The Sensorial Dimension of the Contemporary Museum between Design and Emerging Technologies*

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Abstract. Nowadays, society passes through a moment of transition, in which technological progress has offered the possibility, as well as the challenge, of gathering and transmitting an infinity of information in such short time. In this context, the museum transforms, it becomes a sensitive organism that modifies the visitor-artwork relationship, introducing new models of interaction and fruition. Design in line with digital technologies play a determinant role in this transformation, generating new languages and experimentations that multiply the levels of artwork narration, introducing new temporal dimensions and exhibition paradigms. Despite the considerable progress accomplished in recent years both by research and industry in the fields of acquisition techniques, digitalization, computer graphics, visualization, most of the applications for the communication of cultural heritage on site and on line still have many limitations concerning their ability of engaging the users. They often lack narrative metaphors, sensorial and emotional involvement, while interaction interfaces may appear hostile for a considerable part of the visitors. Starting from the most appropriate learning style to the characteristics regarding the user’s identity, he has the necessity to enter a space, be it real or virtual, able to stimulate him towards future insights and knowledge acquisition. Storytelling and perception come into play in order to build experience, which needs to engage the visitor emotionally, but it must also be capable of not subtracting him to the real visit. It has to offer valid hints, but it must not become a substitute of reality, while technologies must not transform into barriers, but into an opening towards a future accessible to all. With the forthcoming objective of understanding how to overcome limitations and build enhanced fruition and adaptive, personalised interaction models where the visitor stays at the centre of the design scene, this paper analyses the current transformations, providing a general view of national and international experiences that use the technological potential in an innovative way, defining best practices in the field. The connections between user and technology related to space and time will be highlighted, as well as the storytelling methods and the interactive, engaging and sensorial visitor - museum experiences.

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1. “Technoliquidity” and the Contemporary Museum

The recent developments in design for cultural heritage are oriented towards the experimentation of new systems for the enhancement and inclusive fruition of cultural assets with the support of new technologies. In this context, the digital era flowed into Bauman’s “liquid modernity” [1] and it revolutionized communication, thus radically transforming the interpersonal relationships. With “technoliquidity” [2] (and thus the conjunction between the two phenomena), two main components of
the individual structure have been modified: his reference culture and the way he experiences and perceives the world. In a little more than a decade, almost everything has changed, and we are now immersed in a scenario that offers a new vision of the museum as a hybrid and complex device, where intangible and virtual not only coexist with physical assets, but they also question the existence of the museum as a physically determined place [3]. The changes of a society that is constantly evolving towards new frontiers, from spatial organization to human-device relationship, together with the advent of ever more advanced technologies, bring about the necessity to update the models of fruition both in order to satisfy the user’s needs and to enable creative knowledge transfer. Therefore, fruition evolves from passive into active, while interaction becomes mandatory.

The art historian Charlotte Klonk mentions in her studies the existence of three important moments during the evolution of the exhibition spaces. “The white cube” is mainly focused on bringing forward the cultural assets, arranged at a certain distance from one another in order to stimulate the visitor to observe them in a different way. Later, this model gets contrasted by an exhibition layout mainly focused on architecture, such as the one of the Guggenheim Museum in New York, often criticized for moving cultural enjoyment away from the items and transforming architecture into the actual object of the visit. The integration of technologies inside cultural spaces has determined the emergence of a third paradigm, “the black box”, a space that can be totally emptied from material contents and transformed into object of fruition through multimedia installations. Klonk claims that this process probably represents the most radical change inside museums from the last century [4].

However, in each of these different design options, one must not lose sight of the visitor. In a museum, each exhibited item represents a possible destination and the visitor’s itinerary is not just physical, neither geographical: it is an itinerary composed of reading, interpreting, discovering and rediscovering. This means that the artworks contribute to drawing mental maps inside the exhibition space. They are even more significant as they become reference points both for exploring the architectural space and for giving meaning to places [5].

By observing the audience types in relationship with the exhibited objects and with the different fruition models, the anthropologist Genevieve Bell (2002) undergoes a study on eleven American museums, that bring her to classifying them into: art; science and technology; cultural and historical museums. Art museums are characterized by a contemplative and ceremonial atmosphere, where interaction between visitors occurs in a serious, silent way, in order to not interrupt another person’s experience. The visit assumes the character of a special event, it becomes a ritual. Science and technology museums are instead more focused on providing a sense of wonder. The intention is to physically engage the visitor and contribute to building experience through interactive and multimedia installations. Cultural and historical museums can be associated to one of the two categories and to their corresponding fruition models [6].

The elements that seem to be common to all the various fruition models inside museums are liminality, sociality and engagement. More specific, liminality refers to the sensation of containing “out of the world” experiences, since the museum visit has to be “transformative, spiritual, touching”, an aspect which explains the user’s need to benefit from various occasions to stop and contemplate in spaces that encourage this kind of behaviour. In contradiction to some previous studies, Bell also mentions “sociality” as a fundamental feature common to museums, that are perceived as places where to engage in social activities in connection to other visitors. Similarly, “engagement” is directly connected to people’s desire to go to the museum in order to learn something or to interact with objects or ideas [6]. In the various cases, the support of technologies in the right proportion contributes to a more “touching”, “social” and/or “engaging” fruition experience.

2. The Transforming Relationship between Perceptual Space and Empathetic Approaches

The advent of technologies has changed people’s lifestyle with a natural consequence on the connections between context, users and artifacts. It has become clear that due to their complexity, the relationships with the context could not be understood without actively engaging the user himself.
Looking from the user’s viewpoint, the designer becomes an observer, who must know how to interpret people’s active narratives due to his own sensitivity and specific skills [7 p 8].

Therefore, the methodology develops methods that put the user at the centre of the design process. The designer’s tasks are becoming more complex since, besides having to provide the product with an aesthetic value and having to be an expert of techniques, he also needs to be an attentive observer of the surrounding reality in order to understand people’s experiences. In this methodological process, the designer benefits from the support of cognitive sciences, through the study and analysis of the users during daily life, highlighting their behavioural and cognitive features. One of the main authors of this cognitive methodology is Donald Norman, Professor of Computer Science, Psychology and Cognitive Sciences at the Northwestern University, who synthesizes his theory through the model of the “Seven Stages of Action” (Figure 1). This model can be considered a general, basic tool for describing any interactive flux between people, between people and artifacts, between people by means of artifacts [7 p 21-26].

The “UCD_User Centred Design” methodological approach has been developed based on this theory. Its letteral significance highlights a new design method meant to guide all the project choices, the entire development process and the realization of the final product, towards the users’ functional- and performance-related needs. By inverting a known definition by J. Rubin, we can say that UCD does not only represent a philosophy of intervention that puts the user at the centre of the design process and the realization of products, but it also includes the necessary techniques, processes, methods and procedures useful to verify and design the usability of products and systems. In the 90s and specifically in 1999, the methodical structure of the User Centred Design has been expanded, including the design activities regulated by ISO 13407 regarding the processes of human centred design, an approach that has a cyclical configuration, based on a continuous verification of the design hypotheses and solutions and on the possibility to acquire and transfer specific information at the project level, which can be used in each phase of the training process and during the product development (Figure 2) [7 p 21-26].

Later, the User Centred Design has undergone an evolution from computer-based interactive product design to product and service design. Moreover, the original aim has moved from usability design method to user experience design method. Therefore, we can say that while traditional UCD was mainly engaged with identifying and solving problems that emerged during the user-product interaction, experience-based design brought about new reflection themes and project applications,
such as designing for the user experience, finding inspiration from the user, empathetic design and hedonism. The study of emotions regarding the interaction with the artwork inside museums is relevant since they represent a main component of experience and they influence the persons’ actions, their expectations, their future intentions regarding the products that users find and with which they interact [7 p 21-26].

To this end, we report Norman’s levels of cognitive perception to benefit from experience. Each of these requires a different design style. The visceral level is fast since it makes quick judgments on what is good or bad, safe or dangerous and it sends the appropriate signal to the muscles, warning the rest of the brain. The behavioural level is the part of the brain where most of the human behaviour resides. Its actions can be inhibited or enhanced, it is unconscious. Finally, the highest level is that of reflective thoughts, which has the function of general control and reflection, trying to impact the behavioural level. Transferred to design, such levels are different from one another. Specifically, the visceral level represents pre-consciousness, pre-thought, where what counts is the first impression, the initial impact of a product, its appearance, touch, the sensations it produces. The behavioural level refers to the use and experience of a product, but experience itself has various aspects: function, performance and usability. Finally, the reflective level is the one where consciousness and the highest levels of feelings, emotions and thoughts reside. Only here can the overall impact of thoughts and emotions be experienced. This study on the emotional system made by Donald Norman has greatly influenced the definition and development of further experience design methods, such as the one developed by Sanders and Dandavate in 1999 and taken up by Sanders in 2003. In developing their method, Sanders and Dandavate identified data collection as a first element, which they divided into verbal data, whereas what people know and say, behavioural data, by looking and observing users, and finally data on emotions and dreams, using implicit meanings in order to describe and illustrate the experiences [8].

Unlike traditional User Centred Design methods, the experience methods configure the project based on the users’ dreams, on their imagination and on the reconstruction of everything they had previously done, seen or known. Jane Fulton Suri, creative responsible for Isso, claims that “through observation, designers can get informed, through empathy they can get inspired in order to imagine new and better solutions for people” [7 p 51]. Furthermore, in order to better understand user experience, various ways of action can be adopted, such as observing what people really do, both inside their natural context and through prototypes to which people would be exposed on purpose;
asking people to participate, by recording their needs and documenting their environments, as well as by writing down their thoughts and feelings; testing and verifying in a direct way, in order to obtain a personal viewpoint on the experience as object of design and typically lived by the users.

The subjective representation of the user’s experiences contributes to building the perceptual space, which is different for everyone [9]. As illustrated by the neuroscientist Stephen Kosslyn, visual perception, which is important in relationship with space, is not composed solely by real time information, that activate the “bottom-up system”, but also by information which is already available in our minds and conserved in our memories: the “top-down system”. Put together, they shape the mental images [10]. Space experience becomes thus an infinite series of interactions where perceptual space changes based on the human mind, while this gets modified based on experience (Figure 3) [11].

3. User Experience between Extemporary Interaction and Contemplation

Not coincidentally, the emergence of technologies has in fact modified the cognitive and interactive design approaches, as well as the fruition models, which need to take into consideration whether experience is direct or mediated by technologies and, as anticipated by the models of Ubiker-Sebeok (1994) [12] or those of Falk (2009) [13], whether it is socially motivated or oriented towards contemplation, individual or collective. To this purpose, by analysing the experience from the contemplative to the interactive dimension and considering the time variable, various cultural heritage fruition patterns have been identified. The “show” model is a type of approach to the asset close to the traditional relationship between audience (who attends a show) and the item (represented on the scene) [14]. The “traditional museum” model is defined by contemplation in a permanent dimension, while in the case of “performative art”, both the material and intangible dimensions are enhanced by combining design and the artistic components. A further model is the one between permanent/temporary dimension and interaction, represented by immersive exhibits, which often use technological tools in order to enhance experience [14] (figure 4).

Moreover, by putting the human body at the centre of experience, new fruition models are recognized. Direct experience at an individual level requires a deep connection with the item, while inside the collective dimension there is a predilection for social experience. “Moving between the artificial-mediated by technologies dimension, and the individual dimension, we find ourselves in the field of multimedia and hyper-performative devices, which multiply the levels of storytelling of the item through the augmented perception of reality; if instead we move towards the collective dimension, we will find ourselves in the field of social network and peer production, where the fruition

Figure 4, 5. Cultural heritage experience paradigms in relation to time and action. Body and paradigms of cultural fruition [14].
of the initial object and the creation of new superseded items become complex research and design material” [14] (figure 5).

With reference to the learning models and by transferring them into the field of museum fruition, some approaches of cultural learning supported by technological tools can be identified. Communicating concepts, engaging emotively and supporting socialization are possible aims that respectively guide the approaches defined as focused, immersive and collaborative [15]. “Nowadays, design is oriented towards creating circumstances, namely fruition experiences. The visit to a museum or to an exhibition is not seen any more as a series of texts, but as an event to be proposed to the visitor in order to create a unique, original experience for him/her, with a meaning connected to his/her life experiences. In a certain way, we go back to the Grand Tour, the author trips such as that of Goethe’s, designing nowadays for customized profiles” [16].

In fact, the “focused” approach has the main goal of obtaining measurable results, based on the “teacher-student model”, where the user receives precise information from the museum or the exhibitor. The influence of the behavioural learning model is obvious, and the user is encouraged to follow structured and sequential itineraries with precise objectives. The “immersive” approach is more connected to experience, the intention being that of actively engaging the user. Here the user gets encouraged into building the experience, while the institution provides proper tools instead of direct information, leading us back to the constructivist learning paradigm. Finally, the “collaborative” approach highlights socialization between visitors, encouraging dialogue and collaboration [15].

It is here that narrative steps in as a powerful tool, essential for the knowledge transfer process and an integral part of cultural heritage enjoyment. The phases of narrative are being analysed starting from Greimas’ actantial model and the canonical narrative one to the “storylistening trance experience” identified by Sturm in 2000. Seven fundamental moments have been therefore identified: “contact”, the moment when the user establishes the first connection with the narrative; “familiarity”, when the user starts growing faith; “immersion”, when narrative manages to engage the user and he feels effectively “immersed” in the story; “identification”, seen as climax of the narrative, when the user identifies himself with the story and he creates connections with his own past experiences; “emersion” as the moment when engagement starts diminishing, narrative gets to an end and the user starts exiting the “trance”; “space out” is the moment after the end of the story, when the user starts forgetting the details, keeping in his memory only some general elements; finally, “transformation” represents how did the story affect the person, which can vary from almost nothing to a very significant impact [17].

On the other hand, a study by Levasseur and Veron on the audience’s behaviour during an exhibition at the George Pompidou Centre in Paris, has brought to a classification of the visitors that is still a reference today for the exhibition field. The research, made through systematic observation of itineraries, attitudes, comments and a series of detailed interviews with the visitors, brought therefore to the definition of four visitor patterns with names inspired from the animal world: the ant or the proximal visit, the butterfly or the “pendular” visit, the fish or the “flowing” visit and the grasshopper or the “punctual” visit. Each of them has been assigned some general features based on the distance from the exposed items, the length of the visit, the number of stops, the behaviour regarding empty spaces, the strategy adopted by the visitor in walking through the corridor or inside the room used for the study and finally the order they follow (whether it is chronological or not) [18].

Through a detailed study of light and of its effects on spatial perception, James Turrell makes various experimentations during the years, bringing the user to the edge of perception and eliminating the possibility to identify his own position in space through objects or barriers. Reflection and meditation are encouraged, also managing to induce the sensation of infinite space [19]. Similar approaches are being used in Lila Chitayat’s “Sensing Sound” project [20], where she designs a space for experimenting the capacities to hear, listen and see sound. Furthermore, through an open platform, real time compositions can be made. The support of technologies is useful to explore the human capacity to listen through all senses.
With the intention of personalizing the experience and “using” technologies both in the interest of the visitor and in that of the institution, the “V.E.D.I. Vision Exploitation for Data Interpretation” project is conceived in order to “invisibly” track the user. Putting together existent technologies, such as Computer Vision, Machine Learning, Behavioural analysis, data mining and first-person vision, the people behind “V.E.D.I.” project can recognize what the visitor is observing by using his own viewpoint due to the Hololens smart glasses. The same system offers additional information on certain works, with the possibility to see a specific object in 3D and even to observe its hidden parts. The most interesting itineraries are being tracked through a “hintmap”, while also analysing the spatial layout [21].

Current technologies enable us to explore new perspectives and to interpret immersive storytelling in an innovative manner. This is in fact the intention of Borderless TeamLAB when realizing MORI Building Digital Art Museum Tokyo in 2018 [22]. Visitors are being engaged in an artistic interactive experience that goes way over physical borders. Technology participates to the creation of a totally immersive environment with the result of an artistic three-dimensional world where the person can explore, discover and share the fruition experience. Narrative and space are being interpreted in a different way and there is a tendency for designing a polysensorial experience for the user.

The human being and his capacities to perceive the surrounding environment are also the focus of the “(Un) balance” project, through an interactive experience in extended reality that “invites people to play on the edge of stability by expanding body awareness”. The participants are stirred to take part in “out of the box” experiences, by creating an alternative reality with the support of virtual and physical tools [23].

4. Design Sensoriality beyond Physical Boundaries

“Non-stop” society is characterized by the inevitable embrace between the liquid world as preannounced by Zygmunt Bauman, and the digital revolution as proposed by Steve Jobs. Therefore, in the shadow of postmodernity we can talk about “technoliquidity” as a new paradigm for explaining the phenomenological expression of the “technoliquid” mind. Sensation seeking, pervasive narcissism and ambiguity are enhanced by technology, thus defining the features of the postmodern person in the digital era. In other words, digital revolution and the “virtualization” of reality intercept, enhance and mould some of the liquid person’s features: narcissism, velocity, ambiguity, sensation seeking and the need for infinite “light” relationships. Digital revolution exists because technology has become an environment to inhabit, an extension of the human mind, a world intertwining with the real world and determining cognitive, emotional and social restructuring of the experience, able to influence once again the construction of identity and relationships, as well as the living experiences [2].

In this context, ‘stimulating the senses’ is the motto that all museums should adopt today. We cannot pretend anymore that the visitor should be satisfied by traditional methods, but we need to continuously update. The technological world is characterized by a dynamic evolution that often goes beyond the effective capacities of the institutions. Therefore, we need to find compromises able to satisfy the user and to provide him with a personalized experience based on his own needs. The ideal direction is that of a polysensorial and inclusive museum, where everyone can find the suitable way to acquire knowledge. We can get to this only through small steps in fast times, with the final aim of developing new models of knowledge transfer that combine spatial perception and experimentation, immersive and interactive fruition, polysensorial sharing of the cultural experience and valorisation and personalized knowledge dissemination in order to create new cultural places that are both products and stimuli of creativity. This will require an interdisciplinary approach, from the study of spatial characteristics to designing the experience through narrative and perception, with the support of technologies, however without subtracting him to the real visit. The challenge will be that of providing further emphasis to the current models and give meaningful and personalized narratives to the user through perceptual, immersive and polysensorial experiences in the spatial dimension of the project, thus engaging him at various levels.
References

[1] Bauman Z 2006 Modernità liquida (Roma-Bari: Edizioni Laterza)
[2] Cantelmi T 2013 Tecnoliquidità Modelli per la mente 1-3 pp 7-14
[3] Irace F 2013 Digitalization takes Command Design & cultural heritage. Immateriale. Virtuale. Interattivo vol I, ed Irace F (Milano: Mondadori Electa S.p.A.) p 13
[4] Klonk C 2009 Spaces of experience: art gallery interiors from 1800 to 2000 (New Haven: Yale University Press)
[5] Zingale S and Carità F 2013 Elogio del museo -labirinto. Il Museum fűr Moderne Kunst di Francoforte Design & cultural heritage. Immateriale. Virtuale. Interattivo vol I, ed Irace F (Milano: Mondadori Electa S.p.A.) p 115
[6] Bell G 2002 Making Sense of Museums. The Museum as 'Cultural Ecology' (Intel Corporation 1999-2002) pp 5-7
[7] Rizzo F 2009 Strategie di co-design. Teorie, metodi e strumenti per progettare con gli utenti (Milano: Franco Angeli)
[8] Capece S 2009 I passi del design. Principi e nuovi strumenti per il prodotto inclusivo PhD Thesis “Dottorato di Ricerca in Design Industriale, Ambientale e Urbano” Seconda Università degli Studi di Napoli
[9] Damasio A 2010 Self comes to mind (New York: Pantheon Books) pp 157-159
[10] Kosslyn S 2005 Mental images and the brain Cognitive Neuropsychology 22 pp 333-347
[11] Niaka A 2019 Mind and Space in Flux | Designing a physical interaction in a space with memory of the users’ experiences through time Available from: http://www.interactivearchitecture.org/category/research [accessed on 07-04-2019]
[12] Marota A 2007 Il museo come evento culturale Scene del consumo: dallo shopping al museo, ed Pezzini I and Cervelli P (Roma: Meltemi editore, Collana “Segnaturze”) pp 314-320
[13] Falk J H 2006 An Identity-Centered Approach to Understanding Museum Learning Curator: The Museum Journal 49 (2) pp 151-166
[14] Trochianesi R 2013 Nuove prossemiche museali e culturali. Corpi, gesti, relazioni, comportamenti Design & cultural heritage. Immateriale. Virtuale. Interattivo vol I, ed Irace F (Milano: Mondadori Electa S.p.A.) pp 66-68
[15] Spallazzio D 2013 Tecnologie mobile per l’apprendimento culturale. Nuove opportunità e possibili approcci Design & cultural heritage. Immateriale. Virtuale. Interattivo vol I, ed Irace F (Milano: Mondadori Electa S.p.A.) pp 174-176
[16] Proni G 2013 Il paesaggio dei segni per la fruizione del Cultural Heritage Design & cultural heritage. Immateriale. Virtuale. Interattivo vol I, ed Irace F (Milano: Mondadori Electa S.p.A.) p 108
[17] Sturm B 2000 The "Storylistening” Trance Experience The Journal of American Folklore 113 449 pp 287-304
[18] Levasseur M and Veron E 1983 Ethnographie d’une exposition. Histoires d’expo Peuple et culture (Paris: Peuple et Culture) pp 29-32
[19] Museum Frieder Burda 2018 James Turrell - The substance of light Available from: https://www.museum-frieder-burda.de/index.php?id=23&L=1 [accessed on 15-10-2019]
[20] Safran A and Chitayat L 2017 Sensing Sound, Interactive Sound Installation Available from: http://www.lilachitayat.com/portfolio-item/sensing-sound/ [accessed on 10-10-2019]
[21] Farinella G M et. al. 2019 VEDI: Vision Exploitation for Data Interpretation DOI 10.1007/978-3-030-30645-8 68 pp 1-3
[22] Borderless TeamLAB 2018 Wander, explore, discover in one borderless world Available from: https://borderless.teamlab.art/ [accessed on 20-09-2019]
[23] Legarnisson E 2018 (Un) balance_Mindfulness through movement-based interactive experiences in XR Available from: http://www.interactivearchitecture.org/category/research [accessed on 12-09-2019]