

Events

REACH-ID 2021 Symposium

Research and Reflections on the Use of Digital Technologies for Representation

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The symposium REACH-ID (*Representation for Enhancement and management through Augmented reality and Artificial intelligence: Cultural Heritage and Innovative Design*), was held in webinar mode also in its second edition. The virtual events, imposed by the pandemic, have now amply demonstrated the possibility of creating a place for dialogue that overcomes spatial distances.

The relationship between representation, digital technologies, cultural heritage, and innovative design was the focus on which the debate is centered characterizes the encounters organized by Andrea Giordano of the University of Padua, Michele Russo of Sapienza University of Rome, and Roberta Spallone of the Polytechnic University of Turin. These meetings are conceived as the fertile ground for reflections not only on the results achieved or the technical aspects of the research carried out but also on the most profound significance. It was precisely on the relationship between representation and technology that was the focus of the intervention by the president of the UID (*Unione Italiana per il Disegno*), Francesca Fatta, who, beginning with Anaxagoras' and Aristotle's philosophical definition of "man", emphasizes how both the Drawing and technology are creations

of human intellect and, at the same time, instruments at the service of this selfsame intellect. She further underscored how their use applied to cultural heritage may contribute in innovative manners to the understanding, appreciation, and sustainable enhancement of this heritage. With this scope, the studies exhibited show how on the one hand Artificial Intelligence (AI) allows the use of an enormous quantity of raw data, customarily gathered but unused, to speed up and expand the possibility of obtaining information, and, on the other hand, how Virtual Reality (VR) and Augmented Reality (AR) allow the discipline of Drawing to exponentially enhance the ability to represent and communicate reality and the imaginary, permitting new and more articulated means of promoting the use of cultural heritage and an innovative approach to design.

Pilar Chías Navarro, coordinator of the research team *Patrimonio arquitectónico y arquitectura sostenible* of the Department of Architecture of the University of Alcalá, Spain, has highlighted how AR, AI, HBIM, and Information and Communication Technology (ITC) are useful and necessary instruments to reach a greater objective: universal access to culture. Tackling these issues within the context of European programs of re-

search and innovation must, therefore, become a cornerstone of the activities of researchers concerned with culture and cultural heritage.

Reflection on the use of digital technologies, posed by the first keynote speaker, Roberto D'Autilia, professor at the Department of Mathematics and Physics of the Roma Tre University, opened up the symposium. In his communication, he underlined how some problems may only be solved by natural intelligence but even how Artificial Intelligence, by handling the so-called big data, can offer fundamental assistance in the interdisciplinary studies concerning cultural heritage.

Artificial Intelligence and the opportunities offered by the digital world to create a parallel reality, either virtual or augmented, amplify the practical potentials of the disciplines of Drawing, allow for a methodological and operational update, and open the disciplinary boundaries by implementing a real transdisciplinarity in different fields. From such a premise, the contributions participating in the symposium and selected by the Scientific Committee can be considered expressions of a unified discourse in which the syntagms themselves are differently combined according to the specific application. And it is precisely from the



Fig. 1. Logo of the second edition of the symposium.

juxtaposition of these fragments that some key concepts emerge: transdisciplinarity, experimentation, methodological updating, usefulness, accessibility, inclusivity, interoperability, collaborative workflow, social effects, perceptual aspects, and emotional involvement. The talks by the keynote speakers mark the thematic chapters of this discourse, within which the presented researches may be grouped.

The ICT *Herades* platform for the maintenance, conservation, and restoration of cultural heritage proposed by Giuseppina Padeletti and Patrizia Grifoni –CNR researchers at the ISMN (*Istituto per lo Studio dei Materiali Nanostrutturati*) and the IRPPS (*Istituto di Ricerche sulla Popolazione e le Politiche Sociali*) respectively– aims at providing a concrete solution to the growing need of new instruments for the management and enhancement of the cultural heritage, increasing its resilience.

The digital world permits the creation of informational models to gather the overwhelming amount of data produced in the multi-disciplinary studies aimed at knowledge, maintenance, conservation, and restoration of cultural assets. Precisely in the context of the HBIM, the talks have shown how AR can become a concrete instrument for the analysis and management of the cultural heritage, allowing to update information *in situ* regarding physical

consistency of the assets, adding information obtained from the real world to the digital model and favoring interoperability by the continuous and direct exchange of information among involved individuals.

The potential of digital has been experimented in many other applied fields, spanning from the digital reconstruction of objects or sites that have never been realized or no longer exist, exploitation of non-accessible assets, digital implementation of ancient treatises to recover and comprehend them, experiences in expanding the knowledge of museum pieces, projects for virtual museums to make inaccessible collections available or bring lost collections back to life.

The presented researches aim at building a formative experience that is not a mere simulation of reality, paying specific attention to the construction of the project of interactive fruition requiring the collaboration of different skills.

A food for thought emerged from the interventions concerns precisely the involvement obtainable from the different modes of fruition. Virtual experience, in fact, cannot replicate the emotional response that arises from a real experience but permits interaction with the digital twin of the object, an interaction generally precluded with the actual object. Those solutions proposing virtual usage alongside the fruition

of reality without aiming at replacing it offer the opportunity of enrichment. Conversely, when experiencing the real is not possible, the effort of the researchers is concentrated on making the virtual experience as realistic as possible, implementing interaction with the virtual model and optimizing the perception of virtual space.

In some of the proposals presented, the use of technology is motivated by the aim of rendering culture usable, accessible, and inclusive: the digital fabrication and some specific applications of AR and VR allow people with physical and cognitive disabilities to undergo experiences, by giving substance to the concept of the “design for all” in the view towards a society based on equality.

By extending the areas of application, Camilla Pezzica –Lecturer in Digital Methods in Architecture and Urbanism at the Welsh School of Architecture, Cardiff University– has introduced the topic of the interdisciplinary connection between representation, planning practice, AI and the opportunity afforded by the technological advancement in the management and enhancement of the urban and the territorial environment. Several contributions have emphasized how the capability to represent extends to the capability to analyze, understand, manage, and valorize the object being represented.

The representation of a territory or an urban structure is a multidisciplinary and multidimensional endeavor. It is in the management of relations among the different pieces of information that AI can intervene, which, according to computer vision, can be trained to reproduce processes and functions of the human visual apparatus, simulating the ability to read the typical signs of the discipline of Drawing, thus becoming an essential instrument to analyze, monitor, and manage the city and the territory via the interpretation of the signs that constitute them.

The possibility of creating virtual experiences that are, at the same time, tied to the physical consistency of urban instances, by geolocalization or tracing of a physical target, allows the creation of instruments for participatory planning and management of the urban space, just as projects to valorize the city and the territory through immersive narratives into the past and thematic museum itineraries via AR and VR experiences.

It is interesting to note how many of the experiences presented at the symposium were born in a teaching environment, demonstrating the prolific exchange that should always be present between research and teaching. The demands imposed by the pandemic highlighted the need to update the educational and training practices just as the modes of fruition of the cultural heritage. There is, furthermore, another interesting consequence of the research inherent to these topics: the possibility to involve younger students in the emerging research, thanks to their familiarity with the digital vocabulary of their generation.

The talks by Francesca Matrone –research fellow at Department of Environment, Land and Infrastructure En-

gineering of the Polytechnic University of Turin– and by Violette Abergel –researcher at the research unit *Modèles et simulations pour l'Architecture et le Patrimoine*, of the *Centre national de la recherche scientifique* (CNRS) and French Ministry of Culture– demonstrated the necessity and possibility of implementing a methodological update of the discipline.

Since the birth of digital technology, the field of representation has questioned itself, acquiring new instruments and integrating the digital model among the models it utilizes. Planning, design, conservation, and all the disciplines related to the disciplinary scientific sector of Drawing have been overturned by the possibility of creating a digital twin of reality that may be analyzed and simulated in ways otherwise impossible with analogic technologies.

The continuous development in the field of digital technologies brings this potential to considerable levels.

Today AI permits the automatization of processes related to the representation, from the semantic segmentation of the numerical models derived from the 3D survey to the dynamic recognition of certain objects thanks to the training on the dataset created via photogrammetric models.

Also, the possibility of creating augmented and virtual models of reality has significant repercussions in many fields related to the discipline. Exhibited were experiments in representation techniques on a holographic table, virtual simulators to teach topographic surveys, interactive experiences in which AR becomes a true teaching tool, ending with studies on the interaction between the physical, inform-

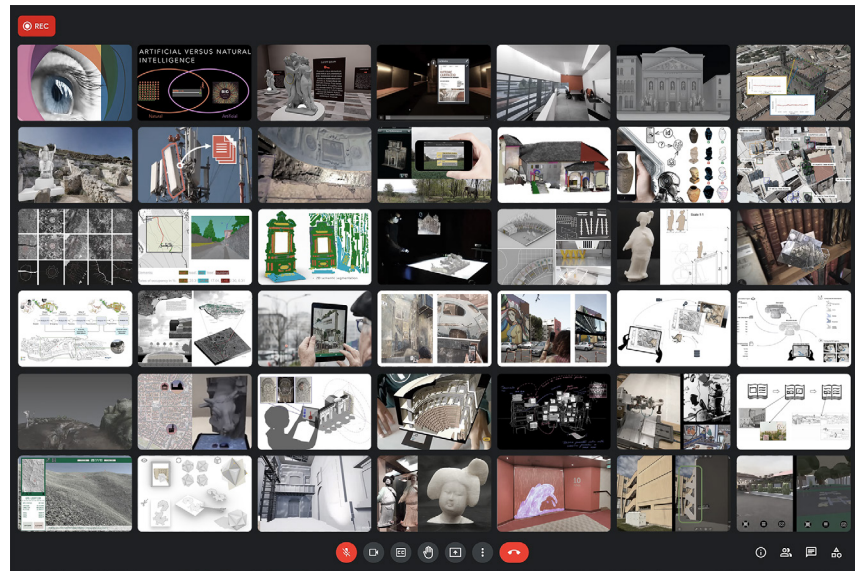


Fig. 2. Virtual mosaic of the studies proposed in the symposium (author's elaboration).

ative, and digital models, in which the aim is to turn the physical representation into a narrating artifact to which AR contents can be connected in a continuous interchange between reality and the virtual.

The artistic installation *Divina!*, presented by the Laboratory *Astro* of the Department of Civil and Industrial Engineering of the University of Pisa in collaboration with *Follia Lab* and *Aca3D* utilizes AI to enable communication between technologies belonging

to different eras. The results obtained demonstrate the rapid obsolescence of technological language that must be faced within these kinds of studies.

The outcome of these researches has therefore revealed the role of digital technologies in the renewal of the discipline, but they also highlighted how appropriate it is to constantly question on the ethical implications arising from the use of these new instruments.

The symposium has assumed the form of a self-sustained dialogue on

ever-new reflections and questions, itself becoming a shared process of research. The contributions are elements of a far larger mosaic, influencing each other and aggregating continuously, varying the whole structure. A mosaic in the making, therefore, which will unfold in the next edition of the symposium, already planned for 2022, assuredly enriched by the results of the researches still being carried out and those that will take shape from the reflections born from the 2021 meeting.

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