DOI: 10.20472/AHC.2019.005.009

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SURVEYING THE TECHNICAL AND VISUAL FACILITIES OF DIGITAL TECHNOLOGY IN MURAL PAINTING

Abstract:

Digital technology and new inventions caused changes in methods, facilities, living style, and eventually in art. New perceptions of aesthetic and existence appeared. In this regard, mural art and its concept experienced many alterations. Now, we observe diverse frescos benefitting from capabilities of soft and hardware digital, in the process of their creation. Acquisition of vast capabilities of digital technology, devices and facilities indicates that modern devices are more advanced and their utilities are more diverse than the traditional ones. Nowadays, with the expansion of technology and artistes' tendency in using modern devices, necessity for perception of new concepts in frescos as multi-dimensional art is quite noticeable. Restrictions are minimized and possibility for performing them with modern capabilities in interaction with architecture environment, space, and audience senses is provided and special visual attractions for artist and urban management is created.

Keywords:

Digital, Mural, Fresco, Visual, Multi dimensions

Introduction

Fresco, today unlike the past, is not restricted by equipment, tools, specified technical methods and even not limited to special area; rather this art nowadays is affiliated to linguistic and expression of idea, conditions, technical provisions for creation of art work, and technological development of its era. So, viewing the world contemporary works; it is easily understandable that the previous equipment and tools are no longer capable for providing all demands of artists. Fresco artists now prefer the modern methods to traditional ones in many cases. This matter puts forward a fundamental inquiry that what elements in modern methods and technology caused this great appetite in artists toward digital new capabilities. Digital technology abilities that are utilized everywhere have been surprisingly influential in contemporary art so that, in one side, we are witnessing the increase of new tendencies in various branches of art, several of which are merely resulted from the advent of digital technology; and on the other side, conditions associated to modern life, which is rapidly changing, and modern life itself do not appreciate previous methods of fresco, except for certain cases. Therefore, the study of digital technology and acquisition of its visual, technical capabilities, even though very slight, is vital for fresco artists about this technology and advancement of aesthetical and applied objectives in fresco. Thus, in present research, the function of digital technology and its technical, visual facilities in frescos are taken into consideration.

1. What is The Digital in Art?

Computer art, in general involves works whose creation and/or operation is dependent upon computer technology. One might talk in more specific terms of digital art when recognition of the role of the computer is, in some way, a part of the work's meaning. (Crowther, 2019)

We are in an interesting position in history. In a place that sometimes the recognition among technical inquiry, scientific research, and art is very difficult and this is an indication that develop various artistic and research viewpoint. Digital technology, which has an irrefrangible relevance with computer and zero and one system, maintains various capabilities, that aside from different sciences, has several applications in the process of artwork creation. Nowadays, computer and its versatile devices are able to provide many facilities for the users in the field of art and are primers in modern transformation of art works. In this way, new artists are born in the field of digital art who could overcome the limitations of materials and affiliated technologies in fresco because, throughout history, artists, technology, and even aesthetic of artworks were imprisoned by constraints of visual and expressive capabilities of equipment and materials, which with slight changes, were used in creation of artworks. Therefore, by artists turning to digital arts, new gateways to art world opened resulted in rapid creations, performances and even more influential modern visual and expressive qualities. Aside from these, the influence of digital field on art created a new challenge in the concept of new realism. According to Stephan Wilson: "Information Arts takes an unorthodox look at this question, focusing on the revolutionary work of artists and theorists who challenge the separations initiated in the Renaissance. It points toward a possible future in which the arts can reassume their historical role of keeping watch on the cultural frontier and in which the sciences and arts inform each other". (Wilson, 2002)

In other word, digital works are able to put a kind of end to the controversy of objectivity and

mentality. Also, digital world is able to provide possibility for both artist and audience to experience, in a mutual interaction, virtual image and reality along with each other. By this specification, a work, aside from creation by computer, can be presented for various applications in form of digital and in this way an identity is granted under the title of “Digital Art”. (Teresa Marra 2013)

In the following table, a list of digital art is presented that fresco artists are able to use, in a kind, so that the dramatic consequence of their works based on the technical and visual capabilities of digital phenomenon in the field of art is expanded.

Table 1: Interactions of Digital Technology in Mural Painting

Some arts related to digital technology	Interactions		
	Method	Direct	Indirect
Digital Art	Using digital technology in creation of images and performing fresco	*	
Video Art	Using animated images and broadcasting by projection	*	
Video Installation	Using video projection and LED and LCD proportional to quality and quantity of walls and monitors		*
Photo Art	Using imaging capabilities of digital cameras in photography and photo layouts	*	*
Interactive Art	Providing possibilities for the interaction of audience with digital fresco by using sensors, computers, and digital controllers	*	
Net art/Web Art	Using internet media and its capabilities according to wall conditions and environmental cultural, social demands and audience in creation of digital fresco	*	*
Live Art	Using human in vast spaces, similar to smart pixels in computer images by which and by using digital devices such as LED lamps controlled by computers, digital images with large dimensions are created	*	*

Multimedia Art	Using various media that computer, as a mediator prepare them for a wall layout	*	*
Sound Art	Using methods of recording and broadcasting sounds and creation of special effects in digital frescos for revival of mental images of audience.		*

Source: author (based on K. Moghaddam, Rahbani 2011)

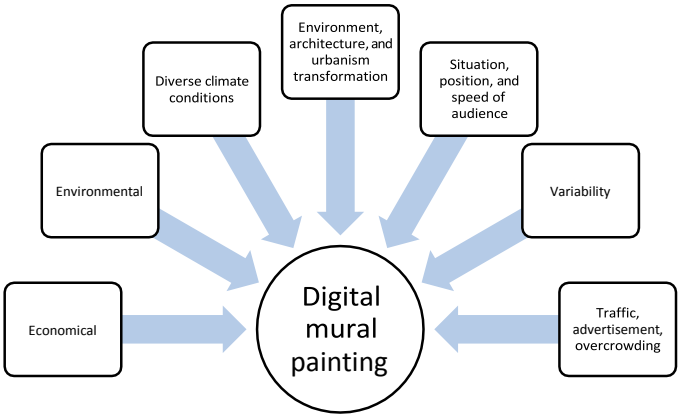
The above table, while confirming the vast use of digital technology in fresco art, indicates that interaction between art and digital technology comprises high capabilities of art fields with environment, architecture, and audiences in various forms and provides diverse capabilities for experimental artists.

2. Fresco (mural painting) and Digital Technology

Fresco is a technique of mural painting executed upon freshly laid, or wet lime plaster. Water is used as the vehicle for the dry-powder pigment to merge with the plaster, and with the setting of the plaster, the painting becomes an integral part of the wall. The word fresco (*Italian: affresco*) is derived from the Italian adjective fresco meaning "fresh", and may thus be contrasted with *fresco-secco* or *secco* mural painting techniques, which are applied to dried plaster, to supplement painting in fresco. The fresco technique has been employed since antiquity and is closely associated with Italian Renaissance painting. (Ward, 2008)

Nowadays, the choice of materials and technic are considered to be important matter because the lifestyle, environment, architecture, and tastes of audience world is quite different from the past and modern world requirements are, in cases, totally far away from the past and using traditional materials and its proportional conditions is not tolerated. As an example, some issues that indicate the requirement of using new materials and modern methods are quite interrelated with aspects like architecture changes and advancement in modern technology in architecture, genesis of new materials in wall, shelf life of the building (wall), environmental changes, space visual specifications and capabilities and its necessity for coordination with the climate and atmospheric conditions, harmony of material used in fresco with the aesthetic structure of architecture, and physical-spiritual features as well as general qualities of audience. Thus, mandatory interaction of these factors and qualitative connections fresco from one side, and the need for considering the diverse capabilities of digital technology in fresco from the other side, necessitate the creation of areas and substrates for the recognition of contemporary digital frescos. The following table has a general view toward this matter and the requirement for paying attention to this technology.

Table 2: Influential factors of digital mural painting



Source: Author

3. Technical facilities, tools and equipment

It should be noted that, in spite of all quality capabilities, digital technology needs devices and equipment which are, in a kind, related to this technology. It should be considered that equipment related to this technology, aside from computer, include a vast range of tools such as cameras, digital filming devices, digital printing machines, laser videos, and other equipment which influential in expansion of this technology in such a way that along with the increase in efficiency and diversity of these equipment, the potential abilities of digital technology divulge constant advance in functionality. Sometimes, these equipment's are such complicated that only technical specialists are able to understand their workmanship. Anyhow, the recognition of the capabilities of these tools is inevitable and obligatory for the artists in order to expand the visual and expressive aspects and spatial creation of their works. Nowadays, this technology presents more recent abilities in creation of art works. Thus, definitions, workmanship, and applications of some of these hardware are listed below along with some samples of digital frescos:

3.1. Controller and processor devices

controller and processor devices are those which perform the processing operations on data as requested and ordered by the user.

3.1.1. Digital computers: The digital computer is a programmable electronic device that processes numbers and words accurately and at enormous speed. It comes in a variety of shapes and sizes, ranging from the familiar desktop microcomputer to the minicomputer, mainframe, and supercomputer. (www.encyclopedia.com)

3.1.2. Microcontroller (MCU): A microcontroller is a computer-on-a-chip, or, it may be considered as a single-chip computer. Micro means a small device, and controller identifies it as a device to control objects, processes, or events. (Hussain, Hammed, Hafeez, Tabinda, 2016)

3.2. Digital printers

Printers: these devices are in a vase range of models and with diverse functionalities so that the possibility of printing images in various dimensions on different surfaces is provided. Presently, printing on materials and general substrates such as tiles, parquets, wallpapers, different metals… in desired sizes and printing on specific surfaces such as stones, mosaic, glass, and even ice to cover tremendous surfaces is possible.

3.3. Image recording devices

3.3.1. Digital cameras: These are cameras that shot images are save electronically instead of saving of common films. When photographer pushed the shutter button, digital camera uses an CCD (Charge Coupled Device)[1] element for taking the image through lenses. A circuit inside the camera save the images shot by CCD in a “storage media” like Solid State Memory with a hard disc. Saved images, by the help from a software, presented along with the camera and through various route (cable, Bluetooth, …), are loaded in a computer (Dall’Alba 2011/2012) Today noticeable number of artists are using this technology for preparation of their images because of its numerous advantages compared with analog. Printing these images by digital printers and displaying them by video players, which are briefly explained below, can be used in creation of exquisite and innovative frescos regarding the necessity of interaction with environment and architecture in external and internal spaces (Ibid).

3.3.2. Digital filming- Video digital: Digital filming cameras, similar to other cameras, are produced constantly in more advanced models and higher efficiencies and are naturally responsive to various demands of interested people in photography. Artists are no exception and are able to use these cameras in order to record their required images in video arts. Playback of the videos are possible by the help of video projection, computers and various display screen which have numerous and influential applications in fixed and animated frescos in external and internal spaces. The use of digital method, compared with analog which was used earlier maintain the following advantages. (K. Moghaddam, Rahbani 2011)

3.4. Display screens

3.4.1. LCD (Liquid Crystal Display): Is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. (www.merriam-webster.com). LCD technology present digital screens from under 1 to 100 inches (Lee, Liu, WU, 2008). The role of these screens for interactive frescos and internal spaces frescos is very important.

[1] Is a device for the movement of electrical charge, usually from within the device to an area where the charge can be manipulated, for example conversion into a digital value.

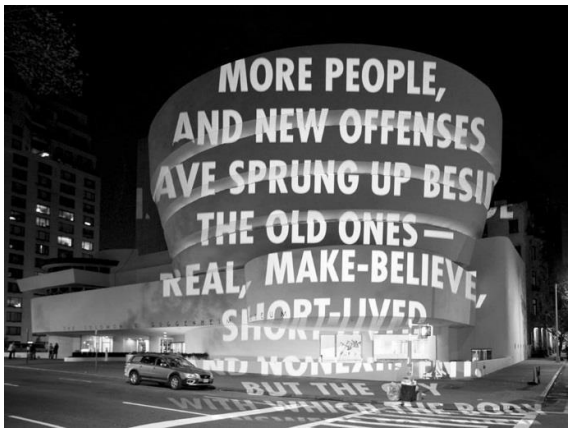
3.4.2. LED (Light Emitting Diode): is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. This effect is called electroluminescence. (www.britannica.com). Of course, it is very difficult to use LED for small screens because the quality of the images lowers; so usually LED is used for very large screens such as color or semi-color screens of external spaces. LED screens has a low energy consumption and live very long and are used in sizes over 100 inches which is formed by millions of LED lamps in external spaces. These digital screens (LCD and LED) maintain special modern visual capabilities which are adequate for decorative, applied, interactive frescos. As an example, interactive frescos with LED sensors or cameras installed on top or down show reaction to the movements of audience or record them or proportional to audience movement display images. This capability in interactive frescos in which the audience plays the main role has a wide application and samples of the applied frescos can be daily observed in the city. (Fig.1)

Figure 1: Interactive wall LED in Winter Light Festival at Canary Wharf

Source: www.lightingdesigninternational.com

LED lamp, aside from above mentioned, possess other applications in digital frescos, which are very diverse and sometimes seem unlimited. One of these application is specific lighting on invisible walls and extensive surfaces of enormous buildings, or even narrow wall and surfaces with small area, on structures, bridges, and on all other narrow areas on which the performance of work is impossible (Fig. 2). Using this technical facility, varied moods with unlimited and rare visual effects are made. It is possible to create invisible surfaces with specific applications in urban spaces, especially in the dark of nights, which are charming and varied and distinctive influential works are created (Bisegna et al 2010)

Figure 2: Jenny Holzer's light projection For the Guggenheim (New York City-2008)



Source: artobserved.com

3.4.3. Plasma Display Panel (PDP): A plasma displays panel (PDP) is a type of flat panel display often used for large television displays (typically above 37 inches or 940 millimeters (mm). Many tiny cells located between two panels of glass hold an inert mixture of noble gases (neon and xenon). The gas in the cells is electrically turned into a plasma, which then excites phosphors to emit light. (www.newworldencyclopedia.org) Of course energy consumption of these displays is more than LED and LCD (Hart, 1992).

3.4.4. Air Screen: Generally, it is used in broadcasting film in outdoor places and since its interior is filled with air, it has a relatively low weight and is produced in various sizes. Therefore, its display screen, due to its weight, can be an appropriate device for digital moving or false frescos in outdoor spaces which does not need long durability (K. Moghaddam, Rahbani 2011).

3.4.5. Touch Screen: A touchscreen, or touch screen, is an input device and normally layered on the top of an electronic visual display of an information processing system. A user can give input or control the information processing system through simple or multi-touch gestures by touching the screen with a special stylus or one or more fingers (Walker, 2015).

3.4.6. Ad Panels: These are also touch screens which are controlled by computers. Although they are mostly used in advertisements, due to their capability in interactions and as mentioned in touch screens, they are widely used in general frescos below horizon line which are installed on the ground or walls (K. Moghaddam, Rahbani 2011).

3.5. Projectors

3.5.1. Video Projection: "due to its fluidity and emission feature, light is able to pass through transparent and semitransparent objects or reflects in collision with other elements. Based on these capabilities, displaying images in form of adumbration by using devices like projectors is possible. projectors made it possible to magnify images using the property of divergence of light rays. This

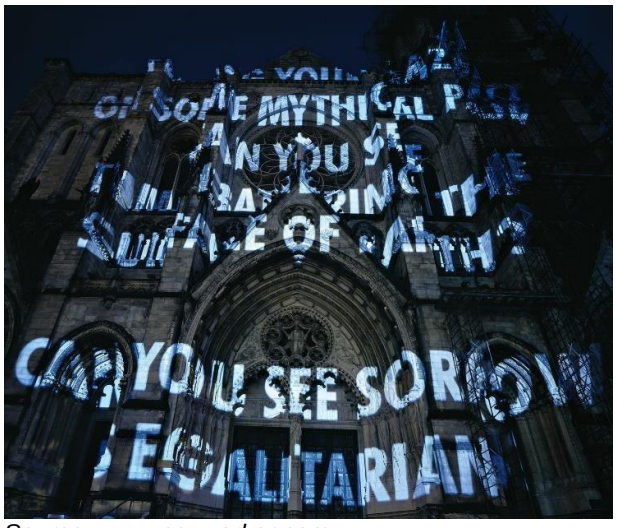
technology is majorly improved and applied based on this special capability of light; so that nowadays, this technic is used in the process of design and implementation tremendous frescos and display of images on simple, compound, or unconventional walls" (K. Moghaddam, 2009). In this way, video projectors are considered as significant apparatus in audiovisual fields and maintain various applications in the fields of advertisement and presentation of modern art works. These devices are able to link simultaneously to computer, camera, video laser, display screen, VCD, DVD, and…, shoot the images and using their light source reflect them on very large simple, compound, regular, irregular walls, or any unconventional screens and displayers (Fig.3). Currently and generally, the display is in two forms of direct and indirect systems that in its direct form two methods of front projection and back projection are customary (ibid). Present video projections offer more adequate capabilities in displaying on irregular walls and three dimensions in dark places or at nights (Fig. 4).

Figure 3: Julian Rosefldet. Using video projection (Rome-2015)

Source: www.romeing.it

It is good to mention that presently the wide capabilities of video projectors caused the creation of numerous and various frescos in external and internal spaces in big cities of developed and developing countries. Along with the expansion of exploitation of these devices, extent of creativity and innovations in presenting digital frescos are constantly increasing.

Figure 4: Jenny Holzer, featuring "To the Forty-third President," from "Blackbird and Wolf," by Henri Cole. Cathedral Church of Saint John the Divine (New York City- 2004).



Source: www.newyorker.com

3.5.2. Water screens: Transparent or invisible walls created by water, steam, or water powder are used to display 3D laser images or film projection in order to provide adequate field reading in form of back projection or direct projection. In this technic, a combination of pumps and complicated system of water pressure adjustment and spraying it in air, a film is displayed on water powder particles. This technic has the capability to be performed indoor and outdoor and it can be utilized in creation of 3D frescos with complete field reading (360 degree) that involves audience other senses. (K. Moghaddam, Rahbani 2011)

This technical capability, transparent quality, softness of walls with flexible, unconventional, unstable frescos is well considered by environmental artists and space makers (Fig. 5).

Figure 5: The Largest water screen projection (Dubai-2017)

Source: becuriousgetsmarter.blogspot.com

3.5.3. Laser projectors: A laser projector is a device that projects changing laser beams on a screen to create a moving image for entertainment or professional use. It consists of a housing that contains lasers, mirrors, galvanometer scanners, and other optical components. A laser projector can contain one laser light source for single-color projection or three sources for RGB (red, green, and blue) full color projection. (www.ktvn.com)

4. Analytical Comparison of Traditional and Digital Mural Painting

Regarding the wide visual and technical facilities of digital technology and its advanced tools and devices, mentioned so far, the diversity and extended visual and expressive capabilities of this technology in modern frescos, compared with traditional ones, can be easily observed. Undoubtedly, quality and quantity changes and developments of fundamental factors of fresco like architecture, apace and environment, audience in urban fresco as a spatial art have contributed in formation of these differences and capabilities. In the following table, the differences and similarities of these capabilities between traditional and modern frescos are surveyed.

Table 3: survey of fundamental factors of traditional and modern (digital) mural painting

Fresco Fundamental factors / Specialties		Traditional Mural Paint	Digital Mural Paint
Environment ant architecture aesthetic	Attention to cultural condition, environment and audience	In some cases	Basic items which are under attention of artist and it is constantly increasing
	Attention to architecture structure of environment	Generally, it is observed	Principles that should be noted but generally and due to advertising domination are not observed
	Attention to wall architecture (possibility of forming fresco)	Frescos were limited to architecture and they were performed only in architecture frame	Frescos can show its domination over architecture and even be performed on space
Technology and strategy	Tools, devices, materials	Traditional tools: colors, brushes, … Method: fresco Buon, fresco platform, mosaic, vitra, Embossed painting, excavation	Devices which are related to digital technology (soft and hardware) computer, digital cameras, video laser, projection, hologram images
	Possibility of creating structural changes in frescos and updating it in short time	Impossible	It is easily possible and capability of changing forms, colors, texture and subjects can be created
	Capability of displacement and mobility partially and totally	It is possible on some moving surfaces like windows, panels, sliding doors, curtains	Nowadays, a branch of frescos is related to moving frescos and fake walls which maintain the capability of moving in space and are classified into moving and semi moving classes
	Restoration and cleaning	Due to using traditional colors, greasy and	Due to utilization of impervious surfaces and

		contaminated layers cover them over the time and restoration and cleaning is very difficult	virtual frescos and also using electronic tools and materials, cleaning is very easy and possible in a very short time
Technology and strategy	Possibility of proliferation of frescos and simultaneous display	It was very difficult and time-consuming and it was necessary to be done under the supervision of a master	With digital facilities, it is possible to multiply them in any necessary number and in any dimensions. It is possible to provide several versions to be displayed simultaneously
	Utilizing sound and movement in fresco	----------	Maintain the capability of using sound and movement in vast area and have active interaction with audience
	Fitness to terms of time, modern life and its requirements	Works are imprisoned in time and place from conceptually and in meaning and they did not match with the speed of changes in life conditions and environment	Digital frescos are coordinate with the speed and instability of modern life and is adjustable with terms of time and modern life requirements
	Project executors	Painter and disciples	Expansion of the interaction between art and science and cooperation of artists with engineers and specialist in digital various fields
Audience	Attention to audience and interactions of audience in works	In some specific cases and very limited	It is a specific feature of these frescos and considering it is increasing ; in some cases, audience has the main role in fresco and its advancement
	Attention to field reading and visibility	In some cases	A noteworthy basic element in digital fresco

Audience	Utilizing all five senses of audience	Based on seeing and touching	The possibility of employing all five senses of audience in interaction of audience with fresco
	Possibility of field reading at night on a scale of day	It was so limited and slight	This capability is a special feature of digital fresco and because of presence of people in streets at nights, is a strong point this type of frescos and the possibility of forming a different space during night, compared with, day and creation of variety in night atmosphere is provided

Source: Author (based on K. Moghaddam, Rahbani 2011)

In consequent of this comparative table and considering the modern life, its requirements and facilities, especially in big cities, and also restrictions of previous methods of traditional frescos, the necessity of utilizing new methods and creation of digital frescos is clearly observable.

5. Conclusion

Digital technology, aside from providing abundant visual, expressive, and technical facilities for artist, is an adequate choice for contemporary fresco in which speed and accuracy are vital factors. Besides, this technology maintains an excellent proportion with presentation of required concepts and issues of modern human and also provides special adequate facilities for fresco and peripheral artists. Thus, using digital fresco propel artists to lean on durability of concepts and beneficial interaction with audience, instead of leaning on durability of materials, to the extent that nowadays and with the assistance of this technology in digital frescos, it is possible to interact with all senses of audience and create a circumstance in which the audience is not only a part of the work but also to be involved in the process of alternative forming of the work and figure out the continuation of the work. Contemporary artists, recognizing digital capabilities and disregarding the past restrictions and spending shorter time, is able to create persistence works; even though the necessity of being aware of recent knowledge for using the facilities and cooperation with specialists is inevitable and turns the creation of a work as an individual creation to a team project in which the presence of specialists alongside artists seems to be mandatory and as per the concept of the work, aside from high expenses, a technical group work is obligatory.

In this way, along with the increasing advancement of equipment and digital technology, even though special restrictions are still governing this field, artists, for creation of influential frescos, proportional to variationism and plurality of modern society, are overcoming restrictions and increasing visual and expressive capabilities and facilities with assistance of scientific and technical fields.

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