New Carriers, Media and Forms of Public Digital Arts

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Abstract. The advances in science and technology bring the public digital arts from traditional carriers towards new media types. The use, the language and the implications of the material itself are different from it being applied as a carrier for public digital arts. These new media types of public digital arts are in need of new carriers and new form languages for its progress and prosperity in the age of the new technologies. In this paper we look into three generations of public arts, from traditional ones with static forms to new ones with dynamic and interactive forms, illustrated and discussed by examples of public arts.

Keywords: digital media, public digital arts, carriers, forms

1   Introduction

The new development in computer graphics has brought the artists into the wonderland of Alice's adventures – together with the new possibilities coming with these new tools are the new challenges. Digital artists must spend a lot of time and effort in learning new technologies but still can hardly keep up with the development [1]. It also applies for public arts, especially when new digital technologies are used. The term "public arts" often reminds people of the traditional art forms such as sculptures, murals and installations in public spaces in cities. Even the pavements in city squares or the lawns in the parks can be seen and used as the carriers of these public arts. The term "carrier" is usually referred more to the material being used in these public arts whereas the term "form" is referred to the shape, appearance or configuration of an artifact created by an artist. Along with the advances of science and technology, more and more new materials are developed, and new forms of public arts continuously emerge. It constantly challenges the artists in applying and mastering these new carries, media types and forms, which cast new light onto the traditional public arts.

For artists, material is of vital importance in expressing their thoughts, motives and emotions [2]. Material is a language of art, and it is the carrier of art. It has gone through several generations in the art history. From natural materials to recent smart

materials [3], there has been distinctively five generations: the first generation of natural materials such as wood, bamboo, cotton, fur, leather and stones; the second generation of man-made materials such as wood-based panels, paper, cement, metal, ceramic and glass; the third generation of synthetic materials such as plastic, rubber and fiber; the fourth generation of composite materials such as fiber-reinforced materials used in aerospace components; the fifth generation of smart materials with one or more properties that can be changed or controlled by external stimuli, such as stress, temperature, electricity or magnetic fields. The advances in the material science has pushed the evolution of material technology forward, which has also a great impact on its application in the field of arts [3, 4].

In the traditional public arts, the materials of the first and second generation are most often used. Along with the development of the material technology, the synthetic and composite materials are more and more applied, however the forms of the public arts remain static. The recent development of the smart materials and especially the digital media brings dynamic forms to the public arts that utilize different modalities of the senses. The further development in sensor technology, computer and mobile networks brings interactivity to public arts [5]. Next we explore the characteristics of three generations of static, dynamic and interactive forms of public arts.

2   Carriers and Forms

Looking into the development of public arts, especially the introduction of interactivity, Edmonds, Turner and Candy [6] defined four categories of art and generative technology according to the carrying material, technology and interactivity:

1. *Static forms*: There is no interaction between the art artifact and the viewer, and the artifact does not respond to its context and environment.
2. *Dynamic and passive forms*: the art artifact has its internal mechanism to change its forms, or at most reacting to the changes in its environment such as temperature, sound or light. The viewer is however a passive observer and has no influence on the behavior of the artifact.
3. *Dynamic and interactive forms*: The viewer has an active role in influencing the dynamic form of the art artifact. The input from the viewer can be gesture, motion, sound as well as other human activity that can be captured by the artifact.
4. *Dynamic, interactive and varying forms*: in this category, the dynamic form of the artifact varies from the original specification of the artifact and the effect cannot be predictable completely, interactively influenced by the human activity.

We consider that it is hard to differentiate the varying forms from other dynamic and interactive forms, since when interactivity is introduced, the "dialog" between the viewer and the perceived dynamic form of the artifact can always "vary" depending on the difficult-to-predict behavior of the human viewer. In the next discussions we do not differentiate the varying forms from other dynamic and interactive forms. We categorized into one "interactive forms". Dynamic but passive forms are categorized into "dynamic forms", next to the first category of "static forms". These three catego-

ries of the art forms fit well with the three generations of the forms as we mentioned earlier in the introduction.

2.1 Traditional static forms

Traditional material such as wood, stone, earth and metal are used in often seen art forms such as paintings, sculptures and reliefs. Most of the public arts today use often these traditional carriers. For these public arts in modern cities, it is important to apply the traditional material with new concepts in the use of shape, color and texture and the combination of different materials. Wood gives people feeling of being warm, easygoing, relaxed and romantic, whereas metal gives the feeling of being strong, hard, cold and serious. But it is not necessary that every material has its code in meaning – it depends also on the other properties such as shape, color, texture and its composition in the space

In the traditional public arts, the conceptual functions and the material functions are often well integrated [7]. The most seen forms of these traditional public arts are static sculptures in the public spaces in the cities. One of the examples is the cast bronze sculpture "Girl on the phone" at the metro station Huaihai Zhonglu in Shanghai (**Fig. 1**). The girl is in a mini skirt, with one hand on her waist, and the other holding a phone, making a call. She looks very casual and comfortable. She is obviously charming and fashionable, but at the same time being a girl next door in the Shanghai's twenty first century. The door of a phone booth made out of copper and glass gives the sculpture a touch of contextualization and realism. The sculpture is placed at one of the busiest streets in the city, not only landscaping the street with a new look, but also bringing the modern city closer to the general public. The use of traditional material and the realism serves well the conceptual functions of an art piece.

Fig. 1. Girl on the phone, Shanghai, by Yong He

Generally speaking, most of these traditional static carriers are still having their applications in modern wood and/or stone sculptures, and architecture, also for their colors and lines. However the modern cities require the modernism in using these static carriers, which leads to an almost complete freedom of materials and process. Not only can a wider range of materials be worked by modern techniques, but also new types and form of materials such as sound and light can be integrated in creating dynamic forms.

2.2   Modern dynamic forms

Every category of arts has its own material carrier and language, which is reflected by the form and the operation of the carrying medium. Sculpture, painting, calligraphy, printmaking, architecture and photography use the visual channel by means of visual symbols such as shapes, colors, lines and visual composition, whereas music and broadcasting use the auditory channel by means of auditory symbols such as voice, audio and tunes. Moreover, movie, theater, opera, dance, television, entertainment and acrobatics integrate both means of visual and auditory symbols, in which color, scenery, stage arrangements are visual symbols, and voice, background music and sound are auditory symbols [8, 9].

The emergence and advances in multimedia and information technology have forever reformed the materials and the forms of arts, with unprecedented impact on the traditional art forms such as painting, sculpture, calligraphy and music. The landscape of the arts had been changed by the digital media. This change gives artists new perspectives into materials. These materials are not only visible, but can also be sensed in other modalities such as sound and smell. Not only traditional hard materials can be used, new materials such as light, water, wind and fog can be applied to create dynamic effects, in which time, as the fourth dimension, is introduced. Public arts do not only allow the artists to express their creativity in space, but also gives the freedom in the time dimension to create dynamic forms.

Fig. 2. Datafountain, Eindhoven, 2004 [10, 11]

One of the examples is the Datafountain [10, 11] (**Fig. 2**), an internet enabled water fountain connected to real time currency rates. The relative exchange rate between Yen, Euro and Dollar is refreshed every 5 seconds and their interdependence is visible in water. Usually a fountain is placed in a space for aesthetic reasons. People experience it as a pleasant object in their environments. The dynamic form of water is used to display the changing exchange rate in an environment, not only having its aesthetic qualities as a usual fountain, but also serving a particular information function.

Another example is the installation "Composition of nine dragons" by Feng Wang in the Xiaolongwan metro station in Nanjing. The installation is inspired by the traditional Chinese stone relief "nine dragon walls", but equipped with new materials and new form languages. It is based on the traditional patterns of dragons that are often seen on jade accessories, but integrating seamlessly new materials such as stainless steel and glass mosaic with rich color and texture dynamics. In the background are traditional patterns such as water waves, moving clouds and flying dragons and in the foreground the relief technique is applied in creating vivid curves. In between the layers of the patterns LED lighting changes its intensity according to the lighting conditions in the environment, creating effects of dynamic colors, shadows and illumination. In this art work the traditional carriers (metal, glass, and stones) and the new media (LED lighting) are well integrated in creating a dynamic art form.

Different from the traditional static forms that are often created for a longer period of time or even for permanent display, the modern dynamic forms are often temporary or time and context-dependent. The dynamic aspects of these forms reflect better the faster tempo of people's modern lives and cater better to the need of experiencing the change from old to new. The new carriers integrate the physical and the digital materials, in both tangible and non-tangible ways, which gives the artists a much richer set of form languages that is only limited by the imagination and creativity of the artist.

Fig. 3. Composition of nine dragons. Nanjing, 2010, by Feng Wang

2.3   Interactive forms

In the new generations of interactive forms, the traditional tangible carriers are integrated with new carriers that are based on information technology, multimedia and electronics. Instead of "art pieces" or "art artifacts", it is now more helpful to think of "art systems" in which the human viewers become part of the art work. Sensor technologies can be integrated into the artifact, its environment and even wearable objects on human bodies to influence the form of the artifact. When creating such an art work, human activities have to be taken into account during the process; artists have to design the interactivity and envision the influence of the human activity on the dynamic forms. It is no long much about constructing the art work, but to creating possibilities, constrains and rules for the viewers to participate in the art system. This requires the artist not only to have a good sense of traditional materials such as wood, stone, steal, water and paint, but also of new materials such as digital multimedia content (i.e. audio, video and a composition of them [12]); the artist needs also to have enough knowledge and experience with technologies that combine or blurs the digital world and the physical world [13], and that detects and involve the human activities as part of the art system. Instead of viewing the art work, the audience is exposed to "experience" the art system [14].

One of the examples of interactive art system is the "Peace in the crowd" [15] installation created for the Dutch pavilion during the Beijing International Design Week in 2011 (**Fig. 4**). With this installation, the artists try to explore how the lighting in a public space helps people to find inner peace in moments which are normally noisy and wasted. The installation detects the movement of the visitors with a set of cameras from different positions and angles using computer vision, and detects the noise of the visitors walking on cobblestones paved on the wooden floor using sound sensors distributed in this environment. The movement and the noise together form the input for the installation as an indication whether the visitors are "in peace". Color LEDs are divided into several groups and mounted on a mechanism driven by servo motors in such a way that the direction of the lights can be controlled. The color and the movement of the lights together form the output of the installation, in reaction to the "in peace" level of the visitors. The visitors often start with exploring the lighting effect in the space, soon discovering the more they move and the more the noise they make, the busier and the more dazzling the light effect becomes. A more pleasant and peaceful experience can only be achieved if all visitors in this installation realize that they need to cooperate to stay calm and quiet together.

A second example is the "blobulous as social actors" installation created by Le et al [16] in 2012 in Eindhoven (The Netherlands). This installation is intended for people in public spaces to feel more social connectedness with each other. Each visitor receives a necklace that integrates a heart rate sensor and a radio based distance sensor (bottom left and middle in **Fig. 5**). Visitors start noticing groups of particles flying on the wall created using projections (top part in **Fig. 5**). After a while, they realize that those particles are actually interactive. They try to make the particles move, change color or create shape individually and together (bottom right in **Fig. 5**). Each visitor can feel in sync or even connected with one group of particles (avatar) because

each necklace captures heart rate of each person and control the avatar' color, shape and movement accordingly. By looking at the avatars, people might understand more about how other people are feeling and doing. For example, if one avatar turns red (which means high heart rate in the system) for some time, other people might notice and do something to change that color into green, maybe. Blobulous plays roles as social actors by mediating humans' social activities while exposing their bio signals.

Fig. 4. Peace in the crowd, interactive light installation, Beijing International Design Week 2011, by Rombout Frieling et al [15]
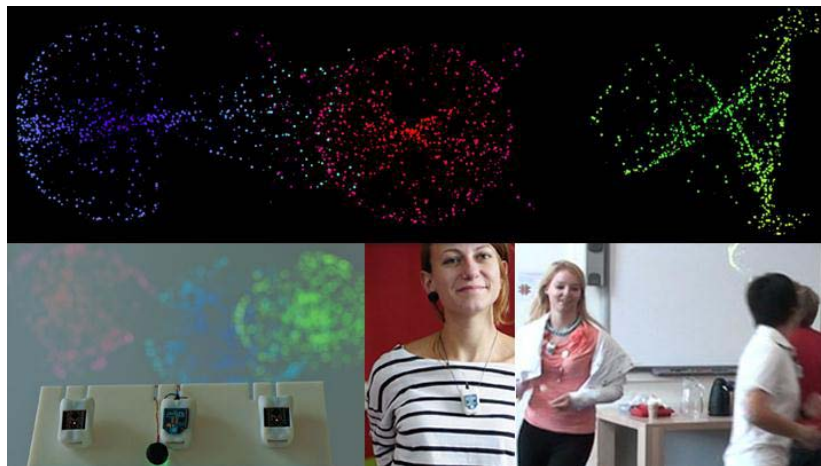
Fig. 5. Blobulous as social actors. Eindhoven, 2012, by Duy Le et al [16]

An interesting direction in dynamic and interactive forms of arts is to explore its application in the area of cultural computing [17-19]. In the East meditation is at the center of Zen practice and many Zen art forms can be seen as vehicles for inward reflection or as visualizations of the sudden and spontaneous nature of enlightenment. Sansui (landscape, literally "mountain and water") ink painting is one of these Zen art forms. Executed with black ink on white rice paper using bamboo brushes, Sansui painting communicates beauty and emotion through simple and pure means, yet leaves spaces for imagination and contemplation. Tosa and Matsuoka projected this style of communication into an Eastern sansui world: the ZENetic Computer [20, 21]. The ZENetic computer is an interactive system with which the user can create a virtual world by manipulating 3D images of sansui paintings. In one of the installation of the ZENetic computer "The Sound of One Hand Clapping" (**Fig. 6**), real stones are used together with digitalized sansui paintings on screens and projections, as well as sound sensors to detect clapping, delivering the essence of an ancient Eastern culture to create an interactive experience [22].

Fig. 6. Sound of one hand clapping, ZENetic computer [20, 21]

Cultures are different [23]. Different cultures need different approaches to address the cultural determinants that strongly influences our way of thinking, feeling and worldview in general. For the western culture, the answer to this need is an artistic and interactive installation based on the narrative 'Alice's Adventures in Wonderland' [17, 18] (**Fig. 7**). To address the western culture characteristics highlighted in the narrative, six stages were selected and implemented as an interactive experience. From start to end, the user undergoes an immersive environment that integrates embodied and virtual agents, real and nature mimicking, and both virtual and augmented reality. Every stage challenges the hardware and software design to provide the intended experience, which at the overall system level is seamlessly integrated.

Fig. 7. Advice from a caterpillar, ALICE installation [17, 18]

3   Conclusions

In this paper we look into the most recent generations of public arts, from traditional ones with static and tangible forms to new ones with dynamic and interactive forms, illustrated and discussed by examples of public arts. The current development in digital public arts involves a significant amount of new carriers in not only material, but also in technology, resulting new dynamic and interactive forms that require the artists to construct their work from a system view and with a good understanding of human-system interaction and related interface technologies. It is no longer about carving stones and casting bronze; it is time to sculpture the interactive experience.

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