Razutis' *Newtonian Galactic Assembly Line* (36 holograms, 1976) (Fig.6), Anaït Arutunoff Stephens' *Detail* (16 holograms, 1976), Harriet Casdin-Silver's *To Soutine and Matisse* (4 holograms, 1996), Susan Gamble & Michael Wenyon's *Bibliograph* (54 holograms, 1991-92), Paula Dawson's *Working Model One* (6 holograms, 1984).



Fig. 4 Ana Maria Nicholson, *Rudie*, 1988, two reflection holograms in a diptych, each 30 x 40 cm, Photo: Timothy Schmidt (Nicholson, 1989).

Fig. 5 Ferruccio Fabbri with his two composite holograms at Fair of Europe, 2012. 2 panels, 83 x 30 cm, Denisyuk holograms, various sizes: 10.5 x 12 cm or smaller (Fabbri, 2014).

Fig. 6 Al Razutis with his work, October 2010 at Deja Vu, Vancouver, Canada. *Newtonian Galactic Assembly Line*, 1974-76, 36 silver halide reflection holograms mosaic, 121.92 x 152.4 x 10.16 cm, created by Al Razutis at Visual Alchemy, Canada, on exhibit at 'Visual Alchemy' touring 1977-1978 (Razutis, alchemists.com).

Holographic Shadowgram

This can only be executed with continuous-wave lasers. In one method, the object is placed in the reference beam path, in front of the holographic plate. When a shadowgram is produced in a single step, the image is always real (a projection in front of the medium), but when it is produced in two steps, both a real and a virtual image are created. This process, related to British inventor Fox Talbot's *photogenic drawing* and Hungarian artist Moholy-Nagy's *photogram*, was rediscovered in 1918 by Christian Shad, who named of *shadowgraphy* (Leonardo, 2001: 379).

Margaret Benyon's one-step laser transmission work *Hot Air* (1970) is the first holographic shadowgram and it was called **non-hologram** by Benyon (Fig.7). This type of the process was titled **silhouette holography** by Dr. Dewy Redman. Afterwards Rick Silberman renamed it *shadowgram* and since then this jargon has been used by artists (Coyle, 1995: 23-26). Silberman says,

It was made directly as a Shadowgram and is one of the pivotal pieces representing the technique, which I developed following a discussion with Steve Benton, in which he directed me to a short article published by Dr. Dewy Redman, titled "Silhouette Holography", in The Journal of Optical Physics (jrholocollection.com)

Silberman began his career in holography in the early 1970's, during which time he created shadowgrams, a reflection hologram technique. His most famous piece, *The Meeting* (1979) (Fig.8) is a hologram of the shadow of a wine glass displayed with the broken stem of a real wine glass, creating a visual record of the object. *Ball and Jacks*, *Mesh*, *Cat's Cradle* and *Rough Cut View* is the example of his shadowgrams. All of them were exhibited at the Museum of Holography in 1979-80 (Silberman, 2006 ; De Freitas, 2008). To *Meeting* Silberman says,

Its place as one of the most memorable holograms ever created. Others had noticed the shadow effect, but I believe I was the first to develop the camera using a ground glass field to light the object, as well as applying it to reflection holography (Silberman, 2006).

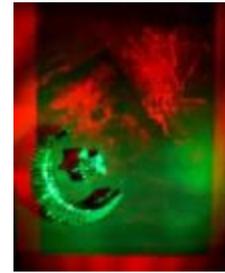


Fig 7 Margaret Benyon, *Hot Air*, 1970, laser transmission hologram, 20 x 25 cm (Dawson, 2011).

Fig 8 Rick Silberman, *The Meeting*, 1979, 25 x 20 cm, reflection hologram, silver halide on glass in 49 x 41 cm, frame with broken flute glass on wooden platform, signed and dated, edition # 12/24 (jrholocollection.com).

Fig 9 Vildan Işık, *HoloSuret-III*, 2012, multi-exposure hologram, 20 x 25 cm, produced at Hangyo Int. Corp. R&D Center Holography Laboratory, Seoul, S.Korea. (Işık, 2014-b: 379).

Holomontage

A laboratory procedure in which the final image is obtained either by layering more than one films or plates together or using multiple exposures is used to create holographic works. Holomontage, which derives its name from photography, uses the superimposition of film or juxtapositions of various parts of an image to create a final image that has a certain unity. "Processes used include multiple exposures or multi-channel techniques, as well as masking. Holomontage gives the artist greater flexibility in the manipulation of form and color" (Leonardo, 2001: 374).

Vildan Işık's *Holosuret-III* is a holomontage (Fig.9). This study contains many different techniques as painting, photography, photocopy and hologram. It was combined different visuality of these techniques to create a new multi-layer visuality. 'Suret' has a lot of meanings in Turkish such as appearance, form, face, copy, text, photos, copies, painting, photography, shape and way. It also means the direction of perceived through the five senses. Therefore, Işık uses the jargon **holosuret** to describe her works (Işık, 2014-b: 329).

In Setsuko Ishii's *Self portrait Body with Fabric 2*, human body is an eternal theme for artistic expression. Hologram comprises about twenty different images of the artist in one piece of hologram. The viewer can only encounter certain images from certain viewpoints. It would be described as *3D collage*. As Ishii notes: "Since it is not possible to look at all images in the hologram from one vantage point simultaneously, viewers unconsciously interact with the holograms" (Ishii, 2012).

Holopainting

This jargon is described in Leonardo as “a work that uses pictorially based holographic images from painting, drawing, collage, etc. in a formal painting structure.” Holopainting was conceived by Dominique Mulhem in 1970s. It was named in French; **holopeinture** (Leonardo, 2001; 375). Mulhem’s holopaintings are executed interference holography and lenticular holography techniques. His technich is close to pointillism (Fig 10). Mulhem explains his work,

(...) holopeintures in programs for 3D modeling, such as those used in cinema for computer-generated movies. They are then painted and textured. And then are made from this digital sculpting a multifocal series of images to have representation in relief in the space. The series is composed of 36 to 72 different images which may take several days to the computer working 24 hours to calculate. Finally they are interleaved according to formats in more or less fine lines for the master of the image space. Interlacing asking for specific factors, compared to LPI of the lenticular network, the distance and the angle of viewing the image. The number of information is so important that a complete holopeinture can reach hundreds of millions of pixels. This work requires a broad technical knowledge in various fields, because it is used from the design to the final realization about fifteen different software. Support: the image is printed with a printer to extreme high resolution and pigment inks guaranteed in time on conformity with ISO 9706 paper. The image is then rolled with the technique of collage under acrylic glass with a lenticular network, the precision of the timing of the order of one hundredth of a millimetre (Mulhem, 2014).

Sometimes artists use ready made holographic foil/paper to past onto the board/canvas to combine with paint. Zdeněk Kočib combined with acrylic paint and pasted small geometric shaped holographic foils. And they are called **luminograms** by him. (Kočib, 2000). As Kočib notes:

Luminograms, a contemporary form of kinetic art, are two dimensional images created with ready-made holographic foils. These “trompe la lumière” compositions demonstrate virtual movement in their fixed images (Kočib, 2000: 107).

And sometimes artists use *ready made holographic foil/paper/etc.* David Warren, in some holographic artworks, uses ready-made holographic papers as a canvas and paint them with oil or acrylic paint. *Paul Davies#2* (2005), *Maxine McKew* (2006) and *Self Portrait* (2011) is the example of his works (Warren, zipsisterholography.com).

Pictorialist Holography

This jargon is described as a manual intervention or manipulation by artist. Artists use different ways to change the appearance of a holographic image; “scratching the emulsion, painting directly on the emulsion or manual manipulation so that the recorded image develops unevenly. Artists are trying to subvert the purely realistic and 3D representations of holography in favor of an abstract, expressionistic and pictorial effect with light. Some also call it light painting” (Leonardo, 2001: 377).

Harriet Casdin Silver’s *Coda* (1992-2000) (Fig 11) and in 1980s, Margaret Benyon’s *Cosmetic Series* (Fig 12) are the examples of pictorialist hologram. About her these works Benyon says,

The emphasis on painting the face during the recording stage of the pulsed hologram is carried through to the final presentation of the hologram in reflection mode, through fusion of the hologram with a painted image of the same face. Sometimes the greens and blues originally used on the lips are repeated in the colours of the paintings, as in *Sonia* and *Margot*. The holographic images are frontal and central, partly to give a classical, hieratic quality to the finished works, but mostly because I had to merge as patial image with a flat one on the image plane, and a full frontal view is flatter than any other orientation of the head. Because the holographic image is a reconstruction of light wavefronts, it cannot be retouched. This means that the original image must be accepted, warts and all; however, it can then be modified externally to a surprising extent, in the following manner (Benyon, 1989).



Fig 10 Dominique Mulhem, *Marilyn-Mondrian*, holopainting, 2012, 25 x 20 x 3 cm (artalog.net).



Fig 11 Harriet Casdin Silver, *Coda*, 1992-2000, reflection hologram, 76.2 x 76.2 cm (gallerynaga.com).



Fig 12 Margaret Benyon, *Cosmetic Series: Richard Hamilton*, 1991, reflection hologram, flesh coloured, silver halide on glass, 43 x 32 cm (jrholocollection.com).

Holosculpture

This jargon was proposed by Georges Dyens and Jean Gilles in 1980s. It is used to describe “artwork that integrates holograms and sculpture, or that suggests through the use of holograms and the hologrammatic light space, as a sculptural form” (Leonardo, 2001: 375).

In 1981, Dyens created his first holosculpture and since that time he uses them in his holographic installations. *Reliqua Terrae* (1983), *Mother Earth II* (1985), *Vertigo Terrae* (1994), *Eclipse on Blue Earth* (2000), *The Red Planet* (2001) are some of the installations used his with holosculptures (georgesdyens.com).

Aaron Kurzen’s *Chalice*, *Primal Manifestation* and *Voodoo Dolly*, in 1977-78, is a 360° holographic stereograms. He described them as “holographic stereogram in assemblage” (Kurzen, 1983: 12). Dan Schweitzer defined his narrative works as “hologram and mixed-media sculpture” and “holographic assamblage”. *Stargate* (1985), *The Paradox* (1985), *Doorway* (1989), *Window and Through the Woods* and *Stargate Revisted* (Fig 13) was constituted white-light transmission holograms and mixed-media sculptures. About these works Schweitzer says,

With *The Paradox*, I inadvertently had found a new direction for my work, one that currently remains dominant. Most of these new works are actually sculptures with holographic elements; many feature sculpted characters that are in some way physically involved with the projected light image. A more recent work, *Doorway*, features a sculptural tableau of two workers carrying the projected-light doorway with a landscape in it over to a material frame. In another sculpture, *Window Installation*, the characters carry a window frame inadvertently through its own image. In *Through the Woods*, the viewer is surrounded by trees, providing the sensation of walking through the image (Schweitzer, 1992).

Anait Arutunoff Stephens’ *Detail* (1976) is not only holosculpture but also composite hologram, that is arrayed of 6 virtual images and 10 real images. In 1978, in her article “My Art in the Domain of Reflection Holography”, she described her artworks as “light-sculpture in bas relief”. Stephens says,

My reflection holograms are of images both behind (virtual) and in front (real, pseudoscopic) of the plate. Some are mounted with other media, such as drawing, watercolor, collage, etc. The first works utilized simple geometrical forms and reflective surfaces. One important work consists of rows of plates (each 10 x 12.5 cm), of identical images, real and virtual, that produce a large pattern. This is light-sculpture in bas relief, a new type of 3-dimensional Op art. The object in real space, 'time reversed' is both visually and mentally challenging. I use the pseudoscopic image to free myself from the restrictions of ordinary 3-dimensionality; the projecting and receding images make space seem more solid to me and its confinements less so (Stephens, 1978: 307).

Sam Moore's *Hand Defined* and *Phoenix* (1996) is holoscultures, too. In the former it was mounted on three holograms on a sculpture and in the latter it was combined with white light transmission hologram and metal (art-in-holography.org, 1996).

Holographic Hybrids

In the end of 1970s, Razutis created the jargon of the holographic hybrids to "identify the combination of sculpture (original or found-object assemblage) and holograms/holographic images and their resulting 'hybrid' aesthetics." These aesthetics are enclosed holographic, post-modern, modern and classical aesthetics (Razutis, alchemists.com). In Al Razutis' *Camera Obscura* (1975), *Venetian Blind* (1970s) (Fig 14), *Surrogate-Dressed for Art New Vouge* (1974), *Hologram of a Translucent Object* (1975), *Venetian Blind-II* (1985) is the example of his holographic hybrids (Razutis, alchemists.com). As Razutis notes:

The sculptural nature of the holographic (virtual or real) image, the fact that it occupies 'space' and displays 'object' characteristics (size, proportion, perspective, depth) is paradoxical to those who appreciate the poetic potentials of 'phantastic' objects 'floating' in space. The holographic image is 'unreal' - you can't touch, smell, taste or hear it. It's a visual ghost of a recording stage or object. It exhibits no gravity, only focal properties. In combination with the world of objects, with sculptures, frames, planes and reflections, it can occupy what I termed 'hybrid' status. The combination of the surreal and the real creates a dialogue about what is 'real', how images occupy memory, how solid and immaterial exchange places. The framed, installed, sculpted results of these 'hybrids' is one of the early accomplishments of a new art medium like holography asserting its place beyond its predecessor art forms - beyond, but not disconnected (Razutis, 1979).

Hybrid holography has also been featured in John Kaufman's works in 1980s; *The Value of a Disposable Item*, *Wall-Floor*, *Lamp* and *To Sleep Perchance to Dream* (Fig 15) is metaphysical and assemblage works of Kaufman (Razutis, 2012 ; alchemists.com).



Fig 13 Dan Schweitzer, *Stargate Revisted*, 1989, 10.16 x 12.7 cm white light transmission hologram set in a 24.13 x 21.59 cm resin stone wall, Ed. #1/18 (globalimages-hologramartcollection.com).

Fig 14 Al Razutis, *Venetian Blind*, 1970s, white light transmission hologram, silver halide, (this work is lost, except for photo documentation) (Razutis, alchemists.com).

Fig 15 John Kaufman, *To Sleep Perchance to Dream*, circa 1980 (Razutis, 2012).

HoloMobile

This jargon is used by Dieter Jung to describe his *mobile holographic sculptures*. As Jung notes,

My first Mobile constructions were built in 1999 with variously shaped colored cardboards hanging on fishing lines from fiberglass rods supplied by the Berlin kite shop 'Flying Colors'. These were followed by a series of more elaborate pieces out of feather steel, hand-made ballbearings and thin anodized aluminum panels – later replaced by acrylic panels – and holograms. This marked the birth of the word HoloMobile (Jung, 2012: 6).

Jung's *Navigator-Eyes of Ikarus* (2002), *HoloMobile XYZ* (2003), *Navigator* (2008), *HoloMobile Continuum* (2008) and *ShenZhen HoloMobile* (2010) are some of the examples of his holomobiles (Jung, 2012).

Another example of holographic mobile is Graham Tunnadin's *Thought*. Tunnadin explains his work:

Designed for the foyer of a hospital which cares for people suffering from brain injuries or disfunction. The mobile rotates 360 degrees over 2 minutes and then returns slowly. As it turns the holograms appear and disappear. Approximately 3x3x4 m from a 10 m high ceiling (Tunnadin, 3D4D.com).

Holokinetism

This jargon was created by Ruben Nuñez in 1974. Nuñez's resource is the kinetic art. He combined hologram with kinetic, and gaved it the name of holokineticism. "The meaning of holokineticism holograms in the light, color, motion and vibration indicate the presence of the three-dimensional in space" (Pepper, 2012). Nuñez says,

When I started to bring to life my first holokinetics holograms with laser, at Optics Institute, when I was university (...) there was opportunities to develop quickly this artistical expression. When they saw the artwork, especially the crystal of Rainbow Planet made at Optical Institute Paris, How do you call it? Holokineticism! Yes, because it's moving, it's poetics, it's three dimensional, it's like the cosmos (Nuñez, video on youtube, upload by K-soul).

Dan Schweitzer's *The Seed* (1980) is "an **optical animation** of a portrait of Einstein watching spiraling photons, as the Earth rotates through an abstracted mushroom cloud". As Schweitzer notes,

In *The Seed* (1980), a film box is abstracted to represent the music of the spheres. I call this effect 'optical animation'. It allowed for a total remanifestation of the mundane. What Ruben Nuñez coined 'holokinetics' could translate it to the sublime (Schweitzer, 1992: 462).

Nuñez along with K-soul made a DVD movie; *Holokineticism - View Ruben Nuñez*, in 2002. Then, K-soul has added two terms; **holokinetic painting** (peinture holocinetiqu) and **holokinetic sculpture**. In his works of the series, the artist has been using electronic screen as a canvas for the movement of the light (K-soul, 2014-b). K-soul explains his works,

The evolution of technologies allows to fulfill the dreams of artists of the early 20th century they already imagined the painting in movement. Now we computer tools, electronic tools, we can do it. In this digital canvas 410.000 paintings are integrated in animated form for a duration of 4 hours. At first, I write a poem then I translate it into pictorial language, into metamorphoses of shapes and colors. These metamorphoses of shapes and colors represent a very careful observation of the evolution of the nature which then I express through diagrams. These diagrams correspond to the interaction between the cosmos, the solar system and the processes of embryogenesis. It took me about fifteen years of hard work to develop the techniques to achieve this holokinetic painting. It is in direct continuity of the works of Paul Klee, Kandinsky, Mondrian concerning the integration of time and movement into the painting (K-soul, 2014-a).

According to K-soul holokinetic painting is the "high-tech canvas of the 21th century and a clever mix among art, science and new technologies. Tools of a holokinetic painter: Photonic canvas - touchpad - electronic brush - computer interface" (K-soul, 2014-b).

Holographic Poem

This term refers to visual art form that combines text or poetry with animation techniques. Richard Kostelanetz is one of the first artists who made holographic poem however he didn't use this jargon. His works were 360° cylindrical white-light transmission hologram. He exhibited these works in 1978 (Fig 16). As Kostelanetz notes:

For the past six years, I have been expressing linguistic and literary ideas by means of diverse media. In 1972 I began to work with numbers, in 1974 with 'book art', in 1975 with both audiotape and videotape, in 1976 with film, in 1977 with photography and in 1978 with holography. With each medium, my aim was initially to find some of its potentials and, finally, to produce artworks that take advantage of them. I am less interested in expressing a particular vision or in exploiting a single 'look' than in exploring the artistic possibilities of a medium. I had followed the development of holography for over a decade without any proposals for working with it until I saw a rotating cylindrical (360°), integral white-light transmission hologram. Stephens presented an example of one of her cylindrical white-light transmission holograms. Then it occurred to me to devise syntactically circular, unending statements of the kind presented in 'Manifestoes' that open my first collection of *visual poems Visual Language* (1970). But holography offers advantages unavailable on a flat printed page (Kostelanetz, 1980: 40).

In 1983, *Holo/Olho (Holo/Eye)*, the first **holopoem** made by Eduardo Kac and holographer Fernando Catta-Preta is a combination of anagrams in which the word *holo* mirrors *olho* and vice versa (Fig 17) (Kac & Botelho, 1989). Eduardo Kac, firstly, creates a series of letters and words of perceptual for holopoem on computer. Then he produces holographic recording from them. He named them **computer holopoems** or **digital holopoems**. If a holopoem is not made with the aid of a computer, he call it **optical holopoem** (Kac, 1996). The artist employs computer animation techniques to create a new kind of visual-poetic composition and he says,

Holopoetry explores motion, displacement, and metamorphosis. In my holotexts I employ a syntax of dislocations that continually drive graphemes from their position. In some poems I use only one word, but in my multiword poems each word is a node or point of intersection. No word is the origin or beginning. Even in the single-word pieces that employ some kind of sequence, this sequence is never hierarchical (i.e., linear) and never assumes a fixed beginning or end. (Kac, 1993).

In 1983-1989, Kac produced holopoems using with computer graphics and fractal geometry. It was named **fractal holopoetry** by the artist (Kac & Botelho, 1989).

Dieter Jung's *Hologramm* (1979-1983) is a holopoem, too. In this work the poem (poem by Hans Magnus Enzensberger) was mounted in a diaphanous cube in which the letters were projected as both real and virtual images (Jung, 1989). Other example of his work is *HoloPoem* (1987) horizontal symmetric text by H. M. Enzensberger (Jung, 2012).

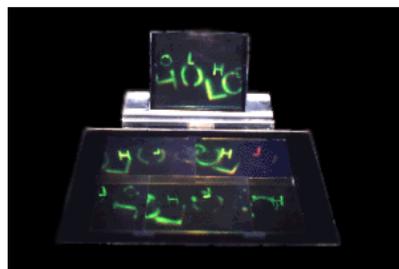


Fig 16 Richard Kostelanetz, *On Holography*, 1978, 360° cylindrical white-light transmission hologram, diam. 41.5 cm and ht. 24 cm, Photo: Robert Haller, Pittsburgh Penn. "It was placed on the inside surface of the transparent Plexiglas cylinder and illumination was provided from below by a single-filament bulb. The cylinder was rotated by an electric motor at 1 rev/min" (Kostelanetz, 1980: 40).

Fig 17 Eduardo Kac and Fernando Catta-Preta, *Holo/Olho (Holo/Eye)*, 1983, reflection holograms mounted on wood and plexiglass (fondation-langlois.org).

Holographic Interferogram

Interferometric holography is a technique which employs double-exposure holograms. Holographic interferometry is termed by scientists in 'non-destructive testing' of various

materials. “Microscopic changes on an object can be quantitatively measured by making two exposures on a changing object. The two images interfere with each other and fringes can be seen on the object that reveals the vector displacement. There are countless engineering applications in this field of holometry” (Jeong, 2010: 385). Afterwards, artists used this technique and renamed interferogram. With this technique, it is possible to use “multiple recordings of the interference fringes of laser light reflected from an object to measure low-amplitude deformations and movements of the object if it moves or is moved during recording”. Two consecutive holographic images are recorded on the same light-sensitive medium, using one object, one surface or one medium, which changes or moves slightly (or is changed/moved) between exposures. It can be produced with either a pulsed or a continuous-wave laser. The reconstructed image appears with zebra stripes on its surface, producing a moiré effect (Razutis, alchemists.com ; Leonardo, 2001: 373).

Sally Weber’s *Laccolith* (2006), *Terrain* (2006) and *Fissure* from the *Strata Series* are the examples of the holographic interferogram (sallyweber.com). Also Al Razutis used this technique in his some works in 1980s such as *Channel 1*, *Incline* and *Field* (Fig.18). Razutis says,

The two 'points' (or poles of disturbance) in 'Field' are superimposed in time, and the interferometric holograms, rendered as a white-light 'rainbow' (H2) hologram (framed above) using S. Benton techniques, were done with manual precision (the twisting of a screw at a time) for the tuning that was required in my imagined result. To me these are creations in 'the tuning of disturbances' in time and in space (Razutis, alchemists.com).

Holographic Installation

The light sources used for display holograms can be placed in different ways in the exhibition hall. The viewer can navigate through them. Especially, white light transmission holography is appropriate for the installation of this type. In installation of Philippe Boissonnet’s *L'ombre D'un Doute*, paintings and holograms were used together. (Boissonnet, 1989: 375). Boissonnet’ work has been exhibited since 1983. He has also created interactive holographic installation. Some of the examples of his installation are *De Profundis* (The remediation of the artist)-1990, *A world of Uncertainty*-2008, *Nowhere Else*-2013, *Relativité*-2013, and *Uncertain Worlds*-2014 (Boissonnet, 2014).

Georges Dyens has used holosculpture, hologram, land art, aluminum, light, plaster, rock music, scrap, sand, wood, polyester resin, laser, fog, soil and plexiglass for his installation of *Vertigo Terrare*, in 1994. Dyens has also used the **holophotogram** (a work that combines holographic images with photographic images) in his installations. In 2000, Dyens mounted hologram on a drawing and named it **holo-drawing**. Dyens also coined the term of the **pseudoreflexion hologram**. This is a transmission hologram, like the reflection hologram, it is illuminated in front thanks to a mirror placed behind the recording medium (georgesdyens.com ; Leonardo, 2001). Installation of Alexander’s *Horrors of War* (1988) was created with a holosculpture used blending with a sound. This is a holographic virtual space image of human skull in real dimensions and comes as close as about 8-10 feet in front of the plate. About his installation Zone writes,

As the viewer walks into the image, a gunshot blast is heard and then a voice of authority declaims: You have entered a restricted zone. In this zone you are in danger of being exposed to the horrors of war. There is no excuse for men and women to kill each other. Nothing justifies this ultimate human sanction. Think about this message and leave this zone immediately! (Zone, 1989).

David Warren cut the hologram in thin slices which he for formed Twitter messages and used them for holographic installation called *Hololujah*, in 2011 (Fig 19). Warren explains the installation:

The holographic text is a combination of actual tweets and fictional tweets. Thirty-four topics are covered which equates to the number of metre frames, each frame containing thirty tweets. Tweeters represented range from Lady Gaga (maybe), NASA updates, a girl next door, while topics included B grade movies, diets, how to rob banks, terrorism and the making of *Hololujah* as well as fictional tweets that discuss UFO's, capitalism, time travel and blondes know best. (Warren, 2012).

It could be seen for further examples of holographic installation created by Ikuo Nakamura, Gamble & Wenyon, Setsuko Ishii and Sally Weber's works (Fig 20) (Işık, 2014,a,b).



Fig 18 Al Razutis, *Field*, 1983, mastered as two-color and two-channel interferometric hologram, exhibited as 30 x 40cm, produced by Al Razutis (hands on) in association with Fringe Research (Michael Sowdon), Collection of the artist, private collections (Razutis, alchemists.com).

Fig 19 David Warren, *Hololujah*, 2011-12, 1 kilometre x 3.5 cm, white light achromatic transmission hologram (Warren, zipsisterholography.com).

Fig 20 Sally Weber, *Trace: Emotions*, 2016, holographic installation, 41.91 x 27.94 x 40.64 cm opened (Weber, 2016, sallyweber.com).

Environmental Holography

This term, particularly is used to describe the holographic works which are integrated nature, architecture or public places. Due to the visual and spatial appearance, environmental holography could be considered a holographic installation (Işık, 2014-b).

From end of the 1970s to today Setsuko Ishii has produced many environmental installations. She notes; “sunlight is ideal light to rainbow hologram.” *Encounter II* (1979), *Munsel's Play* (1997), *Rainbow Chat* (2000) and *Apollonian Gift Series* (1993-2007) are the some of her environmental holography installations (Ishii, 2009).

Environmental art works have been produced using factors including sunlight, time, weather, and climate. Outdoor artworks that make use of factors such as electricity, water, and wind do exist, but the ones that are integrated with sunlight were only realized through holography (Ishii, 2006).

Harriet Casdin-Silver's *Centerbeam II* (1978) (Fig 21) “was a environmental outdoor sculpture by the artists of CAVS and participating scientists and students.” For this collaborative outdoor environmental installation “the system for reconstructing the holograms by both sunlight and artificial light was refined” (Casdin-Silver, 1989: 323).

In installations of Sally Weber's *Lightscape and Focal Point* (1982), sunlight diffracts could be seen as holographic elements into spectral colors that alter with their positions or lighting conditions (Weber).

In 1990, British Rail commissioned Graham Tunnadine to produce the *Holographic Clock*. His massive spiral construction incorporated 132 reflection holograms used to indicate numbers and, linked to an atomic clock and computer controlled specialist lighting, could be used to tell the time (Pepper, 1995: 234).

Martin Richardson's *English Oak* (1982) (Fig 22) is the another example of environmental holographic art works. Richardson explained this work in his article entitled "Mixed Media: Holography within Art":

I designed the series of holograms entitled English Oak to be lit by sunshine rather than by conventional gallery lighting. The main elements of these works are the real bark of the trees and the 8x10-inch reflection holograms surrounded by the bark (Color Plate No. 0). Each hologram has an image volume of approximately 2 cubic feet. In this holographic space, detached leaves and twigs appear to float, submerged in red light. The subject matter appears in silhouette, producing an effect similar to that of looking up into the branches of a tree at sunset. The illusion is heightened by the juxtaposition of the hologram with the real bark framing it. Unsuspecting viewers may think that the hologram is a box illuminated with red light, not realizing that the hologram is actually a flat surface and that it creates its image by behaving somewhat like an optical mirror, i.e. it actually focuses the rays from the sun into an image by diffraction (Richardson, 1987; 253).

Sometimes artists use ready made holographic materials. *Sally Weber's Evidence of Time* (1993) and Japanese artist Hiro Yamagata's *Quantum Field X3* (2004) (Fig 23) is the example of environmental holographic art created with ready-made holographic materials.



Fig 21 Harriet Casdin-Silver's solar-tracked holograms on *Centerbeam II*, a CAVS/MIT collaborative outdoor environmental sculpture, in Washington, DC, 1978, Photo: M. Palumbo. The holograms, which are from the *Equivocal Forks II Series*, each measure 31.75 x 41.91 cm, with the images projecting frontally 91.44 cm (Casdin-Silver, 1989: 323).

Fig 22 Martin Richardson, *English Oak*, 1982, reflection hologram, silver halide on 20.32 x 25.4 cm glass plate, Collection of the Museum of Holography, New York (Richardson, 1987; 257).

Fig 23 Hiro Yamagata, *Quantum Field X3*, August 13, 2004 – April 30, 2005, consists of two huge structures covered with holographic panels, onto which laser beams are projected to create a vibrant composition, Guggenheim Bilbao Museum (guggenheim-bilbao.es).

Conclusion

The examples described in this thesis have shown that there are many terms in holographic art. Some of these are taken from other disciplines and the others are added by the scholars who developed the technique. Holographic art uses the jargon of science besides different art disciplines. From the early 1970s to today it is being developed by artists. Artists continue building the own jargon in holographic art. To understand holographic art, it is important to master the holographic art jargon. We should know the holographic art jargon created/used by artists beside created by scientists and holographers to give meaning to holographic art.

Holography is still an evolving technique and its terminology will be much richer than it is today. Additionally the usage of various science, technology and art forms with

holography helps holographic art's jargon to get richer in a steep way. Time will show us which of these words will survive and be used in holographic art. The examples described in this thesis have shown that using different diversity of different holograms in art enriched artistic expression and it also enlarged the limitation of many branches of art. Therefore, it can be said that with the interdisciplinary structure of the holographic art jargon will be enlarged.

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