38.3 The Project 'Art for Learning Art' in Contemporary Art Museums

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Abstract

Projection-based augmented reality and virtual reality are used in a visual arts-based educational project in contemporary art museums from an a/r/tographic perspective. The project 'Art for Learning Art' (in Spanish, *Arte para aprender arte*), at the Museo CajaGRANADA in Granada (Spain) has been developed in collaboration with the University of Granada since 2013. We have employed creative, educational and research methodologies inspired by exhibited works in art museums to encourage visual feedback of visitors participating in collaborative installations. Two such experiences also were produced at the Tate Liverpool Gallery and Museum in March 2018; utilising the methodology of mediation through projection-based augmented reality and virtual reality, which introduces facets of visual and physical experience that alter the whole experience for the museum's public. By putting on virtual reality headsets, and playing with physical movements, we generate images and change the projections in the museum using projection-based augmented reality to disrupt the way the public typically moves in the museum. The purpose of the developed interrelations with artworks in the Museo CajaGRANADA and the Tate Liverpool Gallery and Museum was to create collaborative digital images by playing with select artworks exhibited in the museums' collections. We use this kind of mediation in art museums to develop a visual understanding to provoke learning about art through art creation in a contemporary way. The results are extraordinary as images; they are collaborative artworks, which connect visually with the artworks in the exhibition.

Keywords

projection-based augmented reality, virtual reality, art education, contemporary art museums, teaching methods, a/r/tography

'Art for Learning Art' is a methodological project in museum education. This visual a/r/tography promotes a model of participatory and creative intervention. It is

DOI: 10.1111/jade.12245

characterised by the involvement of the public in the creation of artistic images based on contemporary artistic strategies. One of the main goals of the project is for visitors to react in similar ways to contemporary artworks using visual thinking. The participating public learns the appreciation of contemporary art through acts of artistic creation. The most direct way to do this by using aesthetic clues left by artists on their artworks. We wish participants to learn the languages existing in visual art by creating in the wake of art history's greats. In these exhibitions we have used works from Picasso, Miro, Chagall, Tapies and Munch, who used similar methods to develop their works as the visitor/participants in the *Art for Learning Art* exhibition: by playing aesthetic games, solving visual problems, creating critical metaphors, connecting visual concepts, using visual associations to develop ideas, and collaborating with social and cultural media.

Regardless of the materials and tools used, there is a visual echoing of certain aesthetic concepts emerging from the exhibited artworks. As such, our visitors are immersed in a creative process much like those used by professional artists. They change their wonted act of passive artistic appreciation to an act of creative visual interpretation. For this reason, original artworks are exhibited beside our arts-based pedagogical proposals to catalyse the creative action.

Why virtual reality and projection-based augmented reality in education in contemporary art museums?

Why use digital technologies in this context of artistic mediation at the museum? Art is always searching innovation. Artists are aware of new ways of visualising. When we talk about the visual arts, each technological development in the field of the image produces a creative enthusiasm and consequent educational approaches reveal this tendency.

However, contemporary visual artists have moved from material and technical interests to centre on critical culture, personal poetics and aesthetic concepts. New ways of creation do not always require the utmost in manual skills and currently the idea of art, as *tekhne* seems difficult to maintain. Consequently, contemporary teaching methods in the visual arts have taken that turn, leaving aside most material and technical inquiries to focus on symbolic concepts and forms, as dictated by contemporary culture.

However, we are experiencing an incredible explosion of advancements in digital and visual techniques, and the temptation to turn them into an objective in itself again appears because they promise radical changes and innovative forms of visual experience. These new ways of aesthetic experiences through creation are changing because reproductions, interactions and games of interactive artworks change the stagnant, lonely, silent or passive aesthetic experiences provoked by classical and object-based artworks.

Virtual reality and projection-based augmented reality are extraordinarily useful experiences of appreciation for museum education for three reasons:

1. Both techniques establish new kinds of relationships with cultural heritage by producing immersive perceptual experiences based on visual reproductions. They produce holistic and complex experiences: (a) spatial and corporal, in terms of walk, translation, proximity and scale; and (b) on the aesthetic level, they are intensely sensory and vivid, while the accuracy of the reproductions is in

combination with the multisensory experience: high-resolution images, enveloping sound environments, and haptic sensations of weight, contact, texture and/or impact.

2. They are intrinsically interactive and collaborative. This implies interplay and connection with others to create a space of connectivity around the artworks. The public alters time and manipulates the material, can redo and undo. Digital materials offer countless options because the toolkit is broad and fully configurable. Deformations, destruction and construction can occur, among many other possibilities.
3. They strengthen the awareness of aesthetic experiences in the museum. These kinds of technologies and interfaces have developed rapidly in the field of computer games. The gamification of artistic appreciation is far from being related to trivialisation, entertainment and strictly recreational. To the contrary, appreciation and creative aesthetics become intertwined in an indistinguishable way, producing an authentic act of creative and poetic play; defined by the authors as a moment of experiential comprehension (Dewey 2005), free (Callois 1986, 7), speculative and collaborative, 'the act of playing requires always playing along with' (Gadamer 1991, 23).

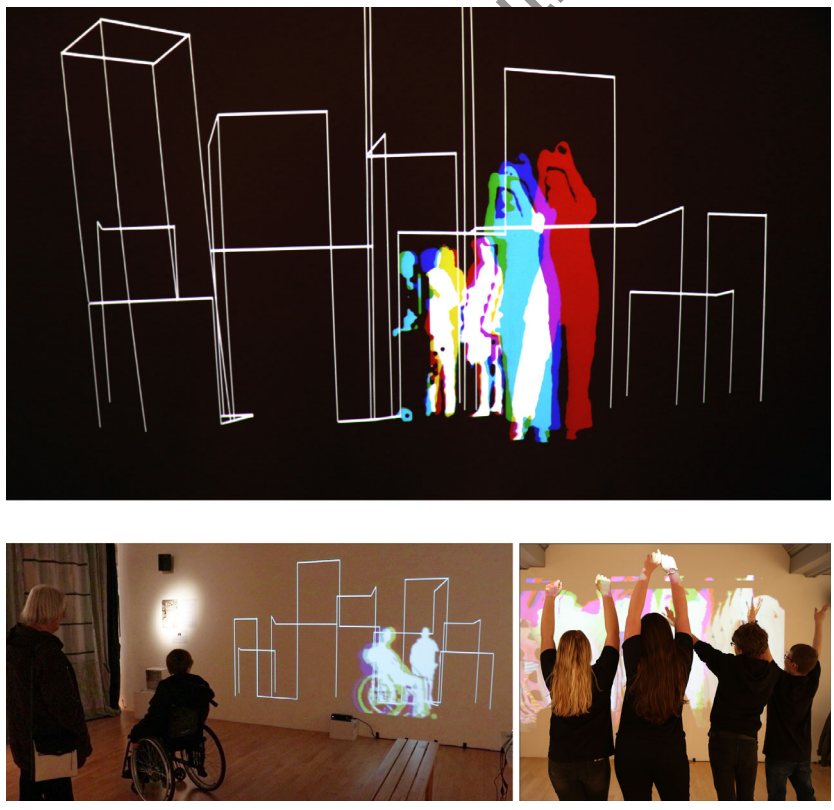

Figure 1
Authors (2019) *A projected Mirage*. Descriptive photo-essay with three photos by Maria Avariento with a visual quotation (Kiluanji Kia Henda 2013)

Changing the skins from digital images: projection-based augmented reality and sculpture at Tate Gallery in Liverpool

One new media art development that has emerged in the last decade is based on the projected image. Although there are many variants, the term 'projection-based augmented reality' (Bimber 2002) basically covers those techniques which use the projected image to integrate digital content in real environments. This integration can take place in three ways: (a) through the projection of a virtual space immersed in a physical space (spatial augmented reality); (b) converting any surface (bi- or three-dimensional) into a dynamic video screen (video mapping); or (c) by adapting the projection to the shape of three-dimensional objects to transform their appearance (projection mapping) (Ekim 2011, 11).

There are two fundamental reasons to explain why the use of these techniques by visual artists is increasing: the first being that the hardware associated with these technologies is affordable and easily accessible. All you need is a computer, a digital projector and the software to process videos and images. The second reason is the growing number of projection mapping software with user interfaces does not require great programming skills.

This democratisation of this medium also broadens possibilities for its use in art education programmes and curricula since most cultural and educational institutions already have the necessary hardware and software in their classrooms (Sisman & Kucuk 2019). We must evaluate the inclusion of these and other techniques for the development of new methodological models in art pedagogy, according to the current context (Sanders III 2006, 102–3). The use of projectors as solely for projecting subject matter, to becoming an active tool for the creation of digital content implies a methodological turn towards a/r/tography in the teaching of visual arts.

In museums, the use of projector-based augmented reality allows for the creation of a/r/tographic and interactive installations, favouring its use for educational purposes. In this case, as Kwastek (2013) and Paul (2008) point out, this interactive technique is a facilitator for the design of pedagogical-artistic devices that goes beyond the exhibition of predesigned didactic contents. In an a/r/tographic approach, our objective is the creation of artistic-pedagogical devices that reach 'a dialectical synthesis between artistic creation and educational activities' (Roldan & Marin-Viadel 2014, 174).

In projector-based augmented reality and video mapping, the interaction is carried out through software. We capture images through cameras and control the projection of images. In this way, we adapt a projected image in real time to a bi-dimensional or tri-dimensional form, for example, a person's hand or face. Image acquisition software is able to recognise and processes the information that the camera obtains, in our case the movements and gestures of the audience.

This information is sent to another software that controls more camera projections. The participatory game consists of projecting onto white surfaces; the images are captured by cameras which spectators point to parts of their faces, with a delay of a few seconds. The result is a disturbing visual experience. Multiple visions of the faces of visitors with different time delays overlap on the surface. It is an experience from the camera/mirror/screen protocol, which alters our visual conception of ourselves.

Two examples were the interactive installations included at the 'From Mittens to Barbies: International Art-Based Educational Research' event that took place from 12 to 18 March 2018 in the Exchange Room of Tate Liverpool.

The first piece *A Projected Mirage* (see Figure 1) was based on the photographic series *Rusty Mirage (The City Skyline)* of Kiluanji Kia Henda (2013). This work was in the gallery next to the interactive installation. Through spatial-augmented reality, a recreation of the space represented in the photographs was projected on one of the walls of the room, combined with a Microsoft Kinect infrared camera. Microsoft Kinect is an infrared motion capture device with multiple cameras and audio inputs that allows real-time motion capture. The potential for implementation of these captures is enormous. This device permits us to explore new ways of media interaction which is accessible to large audiences in real time and provides a high number of possibilities for artists and visual creators through the interrelating of projections and captures.

A Projected Mirage was organised as an immersive and interactive digital space within which the camera was able to translate the movements of visitors into projected shapes in real time. Visitors, therefore, could walk through the space, transforming the projection through the movement of their body in a performative experience, thanks to the use of the Kinect camera and mapping software. Visitors created images mixed with the photos by Kia Henda. Sometimes, images launched by the projector had been transformed by delays, filters and other forms of post-production. This interactive way of communication with exhibited artworks in the gallery enables a visual connection where 'the image becomes something as much to be performed as seen' (Fourmentraux 2016, 269).

The second participatory artwork is *Picto-Lumic A/r/tographic Hands* (see Figure 2). The title refers to the technique picto-luminic, created by Jose Val del Omar, the Spanish filmmaker. It consists of different forms of projection he developed in the 1970s to use in museums for creative and educational purposes through visual images (Val del Omar, 1973, 2). It can be considered a predecessor of projection-based augmented reality and video mapping.

Picto-Lumic A/r/tographic Hands consisted of the conjunction of two types of images: (a) a set of plaster sculptures produced from moulds of the hands of professors and a/r/tographers and (b) four projections onto them, reproducing in real time a video capture of four microscopic cameras available to the public. Participants and visitors manipulated the projections by focusing the microscopic cameras on their own bodies, fabrics and objects within their reach. The scale alteration caused by the microscopic images was blended on the anatomical forms of the sculptures. It produced projections of changing video images as the object focused through each change in the camera. Each sculpture, with its video-projected skin, enters into a dialogue with the other sculptures of hands arranged a few centimetres from each other.

The participants played with the collection of sculptures, painting their white surfaces with changing video images, changing the role of audience into that of creators, who were progressively discovering how they could transform the sculptures in many different ways. Parfait (2016, 473) describes this attitude as 'attentive to all the information present in their immediate surroundings and in control of the narrative'.

These two examples show how projection-based augmented reality provides new interactive routes to encourage active learning at contemporary art galleries and museums from three different perspectives.

First, by shifting the connection of the audience with the artwork into a more contemporary profile of the visitor as 'emancipated spectator' (Rancière 2009) whose intervention and ideas configure the artwork itself.

Figure 2
Authors (2019) *Picto-Lumic A/r/tographic Hands*. Descriptive photo-essay composed of three photographs by Rocio Lara-Osuna

Second, they provoke simultaneous acts of creation and appreciation by the visitor through 'physical, emotional and intellectual experiences, or experiences that are based on the imagination of visitors' (Jewitt 2012, 75). That is, there is a real-time interaction between the work and the visitor that completes it with their experience. Third, the idea that the communicative act between artist and spectator is completed when the work 'operates in the experience' of the visitor (Dewey 2005, 108) is taken to the extreme, because without the participation of the visitor, the work does not exist.

Virtual reality

Virtual reality is a digital technology capable of simulating environments, objects or audio-visual experiences through technological devices that allow us to experience sensory immersion and interact with digital models inside that simulated environment. By means of headsets and controllers (which are used in both hands) the public can interact with a predesigned three-dimensional digital environment. These environments are created previously by digital arts thanks to graphics displays that simulate the perception of the physical world and can happen in any environment with one or several users at the same time. Any interaction or action that happens in the real, physical environment (breaks, falls and deformations, for example) is likely to be reproduced in the virtual environment.

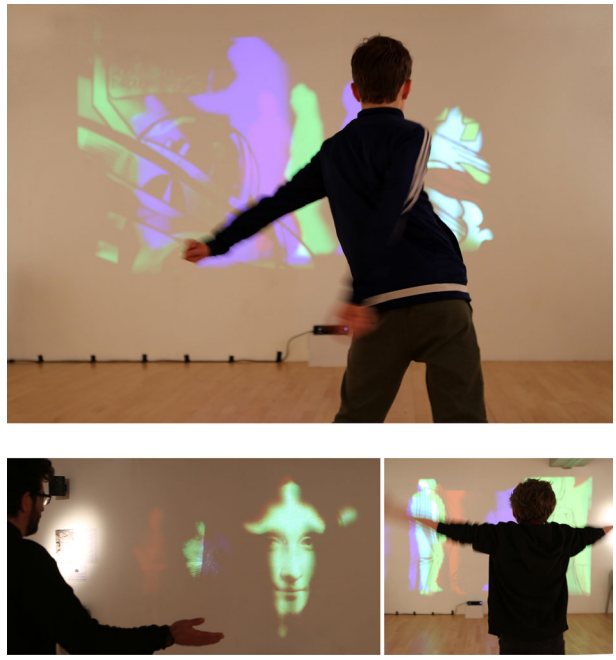

Figure 3
Authors (2019) *Projection-based augmented reality at Tate Liverpool*. Descriptive photo-essay composed of three photographs by Ricardo Marin-Viadel, including two visual quotations (Leonardo da Vinci 1503–19 and Lichtenstein 1963)

Nowadays, virtual reality is applied to many disciplines, especially in teaching and communication of cultural and heritage information (archaeological reconstructions, virtual visits to monuments, construction of prototypes for recreational and educational tourism). Currently the minimum technology needed to have a similar virtual reality experience is a virtual reality viewer/headset and a mid-range smartphone.

This technology does not allow for 3 degrees of freedom (3DoF) 360-degree vision. In this specific kind of virtual experience (3DoF) the environment is observed but we do not have the possibility of real movement within it. It allows translation in the environment but not through the movements of the user; it only allows us to move through the interaction area on the basis of a pointer, not with our own movements. The interactive experience is reduced (see Figure 3).

There are other devices that allow an interaction called 6DoF inside tracking. This technology allows interaction with the environment from the movement of the user in a scenario based in the real space where the user is located. This technology needs scanners and cameras to locate the user inside the space where he or she is, in order to translate their movements into the virtual environment. In this case, the movements are reflected in real time and the displacement in the virtual world corresponds to real physical movement in a space delimited either by external sensors (cameras or scanners) or incorporated in the same headset.

With these technological means, we can make virtual visits to real or fictional spaces, previously designed and stored in virtual libraries. There are numerous platforms on the Internet with free virtual reality content to be used in art education contexts, such as those provided by major commercial brands that are

Figure 4
Authors (2019) *Drawing inside your drawing at museum: virtual reality to understand Chagall.* Descriptive photo-essay composed of three photographs by Jaime Mena, including one visual quotation (Chagall 1977)

common producers of this technology. There are also multiple apps and specific software, both paid for and free, with which we can create our own virtual content.

Making immersive photographs or capturing objects to then later turn into a tri-dimensional objects and transfer them to a virtual environment is relatively easy with means such as a smartphone. Drawing, painting, sculpting or modelling is possible in virtual reality (see Figure 4). It is also possible to translate these digital forms to the physical world through tri-dimensional printing with available design and painting software. We can also do streaming or make animations. All these tools are currently available for art teaching.

Some of the main characteristics of virtual reality are that we can visualise objects that we do not have in a direct and real way, such as scenarios and historical objects or contexts or abstract bodies that may be physically impossible to experiment with in a tangible sense. Virtual reality also allows of multisensory experiences (multiple levels are altered at our perception: balance, movement, touch, scale or time). From its beginning stages, places such as outer space or the bottom of the sea, historical monuments or moments, or microscopic scenes such as the structure of a cell, have been practical applications of virtual reality in schools and science museums.

A virtualised work of art allows its manipulation, can easily be shared with other users of this technology, and can be moved anywhere, without cost of materials or products in its manufacture along with saving space. Virtual reality offers

new digital tools that can complement learning in art education by offering new tools for experimentation, creation and artistic knowledge.

The virtual work that we show here is a collaborative creation based on the lithograph *Etching XV*, by Chagall (1977). The public employed the headset and used the controls to draw. Drawing in a virtual reality environment allows an extraordinary visual creation experience, both for its novelty and because the viewer can walk inside his or her drawing. In this case, we asked participants to draw bombers in the virtual space. The growing group of floating airships in black lines drawn by previous visitors constituted an oppressive and frightening space around the viewer/participant when they open their eyes into the virtual scene for the first time.

Conclusions

The novelty that technology produces always holds the possibility of confusion for art educators, because we can fall into the trap of believing that a new visual technique automatically produces new visual ideas. Technological innovations do not always turn into excellent artworks. A new technology does not guarantee an improvement either in artistic production processes, or the results, nor does it guarantee the improvement of the teaching/learning process. Nevertheless, these two technologies directly disturb the experience of the public in museums. Both virtual reality and projected-based augmented reality have an enormous potential in this respect. They change the way we define what an artwork is, as well as the way we understand our relationships to artworks. Therefore, they can also transform our methods of artistic mediation.

An a/r/tographic approach to art education should use the enormous visual library that is the history of art for arts research, promote current artistic creation and connect audiences to artistic knowledge through teaching programmes. The use of technological means, such as virtual reality and augmented reality-based projects allow us to establish a creative, research and teaching relationship with works of art in a way that is other than textual. The intuition of tactile, kinetic or visual devices and image-based interfaces facilitate their deconstruction, alteration and reconstruction. They provoke active, collaborative and critical ideas of culture and tradition, allowing us to create something that is not too sacred and complete to put our mind and hands to.

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