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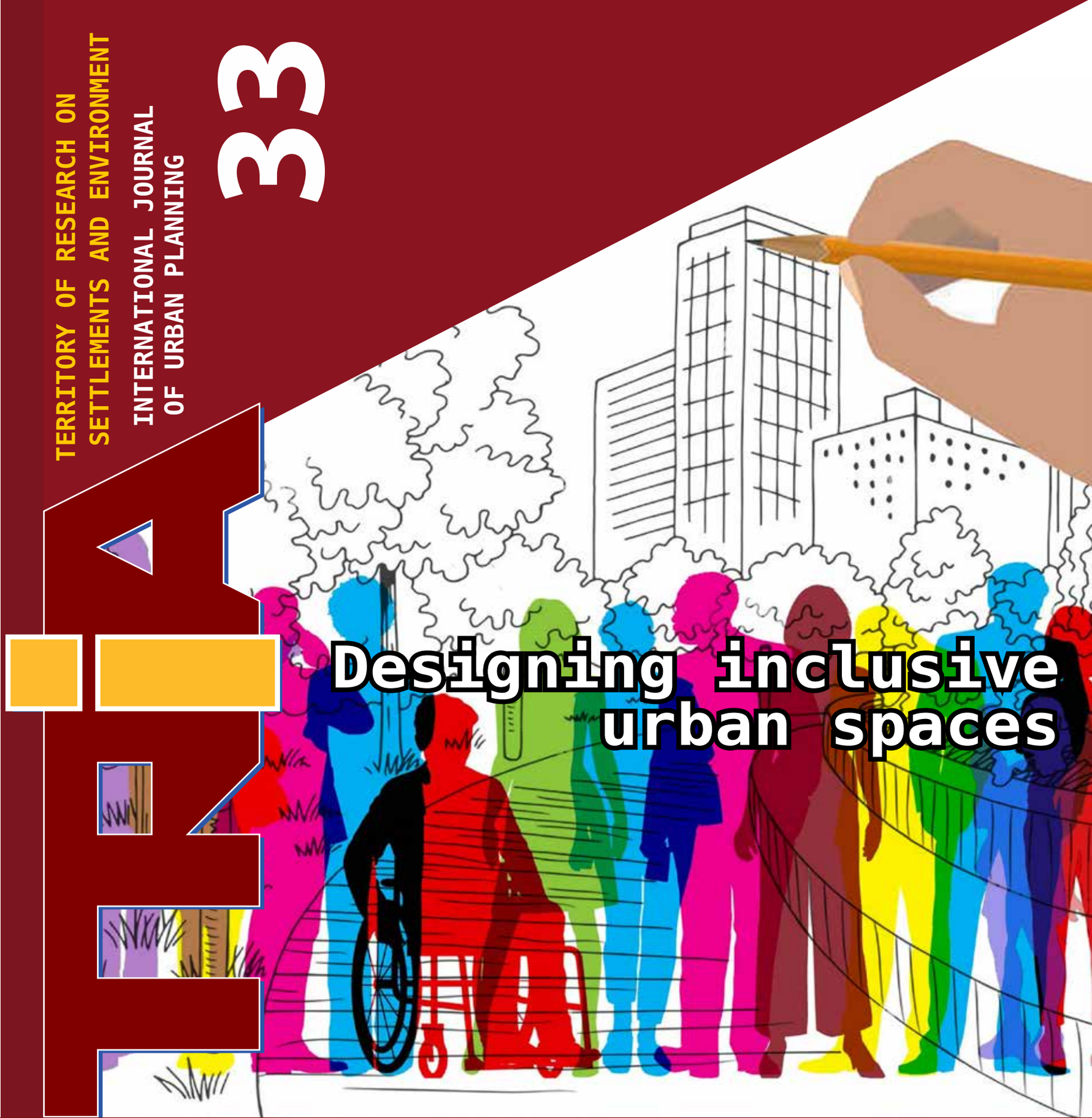
33

Designing inclusive urban spaces



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abstract

Informative city modeling and augmented reality: the City Augmented Reality for the Environment-CARE project

Ida Zingariello, Romano Fistola

Abstract

New technologies, applied to urban planning processes, are increasingly assuming a central role as a tool to support planners in decision-making processes, orienting design choices towards sustainable solutions that are compatible with the available resources. The phenomena triggered by the relationship between planning processes and new technologies are able to able, among other things, to enable new experiential modes capable of creating alternative levels of knowledge of the city to the traditional ones. In particular, information digitizing processes, necessary for the development of the city information model, better known as Urban Digital Twin (UDT), and Augmented Reality (AR) tools represent an innovative resource at the service of territorial governance policies (Fistola & Zingariello, 2024). Starting from these reflections, the project City Augmented Reality for the Environment-CARE, developed by the AURUS research group, was created with the aim of simulating new design choices and test them in terms of economic, environmental and social sustainability.

Keywords:
Urban Digital Twin, Smart City, Augmented Reality, City Information Modeling, Bottom-Up Planning Process

Modellazione informativa della città e realtà aumentata: il Progetto City Augmented Reality for the Environment-CARE

Le nuove tecnologie, applicate ai processi di pianificazione urbanistica, assumono sempre più un ruolo centrale come strumento a supporto dei pianificatori all'interno dei processi decisionali, orientando le scelte progettuali verso soluzioni sostenibili e compatibili con le risorse a disposizione. I fenomeni innescati dalla relazione tra i processi di pianificazione e le nuove tecnologie sono in grado, tra l'altro, di abilitare nuove modalità esperienziali capaci di creare livelli di conoscenza della città alternativi a quelli tradizionali. In particolare, i processi di digitalizzazione informativa, necessari per la messa a punto del modello informativo della città, meglio noto come Urban Digital Twin (UDT), e gli strumenti di Augmented Reality (AR) rappresentano una innovativa risorsa al servizio delle politiche di governance territoriale (Fistola & Zingariello, 2024). A partire da queste riflessioni, il progetto City Augmented Reality for the Environment-CARE, sviluppato dal gruppo di ricerca AURUS, nasce con l'obiettivo di simulare nuove scelte progettuali e testarle in termini di sostenibilità economica, ambientale e sociale.

Parole Chiave:
Gemello digitale urbano, Smart City, Realtà aumentata, City Information Modeling, Pianificazione Bottom-Up

Informative city modeling and augmented reality: the City Augmented Reality for the Environment-CARE project

Ida Zingariello, Romano Fistola

1. Introduction

New technologies, employed in every field of human knowledge, can no longer be considered as mere tools capable of optimising all kinds of human activities. The rise of technologies that are increasingly pervasive and dominant in all branches of human activity, think of the rapid and pervasive spread of Artificial Intelligence technologies, requires us to make an opportune reflection (also of an ethical nature) on how technological innovation should be adopted. Rather, it is necessary to recognise the role of new technologies as essential tools to support knowledge, or innovative instruments capable of enabling new forms of access to knowledge.

In this regard, even in the field of urban planning, it is necessary to investigate and learn the capabilities of new technologies in order to integrate them consciously into planning and decision-making processes. It is not a question, as has too often been the case in cases of smart city planning, of simply adding technologies to cities or using technology as a mere attractor for potential investors, but of adopting new technologies at the service of innovative territorial governance processes so that they are sustainable and compatible with the available resources. Over the past twenty years, many results related to the design of smart cities have unequivocally demonstrated how, in the absence of an upstream process of conscious appropriation of new technologies, capable of making technologies interact with the city's social, economic and environmental ecosystem, the results are nothing more than cities in which today (after more than a decade of interventions considered smart) little has been achieved in terms of smart management of transport, energy consumption, public safety, etc.

In consideration of the current scarcity of available resources, it seems evident that true urban smartness is to be found in the implementation of development processes guided by the principle of sustainability, rather than growth (Fistola et al., 2021).

The availability, through new technologies, of methods and procedures capable of enabling an appropriate ex-ante assessment of the transformations planned for the urban context represents an opportunity to increase the critical awareness of planners and decision-makers. In this sense, technologies for pre-fuguration urban transformations can play a crucial role in the definition of new processes of governance of territorial transformations able to efficiently evaluate the available resources and open the way to new levels of knowledge available to all city users.

2. New technologies for urban planning

The most advanced technologies in the field of governance of territorial transformations are identified, in the first instance, in the processes of informative city modeling, which, thanks to City Information Modeling (CIM) technologies, allow urban planners to digitise entire city sections. The outcome of this information modelling process is the creation of the so-called Digital Urban Twin (UDT).

A digital twin is a virtual representation of a physical system, capable of replicating not only its morphological characteristics but also the processes that determine it, and which is continuously updated through the exchange of information between the physical and virtual systems (VanDerHorn & Mahadevan, 2021). At the urban scale, the realisation of digital environments that model and replicate human habitats (which are in turn endowed with computational capabilities and so capable of communicating with the Internet thanks to sensors or other networked objects) results in the definition of the UDT. Currently, reflections on the realisation of the UDT are leading the way for the most innovative research in urban studies. Today, many cities are in the process of building their own UDTs, although the results are still rather immature to the extent that they are still limited to computer programming of the city rather than understanding its structure and parts.

Starting from the concept of UDT we can define the more punctual concept of Digital Twin Instance (DTI) considered as a single digital instance connected and federated to its physical twin. In this regard, if we imagine to translate a new urban project by digitising it in the form of a DTI, it will be possible to verify through it the modifications that the new intervention will bring to the built context, in other words we will be able to have a real urban prototype thanks to which we can preview the planned interventions.

In addition to this, if we place the tools of Augmented Reality (AR) beside the information modeling processes of the city, it will be possible to activate an DTI by superimposing it on the physical reality to which it refers. In other words, AR tools enable the grafting of the digital content of the UDT or of the individual DTI within the physical space of the city and make it possible to use and interact with it through common devices available to each of us.

In this regard, it is precisely the use of the digital twin through augmented reality visualisation tools that activates the above mentioned pre-figurative approach capable, as we shall see, of defining new forms of urban planning. Such an approach, in fact, will allow all the stakeholders of the planning processes (planners, decision-makers, stakeholders and citizens) to share the outcomes of these processes, throughout the entire planning process, triggering a new collaborative process for the co-creation of new urban settings. In this sense, the visualisation of an information model of the city by means of common devices represents a transversal sharing tool that can be used by both experts in the field and ordinary citizens.

Specifically, the virtualisation of urban objects and their use by digital means, translates into a dual planning tool: it allows planners and decision-makers to simulate and verify their design choices in advance, and at the same time, if put at the service of citizens, it allows them to pre-figure a new urban context.

In this regard, how does the use of an augmented urban space mediated by AR technologies affect citizens' knowledge of the city? That is, what effects does the opportunity to prefigure a new urban context have on the citizen?

Visualising, on site through a common smartphone, a digital model as an exact replication of the design hypothesis proposed by the planners, will allow citizens to become informed about a specific urban project, finally becoming active subjects within the decision-making processes. Overcoming the limits dictated by not possessing specific technical skills (which often limit citizens' participation in traditional planning processes), visualising and interrogating a specific DTI in its physical context of reference will activate in citizens a critical awareness that will trigger new bottom-up planning processes and an innovative form of participatory planning.

3. The City Augmented Reality for the Environment-CARE project

The above has been investigated through various experiments by the AUgmented Reality for Urban Systems-AURUS research group whose activity, for years, has been traced by the awareness that technological innovation, through conscious and widespread adoption, can play a role crucial in the management and direction, towards sustainable development, of the city system.

Starting from these reflections, the City Augmented Reality for Environment-CARE project, developed by the AURUS group, was born with the aim of simulating new design choices by pursuing solutions that are sustainable in economic, environmental and social terms.

Specifically, the CARE app allows users to visualize, through a common smartphone or tablet, the possible tree essences that will green up Via Posillipo in Naples. As a result of an attack by parasites, the historic pines in Via Posillipo had to be felled; hence the need for a replanting plan which, following analyses by administrators and agronomic experts, will have to provide for the alternation of tree species in in order to favour a biodiversity capable of preventing new infections by parasites. CARE, designed by Unity, takes advantage AR image tracking technology, so it's necessary to frame, by the smartphone, an image used as a marker and by tracking this image, it's possible to see the tree in its future location and real scale (Fig. 1-2).

Thanks to their smartphone, in fact, all stakeholders, first and foremost citizens, will be able to have a preview of the new morphological structure of one of the most iconic arteries of Naples, viewing live and on demand a list of trees foreseen by the plan of

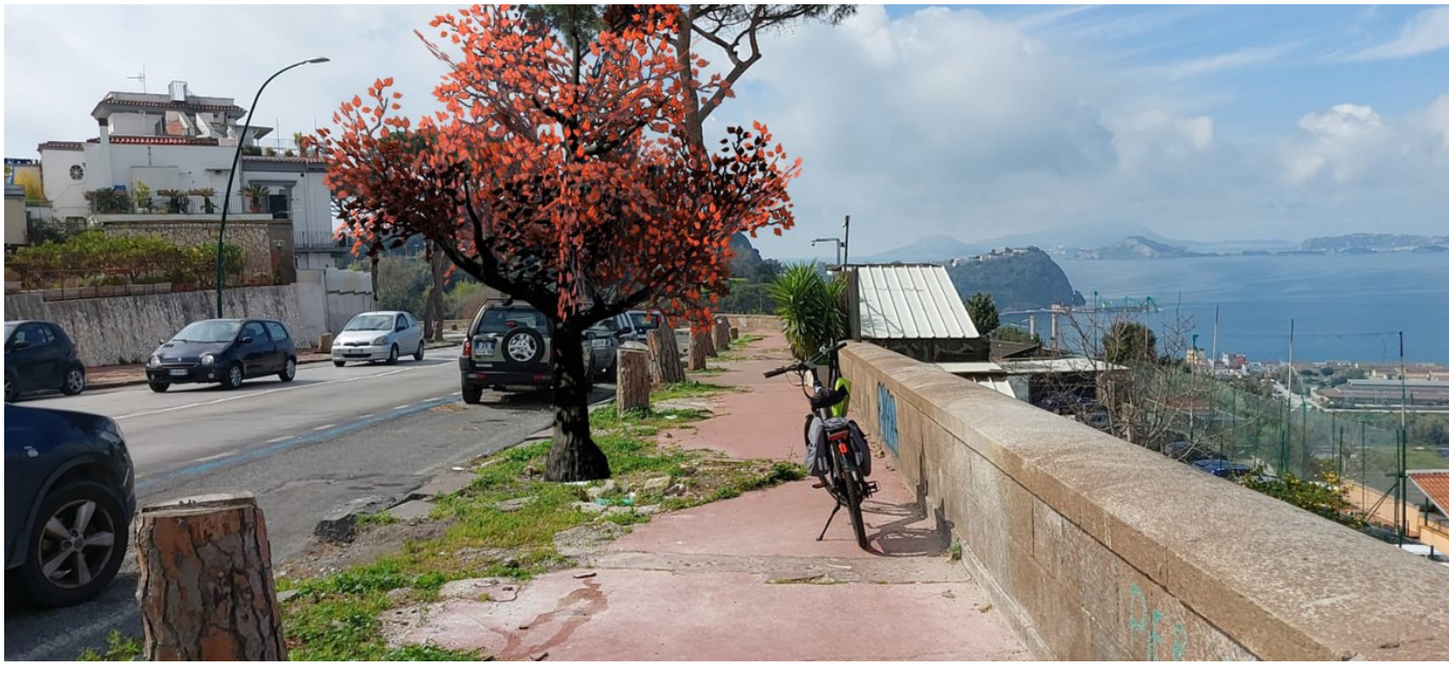
replanting Via Posillipo, in order to express one's point of view which must be received by the administrators and guide the final choice (Fig. 3). The CARE application, which is currently being implemented, is easy to understand and accessible to every type of user, just open the .apk file downloaded on your device, frame the marker located at the point where you want to view the tree, and it will be visible in full scale.

It is interesting to note how, once the digital tree has been visualized, various interactions between the subject and the digital object will be possible (for example, it will be possible to walk around it, look at it even from a considerable distance and perceive the movement of the leaves), pre-figuring the physical presence of new trees. On the other hand, viewing the simple three-dimensional model on a monitor not on-site would allow us to equally visualize the different tree types without however experiencing the potential that AR technologies allow us to investigate in terms of increased use.

City information modeling and AR technologies are capable of generating a profound transformation within the traditional categorization of urban spaces. Placing one or more DTIs into the urban context, which in the case of the CARE project correspond to different tree essences, triggers a process of interaction between physical entities and digital entities that generates a Hybrid Digital Space (HDS); a new category of space that declares the overcoming of the common categorization of physical space and digital space in favor of a contamination capable of defining a new typology of hybrid space (Curtis & Opromolla, 2019).

Technologically mediated reality gives rise to an osmotic relationship of mutual belonging between physical object and digital object. The interaction that is generated must not be understood only as the outcome of the use of a technology but as the result of

Fig. 1 – Prefiguration by CARE app of a kind of tree that will be planted in via Posillipo (source: AURUS Research Group)



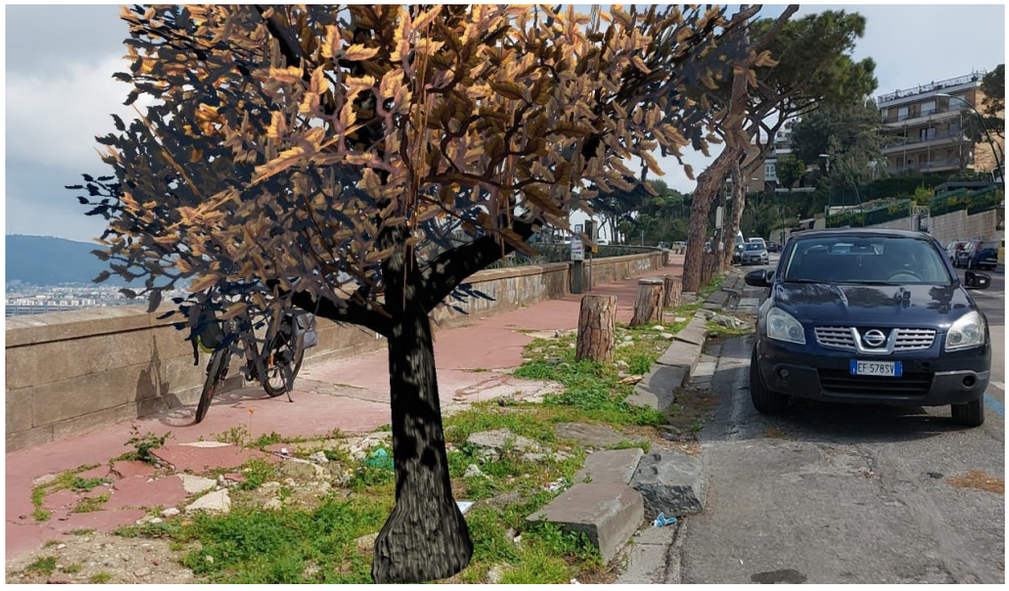


Fig. 2 – Prefiguration by CARE app of a kind of tree that will be planted in via Posillipo (source: AURUS Research Group)

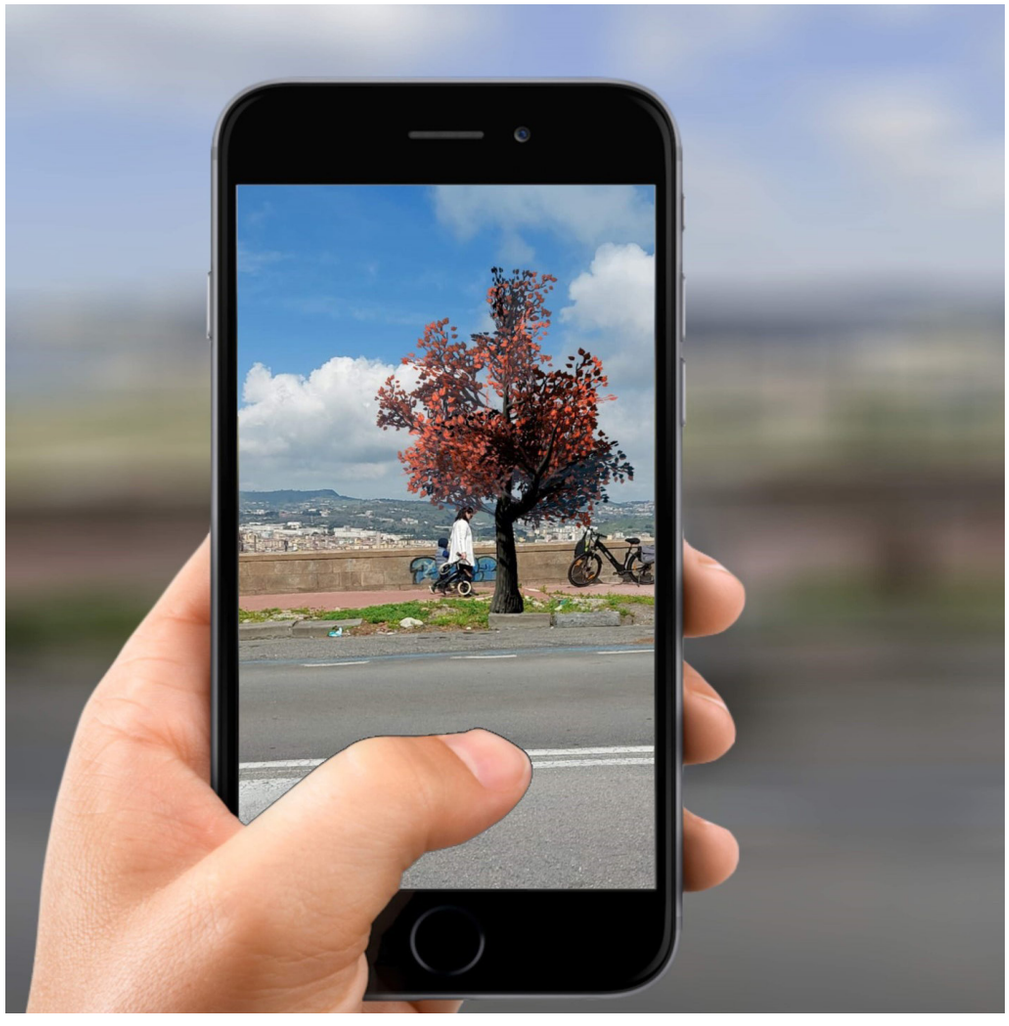


Fig. 3 – Use of the CARE app by smartphone (source: AURUS Research Group)

the mutual influence between user, physical object and digital object (Maniello, 2023).

The experience made possible by the use of an HDS is a new process of increased knowledge of urban places that arises from the possibility of interacting simultaneously with physical objects and digital objects, perceiving them both as real.

In this sense, the result of CARE is double: on the one hand it represents an innovative planning tool at the service of planners and citizens; on the other hand it is a tool for urban regeneration, capable of giving urban space the new configuration of digital hybrid space.

4. Conclusions

The technologies available to urban planning practice are numerous and constantly evolving (it cannot be ruled out that, given the powerful advent of AI, many cities will be configured early as Artificial Intelligence City-AICs), but if we want to take the road towards a more conscious and sustainability-oriented urban planning (as an ethical approach to the use of available resources requires us to do), new or ultra-new technologies are not enough, it is necessary to build a theoretical-disciplinary framework through which to understand and describe the outcomes of these technologies on the city system.

The use of new digital technologies, unstoppable in their advancement, will increasingly be understood as an ethical issue necessary for the definition of a solid methodological base from which to draw before using any technology. In fact, if technological support translates into mere functional support and the dialogue between urban planning and new technologies remains superficial, technology becomes a tool for its own sake destined in the short term to lose its initial fascination.

In this sense, with a view to an evaluation process of the results, following the eventual use of the application by planners and decision-makers, it would be interesting to evaluate the response of citizens in terms of the usability of the application. Usability is one of the main objectives whose achievement guides the AURUS group in the definition of the CARE project and many other projects under development. In fact, the CARE app was created with the intention of simplifying and facilitating the approach to AR technologies by overcoming the limitation dictated by the use of expensive AR glasses. Thanks to the opportunity to enjoy AR content simply through one's smartphone, it will be possible to considerably enlarge the catchment area of CARE users in an attempt to start an innovative and effective bottom-up planning process. Gathering as many evaluations as possible from citizens and decision-makers themselves will make it possible to arrive at conscious planning solutions that are the result of a collective awareness and therefore meet the needs of each user of urban space.

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Ida Zingariello
Department of Engineering (DING), University of Sannio, Benevento, Italy
AURUS Research Group
izingariello@unisannio.it

Ida Zingariello, BIM expert architect, is a PhD student at the Department of Engineering, University of Sannio. In 2014, she obtained the Master's degree 'Expert in design in emerging technologies' at the National Institute of Architecture and in 2018 the Master's degree 'BIM-Building Information Modeling' at the Sapienza University of Rome. Expert in Digital Architecture, she has collaborated with design offices in Italy and Europe exploring the boundaries between real and virtual architecture.

Romano Fistola
Department of Civil, Building and Environmental Engineering (DICEA), University of Naples Federico II, Naples, Italy
AURUS Research Group
fistola@unina.it

Romano Fistola, architect, founder and coordinator of the AURUS group, is a university professor at the University of Naples Federico II. In his teaching and training courses, he adopts systemic logic and complexity theory for the reading and interpretation of the urban phenomenon. For over twenty years, he has been dealing with the relationship between new technologies and the governance of sustainable city development. An expert in Geographical Information Systems, urban smartness, Urban Big Data and applications of augmented and mixed reality for the prefiguration of changes in the city, he has published over 140 contributions, including scientific articles and books, for national and international editions.