AR moulded-objects performing Giuseppe Verdi's 200th birthday

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"Muri e divisioni" is a collective exposition of contemporary art during the Giuseppe Verdi's 200th birthday. A call for artists was organized by Accademia delle Arti di Macerata, a local no-profit organization composed by 40 artists, to collect proper artworks for the exhibition. An augmented reality (AR) experience was planned to engage visitors with Verdi's music, from *Nabucco* and Il *Trovatore*, and with AR moulded-objects, an inimitable outcome resulting from the tangling of artworks, human interaction, gesture and music, emerging from 7 of the displayed paintings.

The event exhibition "Muri e divisioni" took place from July 18th to September 29th 2013 in a Gallery called Palazzo Galeotti located in the city centre. To live the augmented reality performance, a mobile device and a free AR browser *Aurasma* were used, but also *Metaio* SDK to create a stand-alone desktop application for those visitors without tablet or smartphone. Two musical paths were created: one was based on "Dio di Giuda", "S'appressan gl'istanti" and "Va pensiero" from *Nabucco*; another "Di quella pira", "Tacea la notte placida", "Terzetto Anima mia!" and "Stride la vampa" from Il Trovatore. The music augmented 7 artworks of the painters: Simona Breccia, Hernàn Chavar, Dorian X, Gabriella Gattari, Luna Simoncini, Marco Temperini and Tomas.

The augmented reality has been created to make visitors perform a unique experience in a contemporary art gallery. The public may dynamically live something special, while appreciating paintings and installations. Giuseppe Verdi's music augments pieces of art and specific gestures appear at the same time. The visitor has to abandon his/her apathy to perform something unexpected and to enjoy the two itineraries.

The trial was carefully prepared in order to create a joyful performance, where technology is conceived as playful and lightening. To achieve this goal, as augmented reality isn't a daily practice for most of the guests, a first performer was introduced to animate the gallery showing how to play with Giuseppe Verdi's music and AR moulded-objects.

As resulted in previous trials, during public performances using augmented reality (e.g. Street Poetry: Guazzaroni, 2013a; 2013b), the first phases of the experience are crucial. In fact, these earlier learning trials reveal that dividing the impact of augmented reality in different phases is recommended for the success of the whole performance.

In L'Aquila, for example, a walking workshop, with about 100 educators exploring pieces of art, using mobile devices and augmented reality, was divided in 7 phases based on the 7E learning cycle (1. Elicit; 2. Engage; 3. Explore; 4. Explain; 5. Elaborate; 6. Extend; 7. Evaluate) (Eisenkraft, 2003; Guazzaroni & Leo, 2011):

1. Elicit: Researchers prepare useful technologies (e.g. software, applications for different types of smartphones or tablets, points of interest etc.) and appropriate content (e.g. videos, texts, pictures etc.);
2. Engage: A performer explains the experience they are going to have;
3. Explore: Visitors start detecting artworks or listening to broadcasts in augmented reality, while exploring the location;
4. Explain: Participants interact with real objects and points of interest;
5. Elaborate: Guests create original content;
6. Extend: Participants collect additional content;
7. Evaluate: Researchers bring together useful information to evaluate the performance.

Fig. 1 - H. Chavar's AR interactive painting.

Fig. 2 - People interacting with AR in Galleria Galeotti.

Fig. 3 - Performing AR.

The outcomes of the workshop, obtained using *ex post* questionnaires and interviews, enlighten that individuals participating in vanguard experiences, enhanced by technologies, need clear explanation and modelling of what they are going to live before starting the real experience, to avoid confusion and lack of interest (Guazzaroni, 2013a; Guazzaroni, 2013b).
For Giuseppe Verdi's experience only the following phases of the above-mentioned 7E learning cycle have been applied:

1. Elicit: Researchers prepare useful technologies and proper content (e.g. videos, music etc.);
2. Engage: A first performer models the experience in the gallery thus people can imitate him/her;
3. Explore: Guests play with artworks or listen to music, while exploring the location;
4. Extend: Participants collect additional content;
5. Evaluate: Researchers bring together useful information to evaluate the performance.

The first phase regards the choice of technologies and content to create a positive experience for the exhibition event. This phase is described in the implementation paragraph. The second phase is devoted to engage guests in the performance and in activating mirror-neurons. Mirror-neuron is a recent neurological finding to explore how brain interacts with objects. "Mirror-neuron systems are specialized in executing and understanding the actions of other people, their intentions, as well as the social meaning of their behaviour or emotions".
According to Rizzolatti, humankind's survival depends on "understanding the actions, the intentions and emotions of others" (Rizzolatti & Fabbri-Destro, 2008). Mirror-neuron reacts both when an individual executes an action, as well as when a person perceives another one performing a similar action. When participants are in a gallery, when they enjoy an interactive performance, "they naturally respond to stimuli and to other people's movements. They may also activate a sort of empathetic engagement by starting a corresponding simulation to digital artefacts" (Rizzolatti & Craighero, 2005; Guazzaroni, 2013b; Guazzaroni, 2013c). This is the reason why a first performer has been introduced to model the experience visitors may live interacting with augmented reality, visual art and Verdi's operas. In the paragraphs relating to AR moulded-objects and performance the results of questionnaires are discussed.
In the third phase of the 5E learning cycle, the participant is autonomous, and can play or interact with artworks. In the fourth phase the partaker has already experienced the performance and may be interested in collecting content relating to the exhibition to be seen at home. The fifth phase is for researchers, and it is devoted to the analysis of the questionnaires, interviews or other useful elements observed during the performance.

Fig. 4 - Performing AR.

Fig. 5 - Performing AR.

IMPLEMENTATION

The augmented reality experiences created for the exhibition event have modified the showed artworks. Consequently the AR could change the artists' hand touch. In the first phase of the project, an analysis of the selected artworks and of the artists' philosophy was realized.
This study was divided in two different phases:

1. Analysis of the text each artist proposed to the organizing committee, to highlight the meaning of selected artworks;
2. Meeting with selected artists to explore objects and choices of their paintings.

After this study, the "Interaction Design Process" (Billinghurst, 2012) started as follows:

a. Discover: User Needs Assessment;
b. Design: User Interface Design;
c. Evaluate: Usability Evaluation

The user needs assessment was carried out using the information relating to previous editions of Macerata Opera Festival exhibitions.
Two types of users have been found:

a. Frequent hands-on;
b. Occasional

Based on these two profiles, an art performance in AR was realized and divided in a mobile experience and in a desktop one. In this last choice, the occasional user, helped by a first performer, could position in front of the webcam, printings of the paintings and interact with them. The outcome was a composite phenomenon among performer, AR moulded-objects and users (frequent or occasional). This experience disclosed a sort of "artistic entanglement" where two basic circumstances are possible:

1. Emotional conditions of the performer, of the user, and of another occasional user (based on his/her attention to the AR moulded-object);
2. The conditions of the AR moulded-object (standby; playing music and/or actions)

For example, during an AR performance, the first performer met a classmate, and also present teammate in a school. She was visiting the event exhibition with her child. The performer and the occasional user share a similar education background. Nevertheless, their attention to the moulded-object during the event was different. The performer showed the visitor an artwork augmented with music and action; the performer started playing music, the visitor activated actions, meanwhile the child tried both music and actions. Different conditions entangled together creating an unexpected complex techno-artistic performance. The result is a unique interaction that can be exemplified by the tangling of the different conditions of each element.
To implement the real experience a user interface design was realized, in addition to the study of the interface, subordinated to the results of the first phase and of the presence of the performers. A sequence of actions of the selected faces was chosen to be coherent both with Verdi's music and the artists' philosophy. These elements were called AR moulded-objects. AnAR moulded-object is a unique outcome resulting from the blending of artworks, human interaction, gesture and Verdi's music. The designer of the experience has the power to mould artistic objects and create dynamic performances that may involve the public.

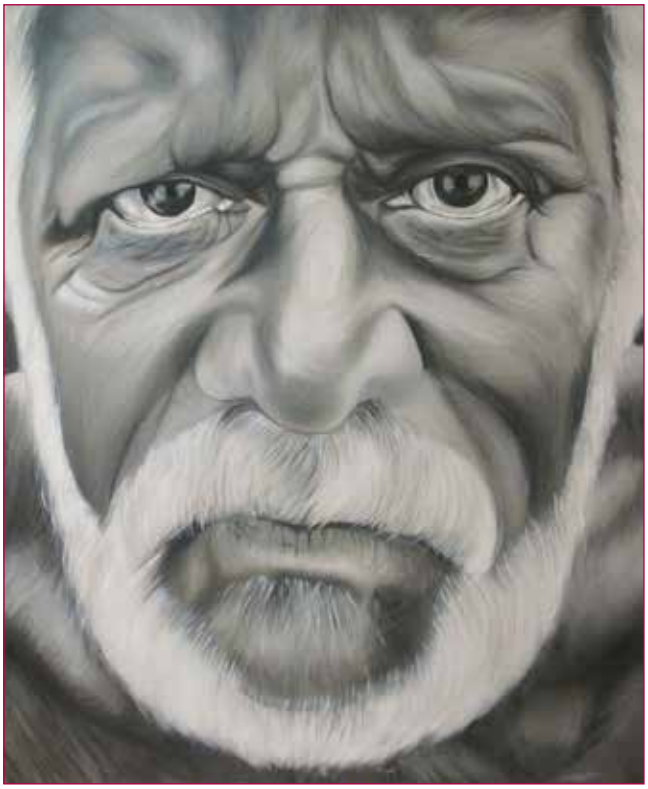

Fig. 6 - S. Breccia's AR interactive painting.

One of the highest difficulties was to animate faces without spoiling the original expressivity and delicacy. Consequently the outcome AR performance evolves into a new communicative object (N.C.O.) (Compagno, 2013) that operates, in this case, in the artistic artwork reinterpreting and conveying the artwork in a condition of perpetual mutation. The language of this N.C.O. is based on the AR moulded-objects. It is not limited to express the communication content, but it reorganizes its whole identity. Namely, the creators of the experience change one object into another entity. The interactions of this object with the various actors (performers, users etc.) create an artistic entanglement or a maze of complex relationships.
The artists weren't informed about the technological mutations that were applied to their oeuvres. In fact, designers were hesitant to inform them before the opening day or not. During the vernissage, the selected artists could find moulded objects in their works. It was a surprise that they couldn't have imagine. The whole experience has been monitored using ex-post questionnaires, interviews and direct observation.

Fig. 7 - Tomas' AR interactive painting.

Fig. 8 - User interacting with AR in Galleria Galeotti.

MOULDED-OBJECTS AND PERFORMANCE

The exhibition event "Muri e divisioni" opened July 18th, 2013. The artists weren't been advised about the augmented reality that modifies their works. Some painters were enthusiastic, other showed attention in the experience and one wasn't completely satisfied by the selected music for his canvas. The public reacted in different ways. In general, they were amazed and engaged by the performer and participated to the experience. Moreover, an *ex-post* test was distributed to 50 users (occasional and frequent hands-on) in order to collect useful information for the evaluation.

Most of the participants declared to have truly enjoyed the AR performance (60%); 20% said to have enjoyed it and 20% declared to have hardly enjoyed it.

For 48% of the public the activity performed highly promoted an emotional bond with contemporary art. For 36% of the visitors the activity performed promoted an emotional bond and for 16% scarcely promoted it.

Most of the visitors declared that they would really recommend AR experiences to other people (68%); 16% would warn such experiences and 16% would hardly recommend them.

As for technological difficulties, most of the public could easily enjoy the performance (80%), while 20% declared to have encountered problems using the AR browser in their smartphones or tablets (e.g. obsolete operating system etc.).

An interviewed visitor said: "it was engaging and exciting to participate in the exhibition "Walls and divisions" that allows people to deal with art in a different and touching way. Thanks to AR there is no longer a simple contemplation, but a real opportunity to experience the exhibition as a whole. Moreover, it becomes a real chance to share feelings with other spectators. A new way to enjoy contemporary art merged in a new surreal dimension". Another one declared that the he really enjoyed the experience because it was interrelated with the concept of manipulation. An enthusiastic visitor wrote, as a comment, in her questionnaire that AR could help her to arrive to the truth of the artwork. Other visitors pointed out that the combination of painting and opera music was stimulating, as other languages were used in an art gallery. They were mixed together to grab the attention, to promote the event and the territory.

CONCLUSION

The evaluation has revealed that most of the visitors heartily enjoyed the AR moulded-objects displayed in the two itineraries based on Verdi's opera music. They could perform an active experience and abandon the apathy of the user's role in a traditional art gallery.

The best outcomes are relating to the playfulness of the performance. A kind of modern circus based on N.C.O., on their mutable and unpredictable properties, as well as on the involvement of the visitor invited by a first performer to enter a surreal world. The AR performance has promoted an emotional bond with contemporary art. Moreover, most of the spectators would have recommended such experiences to other people.

The whole experience originates a format for contemporary art galleries where a first performer engages visitors, modelling the experience to activate other people's mirror-neurons. Here moulded-objects are the basic elements to create a new language of the artistic communication based on the AR. For this reason, the AR is defined a new communicative object (N.C.O.). On the other hand, to realize a positive experience with moulded objects an attentive analysis of the artwork is required. In fact, the oeuvres should be analysed studying the poetic of the painter, in order to incorporate his/her philosophy of art in the moulded-object.

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Abstract

"Muri e Divisioni" è una mostra collettiva di arte contemporanea. Una call for artists è stata organizzata da Accademia delle Arti di Macerata, un'organizzazione locale no-profit composta da 40 artisti, per raccogliere opere adeguate per la mostra. Un'esperienza di realtà aumentata (AR) è stata progettata per coinvolgere i visitatori con la musica di Verdi, dal Nabucco e Il Trovatore, e con la modellazione di oggetti in AR, un risultato inimitabile derivante dal groviglio di opere d'arte, interazione umana, gesto e musica, che emerge da i 7 dipinti esposti.

La mostra evento "Muri e Divisioni" si è svolta dal 18 luglio al 29 Settembre 2013 in una galleria chiamata Palazzo Galeotti situato nel centro della città. Per vivere la performance della realtà aumentata sono stati utilizzati un dispositivo mobile e un browser AR gratuito Aurasma, ma anche Metaio SDK per creare un'applicazione desktop stand-alone per i visitatori, senza tablet o smartphone. Due percorsi musicali sono state creati: uno basato su "Dio di Giuda", "S'appressan gl'istanti" e "Va pensiero" dal Nabucco, un altro "Di Quella Pira", "Tacea la notte placida", "Terzetto Anima mia!" e "Stride la vampa" da Il Trovatore . Le 7 opere dei pittori riguardano Simona Breccia, Hernàn Chavar, Dorian X, Gabriella Gattari, Luna Simoncini, Marco Temperini e Tomas. L'esperienza di Giuseppe Verdi e' stata e ideata e realizzata dai due autori.

Keywords

AR; museums; exhibition

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