

BECOMING-WITH, ENCOUNTERS IN AN AUGMENTED GARDEN - ARCHITECTURE AS INHABITABLE MEDIA OBJECT

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BECOMING-WITH, ENCUENTROS EN UN JARDÍN AUMENTADO - ARQUITECTURA COMO OBJETO MEDIÁTICO HABITABLE

RESUMEN: Este artículo investiga el impacto de la informática espacial, la Web 2.0, las redes sociales y los anchos de banda elevados en la arquitectura contemporánea. Explora el modo en que estos avances hacen converger las tecnologías de la comunicación y los espacios físicos, permitiendo la habitabilidad virtual tridimensional. Este cambio de paradigma ha dado lugar a comunidades virtuales y a una sociabilidad espacial híbrida, desafiando las nociones tradicionales de la arquitectura como algo estático y aislado. El artículo presenta un proyecto de investigación dirigido por la práctica, *Becoming-with*, que despliega una instalación de realidad mixta específica del lugar en Giardini Margherita, Bolonia. Examina el potencial de cultivar un entorno espacial que integre la información digital con el espacio físico, creando una experiencia socioespacial híbrida. El artículo analiza la interacción entre arquitectura y medios de comunicación, destacando las implicaciones del diseño de espacios sociales de realidad mixta en los entornos arquitectónicos. En última instancia, explora la aparición de una espacialidad arquitectónica transformadora y envolvente, configurada por las nuevas tecnologías de los medios de comunicación e Internet.

PALABRAS CLAVE: Espacios híbridos, Internet espacial, interfaces espaciales, telepresencia corporal, Arquitectura como objeto mediático habitable

ABSTRACT: This paper investigates the impact of spatial computing, Web 2.0, social networks, and high bandwidths on contemporary architecture. It explores how these developments converge communication technologies and physical spaces, enabling three-dimensional virtual inhabitation. This paradigm shift has given rise to virtual communities and hybrid spatial sociability, challenging traditional notions of architecture as static and isolated. The paper presents a practice-led Ph.D. research project, *Becoming-with*, which unfolds a site-specific mixed reality installation in Giardini Margherita, Bologna. It examines the potential to cultivate a spatial milieu that integrates digital information with physical space, creating a hybridized socio-spatial experience. The paper discusses the interplay between architecture and media, highlighting the implications of designing social mixed-reality spaces on architectural environments. Ultimately, it explores the emergence of a transformative and immersive architectural spatiality, shaped by new media technologies and the Internet.

KEYWORDS: Hybrid spaces, spatial-internet, spatial-interfaces, embodied-telepresence, Architecture as a Inhabitable Media Object



1. Introduction

The present study delves into the impact of the emergence of spatial computing, the proliferation of Web 2.0, social networks, and high bandwidths in contemporary architecture. These developments have led to the convergence of communication technologies and the physical spaces we occupy, as information and data are increasingly capable of being *inhabited* in three dimensions and *virtually embodied* in the actual world. This paradigm shift marks a significant step forward for architecture, as alternative realms are superimposed on our everyday scenes through the Internet and social media. As a result, the paper argues that this advancement has led to the formation of virtual communities, enabling novel and hybrid spatial modes of sociability, which pose a challenge to the conventional comprehension of our architectural environments as not static and isolated anymore, but rather plastic and hybrid as they have become the medium of the message¹, the spatial envelope for the streams of inhabitable information.

The paper contributes to a practice-led Ph.D. piece of research by unfolding the site-specific mixed reality installation of *Becoming-with - encounters in an augmented garden: a multi-user social mixed reality experience*, exploring a hybrid condition of spatiality combining physical and digital spaces and bodies in the Giardini Margherita in Bologna. *Becoming-with* investigates an inclusive virtual-physical, social and public place where human and non-human relationships and speculative hybridizations stimulate the flourishing of novel ways of seeing, perceiving, being, and becoming in the world that allows for the consideration of new methods of architectural spatial production, practiced through new media technologies and the Internet.

The paper discusses the interplay between architecture and media in the present day and reflects on the impact of designing social mixed-reality spaces on the domains of architectural environments. It provides a background that situates the *Becoming-with* installation in theoretical and cultural discourse. Secondly, it introduces the project, methods, and findings in depth. Finally, it concludes with the installation's contribution to the design of hybridized architectural spaces and their programs.

2. Background

In the captivating landscape of the 1990s, Marcos Novak emerged as a visionary, unveiling the concept of *cyberspace* in architecture as a realm, where information merges with physical space in real-time, creating a hybrid spatial construction. Novak's definition of cyberspace invites us on a compelling exploration:

a completely spatialized visualization of all information in global information processing systems, along pathways provided by present and future communications networks, enabling full copresence and interaction of multiple users, allowing input

and output from and to the full human sensorium, permitting simulations of real and virtual realities, remote data collection and control through telepresence, and total integration and intercommunication with a full range of intelligent products and environments in real space. (Novak, 1991, p. 225)

In his reflection, Novak positions humans within information space as an architectural situation and points out that cyberspace possesses an architecture of its own and is able to accommodate architecture as well. Specifically, he asserts that architecture has already made its way into cyberspace. «Now cyberspace is about to colonize real space and physical architecture.

Information and interactivity will be ubiquitous, and physical space will be intelligent.» (Novak, 1996). Novak (1996) also anticipates that contemporary gateways to the digital realm, namely computer and telephone screens, are destined to undergo a transformation, whereby they will expand to envelop the entirety of the surfaces and dimensions of our inhabited environments. This statement highlights that cyberspace, in its many forms, will not replace physical space; rather, the two will merge into what is already forming with names like augmented reality², tangible interfaces³, and intelligent environments⁴. Novak (1996) articulates that affective computing and wearable devices will soon bring technology to the body, and warns about the need to test these concepts and methods in different contexts, disciplines, discourses, and epistemes.

Architecture, according to Novak, has become *transArchitecture*:

transArchitecture, architecture beyond architecture, is an architecture of heretofore invisible scaffolds. It has a twofold character: within cyberspace it exists as liquid architecture that is transmitted across the global information networks; within physical space it exists as an invisible electronic double superimposed on our material world. (Novak, 1996)

As the *transArchitecture* model intends to seamlessly integrate both information and material components, effectively merging the virtual and actual realms, it is necessary to inquire about the applicability of this paradigm at the intersection of contemporary architecture, new media, and design practice.

Novak (1991) argues that the present-day mode of communication has transcended the traditional boundaries of physical proximity, as individuals now engage in social interactions with acquaintances, relatives and colleagues within their immediate vicinity and across diverse temporal and cultural domains.

¹ In reference to the phrase «The medium is the message» by the communication theorist Marshall McLuhan, to be found as the title of the first chapter of *Understanding Media: The Extensions of Man*, published in 1964.

² Defined in the Oxford Dictionary as «a technology that combines computer-generated images on a screen with the real object or scene that you are looking at» (Pearsall et al. 2010) and allowing, therefore, dynamic and context-specific information to overlay onto the site-specific visual field of the user.

³ Interfaces treating «the whole of physical space around the user as part of human-computer interface (HCI) by employing physical objects as carriers of information.» (Manovich, 2002).

⁴ Spaces can be defined as intelligent, as they monitor, in real-time, the users actions and interactions with them «via multiple channels and provide assistance for information retrieval, collaboration and other tasks (think of Hal in 2001).» (Manovich, 2002).



Figure 1: Ariana Grande Fortnite by epredator, licensed under CC BY 2.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by/2.0/?ref=openverse>.

In contemporary times, the proliferation of the Internet, social networks, and spatial computing⁵ have led to a transformation in our interactions with the environment. Specifically, the conventional notions of spatiality, sociability, identity, and time have undergone a significant shift due to the widespread adoption of video gaming and social networking platforms. Informally, the notion of social space was traditionally associated with physical environments:

it was a plaza, public garden, coffee shop, parlor, club. Today, these social spaces are supplemented by and intertwined with social media, sharing platforms, online forums, massively multi-player video games and virtual worlds. Parents' garages, coffee shops and skate parks for teenagers are complemented with the likes of Fortnite and Minecraft, offices and conference centers with GTA, Zoom and Red Dead Redemption. (Nazmeeva, 2021)

With today's ubiquitous computing⁶, video gaming, social media platforms, and the Internet have become social environments (Figure 1). Along with people, places, objects, and images, digital media and communication technologies are interwoven into the network's fundamental fabric, and networked spaces have evolved into spatial mediums themselves. The COVID-19 pandemic and the resulting physical constraints, isolation protocols, and lockdown measures have profoundly impacted human social interactions and our connection to the physical and virtual world. A significant change has been the shift towards digital platforms as the primary means of social interaction, leading people to explore virtual environments for cohabitation and community building. Consequently, a new form of interpersonal spatial and sociocultural engagement has emerged: *SocialVR*.

⁵ Spatial computing can be understood as «human interaction with a machine in which the machine retains and manipulates referents to real objects and spaces. Ideally, these real objects and spaces have prior significance to the user. For instance, a system that allows users to create virtual forms and install them into the actual space surrounding them is spatial computing. A system that allows users to place objects from their environments into a machine for digitization is spatial computing.» (Greenwold, 1995, p. 11).

⁶ Parisi (2013) defines ubiquitous computing as «The embedding of computers in every object (from media objects to medical and weather technology). In 1988, Mark Weiser at Xerox Palo Alto Research Center (PARC) used the term ubiquitous computing to describe future technology that could monitor (track) and anticipate (calculate the probabilities of) users' needs, without the user having to attend to or directly operate the technology. For example, mobile phones are designed to interact with both the users and the digital media environment, without direct attention.» (Parisi, 2013, p. 268).

Social Virtual Reality (SocialVR), exemplified by platforms such as SecondLife, RecRoom, AltSpaceVR, Horizon, Sansar, VRChat, and others, constitutes an internet-dependent framework for social engagement. This paradigm is facilitated through immersive technologies within meticulously crafted three-dimensional virtual environments. In these virtual realms, individuals or groups, embodied by avatars, have the opportunity to engage in real-time interpersonal dialogues and participate in shared activities in spatial dimensions.

The application of this specific technological breakthrough has garnered significant attention in the fields of gaming and entertainment. Yet, its potential for enhancing social interactions has only begun to be thoroughly explored in recent times. Although it shares similarities with conventional online communication methods, the emergence of SocialVR introduces remarkable implications for the development of new architectural spaces, fundamentally changing how we perceive spatiality. These revolutionary technologies have transformed our ability to interact with and traverse digital environments, leading to a redefinition of communication and interaction within these spatial digital realms.

In contrast to traditional telecommunication methods found on social media platforms like Instagram or YouTube, which primarily revolve around user-generated content in the form of visuals, text, or videos, SocialVR takes things a step further. This emerging domain enables users to create, edit, and distribute content in a spatial and physical dimension within the vast expanse of the Internet. SocialVR stands out with its seamless streaming of 3D objects, avatar bodies, and virtual spaces, transcending geographical boundaries and bringing telepresence into navigable spatial dimensions.

The documentary films *We Met in VR* (2022) and *Club Zodiac* (2020) by Joe Hunting provide insights into novel forms of collaborative social gatherings within the VRChat platform. These gatherings serve as alternatives for users to surmount the physical limitations imposed by COVID-19 restrictions and partake in intimate interactions, social engagements, and entertainment.

Club Zodiac presents a collective of dancers who engage in their artistic practices from the confines of their homes, facilitated by motion capture devices and VR headsets that enable real-time full-body telepresence. Of particular interest in this documentary is the evolving relationship between users and their inhabited physical spaces. Notably, many users have transformed their physical surroundings, deliberately eliminating obstacles to create liberated spaces conducive to navigating the virtual realm.

Such transformation is achieved by merging spatial computing and SocialVR platforms, effectively rendering the virtual space as an interactive interface for spatial communication. In this paradigm, users abandon traditional two-dimensional interfaces, opting instead for bodily actions to directly interact with tangible objects, transcending the confines of representative images.

This convergence of technology and human interaction signifies a paradigm shift in the domain of spatial communication, accentuating the prominence of virtual spaces imbued with authentic interactions and experiential depth.

SocialVR's virtual environment effectively immerses users in its own set of virtual affordances, thereby enabling them to liberate themselves from the constraints imposed by their physical bodies. Moreover, these platforms are accessible from any location, most notably from the comfort of one's own home, thereby blurring the boundaries that traditionally demarcate the realms of intimacy and shared experiences, subjectivity and objectivity, as well as privacy and publicity. However, while allowing full freedom to create virtual content unencumbered by the constraints of the physical world, SocialVR still lacks a connection to the actual environment, as it merely renders virtual content onto the physical dimension without making it an accessible part of the experience.

As a result, a notable disconnection emerges between these two realms, giving rise to the perception of their spatiality, temporality, and embodiment as distinct and separate entities. This portrayal of Virtual Reality (VR) as a liberated spatial medium, free from the constraints of the physical world, raises a compelling question: How can architects, in their role as designers, formulate strategies that acknowledge both physical and digital spatialities as essential components within the framework of planning and designing experiences and spatial narratives? Furthermore, what architectural possibilities may arise from the hybridization of SocialVR spaces within our inhabited physical environments?

In this regard, it is essential to delve into Peter Anders' notion of *cybrids*, presented in his paper *Cybrid Principles: Guidelines for Merging Physical and Cyber Spaces* (2005) as mixed realities: spatial hybrid compositions of physical and electronic architecture continuously reinforcing each other. Anders posits that the overlap of physical and digital space within cybrids presents users «with a coherent spatial environment that extends their awareness beyond the concrete world to a dimensionally rich, mediated space.» (Anders, 2005, p. 403). By centering on human social interactions and drawing comparisons between the physical and virtual, Anders states:

Despite its past success, architecture's focus on materiality, both in theory and practice, has rendered it increasingly inadequate for the challenges presented by telematics and global culture. The premises of modern technological culture – its accelerated pace and distributed, asynchronous nature – strain architectural notions of materiality, permanence, and even of presence itself. (Anders, 2005, pp. 395-396)

Anders (2005) calls for the need to build a shared social reality by means of mixed reality technologies along with cybrids as objects «that incorporate the material presence of sensory objects with the capacities of virtual ones.» (Anders 2007, p. 278). In Anders's terms, the cybrid becomes a *spatial assemblage*⁷ of the actual and the digital, performing as the interface of the mixed reality space.

⁷ Dovey (2013) defines assemblage as «a whole that is formed from the interconnectivity and flows between constituent parts—a socio-spatial cluster of interconnections wherein the identities and functions of both parts and wholes emerge from the flows between them. Assemblage is at once material and representational, it defies any reduction to essence, to textual analysis or to materiality. Assemblage is a useful way of re-thinking theories of 'place' in terms of process, identity formation and becoming.» (Dovey, 2013, p. 131).

This concept of assemblage thinking, as a spatial interplay between digital and physical spaces proposed by the cybrids, opens up new horizons for design methods that transcend the traditional dichotomy of perceiving physical and digital realms in binary terms. Instead, it presents a hybrid space where both domains mutually enhance each other's affordances, giving rise to a novel social cybrid space. As Dovey (2013) aptly observes, assemblage thinking enables us to approach architecture, not merely as a formal exploration, but also considering its inherent processes and transformations. This approach shifts the focus from viewing architecture as a static expression of being-in-the-world to embracing a more Deleuzian perspective of *becoming-in-the-world*. (Dovey, 2013).

For Deleuze and Guattari (1987), *becoming* refers to a process of transformation, flight, or movement within an assemblage. It focuses on the relationships between the individual parts of the assemblage rather than viewing it as a static whole. During the process of becoming, an element of the assemblage is drawn into the realm of another element, resulting in a reevaluation of its significance and the emergence of a new unity and properties.

Building upon the preceding practical and theoretical framework, the subsequent segment of this paper delves into the conception and realization of a hybrid public spatial condition. Termed *Becoming-with - encounters in an augmented garden*, this site-specific social mixed-reality project seeks to examine the potential of cultivating a spatial milieu that seamlessly integrates digital information with physical space, thereby providing an extended social and spatial context. By drawing on the concepts of *remixing* and *worlding*, the project endeavors to assemble diverse spaces and actors, fostering meaningful connections between individuals and their surroundings.

3. *Becoming-with: a site specific multi-user social mixed reality installation*^{8 9}

Posthuman feminist theorist Donna Haraway (1988) embraces the concept of assemblage to engender processes of «partial, locatable, critical knowledge sustaining the possibility of webs of connections» (Haraway, 1988, p. 584). Haraway (2008) further argues that «becoming is always *becoming with* – in a contact zone where the outcome, where who is in the world, is at stake.» (Haraway, 2008, p. 244).

Taking Haraway's statement into account, *Becoming-with - encounters in an augmented garden* aims to explore human and non-human social encounters in an augmented public contact zone, approaching the notion of *becoming-with* as a transformative practice for creating a hybrid socio-spatial experience, combining multi-user mixed reality and motion tracking into an environment in which one is conceived and perceived simultaneously as both subject and object and becomes a partial figure in the spatial configuration.

⁸ Short video and documentation of *Becoming-with: a site-specific multi-user social mixed reality installation*: <https://meandother.me/Becoming-with>.

⁹ <https://blog.laval-virtual.com/en/cenk-guzelis-real-virtual-art/>

Figure 2: Digital Object Catalogue as a result of LIDAR scanning survey and site-specific stories, Cenk Güzelis, Anna Pompermaier, 2021.



Becoming-with is located in an urban public garden, the Giardini Margherita in Bologna (Italy). The park officially opened in 1879, was conceived by Count Ernesto Balbo Bertone di Sambuy, and dedicated to Queen Margherita of Italy. The history of the garden mirrors the wider pattern in late 19th-century Italian towns of establishing parks for the public, either by repurposing existing gardens of aristocratic villas or by purchasing new lands. This movement aimed to enhance metropolitan areas' visual appeal and sanitary conditions. The garden was envisioned as a living work of art, resembling English gardens, where people could enjoy natural beauty in an urban setting. The park's function has substantially changed since its establishment in the late 19th century. The location has transformed into a space where various cultural and leisure activities occur, including exhibits, concerts, and horse contests. Additionally, the park has served educational purposes, with facilities like an elementary school and an educational pond created by WWF. The recent transformation of its community greenhouses into a versatile space called Le Serre Dei Giardini highlights its continuous adjustment to address modern municipal requirements, providing a location for cultural events, leisure activities, and communal assemblies.

The garden was chosen as the site of experimentation because it is an inherent quality of gardens to invite exploration and motivate curiosity and imagination. As an architectural archetype, the garden has always been a space for experimentation, where nature is reinvented and artificially manipulated: from the ornate and rigidly structured gardens of the Italian Renaissance to the choreographed gardens of late nineteenth-century England, with their deliberate integration of more natural elements through wild areas of floral and arboreal beauty. Urban gardens play with the alternating simultaneity of vastness and refuge, foreground and background, intimacy and immensity, natural and artificial, and are places for human and non-human interactions and exchanges. Through a multi-user mixed reality installation, we aimed to create a digitally augmented portion of the Giardini

Margherita inside the pavilions called Le Serre that would offer a space of socialization while simultaneously creating a multi-sensorial immersive experience.

3.1 A Spatial Library through Site-specific Media Artifacts

The central focus of the installation was to provide a spatially experiential narrative encompassing the past, present, and future stories of Giardini Margherita within the social setting framed by the pavilions known as Le Serre. To achieve this, LIDAR scanning technology was employed to capture the essence of Giardini Margherita. The scanning process not only offered a Euclidean description of the physical space but also delved into a multidisciplinary exploration of the environment, encompassing atmospheric, topological, cultural, and speculative aspects. This comprehensive approach allowed for capturing movements and details that may not be discernible to the human eye.

The scanning process resulted in the creation of a comprehensive digital object library consisting of 3D cultural artifacts. Our methodology involves reorganizing the spatial configuration of cultural artifacts extracted from the site through 3D scanning and, subsequently, reterritorializing them within a combined physical and digital context aligned with spatial assemblage, which incorporates the processes of *reterritorialization*, a term derived from Deleuze and Guattari's discussion of deterritorialization and reterritorialization, particularly in their works *Anti-Oedipus* (1983) and *A Thousand Plateaus* (1987). Deterritorialization refers to the act of moving away from or escaping a particular territory, system, or set of norms. In contrast, reterritorialization describes the subsequent process where the deterritorialized elements establish themselves within a new context or system, thus creating a new set of relations or territory.

In addition, the meticulous collection of archival footage, text, and sounds formed an extensive media library that played a crucial role in the *worlding* design approach (Figure 2).

Worlding, as a design principle of the virtual space and its spatial narratives distributed onto the physical, follows the idea of *worlding* adopted from Haraway (2016), who describes Terrapolis as a place where companion species engage in relentless processes of *becoming with*, a world in which «natures, cultures, subjects, and objects do not pre-exist their intertwined worldings.» (Haraway, 2016, p. 13). The space is treated as a site of experimentation and encounters, where every moment, object, actor, and sound reveals more profound layers of meaning and hidden affordances in the interaction with the users.

This dynamic environment aims to blur the boundaries between physical and virtual reality following the idea that «Worlding is informed by our turning of attention to a certain experience, place or encounter and our active engagement with the materiality and context in which events and interactions occur.» (Palmer y Hunter, 2018). Worlding becomes *worldmaking* and the driving force of designing a hybrid and assembled spatiality. The design process further relates to the notion of *remixing*, as Manovich (2002) intends, which involves appropriating existing cultural artifacts, such as images, sounds, videos, or texts, and repurposing them for new creative and cultural objects. In the context of digital culture, according to Manovich (2013), the characteristics of a cultural object are determined by its ability to be remixed: «It is never static or complete; it is prone to be recorded or sampled; it is modular or ready to be divided into parts.» (Nazmeeva, 2021, p. 130).

102 The project expands upon this idea of *remixability* further by distributing the extracted site-specific LiDAR scans and digital artifacts from the garden and repurposing them inside the physical environment of Le Serre pavilion as a form of *Inhabitable Hybrid Media Object*, accessible via mixed reality head-mounted displays.

3.2 Architecture as an Inhabitable Hybrid Media Object

In the realm of digital media, Manovich (2013) highlights the concept of remixing, made feasible through the use of various media software, including Microsoft Word, Adobe Photoshop and Illustrator, Adobe After Effects and Final Cut, Mozilla Firefox and WordPress, Google Earth, and 3ds Max. These powerful software tools enable the creation, publication, sharing, and remixing of a diverse array of media combinations, such as websites, interactive applications, motion graphics, and virtual globes, incorporating text, maps, video sequences, 3D models, and interactive components (Manovich, 2013).

Manovich (2013) further introduces the notion of *cultural software*, referring to software utilized to create other software for aesthetic, entertainment, or social objectives. This category encompasses game engines like Unity3D, which significantly enable what Manovich terms *Media hybridity*.

Manovich (2013) provides an illustrative case of media hybrids by citing Google Earth, where aerial photography, satellite imagery, 3D computer graphics, still photography, and other media converge to form a novel hybrid representation, referred to by Google engineers as a 3D interface to the planet. He posits that these emergent new media

gestalts arise when various media interfaces, techniques, and underlying assumptions from different media forms and traditions are merged, and instead of experiencing each element in isolation, they amalgamate to offer a completely fresh and integrated experience.

Similarly, utilization of the cultural software of the Unity3D Game Engine allowed for inserting the collection of cultural artifacts and the library of media objects inside the digital facsimile of the Le Serre pavilion space (Figure 3), which was treated as a spatial envelope to build upon its real-world site-specific affordances. The digital point cloud model of Le Serre acted as a primary source of informational space that allowed the creators to distribute previously mentioned collections of the 3D scanned objects library, site-specific sound recordings, archival video footage, and interactive 3D objects inside the spatial model in precise positioning (Figure 4).

This setup was reminiscent of the experimental drawings *Gazebos* (1966–74) by Archizoom, which featured mysterious and unusual elements to create a different perspective for viewers.

Like the pavilions of Le Serre, the Gazebo structure acted as frames for the objects inside. This frame removed the objects from their usual surroundings and placed them in an unexpected setting. In the *Becoming-with* experience, the Le Serre pavilion played a similar role, guiding users through the augmented hybrid experience.

By blending physical elements with digital scan artifacts, users could interact with hybrid objects in collaborative ways through their bodily interactions, social interaction, and navigation in the hybrid space. Having control over the hybrid space through the body has built a new relationship with the space itself and the exhibited digital media objects within the hybrid space. To better understand this concept, looking into the applications of APIs inside the Unity Game Engine and how they constitute a fully-bodied interactive multi-user experience is helpful.

4. Methods

4.1 Remixing APIs as Worldmaking Agents inside the Unity Game Engine

Application Programming Interface, or API, is a software bridge that enables communication between two or more applications (Cambridge Dictionary, s.f.). To enable third-party developers to build new applications on top of their platforms, the majority of social media businesses today provide APIs. Different APIs have the capacity to join various software components to develop novel and cutting-edge apps. The term API is frequently used to describe web APIs, which permit communication between computers connected by the internet (Cambridge Dictionary, s. f.). APIs, which are protocological objects, grant interested parties very controlled access to the information and functionality of online services (Bucher, 2013). Additionally, programmers and academics can utilize the API to obtain, store, and modify digital footprints that users have left for additional empirical research (Lomborg y Bechmann, 2014).

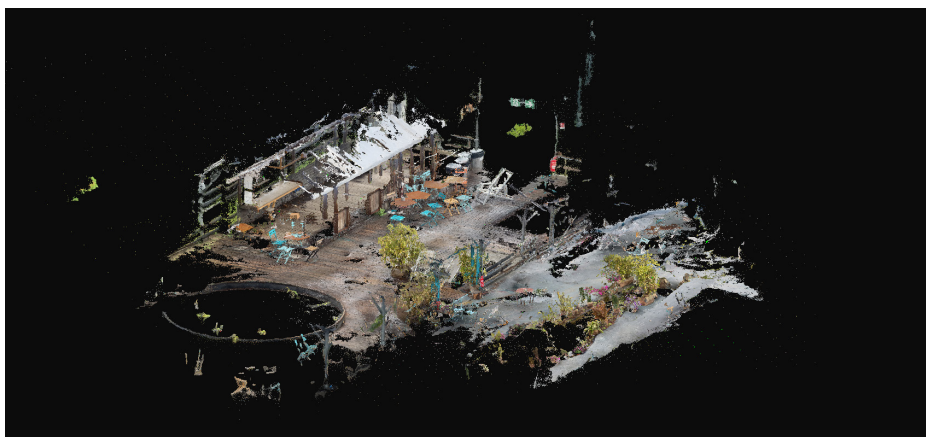


Figure 3: LiDAR scan of the Le Serre Pavillion. This model was utilized to distribute the digital object catalog, Cenk Güzelis, Anna Pompermaier, 2021.

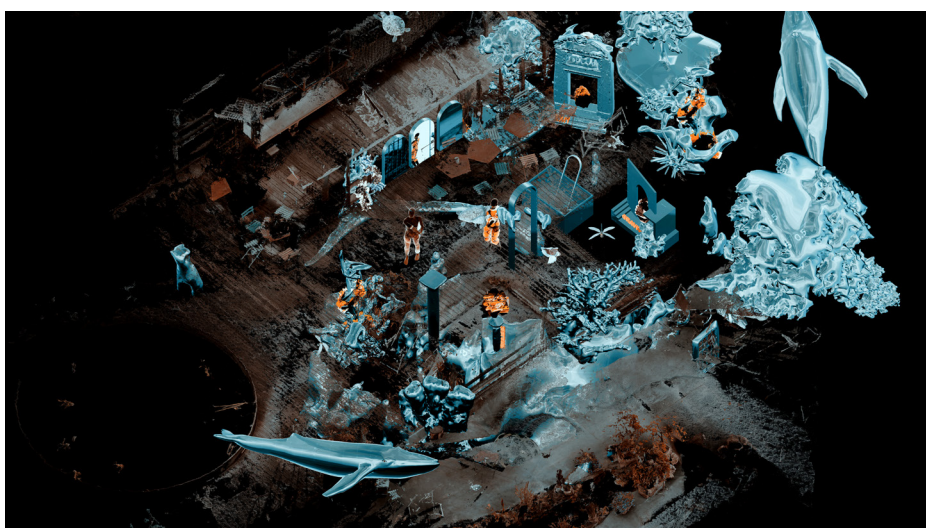


Figure 4: The axon view displaying Unity3D space: distribution of the digital object catalog onto the LiDAR scan model of the Le Serre, Cenk Güzelis, Anna Pompermaier, 2021

The project advocates APIs in this regard as distinct digital communication agents with their own agential meanings, and conceptualizes their interactions as making up the entirety of the socio-spatial experience of *Becoming-with* mixed reality Installation. The primary usage of APIs in this context concentrates on two characteristics to create a distinctive avatar: its existence in the real world and its social interactions.

In light of this, the following chapter describes how the project was transformed into a mixed reality prototype application, based on sociability and embodied telepresence by integrating various API agents, such as the Pose Estimation API and the Hand Tracking API, to monitor the user's movements, proprioceptive mechanisms, and gestures.

Additionally, a seamless connection between the virtual and actual worlds was made using the Passthrough API. The Networking API allows users to share experiences with one another. All of these factors come together to create a social mixed reality setting that offers the experience of hybrid embodiment. Dissolving the hardware and software on the body turns

the body into a collection of pervasive media items, dispersed and placed in clouds for remote communication: The body as a frame becomes a coprocessor of digital information.

4.1.1 Pose Estimation API

The Pose Estimation API employs computer vision algorithms to inform the spatial location and orientation of a user's physical appearance in real-time. In the field of virtual reality (VR), pose estimation is a technique employed to monitor the user's bodily motions and, subsequently, convert them into corresponding movements within the virtual environment. Typically, algorithms are used to find and track key parts of the user's body, such as hands, head, and feet. The user's real-time motion is then calculated based on the abovementioned key factors.

RootMotion's VR IK tool is a widely used third-party application for Unity that estimates a character's pose. The VR IK system is an inverse kinematic (IK) system that can be used

to track the user's movements with great accuracy. Virtual Reality Inverse Kinematics (VR IK) is a useful tool for virtual reality (VR) applications requiring physical interaction with the virtual world. It allows people to fully use their bodies, which is associated with self-presentation, kinesthetic and proprioceptive embodiment, and spatial knowledge.

4.1.2 Hand Tracking API

One important part of the Oculus Integration Software Development Kit is the Hand Tracking API. The software interface lets creators detect and register hand movements and gestures in real-time. The Hand Tracking API uses machine learning techniques to find and track where the user's hands are in space and how they move. The technology understands how the hand is held, where each finger is, and hand movements like pinching, grabbing, and letting go. The API in question offers detailed information about the user's hand movements, which were used to control digital objects in the *Becoming-with* experience.

4.1.3 Passthrough API

The Passthrough API is a notable attribute supplied by the Oculus Software Development Kit (SDK), which empowers software developers to fabricate mixed-reality applications within the Unity platform. The aforementioned technology enables developers to obtain real-time access to the user's surroundings and superimpose them onto the virtual environment generated by the application. This generated a mixed reality environment that enabled users to rely on their physical environment in the experience and navigate precisely inside the pavilion of Le Serre while experiencing the virtual that enhanced the spatial narratives. The opportunity to facilitate uninterrupted access to users' tangible surroundings has enabled the creators to deactivate the Guardian feature of Quest2 Headsets, thereby expanding the confined boundaries of the virtual encounter from a 10 by 10-meter area to a more extensive range that is primarily dictated by the physical structures of Le Serre pavilions.

When the Passthrough feature is used in conjunction with the networked full-body avatars, it creates an uncanny embodied presence for users who are visible to one another: users' proprioceptive and tactile mechanisms are synced with their avatars and their physical movements and interactions with their bodies. The aforementioned outcome can be attributed to the utilization of the Hand tracking and pose estimation models.

4.1.4 Real-time Networking API

Real-time networking APIs are crucial in developing an immersive telepresence experience that can be shared among numerous users within a mixed-reality setting. Utilizing the Networking Application Programming Interface, the system can facilitate the synchronization of data and communication among users across various devices.

In the context of an embodied social mixed reality experience, wherein multiple users coexist within a shared virtual space, it is of utmost importance to establish a conducive social milieu

that facilitates interactivity among them. Real-time synchronization of their movements and actions is necessary for this interactivity, along with the capacity for voice communication.

Integrating a network API, like the Normcore add-on for Unity, enabled the seamless distribution of real-time spatial content across multiple interconnected devices in the shared experience. This system ensured that each participant received current scene details, including the real-time positions of others' telepresence and their social interactions with each other and virtual objects. The platform enabled smooth interactions by synchronizing user inputs, such as hand gestures, resulting in a coherent and synchronized experience for individuals engaging with this expanded garden environment and its inhabitants from diverse geographical locations.

5. Findings

5.1 Here & There: A Hybrid Embodiment

The result of the remixing of API objects within the Unity game engine generated the unique features of *Becoming-with* mixed reality, which allowed the overlap of digital and physical bodies; individuals are able to seamlessly engage with the virtual garden while maintaining their bodily presence within the pavilion. Upon entering the experience, individuals relate to the surroundings and other users through their physical presence and form social bonds with both the environment and other users in the physical-virtual overlap. Observing their digital bodies and hands, individuals employed their physical bodies and proprioceptive systems to traverse the tangible surroundings.

The *there* body, the virtual body, and the *here* body, the physically grounded body, constantly interact through the proprioceptive functions of the human body and the proprioceptive capabilities of the virtual body, facilitated by computer vision and MR headsets. The user and their avatar merge into one, experiencing a hybrid embodiment.

Within *Becoming-with*, this sense of hybrid presence results, not only from the embodied virtual avatars that occupy the visual field and act on proprioceptive and tactile mechanisms, but also from the participants' social interactions that generate a social environment (Figure 5). This sensory symbiosis between the human body and the avatar produces a haptic spatiality in digital space, an internally grounded body image that is independent of and precedes the external geometric space.

In particular, using physically mediated virtual hands enabled interaction with the digital overlay space with natural gestures, allowing users to reinform their environment through their bodily presence and hand gestures (Figure 6).



Figure 5: An excerpt from the Becoming-with Installation: symbiotic sensory experience of the garden through extended full body avatars, Cenk Güzelis, Anna Pompermaier, 2021



Figure 6: A user's point of view inside the Becoming-with Mixed Reality Experience - tactile interactions with the physical and digital environment, Cenk Güzelis, Anna Pompermaier, 2021

5.2 1:1 Physical Digital Overlap

The absence of controllers in the navigation process necessitated users to rely on their bodily movements and interactions within the hybrid space. However, this presented significant obstacles. In a multi-user mixed reality setting, it is crucial for everyone to have clear spatial orientation cues to avoid accidents while navigating through the environment. During the development of a live mixed reality experience, a significant challenge was ensuring that the digital content seamlessly integrated with the physical content in the Unity Game Engine. To address this, it was essential to enable accurate tactile interactions among participants within the Le Serre pavilions' gameplay area, ensuring a consistent experience from each person's viewpoint. To achieve this, a strategy was devised to syn-

chronize the initial world orientation of all headsets toward a uniform direction. This way, everyone would start their experience from the same reference point, promoting a smooth and safe interaction with the mixed reality content.

In the LiDAR scan of the Le Serre pavilion, a secure starting point for the experience was identified. The creators placed a digital game object called *null* in the Unity environment at the coordinates (0, 0, 0) facing the positive Z direction. They also marked the identical physical location in Le Serre with a cross, oriented in the same direction as the *null* object.

Before starting the experiment, the creators calibrated the head-mounted displays by setting the 0 coordinate of the headsets at a fixed point in space, using the Oculus Menu button.



Figure 7: Multi-user mixed-reality experience of the Becoming-with – a site-specific installation at Le Serre in Bologna, Lorenzo Burlando, 2021

This ensured that all headsets were aligned correctly. When the experiment began, each headset activated a shared multi-user interface from its respective position, and each user's virtual experience aligned with their physical location (Figure 7).

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6. Reflections

The absence of controllers in the navigation process necessitated users to rely on their bodily moA central reflection in this context concerns the concept of space and its connectivity to social networks and the Internet that the *Becoming-with* project generates: the augmented social environment becomes the *cybrid* space, capable of updating in real-time and hosting spatial content, social interactions, allowing bodies to enter and exit the hybrid space at any time and from anywhere in the world. As the actual space envelops the digital in a 1:1 ratio, a new spatial intelligence emerges that extends the physical world beyond its static boundaries through virtual materialities.

At this juncture, the authors would like to refer to an article authored by Wired Magazine's co-founder Kevin Kelly, which under the title *AR Will Spark the Next Big Tech Platform—Call It Mirrorworld*, reflects on the fact that we are in the process of constructing an extensive and vast 1-to-1 map of our world, which he calls *mirrorworld*. Upon its completion, our tangible physical world will seamlessly integrate with the digital realm. The *mirrorworld*, as Kelly (2019) argues it, is not yet entirely constructed, but it is under construction; soon, every physical place and object, every building, street, trash can, lamppost, bench, and entrance will have a full-size digital twin in the *mirrorworld*. It resembles Borges' map, with the exact same size as the territory shown. «In time,» Borges writes, «the Cartographers Guilds struck a Map of the Empire, whose size was that of the Empire, and which coincided point for point with it.» (Borges y Hurley, 1999, p. 704).

The internet was once considered a disembodied cyberspace, an intangible domain separate from the physical world that could claim its own laws because it was so unlike actual existence. The virtual and physical worlds have historically existed side by side, never meeting. The *mirrorworld* bends that trajectory upon itself. Instead of separating the realms, the upcoming platforms will melt the two together so that digital bits will become embedded in atomic matter: «You interact in the virtual by interacting in the physical, moving your muscles, stubbing your toes.» (Kelly, 2019).

As a result, when considering the future of our livable domains, we may witness scenarios in which our living environments will be digitally curated and distributed in real-time by users as their creative contents, located in a variety of places, time zones, and inhabited by individuals and remote communities. This will open promising prospects for spatiality and online modes of spatial production that juxtapose the virtual onto the physical, global information onto the local space, intensifying and building upon the affordances of the physical spaces. Another interesting aspect to consider when discussing the future of architecture and architectural values as they transition to virtual/augmented worlds is that appreciation for architecture will increasingly be linked to the social and spatial experiences it can provide based on its integration of digital technologies, spatial computing, and social media networking to its very fabric.

7. Limitations

The Le Serre outdoor pavilion specifications have established certain limiting parameters for the *Becoming-with - encounters in an augmented garden* multi-user social mixed reality experience.

The hardware constraints of the pavilions were such that their semi-open structures lacked any shading or roofing mechanism. The consequence of this occurrence is excessive exposure to solar radiation, leading to the impairment of the spatial and hand-tracking sensors of the Oculus Quest 2. The above experience, therefore, took place exclusively after sundown. In addition, the need to run the experience through a local Wi-Fi network required considerable bandwidth.

The experience distribution was constrained due to its site-specific nature, as it was exclusively designed for the Giardini Margherita in Bologna. When placed in a different location, the aforementioned experience suffered a reduction in its physical manifestation. This was due to the loss of connectivity between the experience and the specific spatial context of the Le Serre pavilions.

8. Discussion

The project aimed to provoke questions in and around the field of architecture through the overlap of digital space onto a physical site in a social and public context. How should we, as architects, perceive the making of digital spaces as public spaces that are not necessarily detached from our everyday spaces, practices, and well-known environments, but rather overlapping onto the affordances of the spaces as we know them to provide spatial programs and telecommunication?

In these times, digital technologies are advancing rapidly and digital services are more accessible than ever. As architects, it is our duty to analyze, educate, and utilize these digital tools as alternative strategies for creating spaces that cater to societal, environmental, and cultural needs. These spaces should not be dominated by big tech companies, whose growth relies on users' attention and platform politics; instead, we should explore how culture, site-specific context, and spatial design can synergistically create a new spatial context for peer-to-peer telecommunication. In this regard, the aforementioned notions of *remixing* and *worlding* have served as a lens to inspect the garden and its potential for inclusion in the spatial narrative of human and non-human entities inhabiting the Giardini Margherita in different scales and resolutions, thus creating spatio-temporal experiences that bring together a new set of relations and phenomena.

9. Conclusion

This contribution introduces *Becoming-with*, a multi-user social mixed reality experience aimed at creating a hybrid spatial encounter between Giardini Margherita and the pavilions of Le Serre. The installation combines site-specific spatial storytelling, ubiquitous computing, LiDAR scanning, and game engines to explore novel ways of blending digital and physical elements in architecture, resulting in innovative hybrid spaces.

The present discourse delves into the notion of hybridity, which encompasses the fundamental principles of worlding and remixing. These principles serve as the foundation for a socio-spatial practice that aims to preserve the intrinsic characteristics of particular places, by utilizing LiDAR scan

capturing technologies. Translating physical characteristics into digital twins and modifying them using media software makes it possible to render these spaces easily accessible via spatial computing and social network distribution, even in geographically isolated regions. The present approach signifies a forward-thinking trajectory in the realm of architectural design, wherein architectural spaces undergo a metamorphosis into hybrid and habitable media objects. These objects facilitate the immersion of collectives and enhance spatial narratives. A notable illustration of this phenomenon is the transformation of the Le Serre pavilion into a digitally mediated and augmented garden sourced by the phenomenological journey inside the Giardini Margherita.

The concept of a hybrid media object becoming the architectural place comprises two key aspects. Firstly, cultural software such as Unity3D empowers creators to transform physical places into virtual worldmaking, allowing for spatial remixing and publication in social networks. This integration of digital and physical elements challenges traditional architectural design, as the symbols used in the process become objects to inhabit rather than mere representations. Secondly, this architectural design practice that embraces digital mediation of the physical places recognizes spaces as interconnected and expanded entities capable of accommodating diverse architectural functions, from communal gatherings to housing globally significant data facilitated by Application Programming Interfaces objects. These functions that Application Programming Interfaces offer are juxtaposed and seamlessly integrated within the physical space, enabling individual and collective spatial socialization facilitated by the Internet and ubiquitous computing technologies.

Moreover, the use of Application Programming Interfaces, as worldmaking agents, provides the virtual space of *Becoming-with* with affordances and meanings that they contain in their assembly within the Unity Game Engine; furthermore, by inscribing their information onto the virtual space, they grant users extended bodily capacities within the garden provided through the Internet. From an objective standpoint, these API objects, particularly in embodied mixed reality installations, can be viewed as novel tools for social space-making, extending the social borders of the human body and spatial context into modifiable contact zones. However, they can also be observed as the object of politics and control as they are services offered by corporate companies that create a doubtful environment around data policy, ownership, and surveillance.

References

Anders, P. (2005). Cybrid Principles: Guidelines for Merging Physical and Cyber Spaces. *International Journal of Architectural Computing* 3(3), 391-406. DOI: <https://doi.org/10.1260/147807705775377294>.

Anders, P. (2007). Designing Mixed Reality: *Perception, Projects and Practice* [Conference]. ACADIA, 27th Annual Conference of the Association for Computer Aided Design in Architecture, Halifax (Nova Scotia), CA. https://papers.cumincad.org/cgi-bin/works/paper/acadia07_276.

Borges, J. L. y Hurley, A. (1999). *On Exactitude In Science*. Collected Fictions, Penguin Books.

Bucher, T. (2013). Objects of Intense Feeling: The Case of the Twitter API. *Computational Culture* 3. <http://computationalculture.net/objects-of-intense-feeling-the-case-of-the-twitter-api/>.

Cambridge Dictionary. (s. f.). API. Retrieved 10.01.2024 in <https://dictionary.cambridge.org/dictionary/english/api>.

Deleuze, G. y Guattari, F. (1983). *Anti-Oedipus: Capitalism and Schizophrenia*. University of Minnesota Press.

Deleuze, G., Guattari, F. y Massumi B. (1987). *A Thousand Plateaus: Capitalism and Schizophrenia*. University of Minnesota Press.

Dovey, K. (2013). Assembling Architecture. In H. Frichot y S. Loo (Eds.), *Deleuze and Architecture* (pp.131-148). University of Edinburgh Press.

Fedorova, K. (2013). Mechanisms of Augmentation in Proprioceptive Media Art. *M/C Journal* 16(6). DOI: <https://doi.org/10.5204/mcj.744>.

108 Greenwold, S. (1995). *Spatial Computing* [Master of Science in Media Arts and Sciences at the Massachusetts Institute of Technology]. <https://acg.media.mit.edu/people/simong/thesis/SpatialComputing.pdf>.

Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspectives. *Feminist Studies*, 14, 575-599. DOI: 10.2307/3178066.

Haraway, D. (2008). *When Species Meet*. University of Minnesota Press.

Haraway, D. J. (2016). *Staying with the Trouble: Making Kin in the Chthulucene* (Experimental Futures) (Illustrated). Duke University Press Books.

Kelly, K. (2019, February 12). AR Will Spark the Next Big Tech Platform—Call It Mirrorworld. *WIRED*. <https://www.wired.com/story/mirrorworld-ar-next-big-tech-platform/>.

Lomborg, S. y Bechmann, A. (2014). Using APIs for Data Collection on Social Media. In *The Information Society*, 30(4), 256-265. DOI: 10.1080/01972243.2014.915276.

Manovich, L. (2002). *The language of new media*. MIT Press.

Manovich, L. (2002). *The Poetics of Augmented Space*. Manovich. <http://manovich.net/index.php/projects/the-poetics-of-augmented-space>.

Manovich, L. (2013). *Software Takes Command*. Bloomsbury Academic.

McLuhan, M. (1964). *Understanding media: the extensions of man*. [1st ed.] McGraw-Hill.

Nazmeeva, A. (2021). The City in the Age of Remix. Media-N | *The Journal of the New Media Caucus Winter*, 17(1), 130-148. DOI: <https://iopn.library.illinois.edu/journals/median/article/view/481/686>.

Novak, M. (1996, December). TransArchitecture: Building The Edge Of Thought. *Telepolis*. <https://www.heise.de/tp/features/transArchitecture-3445869.html?seite=all>.

Novak, M. (1991). Liquid Architectures in Cyberspace. In M. Benedikt (Ed.), *Cyberspace: First Steps* (pp. 225-254). MIT Press.

Palmer, H. y Hunter, V. (2018, March 16). *Worlding*. New Materialism. <https://newmaterialism.eu/almanac/w/worlding.html>.

Parisi, L. (2013). *Contagious architecture: computation, aesthetics, and space*. MIT Press.

Pearsall, J., Hanks, P., Soanes, C. y Stevenson, A. (2010). *Oxford Dictionary of English*. Oxford University Press eBooks. <https://doi.org/10.1093/acref/9780199571123.001.0001>.