



The Evolution of Visual Art: From Painting to Interaction Design

Danzhu Li^{1(✉)} and Gerrit C. van der Veer^{2(✉)}

¹ University Twente, Enschede, The Netherlands
lidanzhu@icloud.com

² LuXun Academy of Fine Arts, Liaoning 69121, China
gerrit@acm.org

Abstract. This paper focuses on the application of interactive technology in contemporary visual art, showing that current development has traces in history. We sketch an evolution, from the creation of primitive visual art to interaction design and wearable art. We will discuss how the artist communicates through his creation with the intended audience, and how new technology enables the art work to interact autonomously.

Keywords: Interaction design · Wearables · Stakeholders · Visual art
Co-creation of artistic experiences

1 Introduction

Goal of our research is to attract attention from different stakeholders in visual arts, so that they discover their changing roles and appreciate the potential for unknown mutual collaboration and cooperation. In this way, we may achieve an ecological art environment that supports survival, co-creation, and development. The current paper focuses on the application of interactive technology in contemporary visual art, showing that current development has traces in history. We sketch an evolution, from the creation of primitive visual art to interaction design and wearable art. In Sect. 2, we will show how visual art has always resulted in an artifact (a “thing”) to communicate and to trigger understanding, experiences and behavior in an audience. In Sect. 3, we will discover how in the new world this “thing” can be created to interact: Visual art is getting a true life of its own.

2 A Short Account of a Long History

Interactive technology is developing rapidly. The Internet of things promotes interaction design for diverse audiences and many platforms, more practical, more interesting and more approachable than ever before. As Weiser points: “*The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it*” [1].

Early visual art works were intended to present images (drawings, sculptures) of important entities: gods, people, hunting. Such is prehistoric art: It is a mixed state of

aesthetic and non-aesthetic factors, it does not only serve practical purposes but also shows aesthetic consciousness. Prehistoric art with its simple form and immature techniques attracts modern audiences and artists, partly because the content does not show too many ideas and values, which is also the goal of some streams in modern art [2].

2.1 Ancient Visitors of the Caves Understood and Experienced Their Art

Prehistoric cave- or rock paintings represent the earliest forms of painting that survived, traced back to 40 thousand years ago. We experience a hint of the spiritual life of our ancestors, and we may imagine the intended audience (members of the same tribe, gods), who were supposed to (actively) interpret and understand the message as depicted. Figure 1a shows how the artist triggers his audience to see a depicted hand, where “she” (According to archaeologists, these are feminine handprints.) in fact, paints the space around the (invisible) hand – the audience will “fill in” the invisible. The deer in Fig. 1b may well represent something related to hunt, and tribal relatives of the artist will have known much more about the values, activities, and emotions related to the scene than modern viewers will ever be able to understand.



Fig. 1. Lascaux Cave Paintings, France, Lascaux, ca 17000 BC [3]

2.2 How Our Ancestors Understood Hierarchy and Holiness

Many early historic paintings refer to religious belief, to the existence of a soul. and to prayers: after death people hope to go to heaven or be reborn.

Ancient Egyptian murals are characterized by realism combined with deformation and decoration; hieroglyphs and images are used together, and the artist always maintains the readability (Fig. 2). The picture composition is arranged with characters in a line, with different sizes according to the status hierarchy and carefully represented distances to get the image size in order. Other than this, there is a stylized regularity and unity in the form of expression, and some artistic techniques have been used continuously over many centuries to form a unique style of Egyptian art. The intended audience, whether human or god, will have understood the emotional intentions and the esthetics in relation to their interpretation of the meaning.

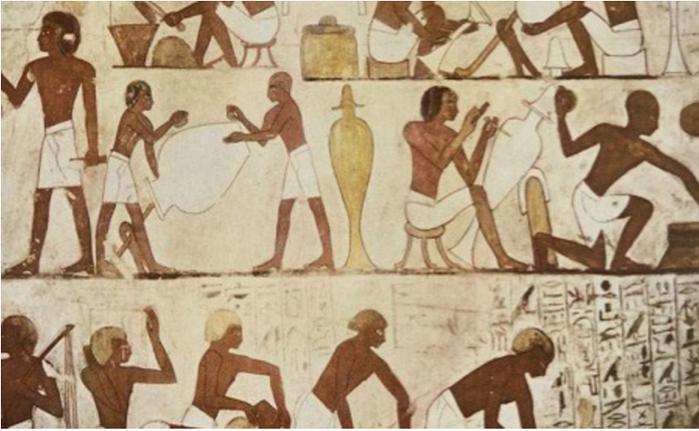


Fig. 2. Egyptian mural. ca. 1100 B.C. [4].



Fig. 3. Painting of the ode of the River Goddess, Gu Kaizhi, A.D. 348–409 [5].

Chinese early paintings, like early Egyptian art, use exaggeration to highlight the main characters, to distinguish their status hierarchy, e.g., see the Lo River map (Fig. 3). In early Christian religious painting, the halo is used to distinguish between saint and man (Fig. 4a). The same technique can be found in Buddhist paintings (Fig. 4b) where the Buddha has a head halo and a back halo, which represents the highest level of this god. Some gods only feature a head light, indicating the difference in rank. This style shows many expressive techniques in painting and sculpture, representing the meaning as well as the specific style and workmanship, which is related to a specific period. These characteristics often are used as the basis for dating.



Fig. 4. Halos of Christian gods (Giotto di Bondone: Ognissanti Madonna. Italy. c. 1310) and Buddhist gods (Dunhuang Mural. China. ca. 538 AD) [6, 7].

2.3 From Painting to Writing – New Understanding Needed from the Audience

In a next stage of civilizations, series of images were used to represent spoken language, where the individual imagines were supposed to be named and the string of names was supposed to (actively) be interpreted by the audience as a spoken sentence.

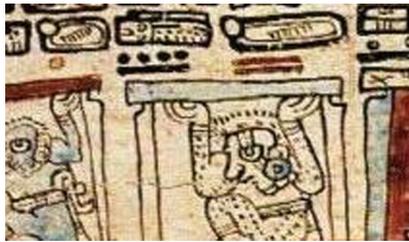


Fig. 5. Mayan text, Around the Christian era [8].

Examples may be found in Mayan texts (Fig. 5), Egyptian hieroglyphics (see left bottom corner of Fig. 2), and Sumerian cuneiform script. In each case, this type of script was used extensively for several centuries. However, in due time, the images lost pictorial details and developed into new type of “abstract” art styles, like Chinese calligraphy. Chinese characters are the only words in the oldest text that are still in use today. Figure 6 provides an impression of the development over time. Chinese calligraphy has independent aesthetic value, so it can be appreciated as a visual art. It is a technique which people learn by copying and creating their own style. The audience is supposed to appreciate the non-figural artistic qualities in relation to the meaning of the language.



Fig. 6. Examples of transformation of Chinese characters “Horse” over time [9]

2.4 Artists Challenge the Audience to Be Active

New developments in artistic techniques allowed, and triggered, active behavior of the audience: horizontal Chinese scrolls require the viewer to walk the painting from the start of a story to the end (Fig. 7a).



Fig. 7. Han Xizai Evening Banquet, China, 937-975 AD [10]; John Gipkin, Bishop King Preaching at Paul's Cross before King James I. (1616) [13].

A different type of activity is triggered by the technique of panorama painting, displayed at a 360-degree angle, so that the audience can walk around and feel immersed in the visual representation of space. Like the Panorama Mesdag of Netherlands [11].

The development of perspective drawing provided the suggestion of 3D images as rendered on a 2D surface, an early type of virtual reality, that was originally sometimes considered to be what we now would label photo-realistic. For example, (Fig. 3) the perspective and composition of Chinese paintings are free and flexible. [12] Artists use this to break the limitation of time and space, aiming at a virtual reality in the viewer's mind. Later, artists took the liberty to play around and leave the interpretation of the suggested 3D work to the viewer (Fig. 7b). In due time, the photorealistic rendering was sometimes labeled "trompe-l'oeil" – showing that the intended interpretation of "normal" painting was already beyond photo realistic, and in this way the trompe-l'oeil requires the viewer to appreciate that this is not just a precise rendering but a successful attempt to confuse the experience of reality. This shows that appreciation and interpretation develop and changes with the development of (art) history. From early 3D glasses to virtual reality, augmented reality, and so on, the audience of visual art changes in understanding, experience, and active participation.

3 Modern Times

In addition to the evolution of painting style and techniques, there is the development of color, material and composition. Developments are the result of artists applying new techniques, and of artists triggering their audience to give meaning and be active viewers to appreciate new types of experiences.

3.1 Visual Art Becomes an Acting Agent

Today, people can interact, talk, and touch art works in real space or by wearing equipment. Information and communication technology allows visual artists to develop active pieces of art. The art work can, in principle, be provided with sensors to be aware of the presence, the movements, the facial emotion features, and even the identity of individuals or groups of spectators. The art work could be programmed to react to spectator behavior or to trigger spectator behavior.

Experiences in the Different Contexts. From our analysis of museums, galleries, and international conferences we detect an amazing jump in the impact of technology on art. We will discuss some examples from the art exhibition at CHI 2016, San Jose: ‘Breaking Andy Wall’ (Fig. 8) is an interactive installation. When participants smash the canvas with the hammer, they can gradually break down the art piece. Through the playful destruction and reconfiguration of iconic art pieces, this installation reconfigures relations between art objects and their audiences [14].

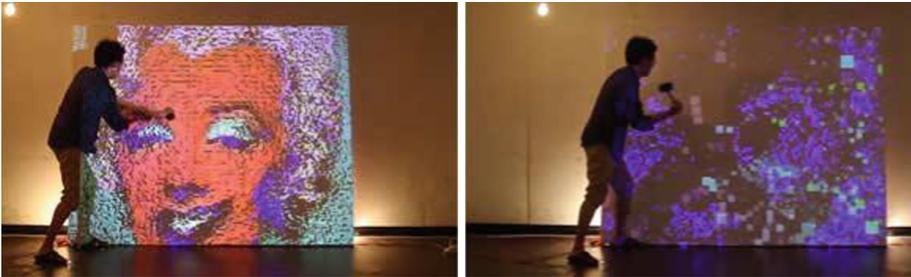


Fig. 8. Breaking Andy Wall, Interactive Art, Leo Kang

Pace Beijing Gallery is exhibiting works of Team lab from Japan: *Living Digital Forest: Lost, Immersed and Reborn* (May 20–Oct 10, 2017), e.g., Sketch Town (Fig. 9), a town that grows and evolves according to the pictures drawn by children. The “town” in this work will be developed by all participants. After the 2-D drawings of the cars, buildings, UFOs, and spaceships are completed, they are scanned, become 3-D and enter a virtual 3-D townscape. Every component of the town has a role to play; for example, the fire trucks and cranes serve to protect the town. Children can interact with the final townscape by touching individual components to alter their behavior [15].



Fig. 9. Sketch Town, Co-Creation Art, Team lab, Japan, 2017 [15]

Chinese Artists Play with Their Audience. The work “Life · Hair” (Fig. 10) was created by students at China Central Academy of Fine Arts. The main material is embroidered women’s hair on silk. Artist uses technology (the principle of static electricity) to let the audience feel the delicate emotion of women through their touch. For technical solutions, the artist collaborated with students majoring in nuclear physics at the Tsinghua University. So, the artist calls it a cross-border art.



Fig. 10. Life - two scenes from Hair, Interactive Art, Chen Yu, Beijing, 2016 [16]

The authors of work “Source” are Jiang Xiaoyan and Liu Hanlu, the Digital Media Art Institute, Shanghai Conservatory of Music (Fig. 11). In the picture, objects on the wall (simulated umbrella surface) can move with the music of the GuZheng. When the audience strikes the strings, the points on the umbrella surface are gradually converging into lines, and then covering the three sides of the umbrella, demonstrating that music can be relaxing.

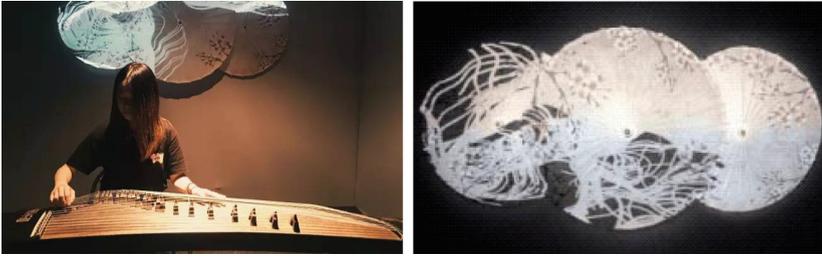


Fig. 11. Source, Co-Creation Art, Jiang Xiaoyan and Liu Hanlu, Shanghai, 2017 [17]

3.2 Art and Technology

As the great French literature master Gustave Flaubert predicted, “the more time goes by, the more art will become scientific and conversely, the more science will become artistic. Both will unite at a summit after having been separated at the base”. The development of contemporary art has been closely related to science and technology. The exploration of the new art language was meant to be a combination of technology and science, interactive, and more intuitive. Thus, we see such as new media artists, audio-visual art, code artists and other new nouns of art have a significant attribute of this era.

Wearable Art - Interactive Textiles. Wearable devices are not just a hardware device supported through software, data exchange, and online interaction [18]. Wearable devices may have powerful effect on our perception of life. Smart fabric in wearable devices is a very representative case. The trend is to make core computing modules smaller (to nanoscale units), and they are increasingly being used by artists. Philips Design gave (in 2007!) a glimpse of how will fashion look in 2020 (Fig. 12a): The Buble Dress changes its look instantaneously according to wearer emotional state. It is made up of two layers, the inner layer contains biometric sensors that pick up a person’s emotions and projects them in colors on the second layer, the outer textile, though limited to the sensor module and bulky looks [19].



Fig. 12. Buble Emotion Sensing Dress. Design group at Royal Philips Electronics, Netherlands. 2007 [19]; Fabric Strain Sensor, AdvanPro. Hong Kong [20]



Fig. 13. Kino project of MIT media lab: Pattern Changing & Shape-changing jewelry. USA, 2017 [22]; MIT's Duo Skin, USA, 2016 [23]

In fact, both artists and scientists are aiming at a substance between visible and invisible. Sensors are become smaller, and smart fabric applications become more flexible and comfortable. The SOFTCEPTOR technology of fabric sensors is currently the world's softest smart sensor being developed by the Hong Kong Polytech University team. It's a piece of washable fabric as well as a strain gauge (Fig. 12b) [20]. In contact with human skin it senses physiological information and activity signals. Artists can develop more creative channels allowing the audience and different stakeholders to work together to co-creative [21]. Technology turns inspiration and creativity into reality. More and more artists focus on interaction mechanisms with wearable and implantable devices as well as integrating Internet-of-Things technology with new interaction art paradigms. They challenge traditional thinking and bring about an art revolution and even build a new world view. What is necessary is that this innovation requires collaboration with more interdisciplinary experts. And this cooperation and co-creation will generate a new cognitive system (a symbiotic relationship between human beings and everything, including machines, of course) (Fig. 13a) [22]. The work of MIT explores a dynamic future. Kino robots attached to garments, they generate shape-changing clothing and kinetic pattern designs—creating a new, dynamic fashion. MIT's DuoSkin turns temporary tattoos into on-skin interfaces. DuoSkin devices enable users to control their mobile devices and display information. In the future, on-skin electronics will converge towards the user friendliness, extensibility, and aesthetics of body decorations, forming a DuoSkin integrated to the extent that it has seemingly disappeared [23] (Fig. 13b).



Fig. 14. Mario Klingemann's Neurography, artificial intelligence creations, 2017 [24]

Beyond Wearables: Arts, Humans, and Things - New Cognitive Systems and Symbiotic Relationships

The early computer aided graphic art has rapidly developed into the Contemporary interactive art. And it occupies almost half of the contemporary art market. Both the artist and the audience are flocking to it. Technology enhances expressiveness and empowers the artist, and push some art pioneers unique in a short period. Some contemporary visual artists want to achieve interaction of art by means of wearables (VR glasses, sensor gloves, smart fabric, etc.) So where does art leads after that? As the different stakeholders of contemporary art constantly innovate, experiment and cooperate with new technology, the boundary between art and technology becomes increasingly blurred. The birth of AI gives many possibilities to art. Through deep learning and powerful and accurate algorithms, AI systems can be made to understand art, and even cultivate an artistic creativity. Figure 14b [24] shows AI art creations. Artist Mario Klingemann has a deep interest in human perception and aesthetic theory. He researches neural networks, code and algorithms. The advancements in artificial intelligence, deep learning and data analysis make him confident that in the near future “machine artists” will be able to create more interesting work than humans. From participation to independent creation, will AI eventually replace artists? For most artists, the question is whether AI is liberating or constraining them. The intervention of artificial intelligence is only a small part of the development of visual arts. It is difficult to replace human spontaneity and imagination and complex emotional systems. Artists are rich in inspiration and creativity. They try to co-create with audience. Artists have long experimented with the creation of multi-sensory experiences. In addition to the use of wearable devices, they also attract visitors’ attention with smell, touch, and so on, to communicate a richer user experience. Like (Fig. 15), where the group of pictures was taken at a gallery of the modern museum in Stockholm: The artist used a large amount of lavender in the exhibition hall. When visitors came close to the space, they smelled fragrances. And senses feel directly to relaxation, harmony, and reminiscent of the symbiosis of human beings and nature.

Whether artificial intelligence or the integration of senses, it’s a challenge to artists. Because of the influence of computers and the internet on visual art, art creation is popular. Resource sharing and usability of interfaces and tools allow everyone to be an artist. Even people who don’t have programming skills and art foundation can use tools such as Processing and Arduino to play art (there are lots of online courses and lectures). Faced to the challenge, do artists insist on their pursuit of art or make a change? How to make the vitality of art work last for a long time? How to continue and inherit the traditional art and techniques in the contemporary environment? How does the artist adapt to the contemporary environment? This is a problem for all contemporary artists. This is also a problem for all stakeholders. Thereupon: what is going on in the domain of visual art is the development of a new symbiotic relationships between cognitive systems, art, and technology (Fig. 15).



Fig. 15. Most Ghosts Hold Grudges, Susanna Jablonski. Stockholm, 2017

4 New Techniques and Art Styles Need Understanding from All

We followed examples of historical steps in visual art to interaction design. From ancient times to the present, technology and science have played a fundamental role, and people's understanding and application has been closely followed.

Artists and their works will be more diverse, and the number of participants will increase. Stakeholders of current and future visual art should understand their new roles. Technology is still an alien domain for most artists. They should develop insight and learning ability for new techniques and paradigms, and consider blended creative patterns. It also requires stakeholders to study and develop components that are smaller, flexible and easy to use, so that more people will accept them. Universities should understand the importance of interdisciplinary collaboration and education. Galleries should be tolerant and encourage artists to innovate and experiment. Audiences should improve their understanding of contemporary art and become happy to co-create.

Acknowledgement. We thank Ernest Edmonds for his presentation on CHI 2017 that gave us inspiration to study the relation between art and technology, and we thank Elly Lammers who gave us advice and support.

References

1. Carlile, S.: Ubiquitous Computing a.k.a. "The Internet of Things", January 2016. <http://www.starkey.com/blog/2016/01/Ubiquitous-Computing>
2. Clottes, J.: What is Paleolithic Art?. University of Chicago Press, Chicago (2016)
3. Lascaux Cave Paintings. France. http://art.china.com/news/yjiji/11159337/20160418/22457325_all.html
4. Egyptian mural. ca. 1100 B.C. http://tupian.baike.com/14315/11.html?prd=zutu_next
5. Kaizhi, G.: Painting of the ode of the River Goddess. A.D. 348–409. http://blog.sina.com.cn/s/blog_6b1108160102y3xy.html
6. di Bondone, G.: Ognissanti Madonna. Italy, c 1310. <http://www.youhuaaa.com/page/painting/show.php?id=46909>
7. Dunhuang Mural. China. ca. 538 AD. <http://baike.sogou.com/h192919.htm?sp=Snex&sp=153037306>
8. Mayan text, Around the Christian era. http://www.360doc.com/content/15/0413/07/21704376_462795051.shtml

9. Examples of transformation of Chinese characters “Horse” over time. <http://www.ahshuhua.net/wenhuachuanbo/2014shang/whcb20140131madeyingbian.html>
10. Xizai, H.: Evening Banquet, China, 937–975 AD. <https://fejune.tuchong.com/albums/0/19280734>
11. Panorama Mesdag. <http://www.panorama-mesdag.nl/bezoek/>
12. Yudong, C.: Art of Chinese Painting. Shanxi Education Press, Shanghai (2009)
13. Gipkin, J.: Bishop King Preaching at Paul’s Cross before King James I. 1616. <http://journalofdigitalhumanities.org/3-1/transforming-the-object-of-our-study-by-john-n-wall/>
14. Kang, L.: Transgressive and Playful Exploration on the Dynamic Role of Users in Art and Design (2015). http://www.laewoo.com/breaking_andywall/index.html
15. Team Lab: Sketch Town. Pace Beijing (2017). <http://art.team-lab.cn/w/sketchtown/>
16. Yu, C.: Life • Hair. Beijing (2016). <http://wx.paigu.com/a/774622/50374629.html>
17. Xiaoyan, J., Hanlu, L.: Source. Shanghai (2017). http://www.sohu.com/a/152503391_309195
18. Gowrishankar, R., Bredies, K., Ylirisku, S.: A strategy for material specific e-textile. interaction design. In: Smart Textiles, pp. 233–257. Springer, Heidelberg (2017). https://doi.org/10.1007/978-3-319-50124-6_11
19. Weir, J.: Bubelle Emotion Sensing Dress, November 2007. <http://crunchwear.com/bubelle-emotion-sensing-dress/comment-page-1/>
20. AdvanPro: Fabric Strain Sensor, Hong Kong. <http://advanpro.hk/?p=25&tab=0>
21. Candy, L., Edmonds, E.: Explorations in Art and Technology. Springer, London (2002)
22. Kino project of MIT media lab: Pattern Changing & Shape-changing jewelry. USA (2017). <https://www.media.mit.edu/projects/kino-kinetic-wearable/overview/>
23. MIT’s DuoSkin turns temporary tattoos into on-skin interfaces, August 2016. <https://www.techcrunch.com/2016/08/12/duoskin/>
24. Klingemann, M.: Neurography-Artificial intelligence creations, November 2017. https://www.sohu.com/a/203047633_373406