Reshaping the Museum of Zoology in Rome by Visual Storytelling and Interactive Iconography

Fernando Salvetti[1,2(✉)], Giuseppe Amoruso[3,4], Sara Conte[3,4], Silvia Battisti[1,2,5], Barbara Bertagni[1,2]
[1]Centro Studi Logos, e-REAL Labs, Turin, Italy
[2]Logosnet, e-REAL Labs, Lugano, Switzerland and Houston, TX, USA
[3]Politecnico di Milano, Design School, Milan, Italy
[4]INTBAU Italia, Bologna, Italy
[5]Università Cattolica del Sacro Cuore, Rome, Italy
salvetti@logosnet.org

Abstract—This article summarizes the concept of a new immersive and interactive setting for the Zoology Museum in Rome, Italy. The concept, co-designed with all the museum's curators, is aimed at enhancing the experiential involvement of the visitors by visual storytelling and interactive iconography. Thanks to immersive and interactive technologies designed by Centro Studi Logos, developed by Logosnet and known as e-REAL® and MirrorMe™, zoological findings and memoirs come to life and interact directly with the visitors in order to deepen their understanding, visualize stories and live experiences, and interact with the founder of the Museum (Mr. Arrigoni degli Oddi) who is now a virtualized avatar, or digital human, able to talk with the visitors. All the interactions are powered through simple hand gestures and, in a few cases, vocal inputs that transform into recognized commands from multimedia systems.

Keywords—visual storytelling, interactive iconography, digitized experience

1 A new immersive and interactive concept for the Zoology Museum in Rome

During 2021 and 2022, we designed and developed the concept of a new immersive and interactive setting for the Zoology Museum in Rome, Italy; then, we installed all the new solutions that are now part of the permanent exhibit.

The concept, co-designed with all the museum's curators, is aimed at enhancing the experiential involvement of the visitors by visual storytelling and interactive iconography. Through the promotion and organization of multimedia content, this invention is about the integration of various technologies to facilitate the use of cultural content by expanding the current exhibition space through the development of interactive solutions capable of increasing visitors' (of all ages) involvement.

Thanks to immersive and interactive technologies designed by Centro Studi Logos, developed by Logosnet and known as e-REAL® and MirrorMe™, zoological findings and memoirs come to life and interact directly with the visitors in order to deepen their understanding, visualize stories and live experiences, and interact with the founder of the Museum (Mr. Arrigoni degli Oddi) who is now a virtualized avatar, or digital human, able to talk with the visitors. All the interactions are powered through simple hand gestures and, in a few cases, vocal inputs that transform into recognized commands from multimedia systems.

Fig. 1. Initial rendering of the Arrigoni degli Oddi room with the avatar of Mr. Arrigoni, founder of the museum, within his office

Fig. 2. The interactive avatar of the museum's founder, Mr. Arrigoni degli Oddi, within his office

Fig. 3. The interactive avatar of Mr. Arrigoni in detail: he is programmed to be a talkative digital human, able to share information about his life and the history of his zoological collection both in Italian and English

To summarize, our intervention relates to

- The development of multimedia content and digital exhibits.
- The application of methodologies aimed at seeing the museum's heritage come to fruition.
- The realization of animal bones using 3D reconstructions through scanning-based technologies.
- The installation of immersive environments that allow a sensorial and gestural interaction with relevant contents.

Fig. 4. Skeletons room transformed into a hybrid reality setting: real skeletons, interactive animals (e-REAL technology) and 3D reconstructed footprints for tactile exploration

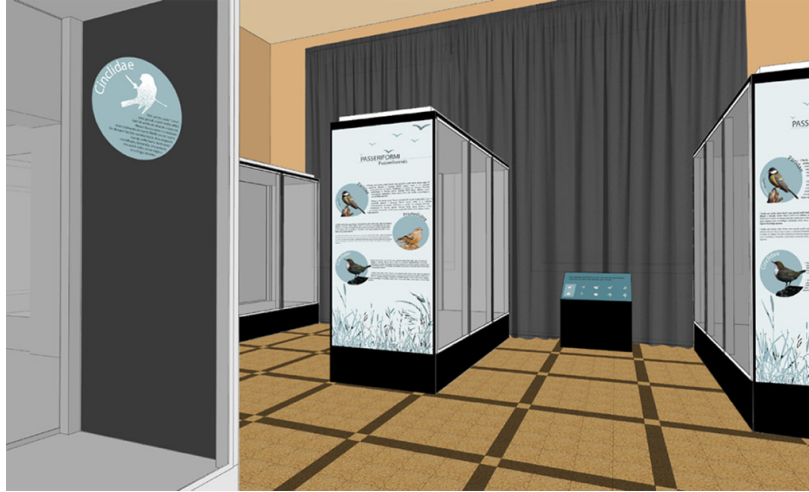**Fig. 5.** A representative 3D reconstructed footprint

Fig. 6. Initial rendering of the birds' room: printed information, 3D animations and audio traces to recreate the sounds of the birds and to give them a new virtual life

Fig. 7. Initial rendering: Whale room transformed into a hybrid reality setting with real elements displayed jointly with a multimedia storytelling made interactive by gesture shaping (e-REAL technology)
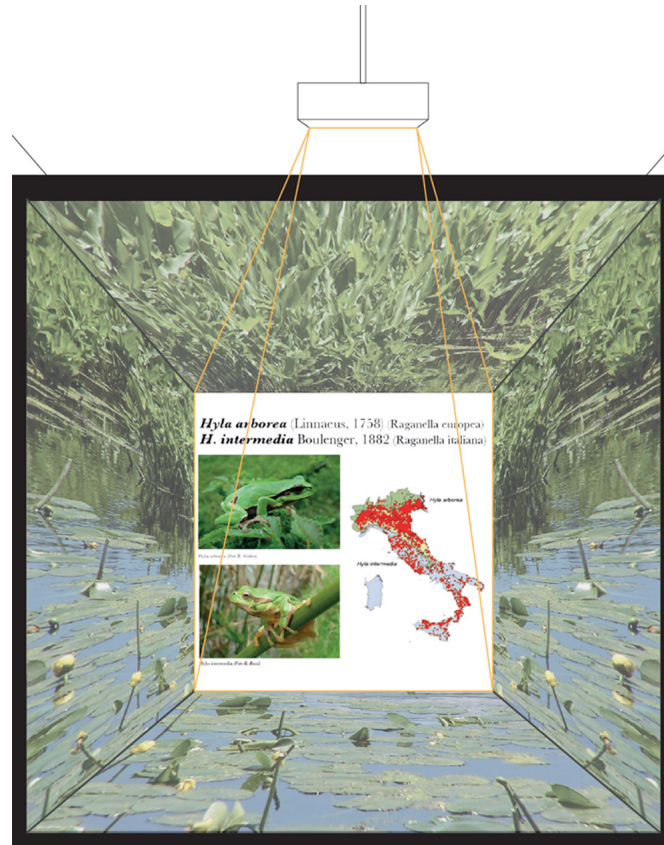
Fig. 8. Initial rendering: a fully mirrored room with 360-degree projections

Fig. 9. Augmented reality mirror (MirrorMe) to learn human evolution by mirroring the interactive skeletons of the human body and the chimpanzee

The main results are

1. Enhancement of the museum heritage, dissemination of its knowledge, and involvement of target audiences through visual and multimedia, tactile, audio, and olfactory communication tools.
2. Use of new digital media to improve the museum's offerings.
3. Improved accessibility to the museum's collection, which has increased through the promotion and organization of multimedia content.

Fig. 10. Details from the skeletons room: enhanced written and visual communication

Fig. 11. The poster introduction to the new immersive and interactive system aimed at experiential involvement and the contents' diffusion by visual storytelling and interactive iconography modalities

The entire project was made possible thanks to the contribution awarded by the European Regional Development Fund (POR FESR Lazio 2014/2020, Action 3.3.1 b), relating to the public notice *L'Impresa fa Cultura*. The contribution awarded was 181,000 euros. The total investment supported by Centro Studi Logos, an Italian company (based in Turin and Rome) from Logosnet, was 227,850 euros [1].

2   Digitalization and cultural heritage 4.0: ways of interactivity in museums and science centers

Cultural heritage is a limitless source of innovation where traditions meet cutting-edge technology, mainly from the ongoing 4.0 digital revolution. Digital heritage, as well as science museums, are very interesting domains because the contemporary audience expects both stability and flexibility from museums, which should increase their attractivity without losing credibility. Technology and exhibition design can help in the creation of new spaces and innovative solutions to grant the audience the enjoyment of a living, memorable experience.

Digitization has a primary role to play in the conservation and promotion of cultural heritage, mainly by enhancing real-life experiences, rather than replacing them. Digital is not only a way to dematerialize our cultural heritage, but—mainly if associated to visual storytelling—also a powerful way to enhance the human capacity to generate engaging content and memorable experiences [2].

Social interaction and collaboration are critical to our experience of museums and galleries. Curators, museum managers, and designers are exploring ways of enhancing interaction and in particular using tools and technologies to create new forms of participation, with and around, exhibits. It is commonly assumed that it is the exhibit that is interactive. We speak of 'interactive exhibits', 'interactive experiences', and even of 'interactives' as something that can be designed by specialists, tested rigorously, and their outcomes measured. In all these cases, it is the object that is assumed to be interactive—something that can be touched, felt, or manipulated is claimed to be more 'interactive' than something that cannot.

Interactivity is normally used to mean physical interaction with an object or exhibit—a 'hands-on' experience. Most people, when they think of interactive exhibits at all, think of the experience of the Bernouilli blower, the ball bouncing gaily on a jet of air, making soap bubbles, or making bridges out of blocks—all commonly found exhibits in today's science centers. Limiting the notion of interaction to merely physical manipulation has been challenged for years, although most proponents still consider hands-on manipulation indispensable.

Richard Gregory, founder of Britain's first hands-on science center, the Bristol Exploratory, speaks of 'minds-on' exhibits and uses illusions to show the workings of the human mind. Jorge Wagensberg, Director of the Museum de la Ciencia in Barcelona, speaks of 'hearts-on' exhibits, which he uses to describe exhibits with a large affective dimension. In these cases, interaction seems to indicate a particularly tangible engagement with the exhibit. Even so, the notion of interaction itself—whether hands, minds, or hearts-on—does not give any real indication of the quality of the experience. Interaction is too vague a term to use precisely enough to be helpful.

Physical interaction is not a prerequisite for interaction, nor is the visitor obliged to publicly interact. It is, however, no coincidence that interactive exhibits and the corresponding educational theories that place interactivity at their core, stemmed from the science center movement. Bereft of objects, science centers had as their challenge to render phenomena visible, which almost by definition involved inviting the visitor to participate in the process of creating rainbows, making waves, and mixing colors.

Moreover, the cultural discourse that would have us believe that the experience of art is unmediated, is conspicuously absent in the world of science and technology—no one pretends that a steam engine explains itself, or that a chemical reaction can be appreciated without some small understanding of what is going on.

But is all as it seems? A closer look at the science center gives quite another impression. On closer inspection, the much-vaunted interactivity often masks experiences which in fact close down the visitor's ability to explore, and limit the ways in which they can direct their own discovery.

What if we started to look at interactivity as the property of the visitor and not of the exhibit? What if we looked at the exhibit as a tool that, if properly conceived, conferred the property of interactivity onto its user? What would this interactivity look like? Is interaction different in museums of fine art compared to those of applied art or design? We would have to answer, no. The nature of the engagement in any informal setting is potentially the same, subject to the way in which the museum chooses the user-languages it employs and the degree to which the museum reduces the barriers that prevent the user from engaging with the material.

Where museums do differ, however, is in their deliberate use—or avoidance—of specific user-languages. Science centers were among the first to be forced to explore the user-languages of observation and variables, as both are proper to the natural sciences. Given their history, they were also among the first to explore the user-languages of problems and games. This is not to say, however, that fine art museums cannot make equally good use of these user-languages. Joaneath Spicer at the Walters Art Gallery in Baltimore, Maryland, turned her entire museum into a resource to solve an art historical puzzle and the new British Galleries at the Victoria and Albert are rich in exhibits which employ the user-languages of puzzles and games.

What is important, we believe, is not the nature of the museum's content, but the degree to which we make explicit use of particular user-languages in order to actively engage our visitors in the pleasure that comes from actively exploring and constructing the world in which we live in all its variety [3, 4]. All the above considerations are part of the vision behind our concept for the Museum of Zoology in Rome.

3 Digital technology for knowledge, design and experiential education for culture

The learning society represents a new human condition linked to contemporary social phenomena, a society where men and women live, work, organize themselves and utilize know-how and knowledge as a new form of capital. This vision lays the structural foundation for economics and social development: starting from Donald Schon's paradigm, 'learning, reflection and change' is translated into the promotion of

creativity at all levels, addressing a critical and civic awareness and inducing a process of social change.

Design, considered as a whole set of disciplines in the universe of industrial design, deals with designing the value of processes, goods, environments and services, of increasing it and imparting this to society and citizens. Experiential design proposes a system of mediation between the territorial context and the cultural heritage system or the widespread heritage (memory, history, landscape) and the reference community intended as the final user. This makes it possible to have multiple forms of representation of goods and legitimizes their differentiated values, access, use and appropriation, whether directly or by using technology. Bearing this vision in mind, design does not solely restrict itself to designing the experience of use of goods (economy of experience) but also introduces an innovative vision of systems and a shared vision of cultural heritage in all its forms; it also makes it possible to start upon a participatory and inclusive learning path and social well-being, which makes its diffusion in the community sustainable and cost-effective (from the institution to the cultural operator, to the different categories of users).

The service economy in recent years has shown considerable potential by creating an innovative system with a social nature, based on a particular type of economic performance. Goods and services are no longer sufficient as economic products; a new need has been created: through a design process, an integrated fruition project can be created, that is to say, the words, giving a sensorial and psychological form to experience.

Knowledge technologies are recognized as opportunities in terms of conservation, study and communication of heritage, but also of creating culture and awareness that is expressed in the contemporary forms of sharing and dissemination. Learning, in the different seasons of life, should therefore be considered as the source of an increasingly innovative economy that becomes sustainable and has an impact if it reaches a substantial and diversified number of users and social subjects.

Design for cultural heritage includes theories, methodologies, and enhancement techniques that have the cultural heritage system understood in its cognitive, social and symbolic dimensions as their application sphere. The disciplines of representation interact with the multiple disciplinary specializations of design, proposing the definition of interpretative models for the analysis and representation of the historical, cultural, aesthetic, and environmental values of a cultural asset as well as its material and immaterial meaning. The value enhancement strategy produces advanced visualizations as well as computer and multimedia modelling. Moreover, the experiential value, with its emotional imprint and fruition, is emphasized through immersive and interactive technologies. The applications make it possible to have a structured and flexible knowledge process including the simulation of forms of innovation and an increase in the social value of the transmission and sharing of cultural contents. In fact, in order to fulfil their educational mission, the spaces of culture need to go beyond the tangible and common sensorial dimensions in order to communicate and share a heritage, understood also as a process of appropriation and as such also linked to the intangible dimension. It is in this direction that the Convention for the Protection of Intangible Cultural Heritage (Paris, 2003) goes. It defines the intangible cultural heritage as 'the practices, representations, expressions, knowledge, skills—as well as the instruments,

objects, artefacts and cultural spaces associated therewith—that communities, groups and, in some cases, individuals recognize as part of their cultural heritage'.

Within the framework of UNESCO, there is the Recommendation Concerning the Protection and Promotion of Museums and Collections, Their Diversity and Their Role in Society (Paris, 2015), which underscores the importance of technologies in assisting museums in their task of educating and encouraging continuous learning. Technologies are therefore changing the relationship between users and cultural content in museums, libraries, and places of learning. The environments must be imagined and transformed by also considering their virtual extension and allowing a range of customizations linked to the selection of contents. Participation and sharing mediated by the user can also create new cultural content by blazing a path to new forms of active and participatory learning. Among the cultural actions that are related to new media and their language, the creation and sharing of information and knowledge are included, as well as the accessibility to heritage through digital artefacts that represent ideas, identities and values of belonging. To these, Manovich also adds the interactive cultural experience, the opportunity to enjoy the experiences and cultural products by visitors, as well as ways to recreate the displayed objects, textual, vocal and/or visual communication and participation in a type of information that 'ecologically' regenerates knowledge and its diffusion. Knowledge technologies offer multiple opportunities and challenges to cultural and scientific practitioners; the challenge of involvement and experience is not only one of technology and design, but also, and perhaps more importantly, a mental and imaginative one [5].

4 The instructional design for the Museum of Zoology in Rome

The instructional design for the Museum of Zoology in Rome is summarized by 3 key words: visualization, interaction, immersion. An effective visualization is the key to help untangle complexity: the visualization of information enables visitors—that are learners—to gain insight and understanding quickly and efficiently. Examples of such visual formats include sketches, diagrams, images, objects, interactive visualizations, information visualization applications, and imaginary visualizations such as in stories. In such a way, visualizations show relationships between topics, activate involvement, generate questions that learners didn't think of before and facilitate memory retention. So visualizations act like concept maps to help organize and represent knowledge on a subject in an effective way.

Half of human brain is devoted directly or indirectly to vision and images are able to grab our attention easily. Human beings process images very quickly: average people process visuals 60,000 times faster than text. This is why we, as humans, are confronted with an immense amount of images and visual representations every day: digital screens, advertisements, messages, information charts, maps, signs, video, progress bars, diagrams, illustrations, etc. If we have to warn people, symbols and images are excellent: they communicate faster than words and can be understood by audiences of different ages, cultures and languages. Images are powerful: people tend to remember about 10% of what they hear, about 20% of what they read and about 80% of what they see and do [6].

Mainly the e-REAL and the MirrorMe technologies submerge learners in an immersive and interactive reality. Multi-surface environments, like the ones we created within the museum's rooms involved by our intervention, require users to be 'physically' engaged in the interaction and afford physical actions like pointing to a distant object with the hand or walking towards a large display to see more details. Based on a body-centric paradigm, the e-REAL setting is well adapted to device- or eyes-free interaction techniques because they account for the role of the body in the interactive environment.

5 References

[1] https://centrostudilogos.info/visual-communication-and-interactive-experiences-for-the-zoological-museum-in-rome/

[2] Scuderi A., Salvetti F. (Eds.), Digitalization and Cultural Heritage in Italy. Innovative and Cutting-Edge Practices. Angeli, Milan (2019).

[3] Bradburne J. Ways of interactivity in museums and science centers. In: Scuderi A., Salvetti F. (Eds.), Digitalization and Cultural Heritage in Italy. Innovative and Cutting-Edge Practices. Angeli, Milan (2019).

[4] Salvetti F., Bertagni B. (Eds.). Learning 4.0. Advanced Simulation, Immersive Experiences and Artificial Intelligence, Flipped Classrooms, Mentoring and Coaching. Franco Angeli, Milan (2018).

[5] Amoruso G., Digital technology for knowledge, design and experiential education for culture. In: Scuderi A., Salvetti F. (Eds.), Digitalization and Cultural Heritage in Italy. Innovative and Cutting-Edge Practices. Angeli, Milan (2019).

[6] Salvetti, F., Bertagni, B. Virtual Worlds and Augmented Reality: The Enhanced Reality Lab as a Best Practice for Advanced Simulation and Immersive Learning. Form@re 19(1). University of Florence (2019).

6 Authors

Fernando Salvetti is the founder and Managing Partner of Logosnet (Turin, Italy, Lugano, Switzerland, Houston, Texas, US) and e-REAL (Turin, Italy, Lugano, Switzerland and New York, US).

Giuseppe Amoruso is Professor at the Polytechnic School of Milan (Italy) and is the founder and Managing Partner of Intbau Italy.

Sara Conte is Professor at the Polytechnic School of Milan (Italy) and is with Intbau Italy.

Silvia Battisti is Professor at the Catholic University of Rome (Italy) and is with Logosnet (Turin, Italy, Lugano, Switzerland, Houston, Texas, US) and e-REAL (Turin, Italy, Lugano, Switzerland and New York, US).

Barbara Bertagni is the Founder and Managing Partner of Logosnet (Turin, Italy, Lugano, Switzerland, Houston, Texas, US) and e-REAL (Turin, Italy, Lugano, Switzerland and New York, US).