New Frontiers for Museum Spaces in the Phygital Dimension:
What Digital Technology Can Do

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Introduction

In recent years, increasing penetration of the museum into the socio-cultural and territorial network signals a potential overcoming of the separation of the world inside the museum and beyond the walls of the institution. The museum becomes an activator of cognitive processes of cultural heritage on display, in a language that is less unilateral and more dialectical. The aim is a language that not only "provides content for visitors to consume" but also "supports multidirectional content experiences" (Simon 2010, 2). This trend is moving toward two intertwined perspectives: On the one hand, the storytelling of the artworks on display unfolds in a polyphonic re-reading, capable of showing the invisible, the unspeakable, the ordinary, according to Borsotti (Borsotti 2019), which are uncomfortable issues outside the traditional museum narrative. On the other, the transformation of traditional coordinates of museums turns the design of sequential spaces, conceived as rigid and predetermined, linked by a chronological-encyclopaedic narrative, into the construction of an exhibition space, designed as three-dimensional reproduction of the stories embedded in the space itself, relying on the centrality of the bodily involvement of the visitor.

In this context, advanced integration of digital technology within physical museum spaces, since the arrival of the internet in the early 1990s (Mandarano 2021), plays a central role in the design of a renewed visitor experience, not only as a tool, but also as a modality of narrating cultural heritage on display. The awareness of the evocative nature of cultural heritage, which requires constant dialogue with visitors, finds an interesting field of application in digital technology, through a system capable of constantly adapting to the changing, ephemeral, and dynamic nature of visitor engagement (Lupton and Lipps 2018). Thus, a sequential layer is being replaced by a hypertextural path, as a translation of the network

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of the digital into the physical space: Visitors can create endless associations based on their own ability to choose and select materials, acting as a "relational trigger" (Borsotti 2022, 449), engaging relationships in space and with other visitors.

The design of phygital spaces (Borsotti 2022; Carella et al. 2019; Debono 2021; Lupo 2019; Nofal et al. 2017), physical but mediated by the use of digital technologies, is moving in the direction of amplifying the emotional and evocative dimension of the space and the artworks on display, superimposing an interactive digital level. In phygital spaces, the contamination between physical and digital is designed in a dialectical dimension, varied by the stories to be told, to the point that the space itself becomes the content to be experienced.

This article aims to extrapolate the main theoretical issues related to the concept of phygital and the impact on behavior in physical museum spaces, linking them to a growing awareness of the multivocal and participatory nature of cultural heritage. The case studies are selected to outline best practices related to the development of phygital experiences, focusing on he topic of tangible interactions in particular.

The Museum in Phygital Space: The Gesture as Meaning-Making of Artworks on Display

The neologism *phygital* blends the words physical and digital. It was coined by the marketing firm Momentum Worldwide to mean the convergence of the consumers' physical and digital world. The diffusion of the term from marketing to daily life stems from the ability to allow a physical interaction of digital experience, joining the two spheres. Further, Gaggioli (2017) describes *phygital* as characterized by context awareness, reacting to the movement of users in space, embeddedness, miniaturized through the phenomenon of the internet of things, and usable through natural interfaces, through behaviors linked to everyday life, reaching a point where ''reality as an app,'' blurring the distinction between real and virtual.

Re-contextualisation the term within cultural heritage, Nofal et al. (2017, 221) speak of phygital heritage, "By blending the digital empowerment of cultural learning, storytelling, and entertainment into the heritage artefact, activity or environment." How the digital technology is blended into everyday life has specific connotations in the field of cultural heritage: Consider the multiplying capacities of digital technology, able to communicate in a flexible, immersive, and personalized way, in contrast with the characteristics of physical reality, through physical affordance,

leading to a reactive physical gestuality and situativity, as the intrinsic link with the spatial context. By considering the relationship between the two variables, physical affordance and situativity, Nofal develops a model that extrapolates three layers of phygital heritage, positioning relevant digital technologies:

1. *Augmented*, as a visible and recognizable communication layer, superimposed on the physical space, through the use of devices such as augmented-virtual reality or in broader terms through wearable devices, potentially context-aware through geolocation technologies, establishing a direct communication between the physical device and the space, activated by the user;
2. *Integrated*, in which the interaction takes place between the spatial context and the artworks on display, in which technology is incorporated, and the visitor, for example through diffuse projection technologies or soundscape and with reference in particular to tangible interactions; and
3. *Actuated*, as an interface directly manipulated by users, through shape-changing technologies, which transform the physical form of objects starting from the input of users. (Nofal et al. 2017.)

Phygital experiences are constructed mainly within the realm of mixed reality (Milgram and Kishino 1994), defined by the virtual continuum diagram, as a continuum from the real environment to the virtual one, encompassing all the cases in which there is a simultaneous overlap between physical and digital reality. In the concept of mixed reality, the integrated visualization of real and digital and their capacity for simultaneous interaction is to be considered contextually (Interaction Design Foundation 2022).

Among different digital technologies, reference to tangible interactions is central (Duranti, Spallazzo, and Trocchianesi 2016; Hornecker 2015; Petrelli et al. 2016), considering that tangible experience is referred to not strictly as limited to tactility, but as multisensoriality, represented by touch as a bodily extension of all other senses (Merleau-Ponty 1945; Pallasmaa 2012). Duranti, Spallazzo, and Trocchianesi (2016) define two categories of tangible interactions: Embedded interactions, incorporating the digital technological level within physical objects, as a smart object; and embodied interactions, in which the focus shifts from the object to the bodily movement of the visitor, which through the gesture becomes part of the storytelling embodied in the space, made sensitive. In both cases, the transparent level can be activated through a language imported from

everyday behaviors, such as speaking, touching, walking, and referring to the concept of natural interfaces "that [speak] – so to say – the language of humans and not vice versa" (Bollini 2021, 147).

To Display the Invisible: Practices of Re-Reading

The link between digital technologies in the phygital dimension and the re-reading of cultural heritage is expressed above all in the recognition of the centrality of the intangible dimension, constructed as the narrative core to be made explicit through the active involvement of visitors. The recognition of intangible cultural heritage as a value to be conserved represents a fundamental step, opening the definition not only to practices but also to physical artifacts (Convention for the Safeguarding of the Intangible Cultural Heritage 2003), as representative of collective knowledge, social practices, and identities of territorial context-areas.

The application of digital technology operates in such as way to sensorially stimulate visitors as well as activate a doubled synesthesia, "the interweaving of the natural senses and a new artificial, virtual sensibility" (Balzola and Rosa 2010, 63). The application of digital technology can take visitors inside the artwork, dematerializing the artwork as it steps outside itself, connecting with the visitor.

Experienced as a constitutive condition, and not only as a physical condition, the relocation of the display of artworks in museums from the context of origin, as well as missing of the meaning of the artwork, recontextualizes through an interpretative choice within the exhibition space. In this dynamic, the invisible is raised. When faced with the material dimension of artworks, it is necessary to bring to light what cannot be seen, to the point of "restoring to the invisible the beauty of the void that the spectator is called upon to fill" (Cirifino, Giardina Papa, and Rosa 2011, 13), an evocative dimension of the story, which cannot be closed in a static representation.

Case Studies

The case studies are selected on the basis of two kinds of phygital spaces constructed through tangible interactions: smart objects and sensitive environments.

In *Whispering Table*, by *TheGreenEyl*, the visitors deepen their knowledge of the festivities of four cultures through the staging of symbolic objects arranged on a table, at which the visitor is invited to sit down. Through the incorporation of sensors, when visitors bring the object close to their

ear, it begins to speak, whispering stories and practices. The objects tell the meaning of food and gestures, giving the visitor the opportunity to enter into the dynamics of different cultures. The shift from an individual to a collective dimension is enhanced by sharing the ritual with other visitors, as well as by the fact that the objects tell stories, starting from the positioning of other objects on the table.

Humania, designed by *KossmanDejong*, at the Nemo Science Center in Amsterdam is a journey of discovery of the human body and its potential. Humania enables visitors to understand who we are and what makes us similar, through various installations that invite visitors to put themselves into play, either individually or by collaborating with others. The actions range from challenging reflexes, to testing balance by holding a stationary device together with another visitor, to staging motor skills. The installations are characterized by a strong performative potential, because it is the visitor who is put on display, through bodily participation.

Consequently, if in the first case the technology incorporated in symbolic objects requires the intimate and natural gesture of hearing as a means of experiencing the plurality of stories that can be activated, in the second case, the body becomes the interface, assuming the role of interactive mediator, engaging in gesture not only as activation but also as transformation of the content on display. Moreover, if in *Whispering Table* the interactive participation component does not express a contributory nature, other than that of activating paths of changeable stories, in *Humania* the performative component through which bodily involvement is stimulated gives life to a changeable work of art, represented by the gesture of the visitors.

Conclusion

This article aims to extrapolate the main characteristics of phygital devices by linking them in relation to the polyphony of the storytelling and the change in inhabiting museum spaces thanks to the centrality of the gesture. By doing so, it emerges how the incorporation of digital technology within the spaces in the phygital dimension transforms the very concept of interface: On the one hand, considering the space as the interface, a three-dimensional representation of a story, and on the other, the body as the main device, enhancing the gesture as the main context-aware medium. The phygital shows that the action as triggered by technology and trigger of relationships is an engine for the transformation of content and the exhibition environment, inviting us to reflect on the potential of

hybridization. In this hybridization, interaction takes place simultaneously on a physical and virtual level, and it can be connected to the opening of digital technology toward the invisible portal and the awareness of the role of the body in the meaning-making of cultural heritage.

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