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Scenographies of the Past and Museums of the Future: From the Wunderkammer to Body-Driven Interactive Narrative Spaces

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ABSTRACT

This paper offers an overview and discussion of the numerous innovative technological solutions adopted for the exhibit: "Puccini Set Designer" ("La Scena di Puccini"), organized with the support and collaboration of Milan's renown La Scala opera theater. The exhibition used a wide range of state-of-the-art technologies to convey most effectively to the audience Puccini's work as set designer. For the co-presence and coordinated use of several technologies that transform the visitor from passive spectator to orchestrator of the museum experience, it marks a step towards the "museum of the future". A true innovator in opera set design, Giacomo Puccini broke new ground through the use of both modern technologies — such as electric stage lighting — and a narrative structure closer to the audience of his day. Similarly, drawing inspiration from the Puccinian set, this exhibition reinterprets the museum space as an exquisitely scenic place where lighting, choreography, narrative rhythm, costumes and colors are produced with the aid of state-of-the-art technologies. The museum space enhanced by these new narrative tools based on innovative technologies resembles a stage set where the main characters are the objects themselves, a set complete with special effects and stage tricks expressly designed to delight the spectator, and keep his interest alive.

Categories and Subject Descriptors

H.5.1 [**Information Interfaces and presentation**]: Multimedia Information Systems – *Artificial, augmented, and virtual realities.* H.5.2. User Interfaces – *Input devices and strategies.* K.3.1 [**Computers and Education**]: Computer Uses in Education – *Computer-assisted instruction, collaborative learning*

General Terms

Algorithms, Measurement, Documentation, Performance, Design, Reliability, Experimentation, Human Factors.

Keywords

Interactive museums, interactive technology, interactive narrative spaces, experience design, exhibit design, museum of the future.

1. THE MUSEUM OF THE FUTURE

New interactive and multimedia technologies represent a very powerful communication tool for museums today, allowing them to compete with other popular venues of entertainment like cinema or theater in attracting a wide audience. In mounting exhibitions, the new technologies offer three types of innovation. First: through augmented reality — produced by the use of computers, projectors and wearable computers — the museum can display (virtually) many more works than its exhibition space would otherwise permit. Second: thanks to digital video/audio and to 3D modeling and animation software, new technologies can help the works come to life by giving them the ability to speak directly to the visitor. Third: through the joint use of interactivity and instruments for analyzing how people move around the exhibition rooms, the museum can transform visitors from mere explorers of artwork in active orchestrators of the very experience at hand.

With this technology-supported communication method, based on the teaching principles of learning through construction and learning through play [1], the museum becomes more effective in getting the exhibition's educational message across. It makes a deeper and more lasting emotional impression on the visitor while fostering a fuller comprehension of the works on display. Thus the new technologies turn the museum's rooms into body-driven interactive multimedia narrative spaces. Synchronized projections on museum walls and on the private eye of wearable computers, audiovisual or 3D animation of various exhibition materials all join with the playful spirit of exploration made possible by interactive technologies to spark in the visitor a sense of wonder, curiosity, genuine interest in the objects on show. Unlike early museums — called *Wunderkammer* or "room of wonders" — holding collections of items destined to awe the viewer, today's museums can take advantage of new technologies to create a sense of wonder not solely through the objects but, all the more so, through the tools used to display them. Paradoxically, for the sophisticated 21st century audience already amply bombarded by information, what sparks greater interest, emotion, surprise is the new means of communication, which in turn predisposes it for the playful learning experience at hand. Lastly, the museum space enhanced by these new narrative tools based on innovative technologies resembles a stage set where the main characters are the objects themselves — a set complete with special effects and stage tricks expressly designed to delight the spectator, and keep his interest alive.

The exhibition "Puccini Set Designer", held in the fall of 2003 at the Ragghianti Foundation, with the support of Milan's renown La Scala Opera theater, uses a wide range of state-of-the-art technologies to convey most effectively to the audience Puccini's work as set designer. Thus it has the ambitious aim of serving as a model for the museum of the future. The following sections describe the technologies employed, the guiding principles used to communicate effectively to the public, and the content, applications, and installations designed and built for the specific needs of the exhibit. An in-depth discussion about the methodological and theoretical issues associated with the production of this exhibit can be found in [2].

2. PUCCINI SET DESIGNER

A team composed by the museum curator, the curator of scenography for La Scala, and a multimedia curator (the author), later joined by a world-class opera scenography expert, discussed the communication objectives and strategies of the exhibit, and examined how the available interaction platforms previously designed by the author [3][4] could best fit the exhibit's communication needs. The curators wished to use technology to help generate a strong visual impact on the public, and at the same time to inform and enchant the visitors. The archival drawings and images on display needed explanations, history, highlight, and development. The exhibit was a classic one, yet it wanted to attract visitors of all ages. While recognizing that the printed catalogue is certainly an indispensable tool for the curious, the student, or the expert, the team of curators did not want to leave uniquely to printed text the task of introducing and lure the visitor into the complex work of a composer who became a certain precursor of the contemporary figure of the film or theater director. Driven by the idea of a modern presentation style, the curators' work started from a thorough analysis of content, specifically aimed at identifying which of the traditional artwork on display needed highlight and explanation. This analysis drove the selection and definition of the interactive installations described below. The traditional part of the exhibit occupied eight separate rooms, each dedicated to a Puccini opera. There was an introductory room, followed by rooms dedicated respectively to: "Il Trittico", "Manon Lescaut", "The Girl of the Golden West", "Tosca" [figure 1], "Turandot", "Madame Butterfly", "Bohème". Visitors would check out "museum wearables" [4] at the entrance and carry them along the exhibit. Three separate rooms were dedicated to the interactive installations as shown in figure 2. All interactive exhibits were designed as body-driven and choreographed by natural, unencumbered interaction.

Figure 1. An image of the Tosca room in the museum

A true innovator in opera set design, Giacomo Puccini broke new ground through the use of both modern technologies, such as electric stage lighting, and a narrative structure closer to the audience of his day. Similarly, drawing inspiration from the Puccinian set, this exhibition reinterprets the museum space as an exquisitely scenic place where lighting, choreography, narrative rhythm, costumes and colors are produced with the aid of the state-of-the-art technologies described below. Some of the most interesting materials at our disposal in mounting this exhibition were the original set designs Puccini commissioned

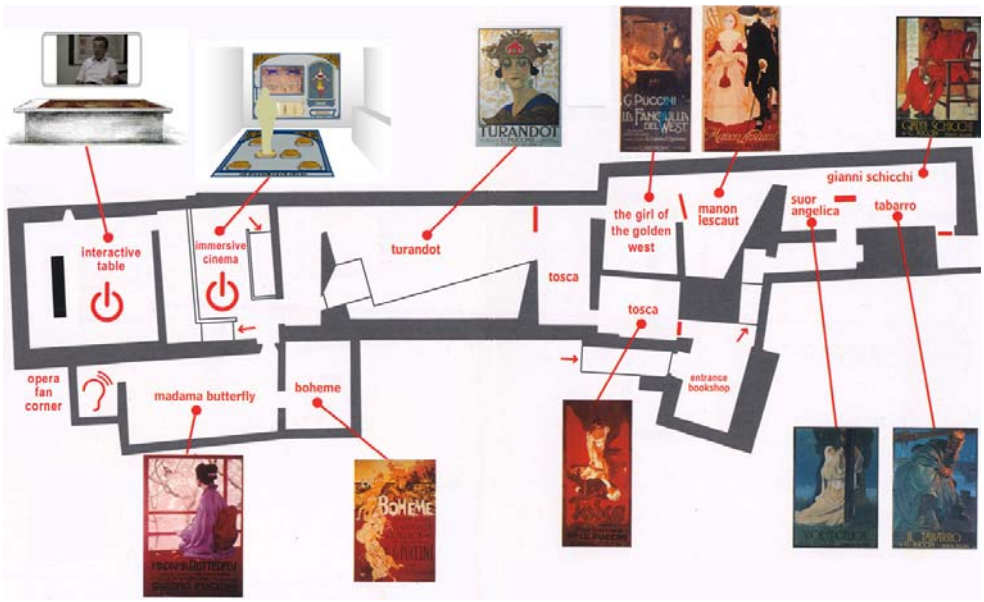
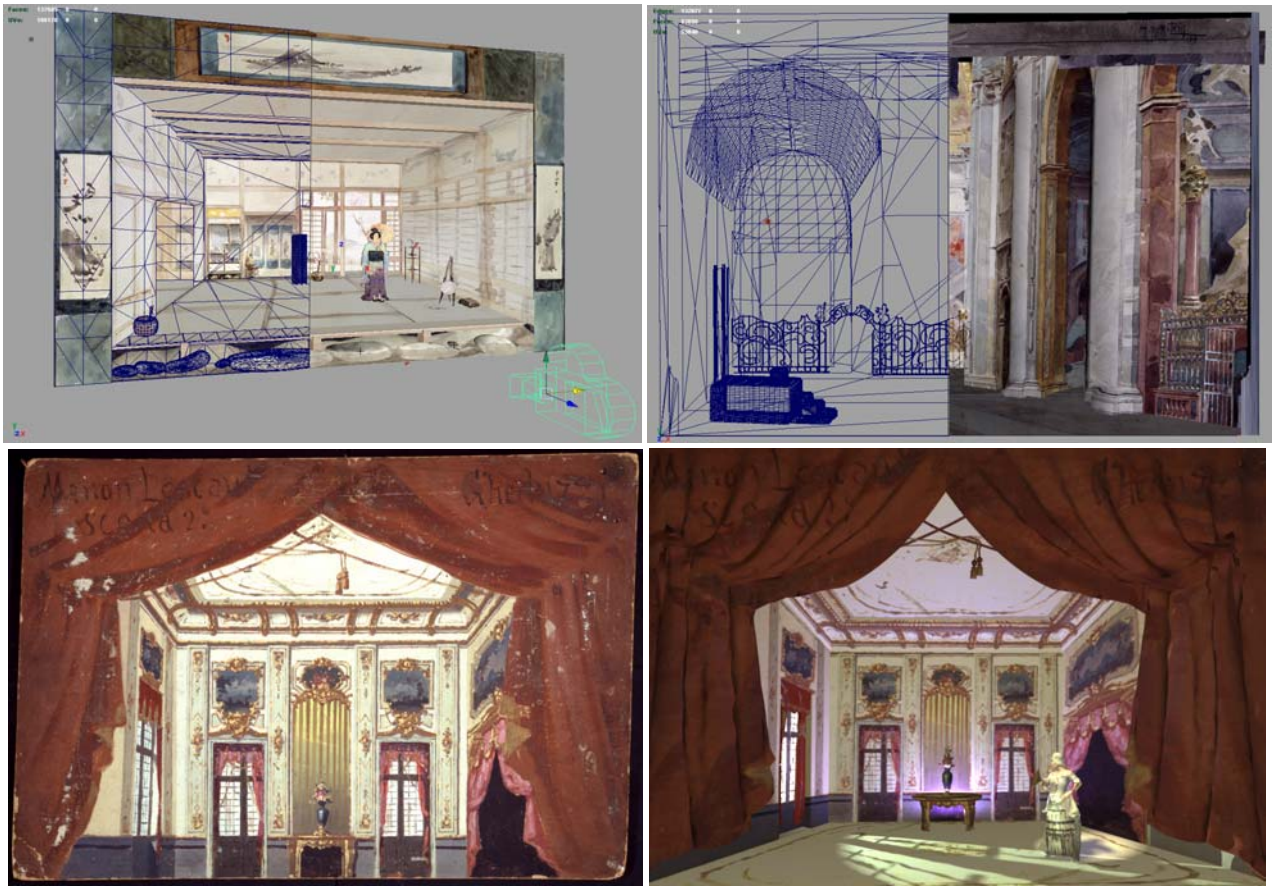


Figure 2. Overall layout of the "Puccini Set Designer" exhibit

for his operas, along with illustrations of respective main characters in full costume. So, the first objective of the exhibition's multimedia section was to give life and emphasis to this iconographic material. We started with fully realistic 3D computer reconstructions of numerous Puccinian sets. Subsequently, we did 3D animations within the same and also some holograms, one for each room of the exhibition. Then to capture the beauty of the costumes designed by Puccini, we did elaborate 3D character animations whose costumes are as true to the original sketches as possible. Naturally, a key task of the exhibition is to inform and educate the visitors on the subject matter presented. The catalog usually fulfills this role, describing in depth, through texts and figures, the various theoretical aspects and specific details of the operas in question. However, many people may buy the catalog yet never find the time to read it. And walking around the exhibition with an open catalog in hand would surely prove impractical. This is why we designed an interactive table, a multimedia catalog in a special room of the exhibition to be consulted almost as if a game. Another room is an interactive immersive cinema for screening, in an awe-inspiring quasi-magical setting, animations of the characters and costumes of the opera Turandot. We built wearable computers that function as audio/video guides to diverse rooms of the museum. Finally, to meet the expectations of opera lovers we created an opera fan corner where people can sit and listen to a selection of Puccini arias behind an invisible sound wall.

2.1 3D construction of sets

On the computer we made accurate 3D reconstructions from two-dimensional images (drawings) of numerous Puccini set designs [figures 3,4,5,6], aiming of course to attain a result as true to the original as possible. This 3D reconstruction process entailed various phases: first, we recreated the room, or shell of the set, then fit in as texture maps the corresponding parts of the digital scan of the original drawing. We accentuated the set's perspective so as to offer the greatest visible surface possible to a viewer standing in front. Next, we worked on the furniture and details, adding the relative texture maps cut directly from the original. These 3D Puccini set designs complement the artisanal models in wood, velvet and other materials commonly used in the past. Thanks to the computer assisted techniques, we could make very many sets. The 3D reconstructions appear in different sections of the exhibition. They constitute the basis for the holograms and for the architectural animations shown on the interactive table; they also come into play in the video documentary presentation table and in the immersive cinema. A team of four 3D modelers worked for several months to model and texture twelve sets using Alias Wavefront Maya 4. In addition to the set reconstruction in 3D, we also produced several short animations within these sets. Some of the animations accurately reproduced Puccini's use of light. Others created camera movements around the sets so as to highlight the detail and beauty of Puccini's scene design work.



Figures 3,4,5,6 . Above: examples of 3D reconstructions of Puccini's scenographies. Left: Madame Butterfly. Right: Tosca. Below: Left: original drawing of Puccini's Manon Lescaut set, from 1893, by Ugo Gheduzzi. Right: computer reconstruction, complete with lighting (ray tracing) and protagonist (Manon Lescaut)

2.2 3D character animation and costume animation

Vivid portrayal of characters and costumes from Puccini's operas represents a highlight of the exhibition. It is natural to picture figures move and sing while looking at them with Puccini's music in the background. So, we chose to use 3D animation techniques to bring these figures to life, trying to identify with the composer when he sought to envision his characters during a future performance onstage. We took seven famous arias from Turandot, along with the five sets Puccini ideated for the opera, and did 3D animations of the figures singing the arias. Of course, as with the set designs, for these figures too we kept as true as possible to the original illustrations. We did the animations in an artistic "operistic" style suitable to the opera in question. Since the spectator must focus attention mainly on the costumes (more so than on countenance), we applied an effect of transparency and luminescence to the face and hands of our virtual actors. Our animation of the physical movement of virtual actors reproduces the natural movement of the human body. To give people the illusion of seeing virtual opera singers, we took great pains to have the lips of the 3D figures move in synch with the singing [figure 7]. To make the most of Puccini costume design, we devoted great attention to the animation of the virtual actors' costumes. The realistic flow and drape of costumes, in perfect coordination with the motions of actors, required elaborate simulations. As the actual costumes for the world premiere of Turandot are on display in the exhibition, the 3D animation of these virtual counterparts makes the visitor's experience all the richer. We realized a total of twelve minutes of 3D character animations (body, mouth, dress), a major achievement for a museum exhibition [figures 8,9,10,11]. These animations took nearly six months of work by a team of four character and cloth animators. We used Alias Wavefront Maya 4.5 for character modeling and animation, and the Syflex plugin for cloth animation. These animations are screened interactively in the immersive cinema.

Figure 7. Example of lip synchronization, cloth and body animation of Turandot's last act.

Figures 8,9,10,11. Examples of cloth modeling for some of the characters in Puccini's Turandot. Left: original drawing. Right: 3D reconstruction.

2.3 Immersive Cinema

The immersive cinema [figure 12] takes up an entire room of the museum. It consists in an animated interactive carpet of light covering much of the floor and in a large vertical projection occupying the full expanse of a wall. This interactive space is devoted entirely to Puccini's last opera, Turandot: it aims to take visitors back in time, as if by magic into the heart and mind of Puccini during his writing of the opera. He probably pictured his characters come alive, sing the arias he was composing. So, using the 3D reconstructions of both Turandot's five sets and the illustrations for the main characters, we sought to re-create what Puccini envisioned. The interactive experience works as follows. The opera's five sets appear as icons on the circa 2.5 by 3.5 meter carpet of light. When the visitor stops on one of the icons he selects the relative 3D animations: instantly a first image of the set comes on the vertical screen. Then when he points to this image he activates the 3D figures, which - magically - begin to sing for the people in the room. One visitor at a time uses the immersive cinema while the others wait for a turn standing on the carpet's outer edge. Due to its size and scope, the interactive cinema represents an "immersive" type of experience, one generally sparking intense participation. The impact of the 3D animation of characters in the interactive cinema is heightened by the fact that this room comes right after the Turandot one where some of the costumes for the opera's world premiere are on display. Thus visitors can compare the real and virtual versions, one next to the other.

Figure 12. The immersive cinema

The technology making this experience possible is computer vision. A camera on the ceiling of the interactive cinema room looks down on the carpet of light. This image of the visitor, shot from overhead, is processed by the computer. It instantly separates the visitor's body from the rest of the picture (segmentation), determining its location on the carpet while analyzing its shape and movement. To orchestrate this installation interactively, the body's position is relayed moment by moment both to the carpet of light and to the program showing the animations on the vertical screen. Two computers and seven synchronized computer programs are necessary for this installation. The carpet of light was authored using Macromedia Flash. The animations on the vertical screen are played by custom proprietary software written by the author in C++ and DirectX. Networking programs connect these independent applications: they are written in C++ and use the RPC communication protocol.

2.4 The interactive documentary presentation table

The last exhibition room holds an interactive table [figures 13, 14]. Unlike the immersive cinema, which involves people more on an emotional level than on a cognitive one, the interactive table presents a series of interviews, images, texts and explanations illustrating the exhibition's more theoretical, historical, philosophical aspects. A multimedia complement to the printed catalog, it introduces the themes of the exhibition and in some cases treats the subject matter in depth. Projected on the table top is an animated interactive visual map, listing the topics visitors can explore. There is also a physical object acting as a cursor on the table. By moving it on key points of the map visitors can select animations and videoclips which they then see come on the vertical screen in front. The interactive table created for the "Puccini Set Designer" exhibit features a series of short audiovisual documentaries on: Giacomo Puccini's biography, the Puccinian Places (the several homes he built and lived in), Puccini Scenographer, Puccini Today, complete with historical images and interviews with experts. One area of the table shows architectural animations and lighting animations realized on the 3D reconstructions of sets.

As with the interactive cinema, the technology guiding this experience is computer vision. A camera looking downward over the table analyzes the location of the cursor and the visitor's hand, then instantly relays the info both to the program controlling the projection of the map on the table and to the one regulating the video projections on the vertical screen. The animated graphical map of content projected onto the table was authored using Macromedia Flash. The animations on the vertical screen are played by custom proprietary software written by the author in C++ and DirectX. The networking programs that connect these independent applications: are written in C++ and use the RPC communication protocol.

By using the interactive table each visitor is able to select his favorite narrative path through the art documentary we produced for this exhibit. He can choose to watch from a minimum of three minutes up to two hours of interviews, animations, and explanations and choose the topics and sequence that best match his interests. Traditional exhibits sometimes show a linear video documentary in a separate room of the museum. During the production of these art documentaries however a problem often arises: if the final edit of the documentary is short, ten or twenty minutes, it ensures a quick rollover of visitors, but it lacks depth and detail. If instead it is longer, an hour or more, while it tends to satisfy most viewers' curiosity, it is often skipped by people who don't have enough time or who do not wish to wait until the end, to start watching the documentary from the very beginning. With the interactive documentary presentation table instead people explore the different sections of the exhibit's video documentary in a non-linear way, they can start any time and can select the order and sequence of topics according to their interests and available time.

Figures 13 and 14. The interactive documentary presentation table.

2.5 Museum Wearables

Visitors of the "Puccini Set Designer" exhibit are invited to explore the museum rooms using the provided wearable computer audio and video-guides. The wearable computer - called Museum Wearable [4][figure 15] - is an interactive enhanced-reality device for museum use. Interactively and progressively in space and time, it generates an audiovisual documentary as a function of the visitor's interests. What determine the wearer's profile of interests are, first, the path he follows in the museum and, secondly, how long he stops in front of the works on show. The wearable consists in a lightweight computer the size of a walkman put in a shoulder-bag or a pouch. As display, it uses a private eye, or small monitor with SVGA- resolution clipped onto special earphones. This private eye presents to the user a visual effect that is the union of two distinct images: the computer generated one and the image of real physical space seen by his free eye. This is possible because the human brain spontaneously merges the fields of vision of right and left eyes in one unique whole. This effect is usually called: Augmented Reality or Mixed Reality. When the user observes a work of art the enhanced reality device projects (virtually) on the museum wall an audiovisual that explains and illustrates it.. The museum wearable relies on an infrared emitter/receiver system to determine the visitor's location in the exhibition space. Thus he must press no button to start the animation, nor deal with any other similar distraction. The wearable computers built for the "Puccini Set Designer" exhibit have a twofold function: as smart earphones, they supply the exhibition's soundscape (Puccinian arias according to the specific room, each featuring a famous Puccini opera); they also show an introductory videoclip to the works on display in the room. This means there is no need for the explicatory info boards which usually accompany an exhibition, interrupting the flow of visitors as they stop to read the relative texts.

Figure 15. Visitor exploring the exhibit with the museum wearable

2.6 Holograms

Each room devoted to a Puccini opera displays a hologram based on the corresponding 3D reconstruction of the set. These holograms are the product of a unique "holographic printer" and, as such, reflect years of research on the part of the MIT Media Lab's Spatial Imaging group directed by Steve Benton. Approximately 400 by 300 centimeters in size, they make it possible to see the Puccini sets as virtual 3D models suspended partially in space - half within the image plane and half without. Unlike other holograms the audience may be familiar with, these have the unique feature of offering a parallax not only horizontal (vision from right to left and vice versa) but also vertical: thus visitors can see the objects in the hologram from above and below. To create these holograms, the author elaborated a particular software that makes it possible to "translate" the sets from the original 3D modeling program format (Alias Wavefront's Maya) to the unique holographic printer format, thus attaining for the holograms a high degree of sophistication and definition.

2.7 The Opera fan corner

For the enjoyment of the opera lovers that an exhibition on Puccini (even if in a set design context) inevitably attracts, we created an opera fan corner. Rather than setting up a listening area with earphones that isolate one visitor from another, thanks to audio spotlights, we defined a listening area within which visitors can listen to Puccini's operas while silence (or a very low volume sound) reigns beyond. The audio spotlights represent a modern version of the sound domes in use in some museums. In comparison to the sound domes, they are much finer and "quieter" around them, have a shape and color that is less invasive of the museum space, and shift easily toward the person listening.

2.8 Production of art documentaries for interactive media

We produced several short art documentaries for the interactive table and for the wearable computers. We explicitly made these keeping in mind their respective forms of interactive presentation, with brief sections, each from two to five minutes long, logically linked to one another. Video production involved the collection of visual material on places with a connection to Puccini, as well as interviews with various experts and curators of the exhibition. These materials were, in turn, put together with archival images and historical audiovisuals so as to offer the public the broadest panorama possible of comments, explanations and illustrations. Particular attention had to be dedicated to the framing and editing style of the video shot for the new medium. For example during the interviews for the museum wearables, close up head shots were preferred to environmental portraits or wider angle shots. The background behind the talking heads was as neutral as possible, so as to focus people's attention on the curator or expert explaining the artwork. This was done to offer the viewer the best use of the small screen real estate, which is a sharp 640x480 pixels, perceived as an SVGA of 800x600. During the edit of video material for the wearables, photo inserts were shown in a static full view, so as to offer a comfortable perception to a standing or moving visitor. We filmed and edited differently for the interactive video documentary presentation table. The front video projection screen was ten feet diagonal long, and therefore most interviews were shot as medium or medium-wide shots. In this case we paid attention to the background behind the talking subjects: we set it to reflect the personality and topics discussed by the speaker. We adopted a dynamic editing style: when showing the locations in which Puccini lived and composed his music we moved the camera along horizontal and vertical pans. When showing archival photographs and drawings we also did various camera moves to create suspense, to illustrate details, and to attract the visitors' attention to the most interesting spots of the picture. It took us almost four full months of work to plan, shoot, edit, and subtitle all the video material of the exhibit.

3. RELATED WORK

Designing interactive exhibits for museums is now trendy. A precursor in the field of body-driven interactive installations is certainly Myron Krueger [5] whose work is still inspiring in many ways. "Be now here" [6], by Michael Naimark, in the mid nineties was also one of the first fully developed installations which allowed the public to interactively explore remote locations using their body motion in space. Nadia Magnenat-Thalmann has developed several techniques to give life to virtual actors and to create realistic cloth modeling [7]. Monika Fleischmann and Wolfgang Strauss have also pioneered the field of interactive computer art and have recently applied their technology and experience to designing cultural and learning spaces [8]. With "Wheel of Life" Davenport and Friedlander [9] have created a unique technology and sensor-driven magical space where participants collaborate with human guides to solve mysteries and interact with virtual characters in an enchanted space. More recently Mary Beth Back and others [10] have created a large scale impressive museum installation supported by new technologies and dedicated to the "Future of Reading". The author has developed a variety of computer vision driven interactive narrative spaces both for museums and the interactive dance and theater stage [3][4][11][12].

4. DISCUSSION AND CONCLUSION

The interactive technology used in the exhibit had previously been developed and extensively tested by the author at MIT, and later packaged and made easy to use at Sensing Places, an MIT spinoff that builds body-driven interactive narrative spaces. It took the Sensing Places team of sixteen people plus helpers one full year of intense work to produce all the content: 3-D models, 3-D animations, video production, subtitles, and holograms.

Interactivity through natural interaction, has been the main guideline in designing all the multimedia installations of the exhibit. The perceptual intelligence of the augmented reality spaces of the museum comes from video camera sensors, and computer vision algorithms the author developed. These perform real time foreground-background segmentation, body tracking, and motion analysis of the visitor in the interactive space. One of the elements of success of the exhibit in this respect was that the installations were easy to maintain: the author run a training session for the non-technical personnel in charge of surveillance at the museum during the first week of operation, and after that the local people became fully in control of the technology.

The author chose not to rely on an evaluation of the exhibit based on a formal type of user study, which requires that visitors fill lengthy standard questionnaires. That is usually a boring task, that visitors often carry out in a rush and superficially, and that sometimes tends to produce meaningless numbers and flawed results. We asked instead our numerous group of exhibit guardians to attentively observe visitors, and whenever possible ask them their overall impression about the exhibit, both inside the space, and on their way out. Twelve people were present on site, one in each room and three at the entrance/exit point. Their role was not only to ensure security in the museum, but also to help people with the interactive installations when necessary, give out and collect back the wearable computers, and most importantly to provide us curators with all the possible feedback of every nature, we could get from our public. This somewhat informal and yet quite accurate evaluation method proved very useful and generated the observations described in this section.

Both the immersive cinema and the interactive table served well small groups of visitors. Even though these installations have only one orchestrator at a time, while the others gather around and share the experience, turn taking happened spontaneously among visitors. This was especially successful in the interactive table where the group interaction stimulated discussion and negotiation among participants about the next move. This can be explained by the fact that rarely people go to the museum all by themselves. The small groups are typically made of people who know each other well (families, friends, class mates) and who spontaneously select a representative to try out the various installations and then take turns among themselves. In the case participants are not familiar with one another, the group interaction favors communication and exchange among participants.

After the first week of the exhibit it became clear that the wearables needed cable ruggedization, as people wearing them would play with and pull the cable connecting the computer to the eyepiece. As a result the eyepiece became disconnected. As soon as the ruggedization phase was completed the wearables

functioned reliably for the duration of time the exhibit remained open to the public. The wearables were powered by common camcorder batteries which lasted for about three hours, they were lightweight (approx 350 g = 12 ounces including batteries), and people only needed a minute or two to check them out and understand how to use them. Approximately 34% of all visitors checked out the museum wearables. These were popular among people of all ages including seniors sometimes, and not only with teens or college students, as the curators originally expected.

The holograms also received great attention and appreciation especially since many of them were intelligently placed next to more traditional 3D reconstruction of opera stages done with wood, paint, and velvet.

Many locals and several foreign tourists (from Germany, France, Spain, the UK, the USA, and northern Europe) visited the exhibit. The exhibit was overall quite successful in that it attracted nearly twice as many visitors as the museum typically hosts, and for the amount of local press it raised. Several people, both local and foreigners, expressed their enthusiasm and appreciation to the local organizing committee. Children were seen leaving the exhibit running around and humming Puccini arias. One of the reasons why the author believes the chosen installations and communication strategies were successful is the fact that the interactive installations are body-driven. People are deeply engaged by the fact that they touch and move around a physical object on the interactive table to explore the various aspects of Puccini's iconographic work. Similarly they feel immersed in the cinema space by the fact that they have to move around their entire body on the carpet of light to see the animations appear on the large vertical screen. It is also important that all installations ensured a full responsiveness and reliability throughout the entire period of exposure of the artwork. If the interface breaks often or does not work consistently, the "magic" of involvement and immersion in the interactive experience vanishes.

Several sophisticated technologies converged in the production of the multimedia section of the "Puccini Set Designer" exhibit: 3D modeling and animation, cloth modeling, video production, computer vision, interactive graphic design, holography, and experience design. All of these technologies helped create interactive narrative spaces through which the objects narrated their own story. The museum became not simply a space that contains and displays precious historical artwork, but resembled more a stage set complete with special effects and stage tricks expressly designed to delight the spectator, and keep his interest alive. For the co-presence and coordinated use of these various technologies that transform the visitor from passive spectator to orchestrator of the museum experience, the exhibit here described marks a first step towards the museum of the future.

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