BEYOND THE MUSEUM'S OBJECT. ENVISIONING STORIES

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Abstract

Under the CEMEC European project, Connecting European Early Medieval Collections, a novel kind of multimedia installation has been created for an exhibition that will be travelling across European Museums until the end of 2019. It is dedicated to the Kunágota sword, belonged to an Avar warrior of the 7th century A.D., currently preserved in the Hungarian National Museum in Budapest, where the installation has been already on display, from the begin of March until mid May 2017. The installation is conceived to be connected to the museum's collections and consists in a holographic showcase integrated in a projection wall. In the showcase, the real artifact is shown and thanks to the virtual projection on and around it, it is brought back to life: the public can watch and listen to fragments of its story, evoking characters, events, voices. Thus, the visitors' experience is enhanced through detailed visualization, virtual restoration, contextualization, storytelling and dramatization of the object.
The concept and the realization have been developed by CNR ITABC - VHLab in collaboration with E.V.O.CA. and the National Hungarian Museum of Budapest.

Keywords: museum's communication, education in cultural heritage, holographic showcase, emotional storytelling, design of user experience.

1 BEYOND THE MUSEUM OBJECT

Today the majority of museums are designed as containers of objects, with the goal to preserve and make their shape and material aspect accessible to the public (not the sensory one that, instead, is neutralized behind a barrier of inaccessibility). The relationships that are established among the objects are of typological and chronological relevance [1].

Their being related to a sphere of life, to a perceptive and symbolic universe, patterns of behavior, actions and living people, is often overlooked. The reason given by curators is that it is difficult to reconstruct such values with a good level of reliability, since intangible information that come to us from the past, especially from a distant past, are sparse and fragmented.

Thus the problem is evaded, and it is preferred to abdicate what should be the real task of the museum: narrate what is beyond the objects, human stories, visions, ceremonies, habits, beliefs, forms of representation, the way of our societies, of us as individuals and of human civilization. The reconstruction of senses and of symbolic dimensions that are "beyond" the object's appearance can instead take the visitor in the middle of a lively and powerful experience [2].

This becomes even more imperative in the case of archaeological museums, whose testimonies are incomplete, lacking even an aesthetic value that could satisfy the senses.

The purpose of using multimedia inside a museum is the creation of an artificial system that reflects technologically, symbolically, the range of life. Thus it embodies and transmits content that otherwise would not be perceptible, increasing the awareness and understanding of ourselves in the flow of history. History that is no longer far away, "behind the scenes", extraneous, but that becomes part of our present and floods us with its flow of voices and colors.

This is the role of narration and evocation inside museums. Objects become the occasional points where history condenses, "coagulates". Indeed a dramaturgy takes place.

Storytelling is the fundamental tool that allows us to recreate the context, to penetrate the form and the meaning of things [3]. The act of narrating does not mean to merely affix captions or descriptions. It means creating a harmonic convergence of script, image, light, sound, mood and atmosphere, in order to compose an expressive unit of which the object is the protagonist, starting and ending point.

The more the essence of the message is conquered, the greater the emotional impact on the visitor will be. His ability to process thoughts, to understand and establish associations will turn on, but also his faculty to enter into a dimension of creativity and self-transformation [4].

Museums are often overly redundant: the exhibited objects are numerous, one may gets the impression that they lack the living space. Similar objects are repeated in the showcases, recalling the usual analytical criterion which favors the comparison among the variations within a certain typology. The visitor easily gets into a state of overload of information or frustration. Thus many objects are not watched, or they are only for few seconds, randomly selected.

But when the visitor is emotionally excited through an exhibition criterion and a language devoid of tinsel and superfluity, minimal but profound and essential, he will feel naturally and immediately involved. The object becomes a portal to go "beyond", the senses are awakened and an intimate dialogue starts, the desire to gather the connections of the story, to discover its epilogue. The visitor feels a growing need of understanding and his cognitive defenses fall down [5].

It's clear that a direction of representation and narration is needed to obtain such a result and a team of professionals able to combine scientific accuracy of the content with its expressive translation. The convergence of communication arts is one of the central issues inside museums: the contamination, in new forms, of multimedia languages, virtual reality with cinema, theater, augmented reality, staging design and lighting allows us to operate adequately, combining science, art and technology. It is a task that requires not neutrality but courage and conviction.

Through the virtual and multimedia languages we can reconstruct not only the space which an object was designed for, exhibited or found, but also the extraordinary experience of temporality through moving images. These ones may suggest a plurality of emotions: warmth, coldness, poetry, frenzy, holiness, temporariness, realism or symbolism, depending on how the movement is represented, interpreted, expanded or accelerated [4].

Through this process the visitor assimilates, translates and reformulates the experience. He establishes new links, new objects and new ideas, something that did not exist before and suddenly lights up inside him [6].

This ability is the foundation of creativity, it is part of the essence of the human being, of knowledge.

Multimedia languages are powerful means to communicate the cultural object according to three levels: legibility, contextualization and narration. They both affect its form and its content, the message it conveys [1].

Beside, the modalities of object's exhibition determine the narrative structure and, consequently, both the language to be used and the level of interaction with the content. If media are enjoyed in the presence of many objects, along the main stream of visitors, mixed with ambient lights and noise, their contents will necessarily have to be explicit and quick to use, the level of interactivity almost null.

On the contrary, if they are played in a dedicated space, dark, quiet, predisposed to favor visitors' concentration, the level of sensory immersion and of interaction may be more layered and deep.

As an example, in the following paragraphs we are going to tell about the work we created for the Kunágota sword, belonged to an Avar warrior chief in the seventh century A.D and currently preserved in the Hungarian National Museum in Budapest.

2 THE KUNAGOTA SWORD CASE STUDY

The case of the Kunagota sword, which is part of the permanent collection of the Hungarian National Museum of Budapest, exhibited in the Avar section, is an example of how the authentic museum object can be integrated into a multisensorial immersive narrative combined with its virtual representation.

The authentic sword originally belonged to the Avar chief of Kunagota, as it was found inside his tomb, in the south-east region of Hungary, as funerary good. It dates back to the 7th century A.D., a period characterized by the establishment of the Avar empire which lasted approximately 250 years, until the early 8th century. In its early period, Avar culture bore the marks of many different cultures: Byzantine, East European and West European alike [7].

The golden sheets applied to this sword formerly belonged to a Byzantine casket, probably used to keep jewels inside; most probably this casket was part of a loot that the Avar warriors plundered the

Byzantines during a battle. The golden sheets were then dismounted from the casket by the Avar soldiers and reused to decorate the sword of an important chief of theirs when he died, so that it could accompany him in the afterlife, in the blue sky of Tengri, according to their shamanic belief of Asian origin. The decorated sword was s found lying beside chief's body, together with two sacrificed horses and other everyday life goods.

For the Kunagota case, an installation has been created, where a holographic showcase containing the real original artifact is integrated in a bigger projection wall (Fig.1). Multimedia contents and lights alternate inside the showcase and on the wall during the different moments of the experience. Since the installation uses techniques of illusion, full control of the environmental lights is mandatory and it is preferable to locate it in a small room, or isolated space, around 15 square meters, quite dark and silent. The experience is composed by three main phases:

1) Wait, neutral vision of the exhibited object where the attention is focused on the artifact inside the showcase;

2) Total vision, contextualization and dramatization of the object, where the attention is focused on the bigger projection on the wall;

3) Details, analytic narration and dramatization regarding the object's figures and pieces, where the attention is focused on the holographic projection appearing inside the showcase, while interacting with the real artifact.

Figure 1. Kunagota installation, phase 1: holographic showcase integrated in a projection wall, CNR ITABC in collab. with HNM

In phase 1 (neutral vision) we want to grant visitors the time to observe the sword in its uniqueness, highlighting the preciousness of the fitting golden pieces upon the sword, with a not invasive communication. For this purpose we can see the real sword well illuminated in the showcase and, in some moments, few holographic animations inside, magnifying some figures and pieces coming from the original object. At the same time we see short captions with few essential information about owners, epoch and context of usage, not following an evocative style. The design of the user experience here is intended to make the user slowly involved in the narration, looking closely at the showcase containing the authentic object, having the time to understand what is happening, and bringing him to the final envision of the story that will be developed in the following two phases.

Figure 2. Kunagota installation, phase 3. Holographic projection of the virtual casket inside the showcase containing the real sword,CNR ITABC in collab. with HNM

In phase 2, we want to give evidence at the original context of funding (dramatization), that is the Avar tomb, trying to visually represent on the big surface, the wall, the ancient beliefs. Thus a contextualization scene appears on the wall, with the real sword still visible in the middle and set inside the showcase but integrated in the surrounding scene. After that, the real sword switches off, substituted by its virtual replica and the projection spreads on the wall. The sword becomes the protagonist of an animated dramatization and we can see the tomb in which the sword was found. The tomb is put inside the imaginary Avars' representation of the afterlife: the tree of life connecting the earth to the blue sky. The tomb is in the bottom, excavated directly from the soil in the roots of the tree; the dead warrior can climb up on the back of his horse (lying beside), and ride to the sky.

The narrative style is not descriptive but metaphysical and evocative, even if based on scientific studies and ancient original drawings. At this stage the opportunity to virtually include the authentic sword into the ancient imagery of Avars turns to be essential: visitors need to find connection with the exhibited object and its virtual representation in order to understand symbolic and ritual values.

Phase 3 is the final part of the narration (Fig. 2): we bring back the attention of visitors to the authentic object and we tell the story of its golden decorations. The evocation and dramatization are brought inside the showcase, as holographic projection, told by a mix of several voices and whisperings, recalling events, episodes and personages belonging to the object's past life. It is a first person drama. What we represent here is the Byzantine casket in its original context, its purloining during the battle, its dismantling and the adaptation of the golden pieces to the sword, once its owner, the Avar chief, died. We understand that the golden figures, belonging to the classical Greek culture, were mostly unintelligible for the Avars, as we see that they didn't take care of their integrity. Holographic animations are projected directly on the Kunagota sword and around it. In this environmental condition, what is is relevant is to make the illusion of bringing specific components of the authentic object alive, like the single golden pieces or the grip. Evocation is organized in different scenes, introduced by short, clarifying titles.

Led lights on the objects are managed in real time inside the showcase and they become part of the visual drama and video compositing, thus playing a fundamental role in the illusion. A backlight creates a deeper space behind the hologram, enhancing its effect, two side key lights (45°) illuminate the whole sword, four spot lights (5°) enlighten the sword's golden details from the top. The integration among the different components is managed through Arduino controller.

Special attention was payed to keep the characteristic of portability, reusability and sustainability of the equipments, and of security of the showcase, as recommended for museums. (https://vimeo.com/209312872)

3 METHODOLOGY

3.1 Virtual replica and 3D reconstruction: making of

With the purpose of generating the virtual replica of an authentic museum object, it is important to choose the appropriate scanning method according to the aim of communication. For the Kunagota sword what has been used is a Structure From Motion (SFM) approach [8].

SFM is an Image-based modeling approach which allows 3D models to be obtained in a semi-automatic way using a set of photos taken by a camera. The process is short time consuming and requires low budget instruments. In the case of Kunagota sword images have been collected using a Canon 6D (35 mm focal length) and a Canon 650 (70 mm focal length), taken from different highs and positions referring to the base where the object is located. Once acquired, the photos have been imported into Photoscan, a software that processes digital images and generates 3D models. As first step the software have computed the camera position for each photo to build the point cloud model. As second step a polygonal 3D model was computed. A first cleaning operation and polygons decimation was performed in Photoscan. Then the model was exported for further optimizations in CloudCompare. Finally the optimized model was imported again in Photoscan to build the textures (Fig.3). According to our experience these techniques can be successfully adopted for digitising museum objects avoiding the most common problems. In fact they have proved to have multiple advantages: not destructive impact on materials, short time of acquisition and post-processing of the data, very detailed textured models as output, economical and portable equipment (photographic camera, lens and lights) and finally the same technique/process can be scaled according to the object by changing the lens. Moreover the acquisition can be done directly in the museum's room, eventually supported by internal staff of photographers.

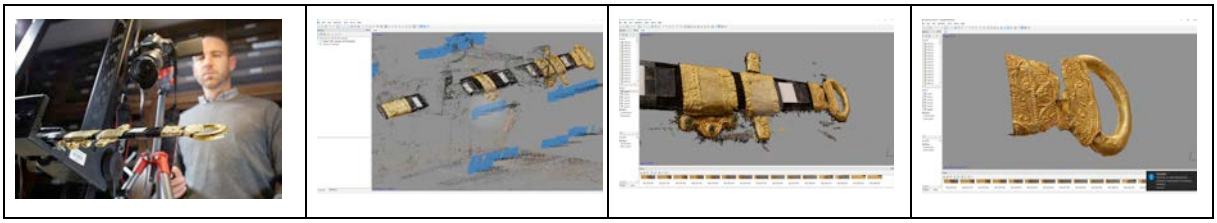

Figure 3. Kunagota sword digital acquisition and 3D model from SFM

The 3D model, created from the SFM approach, have been used as a geometrical reference for the further reconstruction of the original funerary sword and the original relative golden casket (Fig.4). The latter was all around covered with such gold, decorated with small figures of the Dionysos cortege.

This first 3D prototype has been indeed created manually supplying missing parts and sculpting small details of the figures.

From an aesthetic point of view, the sword materials needed to be studied according to the reflective simulation of gold: different types of map have been used, especially created from photographs to give a more realistic appearance. We have used Diffuse, Normal and Specular maps, in line with standardized computer graphics. The diffuse map affects the colour and the main appearance of the object with which it is associated. Normal map simulates the small reliefs of the golden sheets surfaces. More, the specular map is an image in black and white that controls the way in which light interacts with the material: the different tones of grey corresponds to a different level of reflection which simulates the physical behaviour of the golden material.

Figure 4. Up: Authentic museum object (digital replica of the exhibited sword and its scabbard) Below: and original funerary sword with no fitted golden sheet (3D reconstruction)

3.2 Envisioning stories: visual mood

Creating narrative visual scenarios for cultural heritage means that we are trying to create a very powerful link between objects (or places) and persons (the users). It means that we are trying to take those objects into their world. First of all, building an experience upon these objects, with the final purpose to achieve knowledge.

So, creating a deep experience, we can produce a spark for a future knowledge.

But which is the deeper experience for a human being? That's a subjective matter. Anyway we agree on one point: the deeper kind of experience is the one where emotions are involved.

Through emotions, storytellers can reach the goal of establishing historical or scientific informations in the memory of the visitor.

Besides words and traditional linear storylines, we can try to tell stories using colors or light or soundscapes, in a creative way. In such a way, we can establish moods that produce another layer of communication. This subliminal layer, in particular, is based on emotions and perceptions. It's the immersive part of the experience. This paradigm of image manipulation can be applied to any kind of visual content: shooting with a real camera, pre-rendered 3D scenarios, real-time 3D scenarios, 2D images, and so on. Some techniques like Color correction Diffuse lighting, Directional lighting, Camera filters (bloom, glare, sun shaft, etc.) can be applied for this purpose.

The main goal of an hologram inside a showcase is to arise the illusion of reality, as if the virtual contents would be real and effective and the original artifact would come back to life. This must happen under the visitor's eyes, from his individual point of view. Therefore we must not create an alternation of different cameras looking at the scene, because otherwise we would switch to the paradigm of the cinematographic fiction. For the same reason we have to pay attention to always include the whole shape of objects in the field of view of the holographic projection avoiding to cut the edges of the digital objects.

3.3 Envisioning stories: soundscape

The sound, in museums, it is almost always absent. Several reasons can be the cause. One of the reasons relies upon the fact that sound should always be performed in an organized musical structure. But even the idea of soundscapes played for environmental characterization and built on concrete sounds such as water, wind, is excluded too.

On the contrary we believe that such an auditory symbolism would help the visitors, surrounding and preparing them to the visit, creating a deeper mental condition and faculty of perception.

Instead, to propose a musical composition in the background of the visit could be very dangerous. The first problem is the linearity of the musical composition: it has a beginning and an end. Appreciating its development might distract from the cognitive experience of the museum. Another problem is the dynamic range of the composition:"forte" may be too loud and "piano" could be nearly imperceptible.

A different impact could be obtained by a composition specifically designed for a specific exhibition/museum. The composer could take account of these difficulties by creating an adapted composition.

Another aspect is often the "sacredness" of the museums.

Respect for the artistic work requires silence. But what would a Catholic offertory be, without the smooth and regular sound of the bell, or other ecclesiastical functions without the slow tolling of the bell? Religions have always used the sound to create atmospheres, they are part of the liturgy.

Of course the big question is whether museums should propose experiences or merely to fulfill the educational and conservation tasks for which they were born in a cold way. Today we need to think about museums as places where we can live deeper perceptual, sensorial and emotional experiences.

The role of sound and maybe even of a music specifically created according to new compositional paradigms, would be desirable.

In the case of the Kunágota sword installation, sound and music are treated following the typical audiovisual methods. The soundscape is thus a mix of dialogues, ambient sounds and music composition, created to arise an immersive and realistic experience.

4 THE BOX OF STORIES

For years museums worked confining multimedia contents on limited projection screens or surfaces. Digital contents have been juxtaposed with real artifacts but never really integrated and combined together to produce something new and more powerful, as a mixed reality. The intent of creating a real drama inside the museum space to push the user's sensory involvement within a story, has brought to test innovative representation techniques that communicate with the exposed objects, such as holograms or immersive projection spaces.

The basic idea of a hologram is an apparition of something that seems real, in an empty space. Something that doesn't exist but appear as if it was just in front of our eyes.

Indeed these illusion technique were invented a long time ago, the innovation nowaday consists in the adopted technology to produce them. From the end of the XVIII century there were many experimentations in the theatre and the spectators were emotionally fascinated. The public was invited in a dark space and, with proper machinery, imaginary and visionary figures were projected around the room, creating the illusion of floating presences. One of the most famous machine, ancestor of the modern video projector, is known as "Magic Lantern". Using one or more magic lanterns the first horror theater was born.

Starting from the original "Magic Lantern", the main components to build a theatrical machine creating optical effects still remain: (a) a source of light (better if powerful), (b) a real object you wish to project as illusion, (c) a device to form the image, (d) a plane to project the image on (Fig. 5).

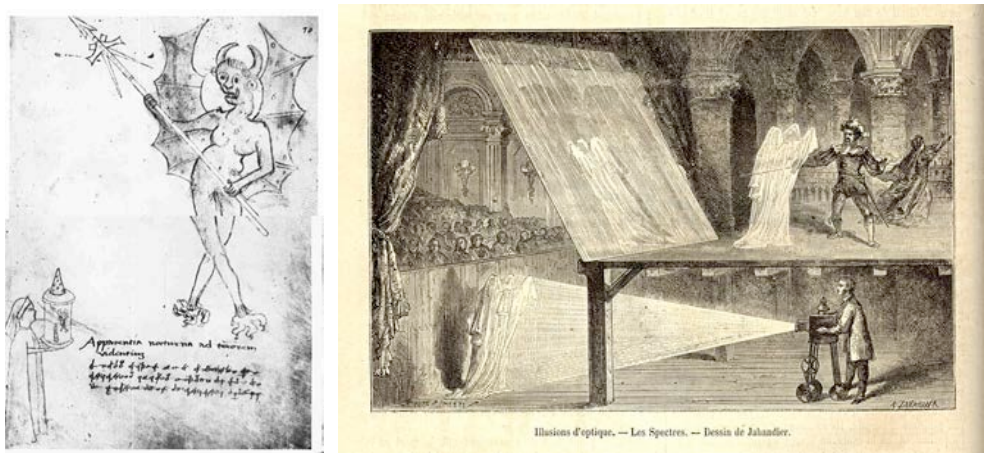

Figure 5. Left: Illustration by Giovanni de Fontana in the Liber Instrumentorum published c.1420. Right: Illustration from 'Magasin Pittoresque' 1869 of a Pepper's Ghost in a French cabaret

Professor John Henry Pepper (1821-1900) realized large scale prototypes of an illusion technique known as Pepper's Ghost. The illusion consists in the perception of a floating figure in the space. Today the ancient ghost technique is used inside a museum showcase, in a TV show and in a concert. Sometimes this technique is called "hologram", but what we see is often a Pepper's Ghost revived by digital technologies. What the spectator perceives on the stage is a reflection of a scene/object which is in a different position. It is an illusion. The trick is to create a relation with the reality to steer the perception of a figure where it is not but where you believable that it is situated. Thanks to a masterly theatrical environment design, a scene located in a dark room under the stage appears to the spectators on the stage. Nowadays the dark room, the light and the real content we want to reflect as illusion are replaced by a monitor (or by a projected surface for bigger dimensions) and virtually represented, the semi transparent mirror is usually a special glass or a film or a common plexiglass (Fig. 6), [9].

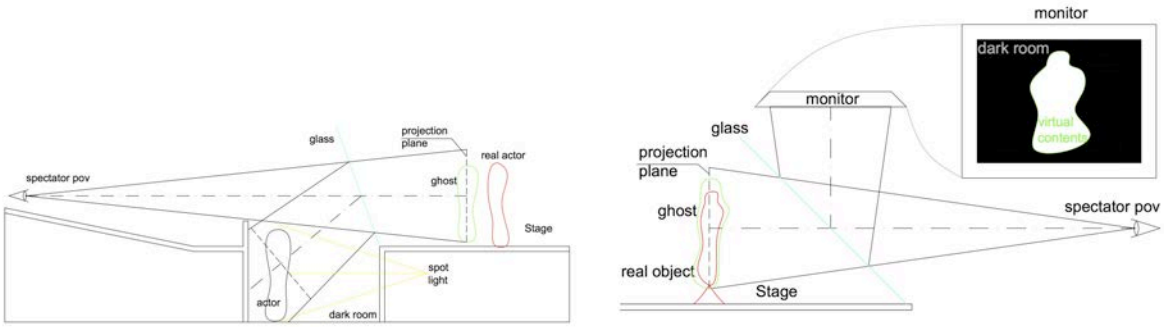

Figure 9. Technical shema of the theatrical machinery and of the new digital setup

The same schema is used in the holographic showcase which is often closed in a standalone structure, a sort of small theater where it is possible to control all the components that are important for the optic illusion. The perspective rules must be designed, experimented and tested to get the best result in terms of user perspective' consistency; for this purpose the requirements for a good Pepper's Ghost effect are (today as in the past):

- Dark environments, full dark is better;
- Dark room not visible to the spectators where the figures "become alive";
- An inclined surface (clear, semi-transparent and semi-reflective) among the spectator and the stage, ideally not perceptible.

The best result in terms of show is the coexistence of real actors (or real objects) on the stage and the ghost. Similarly in a museum's showcase the best impact arrives by the relation from the real object and the ghost projection. There are many substantial differences between a showcase without or with the real object inside: in the first case, the scale of representation is not important (of course the dimensions of the figure need to be inside the dark room, the monitor) because there are no dimensional references on the stage. When a real object is on the stage the scale of projection (the reflected image on the stage) needs to be scaled to create a correspondence between real and virtual contents. One more constraint is the position of the real object on the stage. The reflected images lay on a definite/precise plane of projection, only the perfect overlapping of the real object with this plane can ensure the possibility to perceive the integration of reality and illusion.

Thus nowdays, taking advantage of the available technologies, the challenge is to realize a new form of scenography around the museum's objects The contents production is based on a concrete study of perspectives.. The illusion can be considered a new layer on the real space where the contents find an illusory location around, over or behind the real object.

The dimension of the showcase installation depends essentially on the real artifact's dimensions. The final design of the showcase and the final cost can vary considerably but they are usually easily accessible for museums because the equipments are standardized; dimension is one of the main parameter to increase the cost. The quality of the infrastructural design and the hardware components can considerably increase the quality of the effect.

In the case of Kunagota instaltation we created: a) infrastructure design (showcase, hardware), b) preliminary 3D virtual simulation of the whole system (to simulate and test the best animations to project on the real artifact), c) implementation of a real time rendering platform in VVVV (synchronized multi-display playout, external devices control); d) management of Arduino/MIDI controller to synchronize virtual projections and real lights along the timeline; e) light design.

5 CONCLUSIONS

What the ordinary visitor needs in a museum is simple and involving communication that should also intrigue and stimulate motivation, through both conceptual and emotional solicitation.

In the last years, psychologists, neuroscientists and philosophers have put in evidence the role of emotions in creative processes and intuitive human knowledge: the knowledge and fruition of something always requires the activation of an emotion. Emotions can motivate understanding, conceptual appropriation, self-identification, contributing to higher cognitive process of learning.

Therefore emotion, involvement, participation are issues of increasing importance in the next generation virtual museums, they represent a method to ease access to culture for everybody promoting a greater social inclusion [10].

Authentic museum objects, rather than a representation or a virtual replica, are historically believed to be more important for their uniqueness. This has always affected the sphere of visitors' comprehension: such objects are considered to be able to speak to visitors in ways that a representation could not [11].

These beliefs are increasingly changing as museums are moving away from an object-based exposition, in which it is assumed that the display of objects, with relative didascalic explanation, is sufficient to convey an object's inherent meaning. New communication paradigm have been indeed adopted by museums, especially the ones where the cultural significance is conveyed through the integration of object, display, new media and visitor's mental narrative [12]. In this new paradigm, an object's authenticity is no more an essential issue in comparison to its potential to support visitor participation and learning process. The issue here stands between the perception of the object and its cultural and symbolic baggage and what it means to experience it. The concept of experience becomes more and more central for museum studies.

Authenticity and representation have thus to be revised after the ICT revolution. [13] suggest that authenticity is imparted by the uniqueness of the object but also by a connection with people who give it significance.The museum object can be now read in combination with its historic connection, its context of fruition, the owners and its daily soundscape . That is the reason behind the increase of virtual tools' presence inside museums. Around the Kunagota sword, the case study here presented, an experience has been designed according to three main phases: each one tries to exaltate part of the information needed to understand the museum object and its context; each one is characterized by a special mood and includes either texts, images, 3D reconstructions, sounds or special effects; finally each one tries to immerse constantly the visitors in the beliefs, rites and traditions of the Avars period. The three phases are functional to complete the communicative process: identification of the object, contextualization, transmission of the related story, according to a conceptual and emotional approach. The idea of matching the authentic museum object with the virtual representation of its life, or even with its virtual replica, in a determined narrative framework, is surely promising for constructing new visitors' experiences inside cultural venues. This possibility enhances the sense of authenticity in terms of exaltation of aesthetic features, care for details and stories to be built around the object, working with references, visual connection and multisensorial inputs. In such a way the user is brought to imagine a new dimension, behaviours, thoughts, symbols, "discarding" the museum space. He does not visit the museum only to look at objects but also to listen to stories.

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