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Editorial

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As announced in the editorial of the previous issue, the 19th issue of ArchiDOCT presents a second collection of papers that explore the theme of 'temporality' in architecture and the built environment from a theoretical or an applied standpoint. Once more, a variety of approaches, insights, and opportunities for research that arise from considering time in its heterogeneous dimensions and manifestations such as time, speed, rhythm, sequence or horizon have been handled.

The concept of temporality is, undoubtedly, an inexhaustible source of suggestive lines of research ranging from the more theoretical to the more applied and linked to contemporary problems. One of the most relevant current problems is the climate crisis caused by an excess of carbon dioxide in the atmosphere, as well as the incipient shortage of certain raw materials. Both realities can no longer be ignored and the way we inhabit the planet and satisfy our needs must necessarily be based on responsible and sustainable production and consumption. This is precisely the wording of Sustainable Development Goal 12 of the United Nations. Producing and consuming responsibly is a need that can be addressed through multiple approaches and proposals. One of them is to provide greater durability to those means that we require for an adequate and comfortable day-to-day life, and herein architecture plays a fundamental role. If the buildings, public spaces, and infrastructures that we design and materialize have greater durability, they will not need to be updated, repaired or replaced so frequently and, therefore, we will save significant amounts of materials and energy, reducing the pollution often necessary to produce it.

Durable buildings and works have often been related to heavy, robust solutions, with an important massive character, since these features presumed them to be better able to withstand the effects of the passage of time. This type of materiality has allowed many buildings to reach our days in more than acceptable conditions, being this circumstance especially convenient when they are relevant pieces in the

a Ivan Cabrera i Fausto (Borriana, 1974) graduated in Architecture in 1998 at Universitat Politècnica de València (Polytechnic University of Valencia) and earned his PhD in Advanced Analysis of Design of Structures and Foundations in the same institution in 2016.

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His expertise is in advanced structures analysis and design focused mainly in structures for housing, historical structures and big sport facilities. He has participated in many congresses and published several papers in research journals about these and other topics always related to building structures. In 2016 he was elected Project Leader of the Erasmus+ Project "Confronting Wicked Problems: Adapting Architectural Education to the New Situation in Europe" funded by the European Union which had been the main research project since 2014 of the European Association for Architectural Education Council (EAAE).

In 2012 he became Academic Advisor of the Higher Technical School Architecture and four years later he became Director of this school, being nowadays on active service after being reelected in 2020. From 2013 to 2016 he was member of the European Association for Architectural Education Council (EAAE).

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history of architecture, have a special symbolism in the community where they are located, or, at least, continue to provide an adequate service. Paradoxically, however, this mass character can sometimes be counterproductive. When the comfort standards and tastes that a building satisfied at the time it was erected expire faster than its materiality and upgrading is not advisable or possible, ending its useful life can be a major problem. The amount of materials that we can recover in a condition to be relocated or reinserted in production chains is usually low. In addition, large quantities of rubble and waste are generated, producing a huge energy expenditure.

On the contrary, everything that is projected as temporary has a very different character. Its announced expiration leads designers to choose materials and solutions that require little investment, simplicity in assembly and future disassembly, and consequently little waste. Materials are usually light, easy to move and place. Screwed joints abound, easy to reverse, and making possible the recovery of the intervening parts without any damage that could invalidate them. Many pavilions of numerous world's fairs are magnificent examples. A large number of them has been perfectly dismantled and reassembled in new locations, extending their useful life and the service they provide to society without any substantial need for new materials and with much lower energy consumption than would be required for a completely brand new building. But there are many other examples such as train stations, where, curiously, the weather is a frequent topic of conversation.

Let us use as an example two train stations located in the city of Valencia in Spain. The grand old *Estació del Nord* designed by Demetrio Ribes is one of the architectural jewels of the city. This monumental and patrimonial character exempts the building from being analyzed strictly from the point of view of its functionality and the adequacy of its configuration for the use that it provides today. And, fortunately, this is the case, because its demolition would reveal the low percentage of recoverable materials and, consequently, the immense amount of waste that would be generated. Just five hundred meters away, the *Estació de València-Joaquim Sorolla* was inaugurated in 2010, a temporary infrastructure to accommodate high-speed and long-distance trains connecting the city with the rest of Spain. Prepared to be replaced at any time by the future high-speed rail station when the tunnel through the city is finished, this station was born with an apparent announced expiration date. Its steel structure, serial and repetitive, the bolted joints of the different elements and the simple and modular nature of most of the construction systems used in its facades, partitioning and coverings make the future dismantling of this building simple and with a great capacity to recover the pieces that compose it. All this makes it a tremendously contemporary building, capable of providing a magnificent response to the needs of its time. Thus, the characteristics of temporary buildings and infrastructures in terms of lightness and capacity for easy recovery of the elements of which they are composed should also be the features of the architectural production which is not necessarily scheduled to be temporary.

Temporality is undoubtedly an interesting topic. Researchers from all over the world have proven this to be true with an amazing an unexpected massive response to the call made by the journal for its eighteenth issue. The remarkable set of papers presented in that issue is now complemented with a second collection of manuscripts which the Editorial Committee of ArchiDOCT invites you to enjoy.

"Sensing Time: Temporality in the Design of Buildings and Open Spaces" is a good-practice example by **Madlen Simon**. This American architect was educated at Princeton University and has focused on design thinking as a researcher and educator, currently at the University of Maryland. She considers that while scientific method is a manner of discovering what is, design thinking is a method for envisioning what it should be. She puts design thinking into practice to envision better futures for people and communities. In her own words, Professor Simon's current work weaves together threads of research, teaching, and service into the whole cloth of integrated design thinking; turning the narrative of her work into a kind of tapestry with up to six main strands in the weave: History and Theory of Design Education, Design Thinking, Design History and Criticism, Design Practice, Environment/Behavior Studies and Urban Design, and Design Thinking for Academic Leadership. Madlen Simon's works have received numerous awards and recognitions, including the award for the best paper presented during the EAAE-ARCC International Conference & 2nd Valencia International Biennial of Research in Architecture in 2020. Her manuscript for the nineteenth issue of our journal introduces a very stimulating view of temporality in architectural design. Instead of being something to be fought or hidden, the effects of the passage of time take center stage as a positive aspect that gives character and interest to the spaces we inhabit. Her paper proposes a framework to compare the design of buildings and open spaces across this relevant dimension, analyzing temporality according to different and suggesting lapses of time: moments, days, seasons, and history.

The first manuscript is written by **Stefano Sartorio** and **Francesco Airoldi**, both PhD candidates at the Politecnico di Milano in Italy. The work, titled **"Effects of Spatial Modelling on the Perception of time. Definition of Places Through Temporal Typologies"**, constitutes a remarkable theoretical approach to the relationship between time and architectural design. In addition to aspects previously mentioned, such as the consequences of the passage of time on buildings or cyclical perception variations, these Italian researchers focus on other sides of the concept such as duration, simultaneity, instantaneity, or endurance enhanced by spatial possibilities employed in architectural design. They argue that if space and time are frequently related, then the manipulation of space has a necessary consequence on the perception of time. Their research is illustrated by means of effective examples and some interesting final thoughts on highly topical problems such as the depopulation of inland areas in several southern European countries such as Italy or Spain.

The second manuscript is entitled **"A Spatial-temporal Network-Science Based Study of Walking in Urban**

Green Spaces: A Case Study of One-North Park" and is written by **Anjanaa Devi Srikanth**, a PhD candidate at the Singapore University of Technology and Design, and by her thesis advisor, **Thomas Schroepfer**, a PhD architect and engineer educated at Harvard University, whose work focuses, mostly and in his own works, on the increasingly complex relationship between design and technology in architecture. Their paper deals with time as a parameter to be considered when understanding and predicting pedestrian flows in projects which are not built yet. Their work proves a comparative analysis of temporal correlations between metrical correlations in a Spatial Network Analysis too and observed pedestrian flows using as one-north Park in Singapore as a case study. It also presents insights gained on walkability in the park on a temporal basis.

Luis Bosch-Roig and **Marina Docci** are the authors of the third manuscript. He is a PhD architect and professor at the Department of Architectural Projects of the Universitat Politècnica de València in Spain. His research focuses mostly on architectural heritage interventions, especially in the dialogue between new additions and preexisting remains. She is a PhD architect and associate professor at the Department of History, Representation and Restoration of Architecture of the Sapienza Università di Roma. Her research addresses the conservation of architectural heritage and the history of architecture. Their work, titled **"Time as a Design Resource in Architectural Heritage intervention". The Case Study of the Conversion of the Escuelas Pías Church into a Library**" is strongly connected with their doctoral research and focuses on the importance of time when reflecting on pre-existing architecture. They argue that the different stages in a monument's life are fundamental factors in the design process, requiring understanding of its past, recognition of its present and a good strategy for its future.

The fourth manuscript contains the results of the doctoral research of **Nooshin Esmaeili**, an architect, PhD candidate and sessional studio instructor at the University of Calgary, and her thesis advisor, **Brian Robert Sinclair**, a PhD architect, award-winning professor of architecture and environmental design, and former Dean in the Faculty of Environmental Design, EVDS, at the aforementioned Canadian university. His expertise, experience and engagement span the breadth from science and technologies to art and humanities. **"Soul, Space + Time: Exploring Temporality in Architecture with Reference to Sufism"** deals, in their own words, with the continuous dance of the universe, the cosmos, and nature with time. According to the authors since ancient times, architecture has played a significant role in establishing a link between the divine and the sacred through space. This is especially obvious in many wisdom traditions and spiritual practices such as Sufism, and in architectural styles such as the one of Persia.

Juan José Barrios Avalos and **Jordi Franquesa Sánchez** are the authors of the fifth and last manuscript of this issue of the journal. The first researcher is a Mexican architect and PhD candidate at the Department of Urban and Regional Planning of the Universitat Politècnica de Catalunya. His thesis advisor, Jordi Franquesa, is a PhD architect and professor at Barcelona Higher Technical School of Architecture in Spain. His research deals with architectural education as well as with the dynamics of territories and how we inhabit them with a special focus on phenomena as topical as depopulation. Their essay, titled **"Urban Restructuring of Agricultural Productive Models in Hydrographic Basins Under Water Stress. The Case of the Nazas and Aguanaval Rivers"** argues that the history of a town is often the history of its water and that the passage of time shapes the territories and human settlements, and the use of the water that flows through them is one of the factors that most conditions their configuration. The case of a Mexican basin is used as an example to demonstrate their hypothesis with a remarkable interesting research methodology.

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Soul, Space + Time: Exploring Temporality in Architecture With Reference to Sufism

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With the rapid development of technology and the enormous amount of data we receive daily, most of our attention and awareness are given to the outside. One seems to be separated from their inner self as if they are merely trained to adjust and adapt to this fast-paced world. This has impacted our lifestyles, relationships, and our overall definition of life. Humans no longer have the same relationship, harmony, and balance between the external and internal world, which can be seen in nature and in all other living things. The universe, the cosmos, and nature are in a continuous dance with time. All their components are evolving and transforming from one state to another, day by day and season by season. But in the midst of all these variations and uncertainties, there is life (Jaan جان), which is constant and infinite. The immortality of life/soul/spirit/Jaan makes it eternal and timeless. We are more than our physical body; similarly, architecture is more than bricks, glass, and concrete. Since ancient times, architecture has always played a significant role in establishing a link between the divine and the sacred through space. By aligning and merging the physical, tangible world with the intangible quality of space and place, architects and designers could enhance how we interact with our surroundings and with one another while also enhancing the quality of architecture. This is one of the most important tenets evident in wisdom traditions and architectural styles such as Persian architecture. Sufism, not only as a unique form of spiritual practice but also as a school of self-knowledge, truly reflects the interplay of the external world (zahir ظاهر) with the internal (batin باطن). This research attempts to explore the profound and rich layers of mysticism that are embedded in Persian architecture. The authors also aim to provide insight into how this style of architecture is inspired through its deep-rooted focus on reuniting the physical dimension of each individual with their inner beings, as well as bringing both realms in balance and harmony with the universe and nature. By integrating a literature review, this research then adapts the phenomenological inquiry of hermeneutics to investigate and analyze the concept of temporality through the lens of Sufism, understand the connection of the material world with the ethereal aspects of space and the importance of light and shadow in sacred architecture. This paper argues that architecture is a medium to create experiential moments in space, where one can unite the external world (temporal) with the internal realm (atemporal) on the journey to self-cognition. The research proposes a new lens for architects and environmental designers to compose spaces beyond the ordinary. Today, where all the attention is given to the physical aesthetics of the building rather than the quality of space, we lack enriched environments to lift our spirits and create a healthy atmosphere for our physical well-being. In such a perplexing world, the current research offers a new lens and perspective that connects the physical with the metaphysical, the outer with the inner, and the visible with the invisible.

1. Introduction

> *"Do you know what you are? You are a manuscript of a divine letter. You are a mirror reflecting a noble face. This universe is not outside of you. Look inside yourself; everything that you want, you are already that."*
> *~ Rumi ~*

Time and space are inextricably linked. They complement one another and give each other meaning. They are also both fundamental aspects of architecture. The three dimensions of width, length, and depth are found in space, while the fourth dimension is time. It is through time that space becomes activated, while they both encompass the physical world as we see and perceive it. Architecture is encountered and its meanings are understood through one's

full presence in space, even though the experience is not perpetual. To access the transcendental aspects of the internal world made evident through the external, the idea of temporality offers a valuable description of how we perceive both dimensions in a more concrete way.

Temporality is both important in architecture and in Sufism - the mystical dimension of Islam. This study was performed to explore the concept of temporality and time in Persian architecture through the lenses of sacrality and Sufism. The goal is to connect the idea of the external (Zahir) world with the internal (batin) and explore the importance of the physical world for understanding and grasping the metaphysical. In other words, the seeker (Salik سالک) must pass through the transitory physical world as a way, or Shari'at, to arrive at the truth, or Haghighat. In the introduction of the book "Sense of Unity", Dr. Hossein Nasr also highlights: "There is nothing timelier today than that truth, which is timeless, than the message that comes from tradition and is relevant now because it has always been relevant. Such a message belongs to a now which has been, is, and will ever be present" (Ardalan & Bakhtiar, 1973, p. xi). In Sufism, students learn to understand that they are one with everything in the universe, even the cosmos. This is a similar concept in architecture, where all the elements come together to create a moment and convey a message as a whole. The work of architecture should be viewed as a totality rather than as the sum of its components—gestalt (Sinclair, 2000).

To date, only a limited number of researchers have discussed and explored the notion and relationship of time and temporality in sacred architecture, specifically through the lens of Sufism. This research is different as it focuses on bringing an ontological concept of temporality and connecting it with the physical world of architecture. In the pages that follow, it will be argued that temporality is important both in the spiritual aspect of our life as well as our physical experience of architecture in connecting us with the essence of self. To achieve the ultimate truth (*haghighat* حقیقت *on the Sufi path, the seeker must transition from the temporal (mortal) to the atemporal (immortal).* This paper attempts to demonstrate a similar notion in architecture where the spirit and essence of the place can only be grasped by looking beyond the walls and the floor, the brick and mortar. By employing phenomenological modes of inquiry, this paper attempts to illuminate the concept of temporality and time in architecture, through hermeneutics and examines the importance of light and shadow in the architecture of sacred spaces. By employing phenomenological modes of inquiry, this paper attempts to illuminate the concept of temporality and time, in architecture through hermeneutics and examines the importance of light and shadow in the architecture of sacred spaces.

This effort will provoke a new lens for making places that are not just objects but moments, where people may feel and be fully present. This research will contribute to a deeper understanding of the metaphysical and atemporal aspects of architecture in creating spaces that are beyond form and matter. By embedding and coding spaces into a specific mode of experience and character, we can add depth to architecture and create transcendental environments. This paper begins by defining sacred space as well as introducing Sufism and its interpretation of time and temporality in connection to architecture. It will then go on to explain why and how temporality and time are manifested in Persian architecture from the mystical point of view, with a focus on light and shadow, to create environments and spaces that promote a sense of balance and unity between the self and the external world.

2. Transcendental architecture

Buildings are designed to have different purposes. Depending on the purpose of the structure and the program, some buildings are exclusively designed to serve as shelters. The second category includes places that are not only functional but also designed to provide a more human-centered experience and participate in the health and well-being of the occupants, from feeling charged and uplifted to peaceful and healthy. Historically, sacred places have been among the second category, where, through inducing a sense of mystery, timelessness, and wonder, they have attempted to bring man closer to the Divine on earth. Sacredness is defined by Pallasmaa as "a feeling of transcendence beyond the conditions of the commonplace and the normality of meanings" (Pallasmaa, 2015, p. 19). Pallasmaa continues by elaborating on the nature of our connection with the sacred space, where all the "physical characteristics turn into metaphysically charged feelings of transcendental reality and spiritual meanings" (2015, p. 19). Despite the widespread misconception that sacred spaces are all places of worship, they need not be affiliated with any religion. A sacred space can be a garden, a mosque, or even a library. As Paul Goldberger explains, sacred space can be defined as "the use of material forms to evoke feelings that go beyond the material and which cannot be measured" (2010).

Most people believe that architecture is a type of outward and material art that uses space to define human existence and activity (Pallasmaa, 2016). To better illuminate the existential characteristics of space, Norberg-Schulz introduces the idea of Genius Loci, or "Spirit of place" in architecture. This is a quality that can facilitate the creation of meaningful spaces and poetic atmospheres beyond the physical dimension. He explains that the interaction of people with places is based on their disposition and recognition of the space - one can dwell when he can "orient" within and "identify" himself with the environment he is placed in (1980). We are interconnected with our surroundings, and our relationship with our environment affects how we see and comprehend space. Through the concept of 'self in place' or 'self-transcendence' (Birch, 2014). As Chang states, the sense of place is the result of a "fuller engagement of the self in place." This is due to the fact that "the development of the self moves from individualistic concerns to harmony with other beings as it grows in wholeness (i.e., maturity, spirituality)" (2015, p. 140). She then defines "self" as "the coherent whole" or the "unified consciousness and the unconscious being of a person (Chang 2015, p. 140).

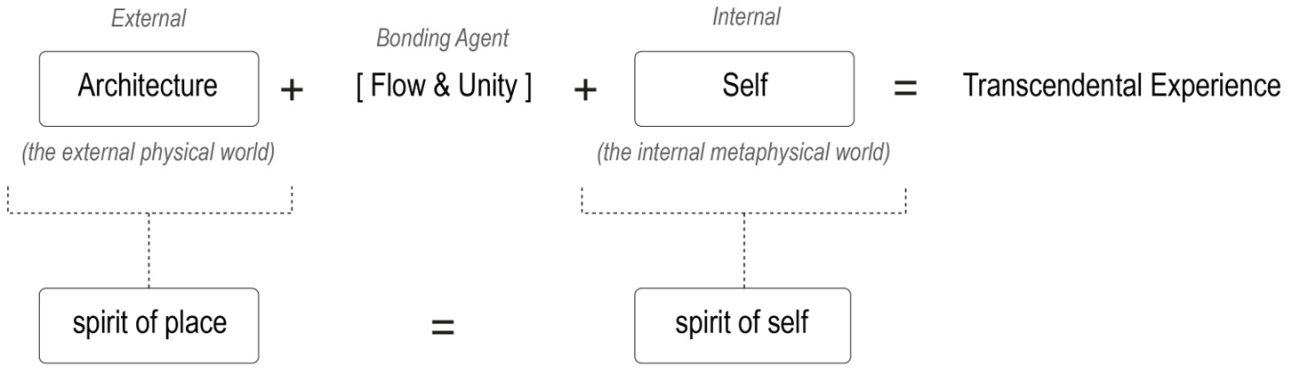

Figure 1. Transcendental experience and the relationship of architecture with the self

Source: (Esmaeili & Sinclair, 2021)

Spaces with mystical qualities aim to act as a conduit, linking us and cultivating our connection with what otherwise would be inaccessible—the Divine. The one that "has neither beginning nor end, for it is timeless, and there is no place for him to be known by location or attributes. Professor Nader Angha states, "All manifestations are the single melody of his symphony" (1996, p. 23). Only by merging the physical world with the metaphysical and flowing from one to the other, outside of the boundaries of time and space, can one achieve transcendental experience—the realm of Divinity that is filled with serenity and tranquillity (Esmaeili & Sinclair, 2021). Refer to Figure 1.

The feeling of flow, which is linked to the concepts of temporality and time, is a crucial aspect of space. Flow occurs when we are completely immersed in the experience of the present moment and fused with its temporal and spatial dimensions (Csikszentmihalyi, 1996). Spaces start to blend together when we enter a built environment, and we go seamlessly from one experience to the next, sometimes without even realising it. As Pallasma asserts, we occupy time, but it is important to understand that time occupies us too (2016). The concepts of time and space are interconnected in architecture. We comprehend time using our human senses rather than how physics describes it. We not only inhabit space and time, but we dwell in both simultaneously. To understand the concept of time, architecture plays an important role as it "mediates equally our relationship with this mysterious dimension, giving it its human measure" (Pallasmaa, 2016).

Through the minds of phenomenology, spatial phenomena, such as atmospheres, are fundamental to the perception of architecture because they are continually "intertwined with temporality" and are "never outside time" (Pérez-Gómez, 2016). It is through the experiential aspects of architecture that we connect with space. Time and space are inextricably linked to the limited physical world, which lacks stability and is always changing. Professor Sadegh Angha talks about how time and space are related by stating that "Without space, time will not exist. Till there is no space, time will not be existent, though it will be limited only" (S. Angha, 1998, p. 242). Although time and space are both required and vital for experiencing the metaphysical world, one should look further to find the essence of architecture – the Spirit of Place. Temporal and ephemeral encounters play a significant role in the design of sacred spaces because they serve as a reminder of the finite, ephemeral nature of this world in contrast to the eternal one we should be seeking.

3. Sufism and time

بی زمان و بی‌مکان باید شدن محو اندر ملک جان باید شدن
جان جان باید شدن

در زمان و در مکان جان جو مباش بهر جان از جسم برهان جو مباش
وهم تو بر تو مباش

> *"Pass the limit of time and space*
> *Then in God's realm, you will attain (the station) selfless-ness*
> *One must become the 'inner essence of the soul'*
> *Do not seek the soul in ordinary time/ space coordinates*
> *Do not seek the soul through physical (bodily) demonstration*
> *Don't permit your own imaginary perceptions takeover"*
> (S. Angha, 1998, p. 240)

Sufism, or *Tassawof* (تصوف) is defined as the internal (*batin*) and esoteric dimension of Islam - a self-discovery journey towards oneness and unity with the Divine. Being a mystical course is what makes Sufism unique and sets it apart from the religious and exoteric (zahir) facets of Islam. Mysticism refers to "the great spiritual current which goes through all religions. In its widest sense, it may be defined as the consciousness of the One Reality – be it called wisdom, light, love, or nothing" (Schimmel, 1975, p. 4). Another distinguishing element of Sufism is the esoteric transmission of knowledge from one master to another, and this is why Sufism is called the path of the heart (Burckhardt, 2008). In the journey of self-cognition, the Sufi (seeker of knowledge and wisdom) should pass through three stages. They are: the Tradition or laws (*shari'at*

شریعت), the Path or the Way (*Tarighat* طریقت), and the Truth (*haghighat* حقیقت). To better understand these stages, professor Sadegh Angha explains: "*shari'at* is like the ship, *tarighat* like the sea, and *haghighat* like the treasure; therefore, whoever desires the treasure must embark, sail the sea, and reach the treasure" (1986, p. 5). The physical world is limited and confined by the dimension of time. However, to discover the truth, one must first enter the physical world and utilize it as a springboard to transition from the external to the internal. The physical world "teaches us that it is possible to emerge from measurable space without emerging from the extent and that we must abandon homogeneous chronological time to enter that qualitative time which is the history of the soul" (Corbin, 1982, p. xxvi).

On this journey, the seeker aims to separate from all the physical attachments and distractions of the ego to arrive safely at the destination and reach the truth within one's heart. Sufism places a lot of emphasis on the heart as the center of "mystic physiology" (Corbin, 1969). As a result, the Sufi seeks to become physically and cognitively aware of the heart by practicing Sufi principles such as chanting (zikr), prayer (salat), or concentration (tamarkoz) both internally and in Sufi centers (Khanegah). Figure 2 displays images of two Sufi centers in the USA. Khanegah translates to 'house of present'. It is the school where the student (Salik سالک) turns for guidance. The word khane means 'house' and gah means 'present moment'. It is critical for the seeker to gradually learn to detach himself from the past and the future to be fully present in the Now (hal), which is also one of the infinite attributes of the Divine - always present. This moment is defined elegantly by Gerhard Böwering as "the breath between two breaths, the one before and after, that cannot be overtaken again once it is gone" (1992, p. 83). The constant heartbeat along with the continuous act of inhalation and exhalation (circular motion) are tangible and temporal aspects of the physical body that are taking place in the present moment. They function as a means of returning the Sufi to the present moment. Bringing one's complete consciousness and attention to the timeless and limitless moment of 'Now' will result in silencing the chattering mind that is constantly traveling in the past or future. Thus, creating a gateway into the peaceful realm of the heart to encounter the self.

To become aware of the moment and unify both the external and internal worlds, the Sufi is practices solitude, stillness and silence. The external and physical practice of being calm, in balance, and quiet allows the Sufi to enter the serene realm of within. One becomes unified with nature and the cosmos once all the barriers of time and space are lifted to reach the ultimate truth that is timeless (*bi zaman* بی‌زمان) and spaceless (*bi makan* بی‌مکان). The seeker's task is to abandon any "trace of temporal consciousness" and become fully present at the moment within his heart to reach his eternal self (Day, 2004). A Sufi who is fully aware and immersed in the present moment is also called "*Ibn waqt* ابن الوقت" which translates to "son of his moment" (Böwering, 1992, p. 83). As previously explained, time is the fourth dimension, which is intertwined with space. In Sufism, the fifth dimension is called life or "Jaan جان". This dimension is the eternal source of life, wisdom, and knowledge, within the heart but outside space and time - a pure reflection of the Divine. To explain the celestial qualities of "Jaan", Professor Sadegh Angha states: "The fifth dimension is the expansion of your soul, which is delicate and knowledgeable from inception" (1998, p. 235).

4. Presence in architecture: Here and now

It is essential to highlight that in Persian architecture, man is 'present' in space rather than 'using' it (the user), and his 'being' in space is what matters most- full presence (Haeri, 2015). Historically, man, through sacred art and architecture, decelerated time to become present, here and now, to access and experience the invisible. We are attracted to beauty, harmony, order, and creativity. When confronted with an astonishing and staggering sense of beauty and majestic qualities, our full attention is captured by the moment, resulting in an "experiential epiphany" or "transcendental quality," triggering something internally and bringing us closer to the source of life within (Sinclair, 2011). According to renowned architectural phenomenologist, Alberto Perez Gomez, we can identify architecture as a "poetic language" (2018). A form of art that moves us beyond form and matter and "enable[s] humanity to overcome its immediate presence and experience a time out of time that is free from both linear temporality and the dreaded return of the same" (Pérez-Gómez, 2018, p. 192).

Architecture has always been a powerful medium that allows one to simultaneously perceive space and time. Our ability to reflect, empathize, and identify with others is something that design can accomplish. We internalize space and the atmosphere as soon as we enter them, whether we are aware of it or not (Pallasmaa, 2021). As with sacred spaces, this internalization of space allows one to be present within it and to completely immerse in the here and now (*hal*). A feature of sacred architecture that brings us closer to spirituality and the present moment is space and the temporality of man's sense of space. Full consciousness and awareness of the present moment "while it can be conceptualized by science (and our clocks) as a quasi-nonexistent point between past and future, is experienced as thick and endowed with dimensions—in a sense, eternal. This has always been the time 'out of time' that is the gift of rituals, festivals, and art, or the time of 'silence,' celebrated by Louis Kahn and Juhani Pallasmaa for architecture" (Pérez-Gómez, 2016, p. 257). Art in general, whether it be architecture, music, painting, or poetry, permits us to suspend time and offers the chance to encounter something immeasurable outside the limited dimension of time (Pallasmaa, 2016). By declaration of time, one is forced to become present at the moment to enter the realm of atemporal unified internally and externally, where time and space disappear. By implementing various design elements in the work of architecture, the designer can create a journey through light, material, form, and choreography of the space where one not only blends with the dimension of time but can reach the fifth dimension - "*Jaan*."

Figure 2. Maktab Tarighat Oveysi (M.T.O) Shahmaghsoudi School of Sufism Centers

Left: Los Angeles Khanegah. Right: Main Hall of the Houston Khanegah. Source: (M.T.O., 2015)

5. Temporality in Persian architecture – Light and Shadow

> "Darkness is *absence of light*. *Shadow* is diminution of light." ~ Leonardo Da Vinci~

Temporal spaces and moments in architecture are of high value to our understanding of the present moment. We can characterize the passage of time and understand atemporal through the ephemeral nature of space. Understanding the significance of the transient qualities in architecture is thought-provoking and reminds us that the "eternal archetypes of spiritual and celestial qualities are reflected through temporal forms, manifesting vital, yet mortal, tendencies which are crystallized into transient styles representing physical and individual limitations. Secular forms, therefore, serve as a bridge between the qualitative, abstract world of the imagination and the quantitative artifacts of man" (Ardalan & Bakhtiar, 1973, p. 97). We consider time and anything beyond the physical through the oscillations we observe in the physical world, such as seasonal changes, natural growth, sun/moon motion, and day-night cycles. In Sufism, it is the light within one's heart that symbolizes the eternal Divine - the source of all existence and the guiding light for the seeker on the path of self-cognition.

Historically, light has been one of the key elements in sacred architecture. In many faiths and cultures, light is associated with sacrality (Esmaeili & Sinclair, 2021). It is known as an emblem of purity, life, and knowledge and is associated with heavenly representations both in art and architecture. As defined by Mario Botta, light is "the visual sign of the relationship that exists between the architectural work and the cosmic values of the surroundings" (Cappellato, 2005). Light symbolizes absolute reality and knowledge, while darkness is the state of nothingness or ignorance. Ardalan defines light in the mystical context as an "absolute existence while darkness is analogous to the phenomenal world" (1974, p. 166). In full darkness (a state of nothingness), we are unaware of our surroundings. However, in the presence of light, we can gather information and move through space. In describing the interconnectedness of light and shadow, Al-Ghazali states, "Know that the visible world is to the world invisible as the husk is to the kernel; as the form or body to the spirit; and darkness to light" (Smith, 1944).

Light defines the atmosphere and the depth of space. Louis Kahn refers to light as the "giver of all presences" (Kahn, 1991). The ephemeral quality of space and atmosphere becomes accentuated through the movement of light, resulting in a more dynamic and animated space. Light also "directs our movements and attention, creating hierarchies and points of foci" (Pallasmaa, 2015, p. 24). As a result, light is highly valued in Persian architecture and is one of the major factors in defining a space. Light and shadow coexist together, and they are inseparable. The Divine Light is formless, timeless, and eternal. Light encompasses everything in the universe and the cosmos and "matter is nothing but light" as explained by Professor Angha (1981). Louis Kahn calls material "Spent Light," and he further explains the relationship of shadow to light as " What is made by light casts a shadow, and the shadow belongs to light" (1991, p. 248). If we claim that light symbolizes the atemporal metaphysical qualities of the world, then darkness and shadow represent the temporal and perishable world of matter. The concept of light and shadow is applied to numerous sacred spaces as well as Persian architecture to emphasize the beauty and spiritual qualities of the Divine in comparison to the transient and limited world of the physical.

The presence of light is enhanced in Persian architecture and in the design of the Khanegah by employing the dome and large windows. The movement of light on the trees; various shades of color in flowers as one walks through the Persian garden; viewing the reflection of light on the surface of the water fountain creating magnificent sparkles in the courtyard; the reflection of light on the tiles and details of the center; and the beautiful scenery created by colorful stained glasses inside the building; the movement of light and colors on the floor; the interplay of light and shadow in different corners of the room, as well as stepping to the center of the space underneath the dome where one is showered with light, all share one quality, and that is the temporality of space and the quality of light (Figure 4). Our spatial encounter of space represents exquisiteness

Figure 3. Sheikh Lotfollah Mosque, Isfahan (Vahedi & Kiani, 2016)

and beauty, but temporal aspects of the physical world that are constantly changing (Ardalan & Bakhtiar, 1973). However, it is through the physical manifestation of space that we move past the experience of architecture as a product or physical creation. Architecture, despite its permanence, becomes an experiential moment of 'being' where one can encounter mystical qualities of the external that will enhance the sense of curiosity and unify one with the everlasting and infinite inner world. As a result, the external (zahir) and the internal (batin) will become unified to create a mystical moment where balance, harmony, and peace dwell.

6. Discussion and conclusion

> "A building's role is to keep us dry, while Architecture's purpose is to move us." ~Le Corbusier~

Architecture is more than simply assembling materials and constructing a structure for people to live in. Creating sensory experiences that connect individuals to their sense of self and the environment is at the heart of architecture. Integrating the temporal and atemporal components of space is essential in creating timeless architecture. At that point, one's internal feeling of self and desire to blend with their environment are further enhanced by the exterior experience of architecture. The goal of the current study was to highlight the significance of temporality in Persian architecture through the lens of mysticism. Architects and designers can bring depth and meaning to the creation of spaces, by examining and understanding the philosophical and theological notions of Persian architecture, teachings of Sufism, and fusing them with the work of architecture. By orchestrating design elements and deliberately focusing on the concept of harmony and self in place, it is possible to inject experiential and transcendental qualities into space that can be felt with the heart and beyond the confinement of time. The scope of this study is limited to exploring one of the many design elements—light and shadow—which have an influence on how space is created in line with the concept of time. To have a deeper and more

Figure 4. Light and shadow in Persian architecture, Nasir al-Molk Mosque, Shiraz (Majlesi, 2018)

thorough grasp of the idea of temporality, especially in a rich style such as Persian architecture, it is important to investigate a variety of other factors, among which light and shadow are just two. Additional research will be required to examine and explore transient qualities in Persian architecture in more depth and their connection with all other elements of design. A natural progression of this work is to explore specific case studies and various design elements to understand the application of these concepts in built projects.

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ArchiDOCT 19, 11 (1) TEMPORALITIES ii

A Spatial-temporal Network-Science Based Study of Walking in Urban Green Spaces: A Case Study of One-North Park

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Keywords: Network Science, Park systems, Pedestrian movement, Spatial Network Analysis, Urban Design

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The design of urban form influences spatial accessibility and movement. The quantification of spatial accessibility is an important tool to understand and predict pedestrian flows in unbuilt designs. This study quantifies the spatial performance of urban green spaces using Spatial Network Analysis. The paper demonstrates a comparative analysis of temporal correlations between metrical considerations in a Spatial Network Analysis tool and observed pedestrian flows in the case of one-north Park, and presents insights gained on walkability in the park on a temporal basis.
one-north Park is a significant spatial component in one-north, a vibrant research and business district in Singapore. The linear green space is located in the centre of the development, providing a corridor that enables the maximisation of frontage for user access and connects many of the adjacent building clusters. Although initially designed to be a singular continuous green space, the development of the vehicular mobility network in one-north has resulted in the formation of separate parcels. The research analyses the role of the parcels as spatial connectors in pedestrian movement during typical weekdays and weekends.
The study involves the development of a pedestrian network model in the one-north planning subzone in order to analyse the distribution of pedestrian movement in one-north Park. The network model is analysed with three metric considerations, which each define how distance is calculated on the network differently. With the use of an empirical sensor-based study, the research captures pedestrian movement patterns in the parcels in real-world settings. By correlating the values of the Spatial Network Analysis with observed pedestrian flows and comparing the three analytical models, the paper presents a spatial-temporal understanding of walking in one-north Park. The study forms a part of a larger research project that uses Spatial Network Analysis to analyse spatial integration in one-north.

1. Introduction

Spatial layouts influence movement. In other words, determining how accessible a space is, is possible by studying the configuration of the context in which the space exists. The study of spatial configuration–the way spaces are linked together–and its association with accessibility and movement has been extensively studied since the proposal of the theory of natural movement in the 1970s and 1980s by Bill Hillier and his colleagues (Hillier & Hanson, 1984; Yamu et al., 2021):

> "Natural movement in a grid is the proportion of urban pedestrian movement determined by the grid configuration itself." (Hillier et al., 1993)

The theory implies that urban form and social behaviour are inherently correlated and analysing one of them can help us understand the other one better. The conception of

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the theory provided the basis for the development of Space Syntax tools and advancement in the broader field of Spatial Network Analysis.

Spatial Network Analysis is the analysis of the type of network that is both spatially embedded and has geometrical properties (Barthélemy, 2011; Cooper & Chiaradia, 2020). This study uses a Spatial Network Analysis tool called Spatial Design Network Analysis (sDNA) (Cooper & Chiaradia, 2020) to model pedestrian movement in public green spaces in a highly dense and integrated urban district in Singapore.

1.1. sDNA: A Spatial Network Analysis Tool

sDNA is an open-source GIS-compatible and Python/command line tool to analyse multi-level spatial networks (Cooper & Chiaradia, 2020). sDNA computes various network measures of the links, which represent the publicly accessible walking routes, of a spatial network. The network measures indicate the accessibility and connectivity of the links.

Analysing a spatial network using sDNA indicates the potential distribution of movement within a defined radius in the network. Network measures may be analysed under different metric conditions in the software, which define how distance is calculated on the network (Cooper & Chiaradia, 2020). The paper demonstrates a comparative analysis of temporal correlations between metrical considerations in sDNA and observed pedestrian counts in the case of one-north park, and presents insights gained on walkability in the park during a typical weekday and weekend.

2. Case study: one-north park

The study is conducted at one-north Park, a 16-ha linear park located in the centre of one-north. one-north is a research and business park in Singapore, and its masterplan was designed by Zaha Hadid Architects in 2003. Some of the key features of the masterplan are its focus on pedestrian and transport connectivity in one-north, the role of a central park that linked all parts of the district, and the use of the existing undulating topography to influence the built form.

one-north Park is a significant spatial component of the district, providing a green corridor that enables the maximisation of frontage for user access and connecting many of one-north's research clusters. Although it was planned as a continuous green space, the road network divides the park into multiple parcels. The park currently consists of six built parcels, which are named and numbered according to its managing body, National Parks Board (NParks). In the study, we study the built parcels of the park (illustrated in Figure 1):

- one-north Park Rochester West (P3): The 0.2-ha park edges along Rochester mall-and-condominium development, and is surrounded primarily by retail commerce. The Rochester Mall also includes office spaces.
- one-north Park Rochester East (P4): The 0.45-ha park is adjacent to Rochester mall-and-hotel development, and its context includes retail commerce and Rochester residential condominium. The Rochester Mall also includes office spaces.
- one-north Park Biopolis (P5): The 3.24-ha park is the biggest parcel, and is located on hilly terrain. Its context primarily includes office buildings and a residential condominium one-north Residence.
- one-north Park Fusionopolis North (P6): The 0.58-ha park was sensitively developed based on principles of environmental sustainability. Abutting an office building, the park has diverse vegetation to attract biodiversity.
- one-north Park Fusionopolis South (P7): The 2.44-ha park is established as a nature sanctuary to support existing bird populations. Surrounded by office buildings, it includes a singular boardwalk across the parcel for pedestrian connectivity.
- one-north Park Mediapolis (P11): The 1.98-ha park is an elevated park above a carpark and other infrastructural facilities. It is adjacent to an office building, and its context primarily includes office buildings and a private school.

The different characteristics and contexts of the parcels of one-north Park indicate that we can expect different pedestrian patterns across a given day, for e.g., walking across a park to access an office at the start and end of business hours, meandering along a park in the evening, running at the park during the early hours of the day, etc. These patterns will also differ across weekends and weekdays.

3. Research Aim and Framework

A common methodology of Spatial Network Analysis using sDNA is the use of empirical studies of pedestrian movement that corroborate the results of sDNA (Cooper & Chiaradia, 2015, 2020; Li et al., 2021). However, there are few studies that attempt to quantitatively correlate the sDNA results and observed pedestrian flows on a temporal basis.

The aim of the study is to correlate Spatial Network Analysis results with temporal pedestrian movement flows under different metric considerations, in order to develop a predictive pedestrian model in one-north park. The research will also present insights on the role of the one-north Park as a significant spatial connector in pedestrian trips during typical weekdays and weekends. The insights gained from the study will determine which analytical model has the highest correlation with observed pedestrian movement flows in one-north Park. The deviations between the network analysis results and observed pedestrian counts will be analysed in future research to improve the robustness of the network model. The spatial model developed from the ongoing study can be used as an effective simulative tool for future design of spaces in the park and their effect on pedestrian movement.

The framework of the study is three-fold: Pedestrian Mobility Data Collection, Spatial Network Analysis, and Spatial-temporal Correlational analysis.

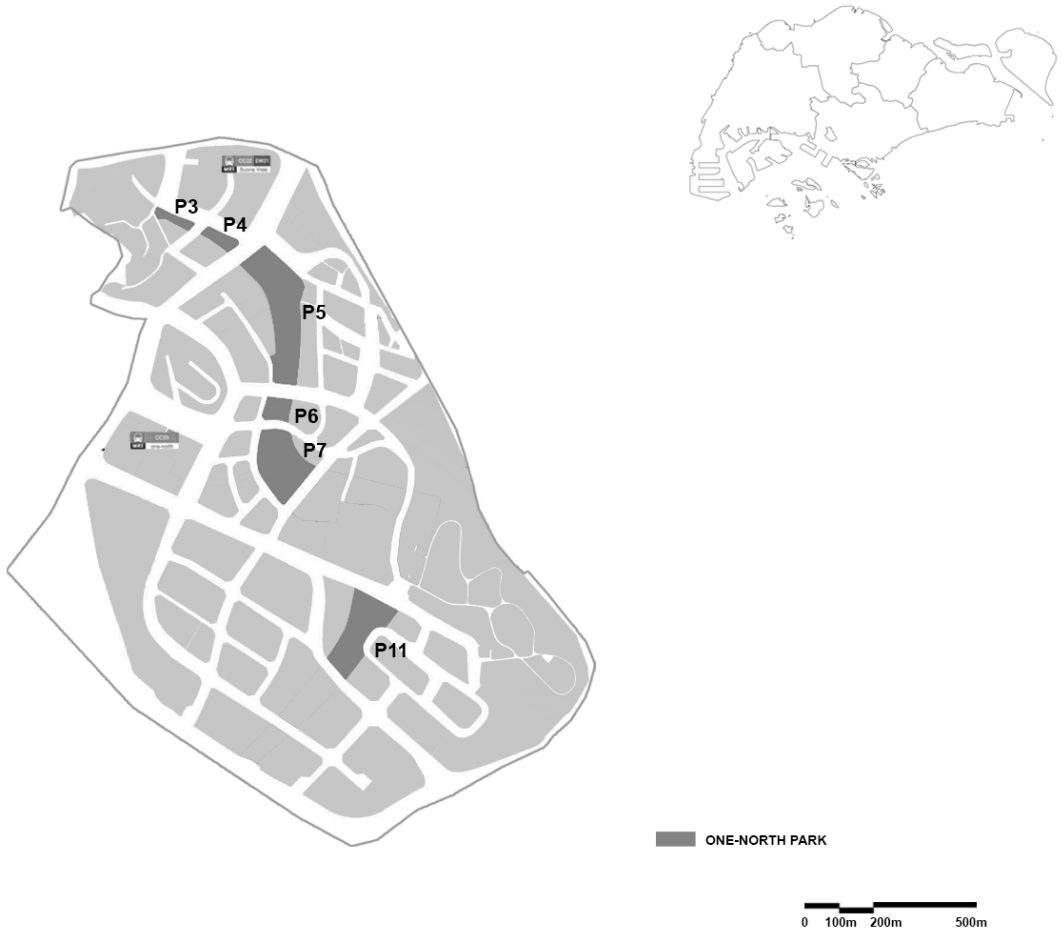

Figure 1. The parcels of one-north Park

P3 - one-north Park Rochester West; P4 - one-north Park Rochester East; P5 - one-north Park Biopolis; P6 - one-north Park Fusionopolis North; P7 - one-north Park Fusionopolis South; P11 - one-north Park Mediapolis

4. Methodology

4.1. Pedestrian Mobility Data Collection

Pedestrian movement data was collected by setting up people counters in the parcels of one-north Park. Bi-directional outdoor people counters using infrared sensors were strategically placed at entry points and key locations in each parcel of the park. Each pair of counters was tied to existing poles or mounted on supporting poles to form an invisible gate, so that the people passing through the gate were counted.

18 pairs of people counters were installed in the six parcels, over two phases. In each phase, pedestrian movement in three parcels was recorded on an hourly basis every day over 2-4 weeks. At the end of the two phases, a total of 31 locations were covered using the people counters. The data was averaged to hourly counts on a typical weekday and a typical weekend for analysis.

4.2. Spatial Network Analysis

A spatial network model was constructed using Rhino and ArcGIS to represent the pedestrian routes in one-north (illustrated in Figure 2). The network was constructed with links (polylines) which each represent the centre of a publicly accessible walking path or space. The network considered the full detail of multi-level publicly accessible spaces in all the parcels of one-north Park, and their 100m radius context. Beyond the localised radius, the rest of one-north district was constructed using a simplified model of footpaths and pedestrian indoor connections. To avoid edge effects (Gil, 2015), the radius of the entire network was maintained at 1000m, to include one-north district boundary.

The network was then imported into ArcGIS, which uses the sDNA tool as a plugin for analysis. Since the topography of one-north is undulating, slope is a significant variable in the Spatial Network Analysis of one-north Park. The outdoor pedestrian street network was draped over a terrain dataset to reflect the slope of the context. The network was assembled by placing the multi-level pedestrian network of

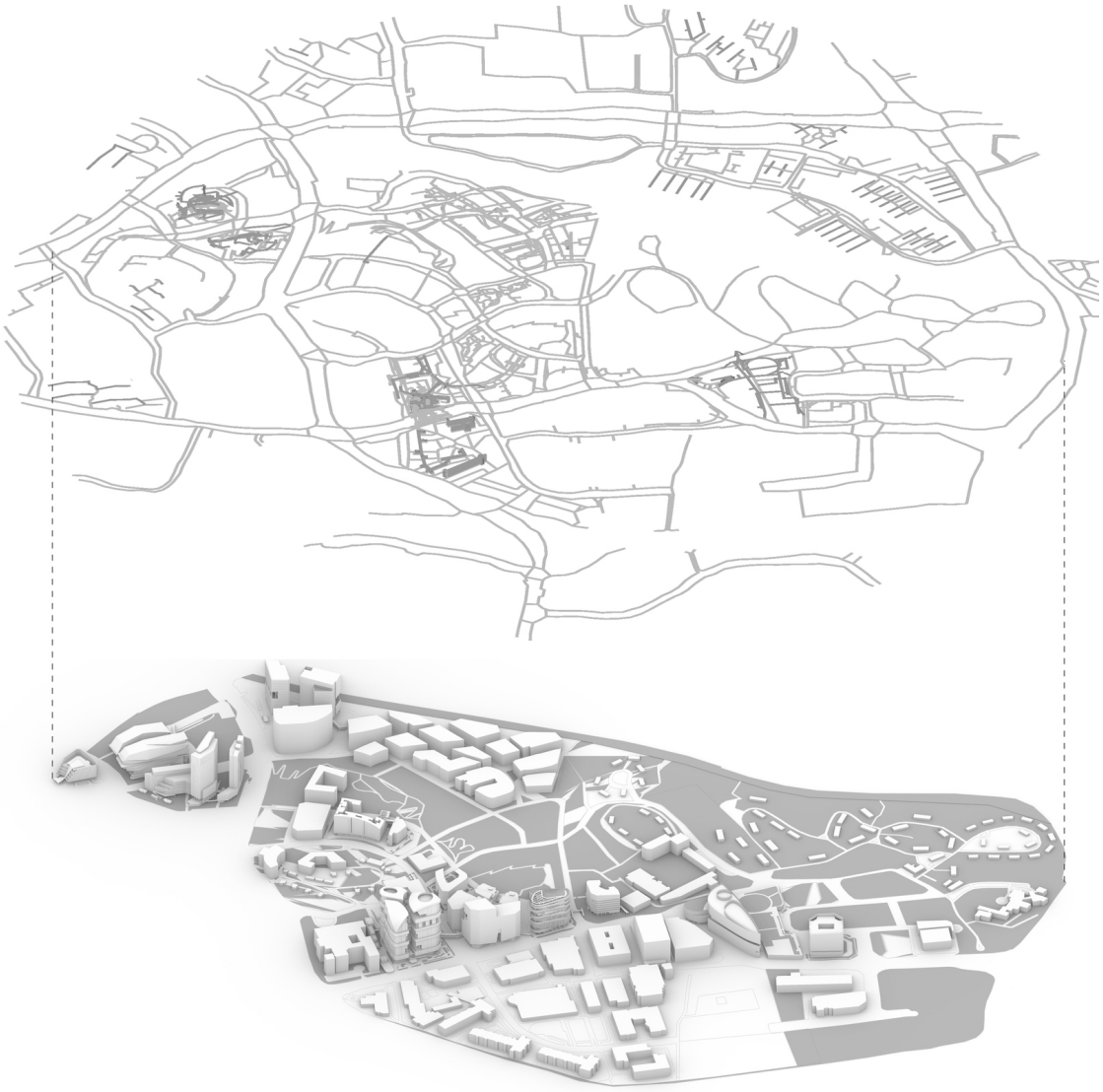

Figure 2. one-north pedestrian network model

publicly accessible spaces in buildings on the street network model. This step helped account for height gain in pedestrian movement through level difference as well as slope. Using sDNA, the network was checked for errors and missed intersections, and prepared for analysis. The network within the localised radius was analysed using the sDNA Integral Analysis function.

The study focussed on one key network measure used in sDNA: Betweenness Centrality. Betweenness is the sum total of shortest paths from each node on the network to every other node, which traverse a given link or node (Cooper & Chiaradia, 2020). Betweenness can be understood as an expression of pedestrian flow.

Using sDNA, analysis of the network model was conducted using three metric considerations:

1. Accounts for Euclidean metric and height gain:
   The Euclidean metric assumes that pedestrians take the shortest paths on journeys. Pedestrians commuting to and from work may tend to follow Euclidean geodesics, as they know the shortcuts.
2. Accounts for Angular metric and height gain:
   The Angular metric assumes that pedestrians take the most direct paths on journeys, i.e., routes with least angular turns. These routes are not always the shortest paths on walking journeys. Pedestrians, unless they are very familiar with the area, generally tend to minimise their turns when walking, because the routes are easier to remember and thus retrace.
3. Accounts for Hybrid metric and height gain:
   A mix of both these patterns can be calculated in the Hybrid metric (the formula used in the study accounts for 50% Angular and 50% Euclidean geodesics).

4.3. Spatial-temporal Correlational Analysis

To test the relationship between spatial network models at different metric considerations and observed averaged pedestrian counts, a bivariate linear regression analysis was adopted for all the network models. The links in the net-

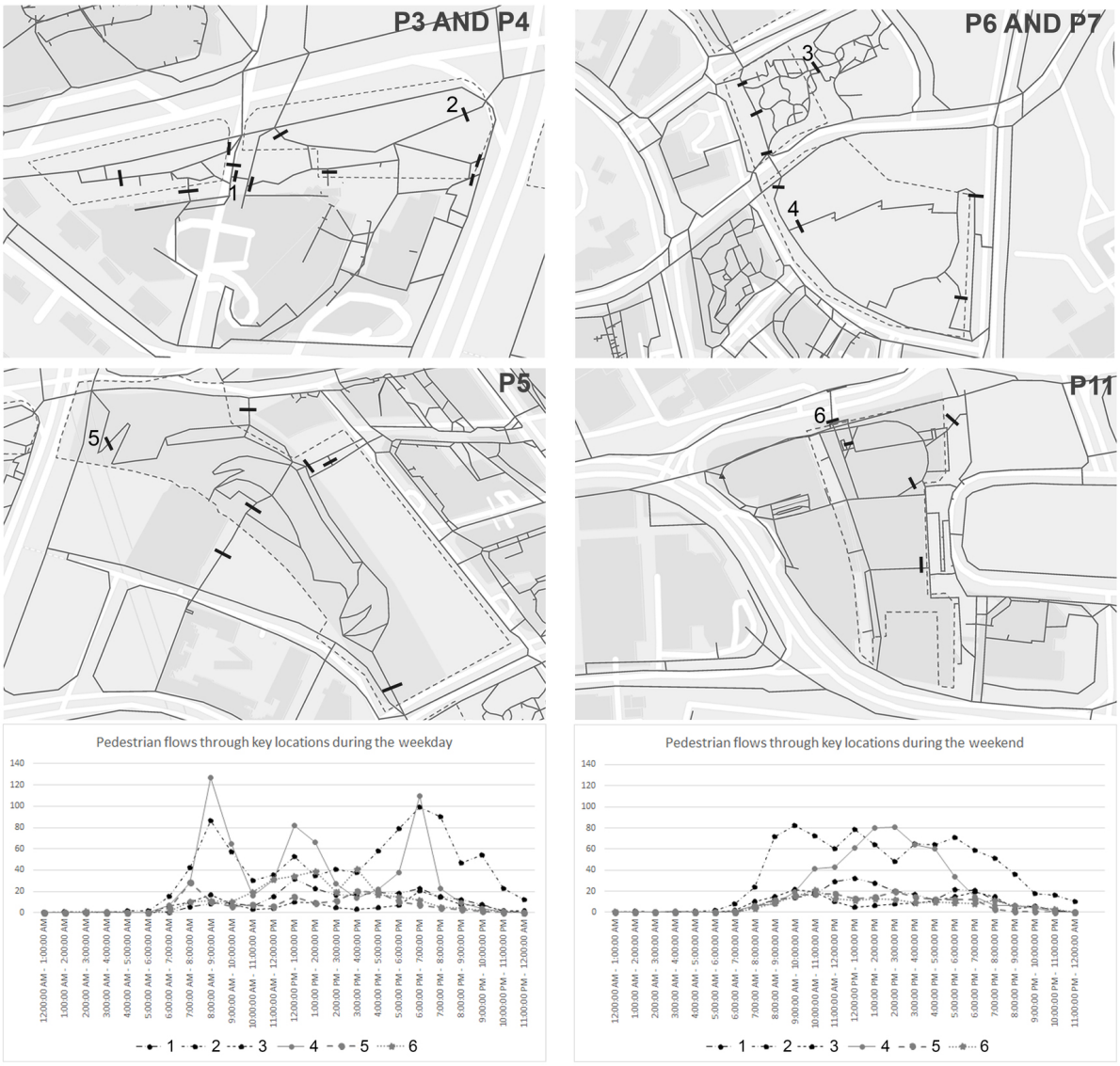

Figure 3. People counter locations in one-north Park

work and the people counter locations were spatially joined to correlate Betweenness values with the people counts.

5. Results

5.1. Pedestrian Mobility Mapping

Based on the data collected from the pedestrian counters, the following observations are made:

- Overall, during a typical day, the highest pedestrian flow activity in one-north Park is noticed during the time period 12 noon to 1 pm.
- There is pedestrian activity in the park during weekdays as well as weekends. The context of the park is unlike a typical monofunctional business park, and can explain the pedestrian movement patterns. During a typical weekday, three time periods see sharp peaks of flows: 8-9am, 12-3pm, and 6-7pm. Since one-north predominantly has office buildings, it can be understood that higher pedestrian activity can be noticed in the most of the parcels of the park at the start and end of business hours, as well as during lunch break hours. During a typical weekend, there is a gradual increase in pedestrian flows from 6-9am, then the flows fluctuate by small amounts until 6pm, then steadily decrease. They can be explained by the presence of residential and retail spaces in the context of the park.
- Pedestrian flows differ in the individual parcels of the park. During the peak hours in the weekday, the following observations are made:
  - During 8-9am, the highest flows are observed in the office entrance at P6 (21) and an entrance to P4 (9).
  - During 12-1pm, the highest flows are observed in the pathway edging along P3 (5) and in the office entrance at P6 (21).
  - During 6-7pm, the highest flows are observed in the pathway edging along P3 (5), an entrance to P4 (9), and the office entrance in P6 (21).

These observations indicate that the parcels P4, and P6 are used as transitory spaces when pedestrians commute to and from office.

- The corresponding time periods in the weekend see different flows in the park parcels. However, some pedestrian patterns are consistent across the weekday and weekend:
  - During 8-9am, the highest pedestrian movement is observed in an entrance to the P4(9). High flows are also observed in another entrance to P4 (6) and the pathway along P3 (5). These high flows are not noticed in the other parcels during the same time, and hence can be attributed to urban attractors near one-north Park Rochester condominium.
  - During 12-1pm, the highest flows are observed in the pathway edging along P3 (5).
  - During 6-7pm, the highest flows are observed in the pathway edging along P3 (5) and an entrance to P4 (9).

  The highly mixed-use context of P3 and P4 can explain the consistently high pedestrian flows across weekdays and weekends. These flows can indicate pedestrian activity to the mall, to the residential condominium, the hotel, and seating spaces within the parcels themselves.
- In P3 (one-north Park Rochester West), the pathway edging the park parcel and leading to the Rochester condominium (5) consistently shows higher flows than other entry points to the parcel during the weekday and weekend. The path also sees high flows during the time period 6-8pm in the weekend.
  This indicates that the perimeter of the parcel is highly and consistently used, but the parcel itself sees fluctuating through-movement in a typical day. Hence the parcel P3 is not observed as a significant connector for pedestrian trips.
- In P4 (one-north Park Rochester East), three entry points to the parcel (6, 7, 9) show the highest flows during 6-8pm in the weekday. The three paths along the primary street North Buona Vista Road (9, 10, 11) show high flows during 8-9am and 6-7pm in the weekday, typical of pedestrian movement at the start and end of business hours. This indicates that pedestrians through these entry points likely go to office spaces in Rochester mall and hotel.
  Outside of business peak hours, the parcel sees comparable flows during corresponding hours in the weekday and the weekend. This means that the parcel sees pedestrian activity consistently during the weekday and the weekend. Hence the parcel P4 is observed as a significant connector for pedestrian trips.
- In P5 (one-north Park Biopolis), the entrance from the primary street North Buona Vista Road (12) sees the highest pedestrian flows during 8-9am and 6-7pm. A similar peak is observed in the weekend, during 9-10am and 6-7pm. While these flows are not as high as those observed in P4, it can be understood that the parcel is used as a transitory space during these time periods.
  Smaller secondary entrances to the park, via Biopolis (13) and one-north Residences (17) see peak flows during 12-1pm in the weekday, but these entrances see significantly lower flows in the corresponding time periods during the weekend. Since the context of the parcel predominantly includes office buildings, it can be argued that the park is used as a connector for office-eating-venue-office trips. The parcel is used as a connector during few certain time periods of the day, but sees less activity compared to the other parcels. The relatively sporadic pedestrian activity, despite its size and central location, implies that the parcel P5 is generally a spatial barrier in the area.
- In P6 (one-north Park Fusionopolis North), all people counters show a consistent pattern of peak hours during the weekday: 8-9am, 12-2pm, 6-7pm. Since the parcel abuts an office building, these pedestrian flows can be assumed to represent the movement of office employees.
  However, this pattern is not observable during the corresponding hours in the weekend. In the weekend, excluding the start and end of typical business hours, values in corresponding time periods are comparable. Since the offices in the context are observed to be closed during the weekends, the park is consistently used by non-employees as well, which means that the parcel is an urban attractor by itself. The rich biodiversity and sensitive landscape design can explain the frequent flows within the parcel, despite its context being monofunctional. From these observations, it is concluded that the parcel P6 is a significant connector for pedestrian trips.
- In P7 (one-north Park Fusionopolis South), the entry points to the boardwalk (24, 25) see high pedestrian flows during 7-8am in the weekday. One possible explanation for this pattern is that the parcel is an urban attractor, meaning people visit the park during this time. There is no clear pattern during the business hours in the weekday, which indicates that it is not used as a shortcut between office buildings. The weekend sees significantly lower pedestrian activity. The parcel P7 is observed as a spatial barrier for pedestrian trips in the area.
- In P11 (one-north Park Mediapolis), the entrance from the neighbouring private school (27) sees peak flows during 3-4pm, but there is a significant drop during the corresponding time period in the weekend. This indicates that the flows represent school children movement patterns.
  The entry point from the carpark below (28) sees high flows both in the weekend and weekday, and peaks at 1-2pm in the weekday. Another entrance to the parcel, which is closest to the adjacent office building (31) and is a pedestrian ramp, sees a peak at 12-1pm in the weekday, but has significantly lower flows during other hours of the weekday, as well as the weekend. The difference in pedestrian flows in the two en-

trances indicates that the ramp is only used by people already in the office building or the vicinity, and not as a primary entrance to the parcel. While there are no consistent patterns to imply that the parcel P11 is used by office commuters, it is consistently used as a connector just after school hours.

The entrances to the parcel that are furthest from the office building (29, 30) see very less flows and no consistent patterns during the weekday, but show substantially higher flows during the weekend, peaking at 7-8pm. The evening flows indicate that the parcel is frequented in the weekend. Hence the parcel P11 can be understood as a spatial connector during certain hours and also as an urban attractor.

5.2. Spatial-temporal Correlational Analysis

The bivariate linear regression analysis shows that:

1. The Betweenness-Angular model consistently shows the highest correlation with the observed pedestrian patterns in the weekday and the weekend. Based on this observation, it can be argued that pedestrians tend to minimise their turns when walking rather than take the shortest paths.
2. All three models have higher correlations with observed pedestrian patterns in the weekend than in the weekday. One possible explanation for this difference is that walking patterns are not generally office-oriented journeys in the weekend, hence the influence of the spatial configuration may be higher on pedestrian patterns in the weekend than the weekday.
3. There is little to no correlation until 5am. During the stray hours of the night, pedestrian trips are made to specific urban attractors (for e.g., grocery store, café, etc.), and will not be influenced by the spatial configuration itself.
4. During the weekday, the Betweenness-Angular correlation varies from 0.11 (little to no correlation) to 0.52 (high correlation). The lowest correlation values (after 5am) are noticed during 8-9am, 12-4pm, and 6-7pm. Interestingly, the peak pedestrian weekday flows are observed within the same time periods, which represent trips by pedestrians commuting to and from office. This means that the spatial configuration alone cannot explain pedestrian trips during these time periods. It implies that a multivariate regression analysis is required in future research to include independent variables such as distance to closest transit egress, the attractiveness of urban points of interest, etc.
5. The Betweenness-Angular correlation value range is shorter in the weekend (0.3 to 0.56) than the weekday. The difference between the correlation values of the Betweenness-Angular model and the Betweenness-Euclidean model is higher in the weekend than the weekday. Further investigation is needed to understand the overlapping relationship of the Angular and Euclidean models and the low correlation of the Hybrid model.

6. Discussion

The comparison of metrical considerations in the sDNA analysis of the network model can be used to understand how people generally choose to walk in their origin-destination journeys. Applying it temporally, i.e., during a typical weekday and weekend, shows different pedestrian patterns in one-north Park, implying that the influence of the spatial configuration may be higher on pedestrian patterns in the weekend than the weekday. The Betweenness-Angular spatial network model can be used to understand pedestrian movement flow distribution in future research in one-north Park. The fluctuating correlation values in different time periods imply that there is a need to account for urban attractors in the spatial network to improve the study of spatial accessibility. A multivariate regression analysis will be conducted in future research to improve the robustness of the model. Future design proposals in the parcels of the park can be simulated using the model to understand changes in predictable pedestrian movement patterns.

The parcels of one-north Park are observed as transitory spaces in different times in weekdays and weekends. one-north Park Rochester East and one-north Park Fusionopolis North are significant spatial connectors in pedestrian trips. The rest of the parcels are observed as connectors for short origin-destination trips during certain time periods. one-north Park Fusionopolis South and one-north Park Mediapolis can be understood better as urban attractors themselves, rather than connectors, due to high pedestrian movement flows in weekday early mornings and weekend evenings. one-north Park Biopolis and one-north Park Fusionopolis South see sporadic pedestrian activity, and don't generally act as connectors between spaces in their context. They can be seen as spatial barriers in the area. Future research in one-north will focus on the pedestrian occupancy of the spaces in the park parcels, by studying bidirectional pedestrian flows in the parcels.

When the parcels are compared to each other, the observed pedestrian flows and the sDNA results show that the connectivity of the parcels clearly influences pedestrian movement, for e.g., one-north Park Fusionopolis South offers pedestrians a singular boardwalk across the parcel, while one-north Park Fusionopolis North offers the choice of a meandering network of routes. Pedestrian movement in the parcels is also clearly dependent on the mixed-use context, for e.g., one-north Park Rochester East and one-north Mediapolis are both parcels that abut buildings, but see different pedestrian flows. The context of one-north Park Rochester East, which has a hotel, a mall, a residential condominium and eateries, is likely a factor that explains the consistently high pedestrian flows through the parcel. The context of one-north Mediapolis is monofunctional, and the parcel is surrounded by office buildings and few eateries. The next stage of the study will use multivariate regression analysis to expand on this insight by exploring the complexity of a weighted spatial network model.

This study is a part of a larger ongoing research on spatial integration in one-north. The data collected from the pedestrian mobility mapping stage in the larger site may

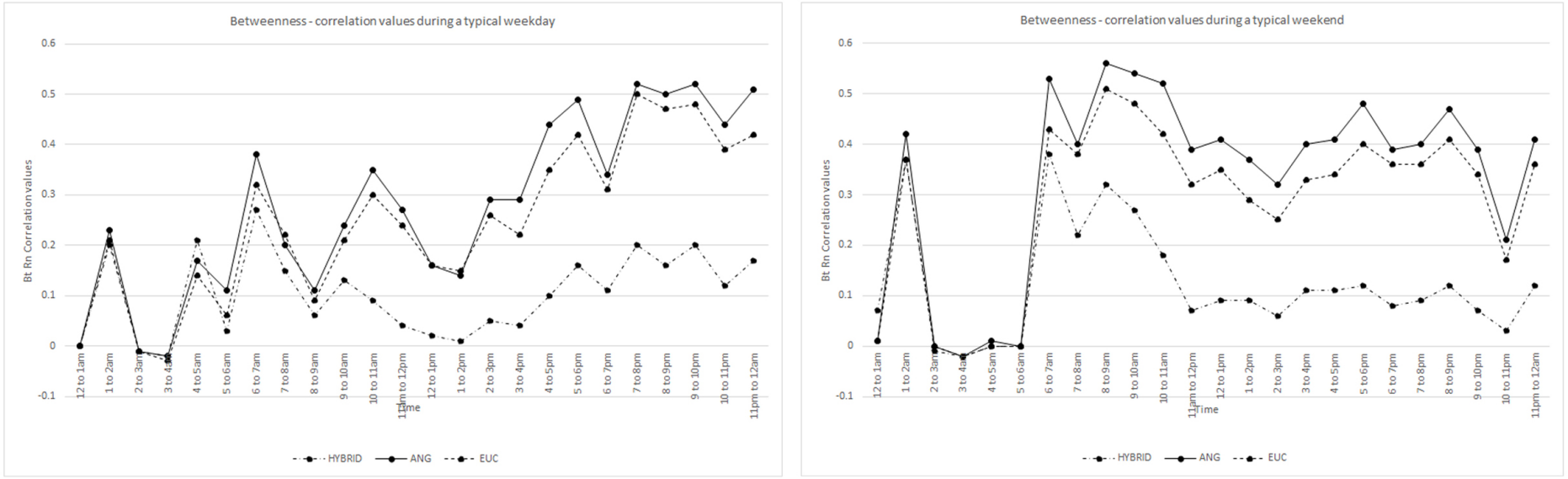

Figure 4. Spatial-temporal Betweenness Correlational Analysis between Euclidean, Angular, and Hybrid Metrical Considerations

change the correlation analysis of the study, and the validation of the metric considerations of the model. The research has certain limitations. While the Spatial Network Analysis shows that urban morphology influences pedestrian movement patterns, pedestrian behaviour can also be influenced by other aspatial factors: the sensorial experiences of spaces, perception of safety, etc. The study also faced logistical limitations. The outdoor conditions for people counters sometimes resulted in erroneous readings, caused by the entry of insects or the accidental displacement of devices by passersby. Ongoing construction work blocked some paths in the parcels for 1-2 weeks, skewing certain sensor readings.

7. Conclusion

The study seeks to utilise Spatial Network Analysis to analyse the distribution of pedestrian movement in one-north Park. The multi-level public pedestrian network model is analysed for Betweenness centrality with three metric considerations: Euclidean, Angular and Hybrid, and the Betweenness-Angular model is found to have the highest correlation with observed pedestrian flows. The use of an empirical sensor-based study allows real-world pedestrian mobility mapping, and observations based on pedestrian flow trends provide insights on the use of one-north Park as a spatial connector. These insights become the basis for improving the robustness of the network analysis and identifying key gaps in pedestrian connectivity of the park in future research. Unbuilt design proposals in the park can be simulated using the sDNA Betweenness-Angular model to understand changes in predictable pedestrian movement patterns. A robust sDNA network model can inform planning and design decisions on how to improve the park's connectivity and spatial usage. The presented study is part of a larger ongoing research project on spatial integration in one-north and contributes to the development of a novel multi-disciplinary methodology using Spatial Network Analysis. The methodology can be applied to other park systems, to understand existing walking patterns and use, and predict changes in pedestrian movement patterns due to redesign of spaces in the parks.

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Effects of Spatial Modelling on the Perception of time. Definition of Places Through Temporal Typologies

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The complex relationship between time and architectural design manifests itself in many ways, some of which are emblematic of how temporalities are part of the very concept of architecture. When we talk about time, we frequently think about its consequences on buildings (i.e. generating forms of decay), or how architecture reacts to its cyclical or linear flow - days and seasons, years and centuries - or how architects refer their work to history. Moreover, in the sphere of design, further typologies of temporalities come into play; after all, projecting something into the future is a significant feature of design itself.

In the field of perception and consciousness, some elements allow us to link the notions of space and time. 20th century philosophical literature is full of reflections on this relationship, starting from the phenomenological approach to reality and subsequent authors like Henri Bergson, Martin Heiddeger and Dino Formaggio, who demonstrated how the individual perception of time was influenced by the pure form of space: topics such as duration, simultaneity, instantaneity, endurance and other kinds of temporalities can be read as consequences of the spatial action on individuals.

If space and time are related, then the manipulation of space - the matter of architectural design - necessarily affects the perception of time. Light and shadow, transparency and opacity, sound and silence, solid and hollow (etc.), are the proper tools of architects' practice to determine different temporalities within spatial design, identifying architecture as the territory where this relationship materialises. In this research paper, references of this concept are investigated through effective examples, which best represents the architectural design capability to determine dilations, contractions or suspension in time perception.

Trying to observe these topics from the research in peri-urban and inner European territories - one of the frontiers of architectural study in Western countries - and acknowledging that architectural design is a modification of time and not just of space, suggests architects to apply time-based design strategies which are tailored to the needs that the 21st century dynamic and unstable context requires.

1. The relationship between space and time

It is a matter of fact: time and space are connected. Studies from the science, philosophy and literature world well defined that. The most famous of these, which generated a wide-ranging critical debate in the early 20th century, involving authors from different cultures and backgrounds, was the one elaborated by Physicist Albert Einstein in 1905 and later expanded, which took the name Theory of Relativity. There were enormous repercussions of Einstein's work on the *Zeitgeist* "the spirit of the age", starting with that first paper entitled *Zur Elektrodynamik bewegter Körper* (Einstein, 1905). For the first time in history, time ceased to be an autonomous and uniquely measurable entity and became a descriptive variable deeply linked to the three spatial ones. To summarise the thinking of the Nobel Laureate in Physics, it is useful to borrow the words of Brian Greene, according to whom «Einstein supports the strange theory that two observers in relative motion with respect to each other have different perceptions of time and distances. As we shall see, this means that two identical clocks, worn by two similar observers, do not mark the hours synchronously and therefore do not agree on the intervals of time elapsed between two fixed events. Restricted relativity shows that this statement has nothing to do with the precision of clocks, but rather that it is a true characteristic of the phenomenon of time» (Greene, 2005, pp. 24–25).

Since the publication of Einstein's works, time has ceased to be just a physical matter and has immediately affected the spheres of philosophy and literature, demonstrating the extent of this "revolution". In fact, 20th century philosophical literature is full of reflections on this relationship between space and time: after all, they are objectively measurable and subjectively experienced, which is

why an inquiry involving the humanistic disciplines lends an aura of greater completeness to the research. Specifically, in the field of perception and consciousness, some elements allow us to link «what Kant had defined *a priori* data of sensitivity, that is, space and time» (Panza, 2014, p. 39). Edmund Husserl, in 1913, started drawing a phenomenological approach to reality from which some authors like Henri Bergson, Martin Heiddeger and Dino Formaggio moved to demonstrate how the individual perception of time was influenced by the pure form of space. Topics such as duration, simultaneity, instantaneity, endurance and other kind of temporalities can be read as consequences of the spatial action on individuals, «once we have interiorized our own duration as motion in space» and «we naturally form the idea of instant, [...] as soon as we acquire the habit of converting time into space» (Bergson, 1965, pp. 52–52). According to Henri Bergson, space is an *a priori* datum filled with perceivable objects, while time is not pure form: pure duration «is given by the succession of our data of consciousness» (Bergson, 1889, p. 58) that we place side by side, arranging them spatially (Panza, 2014, p. 39).

Starting from these premises, it can be stated that spatialized time is the fourth dimension of space; this way, we encounter the territory of architecture, intended as a discipline concerned with the measurement and manipulation of space through design. Therefore, architecture is certainly focused on space, though the project of architecture works is bound to the temporal dimension, meeting various shades of construction phases, perceptive atmospheres, and subjective perception of time by the users. But the relationship between time and architecture today is affected by a crisis of definition «due to the acceleration of processes, the immateriality of the phenomena, and the simultaneous spread of information. The technical and technological acceleration that affects our living and contemporary interest, directed at the past interpreted as a heritage, decidedly emphasises the space-time ambiguity of events» (Faroldi, 2020, p. 20).

Since the research is interested in temporality in architecture and in the cause/effect dynamics of time and speed mutations in certain spaces, it is necessary to renounce the objective and external vision, promoted to conceive the questions that exist between this peculiar and interesting binomy of space and time and, necessarily, to come across the subjective dimension intrinsic to this issue. We will therefore proceed with the tracing of these effects, attributable to spatial forms of the architectural field or tangents to it.

2. Time and temporalities in architecture

The complex relationship between time and architectural design manifests itself in many ways, some of which are emblematic of how temporalities are part of the very concept of architecture. Moreover, in the sphere of design, further typologies of temporalities come into play; after all, projecting something into the future is a significant feature of design itself (Gregotti, 2020): «the central notion is that of design, therefore the action and transformation towards the future» (Ugo, 2007, p. 14). «The fundamental phenomenon of time is the future» (Heidegger, 1976, p. 40), and «the past does not exist. Everything is simultaneous in our life and culture. Only the present exists. In it we recreate the past and imagine the future» (Ponti, 1960, p. 79). In associating the notion of time with the discipline of architecture, we often resort to a schematism whereby the former pre-exists the latter, configuring itself as a kind of universal container within which facts, objects and buildings "happen". In fact, when we talk about time, we frequently think about its consequences on buildings (i.e. generating forms of decay), or how architecture reacts to its cyclical or linear flow - days and seasons, years and centuries - or how architects refer their work to the past. The history of architecture itself often shows some issues related to the schematism explained above, which sometimes move it away from a pure critical view (Ugo, 2007, pp. 16–18). But including the concepts of memory and tradition in the study of this subject, it becomes evident how - through the definition of some temporalities - history of architecture is not definable into a static system but resolves itself into a set of mutations which transforms a present into another one, allowing humans to assert their temporal presence by the natural settlement in space (Rogers & Molinari, 1958/1997, pp. 253–254).

In architecture, thinking about temporalities means also embracing a much broader sense of the concept of time, linked to the notions of space and figure. While space is often thought of as homogenous and external to us, «various qualities that make it perceptible to us are phenomena derived from the presence of a conscious body, such as directionality, envelopment, and orientation» (Judson, 2011, p. 38): as also Steven Holl wrote in his *Parallax*, the apparent horizon, formed by the superimposition of perspectives due to body movement, determines the interpretation of space (Holl, 2000, p. 26). The philosopher Dino Formaggio, in a series of talks given in a seminar at the Faculty of Architecture in Milan between 1985 and 1986 and collected in a 1990 publication entitled *Aesthetics, Time and Design*, demonstrates how architecture operates in perennial confrontation with the material body and time from three pragmatic figural experiences: the figure-image that destroys reified object boundaries, the figure-form that is transformative power, and the figure-matrix that marks the reference to the realm of symbolic archetypes and constitutes a kind of "matrix" for architecture (Panza, 2014, p. 41). To explain that time is not an entity innate to architectural works but, in some ways, undergoes an influence from them, it is necessary to reflect on the meaning of the concept of "place". «Architecture is constituted as a measuring element, capable of confronting itself with the landscape to the point of defining attributions of meaning; the "figure" [...] becomes an element of interpretation of the place» (Spagnolo et al., 2016, p. 177). It is therefore a dialectical game of construction of meanings: a place is born from the spatial interpretation of an anthropogeographic landscape (Gregotti, 1966/2014, p. 61) in which the human mind projects its own emotional and temporal dimension. Consequently, it appears clear how the concept of identity is

linked to the binomial space/temporalities, which is deeply rooted in the definition of places and territories.

Also, technology, as well as architectural composition, plays a key role in constituting the relationship between architecture and temporalities: consider, for example, the role of elevators in skyscrapers, which made architecture out of the simple multiplication of space in height, giving rise to what Rem Koolhaas calls «congestion culture» (Koolhaas, 2001/2004, p. 115). In this way «day and night are radically shortened, time accelerated, experience intensified, life - potentially - doubled, tripled…»: simultaneity is one of the main topics of this building typology, where different functional programs can coexist, giving birth to a kind of architecture which has, in addition to a spatial connotation, strong temporal features (Koolhaas, 2001/2004, pp. 183–200).

The architect's activity is mainly focused on the modification of space in function of living the places; however, as demonstrated above, a spatial design necessarily involves variations in temporality (and *vice versa*). Moving away from the scientific definition of time and space, the investigation continues with a reflection on their specific consequence: the perception of time *in* space.

3. Tools of architectural design in inner peripheries to operate on time by space

If space and time are correlated, then the manipulation of space - the subject of architectural design - necessarily affects the perception of time that determines places through the definition of identity, as previously written. But today, there are contexts that are experiencing a profound "identity crisis" due to processes related to depopulation phenomena: the inner peripheries, significantly distant from the centres of availability of essential services (Tognon & Bovati, 2022, p. 90). They are configured as an archipelago of small isolated centres with a predominantly mountainous or hilly landscape, an important historical-cultural heritage and relevant natural and environmental components. They present strong topics of criticality related to socio-economic opportunities, low levels of income and productivity, environmental and seismic risks, demographic ageing, depopulation and poor maintenance of buildings and landscape: aspects that determine a large number of discomforts and consequently lead individuals to accept a series of compromises to be inhabitants. The role of architectural research applied to design within the identity redefinition of places turns out to be fundamental, as it is the only discipline capable of manipulating space by fostering the projection of human emotions and perceptions that determine new temporalities. It is thus possible to identify architecture as the territory in which this relationship materialises.

After these premises, it becomes clear how necessary it is to reason about what can, in the architectural design field, simultaneously affect spatial conformation and temporal perception, thus conferring a precise identity to places. Light and shadow, transparency and opacity, sound and silence, solid and hollow (etc.) are the proper tools of architects' practice to determine different temporalities within spatial design, «space and time are […] objective quantities. In the heart of this relationship, the architect acquires an extraordinary awareness of the profound energy and opportunity to create time. Without being subject to it; rather, organising it, ordering it […]. The architecture of time becomes an indicator to define, implement, and design a space, since it is an element that possesses time connected to physiological rhythms of use.» (Faroldi, 2020, p. 14). By accepting this assumption, it is useful to investigate where and how those design tools are applied, through some renowned references placed in Italian inner peripheries, which can represent the capability of architecture to determine dilations, contractions or suspension in time perception.

Monumentality/dynamism

Starting from the history of graphic arts, spatial research began to assume the fourth dimension with the Cubist experience. The dynamism and immediacy promoted by the Modern Movement and certain avant-gardes (e.g. Cubism, Futurism, Russian Constructivism), subsequently led to the birth of an architectural language focused on geometrical interpenetration, through the use of diagonals, visual connections, and anisotropic compositions, capable of manipulating the user's perception. Moreover, history shows how political entities have used the monumentality of the classical lexicon to assert and establish an appearance of stability.

The power of dimensional features is evident in the design of stately buildings of the past, such as the Ducal Palace in Urbino, a Renaissance factory commissioned by Duke Federico da Montefeltro, who, with the design of his own residence and the urban redesign of public spaces and streets, wanted to make the entire environment "prince-sized." Today, observing the village from the valley, one perceives the representative role entrusted to architecture through its capability to define the figure of the city, an element common to some later experiences - from the American neo-Palladianism of the 18th century to the totalitarian architectural propaganda of the 20th century - with a shown communication in which the greatness of the buildings and monuments still suggests a sense of suspension in time and a sense of bewilderment in space, where people could feel overwhelmed in front of such majestic isotropic spaces (Gideon, 2004, pp. 420–439).

Light/dark

Some architectures were conceived and are generated by light. Gothic architecture, for instance, well experienced the use of candles and stained-glass windows to moderate and vary the perception of volumes of the built environment, in relation to the flowing of time. In this sense, the perceiver is fooled by the light coming through the colourful windows, constantly changing during the day.

The UNESCO World Heritage site Basilica of Saint Francis in Assisi is the church mother of the Order of Friars Minor Conventual, built in a village in central Italy. The XIII century basilica can be considered a landmark for the nar-

Figure 1. A sense of suspension in time. Laurana L., Ducal Palace, Urbino, 15th century a.D. - photo donated to the authors by Riccardo Abagnale

ration of the previously described hypothesis; indeed, it is a combination of two churches (known as the Upper Church and the Lower Church, plus a further crypt), where antithetical binomials of design tools converge. The case study, while externally showing a gabled facade, the interior of the upper Basilica is an important early example of the Italian Gothic style. This bright and spacious part of the basilica consists of a single nave with cross-vaulted ceiling, in which the transept and a polygonal apse displays a series of frescoes by Giotto. This place of collectivity, used to disseminate the contents of the Bible, the place where people could meet in their community, vibrant and dynamic, is characterised by a diffused clear light. On the contrary, entering the lower Basilica, a visitor immediately sees and perceives a different flowing of time. The Lower Church was built almost entirely in the Romanesque style: it has almost no elevation, vaults are widely decorated with dark/intense colours, and the use of light is significantly divergent from the upper level. It was designed as an enormous crypt with ribbed vaults, giving the experience of living in a sepulchre. Entering the lower basilica, one sees and perceives the function of a sepulchral church, in a more intimate atmosphere dedicated to personal meditation. Few openings, similar to embrasures, allow the visitor to perceive the space. Though this little presence of outdoor light could unveil the passing of time, the composition of the place in elevation together with the refraction of light on the vaults, alienate the presence of time from the visitor's perception, frozen in a continuous present, where time flows in a dilated dimension.

Rhythm/continuity

Rhythm is a concept that architectural and music composition have in common. In both cases, through a spatial arrangement of elements (whether musical notes or, for example, pillars) a perceptible temporal dimension is constituted: time compressions and dilations are possible by

Figure 2. A sense of dilatation of time. Basilica of Saint Francis in Assisi, 13th century a.D. - photo by Francesco Airoldi

increasing or decreasing the rhythm of the elements that constitute and characterise the space.

An example of the above can be sought in the Parish Church of Santa Maria Assunta in Riola, a project of Alvar Aalto located in the Apennines of Emilia, Italy. Due to the dynamism characteristic of the Modern Movement, the architect designed a system that communicates through the juxtaposition of elements, their rhythm, fragmentation, and verticality. From the outside, one perceives an orientation of the volumes given by the shape of the sails in the roof and the figure of the bell tower, which induce the observer to move in space and orient the gaze in a precise direction. Inside the hall, on the other hand, space is manipulated by bringing about time compression in two different ways: through the rhythm of the portal structures transverse to the nave and through the inclination of the walls, drawing an optical cone in the direction of the altar and increasing visual depth, imparting an acceleration to the perception of the space-time system.

4. An example of output: some possibilities in fragile contexts

While it is true that the gap between urbanised and marginal territories continues to persist, it is equally clear that the latter are no longer considered only as a problem but also as an opportunity for the future: a new and different perception that stems from phenomena such as the crisis of cities and the development model they embody, the importance of issues related to territorial security, and a profound cultural change resulting from a substantial «inversion of the critical gaze» that needs to be leveraged by applying a clear methodology to architectural-design research (De Rossi, 2018, p. 5). It is possible to construct a narrative that emphasises and enhances the fragmented and plural nature of the Italian territory, associating the concept of "social marginality" with that of "territorial marginality" and thus giving a strong spatial and temporal connotation to the themes of internal areas (Llop Torné, 2022, p. 18). In a context in which depopulation and abandonment are the most consistent socio-demographic phenomena, it is evident how the issue of living should enjoy privileged attention, and how co-living in coexistence with nature is a determining aspect there. If we conceive architecture as a possible answer to the problem of inhabiting space (in time) - an assumption that constitutes one of the important definitions of this discipline (Gregotti, 1966/2014, p. 45) - the strong relationship that exists between architectural design and the social, economic and cultural dynamics that it can trigger becomes evident. Dynamics which are crucial to re-establish a co-evolutionary and co-existential connection between peoples and territories, bringing the inhabitants back to be an integral and characterising part of it: that is, to reconstitute communities capable of projecting their own habits, customs and ideas into space, making it a place (Galán Fernández et al., 2022, p. 59).

Figure 3. A sense of compression of time. Aalto A., Parish Church of St. Mary of the Assumption in Riola, 1966-1978 - photo by Francesco Airoldi

Acknowledging that architectural design is a modification of time, and not just of space, suggests architects to apply time-based design strategies tailored to the needs that the 21st century dynamic and unstable context requires. All the more so, in a significantly sensitive field such as the fragile territories of inner areas, great attention must be paid to spatial, temporal and perceptual issues, juxtaposing architectural design themes with two particular visions that contribute to redefining places through the attribution of new identity connotations: one linked to the perception of present time and one to the ideas of past and future which territories embody.

First, it is clear how in sites far from the hustle and bustle of metropolises and the dynamism associated with certain architecture and urban conformations, there is often a perception of a present time that flows slowly, defining different social and cultural dynamics. One of the most obvious forms in which spatial variations influence the passage of time is in fact the morphology of the territory: it establishes additional levels of complexity at a larger scale and expands the theme of the research by introducing temporal distances alongside spatial ones. Adopting an effective design methodology in relation to morphological temporalities means acting on altitudes and infrastructures by communicating - through the project - with the ground line and with the concepts of flows and accessibility.

Second, regarding the concepts of past and future, it is crucial to remember that in a built environment the concentration of significant elements from different eras produces a heterogeneous landscape that the human mind considers rich, representative of the villages and towns of Italy's inner peripheries. The importance of this combination is evident both in cases of conservation and reuse projects of existing buildings in established fabrics and in reconstruction situations in areas affected by natural disasters such as earthquakes and landslides (one of the recurring themes in the study of inner territories). Environmental transformations often show people's efforts to preserve,

create or destroy the past, to make sense out of a rapid transition, or to build a secure sense of the future (Lynch, 1976, p. 3). It happens that the quality of the personal image of past and future time influences individual well-being and also our success in dealing with environmental changes, and «the external physical environment plays a role in constructing and sustaining that image of time» (Lynch, 1976, p. 1). However, our strongest emotions relate to personal knowledge, confirming that immediate continuity and individual memory are emotionally more important than remote time. In fact, our minds cannot retain everything: memories are the result of a process of selection and organisation in which we retain what is considered significant and discard what is not.

Dilations, contractions or suspensions in the perception of time, as discussed in the previous paragraphs, thus become effective design actions in the constitution of the identity of places by means of architecture. There is therefore the possibility of a shift in the meaning of territories in places through the projection in them of individual emotions that arise from the temporal perception of well-designed spaces. This awareness represents a fundamental step towards the goal of re-inhabiting internal areas, as it demonstrates the possibility of influencing the idea and image that they project in our minds.

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ArchiDOCT 19, 11 (1) TEMPORALITIES ii

Sensing Time: Temporality in the Design of Buildings and Open Spaces

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Keywords: multi-sensory perception, spatialized time, buildings, open spaces, phenomenology

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The article proposes a framework to compare and contrast the design of buildings and open spaces across the dimension of temporality. We consider the past, present, and future of the designed environment as well as the temporal experiences of dwelling therein. This exploration relates space and time through the lens of human perception, applying phenomenology to the analysis of designed environments. The paper considers four constructs of time: seasonal and daily cycles, one moment to the next, growth and aging, and the historic continuum. We construct our spatialized experience of time in terms of years and days, with seasonal and diurnal cycles characterized by distinctive differences in sensory input. In the moment, our bodies mark time through movement, including observation of dynamic elements of the environment and kinesthetic perception of our own progress around and through places. We directly experience extended time in places as a process of growth and aging. In the longer term, we consider places to be of their time and carrying with them a cultural reference to their locus in history. Visiting historic sites can take us back in time to vicariously experience the memories embodied in place. We conclude with the insight that phenomena that stimulate our experience of temporality may be present in buildings and open spaces alike. Exposure to nature is the key factor in situating oneself in diurnal and seasonal cycles. Designers of buildings and open spaces may intensify or diminish encounters of materials and occupants with nature in ways that promote or deny our spatialized experience of time. Embodied kinesthetic experience along with visual and auditory perception is key to understanding time through movement in space. Designers of buildings and open spaces can accentuate human awareness of marking time by selecting materials and articulating elements that stimulate multi-sensory perception of the body's movement in space.

1. Introduction

> *We have a mental need to grasp that we are rooted in the continuity of time and in the man-made world it is the task of architecture to facilitate this experience. Architecture domesticates limitless space and enables us to inhabit it, but it should likewise domesticate endless time and enable us to inhabit the continuum of time.* (Pallasmaa, 2005, p. 32)

The purpose of this paper is to propose a framework for comparing and contrasting the design of buildings and open spaces across the dimension of temporality. We consider the past, present, and future of the designed environment as well as the temporal experiences of dwelling therein. This exploration relates space and time through the lens of human perception. Or, to turn it around, we could say that our experience of time is mediated through our experience in space. We are interested in sensory intensification (Papale et al., 2016) of the experience of time in space. For an analytical method we turn to phenomenology, a philosophy that deals with human sensory experience of the physical world and constructing meaning from

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that experience. We are concerned with the relationship of people to place, as Heidegger (1996) termed it *dasein*, or being-in-the-world, a richly complex concept of existence which we might, for our present purpose, translate directly from the German as being there. Christian Norberg-Schulz (1979) applied Heidegger's concepts to place in *Genius Loci: towards a phenomenology of architecture*. We seek to provide a framework for considering the phenomena of spatialized time. Norberg-Schulz considers the spirit of a place over time in terms of constancy or loss. Kevin Lynch (1976) developed aspects of this relationship between place and time in *What Time is This Place*? In the classic text, Space, Time, and Architecture, Siegfried Giedeon (1941) situated architecture in an historic continuum. In this brief paper we examine spatialized time more broadly, exploring the variety of ways in which people do and do not sense and experience time in the constructed environments of buildings and open spaces. We ask in what ways people perceive and understand spaces as static or dynamic places. David Seamon (2000) offers a valuable overview of scholarship developing the phenomenological approach to environmental and architectural questions. We rely upon the work of scholars who built the case for multi-sensory perception as key to our experience of space and place (Bachelard, 1964; Merleau-Ponty, 2013; Norberg-Schulz, 1979; Pallasmaa, 2005; Rasmussen, 1964). A full consideration of this topic would require considerably more time and space than we have here. Our aim is merely to illuminate the questions by situating them in two different but related types of designed environments - buildings and open spaces.

2. Frames of reference

We construct our spatialized experience of time in terms of years and days, with seasonal and diurnal cycles characterized by distinctive differences in sensory input. For example, in climates marked by seasonal variation, we experience autumn visually in the changing hues of leaves, aurally and haptically in the crunch of leaves underfoot, in the smell of decaying leaves, in the feeling of cool breezes tempered by warm sunlight. Over the course of a day, we perceive the visual change from darkness to light and back to darkness, often accompanied by thermal change from cooler to warmer to cooler. Changing sun direction and angle provide a richly varying experience of place as different spaces are sequentially characterized by light, shadow, warming, and cooling.

In the moment, our bodies mark time through movement, including observation of dynamic elements of the environment and kinesthetic perception of our own progress around and through places. For example, we watch and listen as the *sōzu* fountain in a Japanese garden marks time visually and aurally with the clack of dropping bamboo tube and gush of water. In a rhythmically designed environment, such as an arcade, we hear and feel our own footfalls on the pavement, hear and feel the constriction of space under the arches, see the change from light to dark as we pass behind columns, feel the thermal change as we move from sunlight into shadow and back again.

In the longer term, we consider places to be of their time, existing on a historic continuum, and carrying with them a cultural reference to their era. This experience is typically constructed through our understanding of style as a marker for time. Visiting historic sites can take us back in time to vicariously experience the memories embodied in place. For example, a visit to an historic prison affords an experience in a constricted cell evoking the horrors of incarceration. Historic preservation, conservation, and adaptive reuse are all processes that require careful consideration of how people experience time and change over time in place.

We directly experience extended time in places as a process of growth and aging. We experience growth through the life cycles of the plant materials of our open spaces, processes typically related to seasonal cycles. For example, trees grow over years and sometimes centuries, marking their age with annual rings. Other plants emerge from the earth in Spring, grow and flower in Summer, die back in Autumn, and hide under earth and snow in winter. We experience the aging of places through the processes of use and weathering. For example, we see and feel changes due to human use over time in stone steps that acquire the imprint of generations of feet moving up and down. We see an example of weathering in the houses of Nantucket, clad in cedar shingles whose initial golden glow deepens to grey over time. We can view maintenance of buildings and open spaces as a form of resistance to the effects of time.

3. Cyclical time

Open spaces necessarily afford direct experience of seasonality and the dynamic of seasonal change. A visit to an open space stimulates multi-sensory perceptions including sights, smells, sounds, and haptic touch of seasonal markers including ambient temperatures, wind, breezes, sunshine, moonlight, shade and shadow, humidity, rainfall, snow, ice, flowing water, thawing earth, decomposing leaves, blooming flowers, newly mown grass, falling leaves, migrating birds, etc. Successive visits over the course of a year reveal the seasonal cycle of the place. The design process offers opportunities to accentuate our experiences of seasonality or defy our expectations. For example, the Herbaceous Border at Beatrice Farrand's Dumbarton Oaks Garden is designed with plants that bloom sequentially from Spring through Autumn, deepening our experience of change across those seasons. The Pebble Garden, on the other hand, mitigates the day-to-day changes with more hardscape than plant materials, walls to shelter from wind, and masonry to store sunshine for radiant warmth on chilly days.

Buildings span the spectrum from affording rich experiences of seasonal change to shielding occupants from awareness of seasonality. The glazed corridor of Glenstone Museum, designed by Thomas Pfifer, wraps around a water garden, immersing visitors in a vivid display of seasonal change as the water plants grow, flower, change color, and die back throughout the year.

A typical office building, however, denies seasonality, restricting temperature and humidity variations within strict parameters and suffusing the interior with constant levels

Figure 1. A glass-walled corridor wraps the water courtyard at Thomas Phifer's Glenstone Museum in Maryland, making seasonal change part of the visitor experience. Photo by author.

of ambient light. The only information about season comes from views out the perimeter windows; tightly controlled interior spaces lack seasonal indicators.

Office buildings' environmental controls also mask sensations of the diurnal cycle such as chilly mornings, warming afternoons, and cooling evenings. Window views afford the only information about time of day. While buildings require light, artificial sources can do the work of illumination without incurring the warming effects of sunlight. Constant lighting levels deny occupants the understanding of time that comes from viewing sunrise, observing and feeling changes in sun angle and direction throughout the day, viewing sunset, moonrise, and moonset.

Open spaces, on the other hand, require sunlight for photosynthesis, the process that converts light, oxygen, and water into energy required for growth and blooming. Open spaces necessarily attune visitors to the diurnal cycle, where sunrise, sunset, changing position of the sun in the sky, and shifting light quality signal time of day.

Water, too, can be a marker for diurnal cycles, when tide plays a role in the environment. While the tide is generally a phenomenon of open spaces, we can experience it indoors at the Querini Stampalia Foundation in Venice, renovated by Carlo Scarpa. A stone stairway leading from the water gate to the primary level marks a daily cycle as rising and falling tides advance and recede on the steps.

We are attuned to cycles of the seasons and days through our perceptions of nature. Outdoor spaces necessarily situate us in nature; by their design they may intensify our experience of time by providing rich multisensory information to mark seasonal and diurnal cycles. Buildings may be designed to afford or deny experience of passing time. Designers of buildings and open spaces alike can create spaces to connect their occupants to aspects of nature that situate us in time, mark the passage of time, and celebrate moments in time. Windows, thresholds, indoor/outdoor spaces, seasonal elements such as inglenook, grotto, porch, terrace, pergola, planting bed, green wall and roof, pool, and fountain are examples of designers' tools for leveraging multi-sensory perceptions of nature to powerfully connect people to the flow of days and seasons.

4. Movement and time

Buildings and open spaces embody time and afford us embodied experiences of time through the kinesthetic sense that tracks body position and movement. Our bodies respond to rhythmic design of buildings and places (paving, steps, colonnades, *allées* of trees, lighting, etc.) that mark

time for us. Regular rhythms make our footfalls function like a metronome beating out a tempo that we can experience with our eyes, ears, and bodies. Changes in rhythm slow us down or speed us up, heightening our awareness of time in space. The elements of buildings and open spaces can work like choreography, directing us to enter, move directionally and rhythmically through space, change tempo, reorient, ascend, descend, move individually, come together, and finally exit, experiencing the journey through space in a kinesthetic sense. Acoustic properties of paving and enclosures can stimulate our sense of sound as we hear our movement through space and time. Buildings and open spaces can be designed to intensify our experience of time through visual, auditory, haptic, and kinesthetic perception. This is easier in the design of built environments, where a higher degree of enclosure offers greater control of human experience within. In open spaces, it is necessary to accentuate in order to achieve a high level of multi-sensory input. Pallasmaa (2005) argues against ocularcentrism, making the case for richer experience through multi-sensory perception of places. It is important to stress here that the design of buildings and open spaces alike can stimulate kinesthetic perception to afford the experience of time to occupants without vision or hearing.

5. History and memory

Buildings and open spaces can take us on time travels. For example, sensory perceptions of descent, constricted space, material coldness, and darkness in Daniel Liebeskind's Jewish Museum in Berlin evoke physical feelings of terror experienced by holocaust victims, thrusting visitors back to the time of World War II. The architecture embodies the experience of the people it memorializes and transfers understanding of that historic experience through sight, sound, smell, touch, and kinesthetic perceptions of the space. While other parts of the museum function as containers of historic objects and contexts for understanding the meaning of those pieces, this area communicates history through embodied experience.

At Caples Jefferson Architects' Weeksville Heritage Center in Brooklyn, New York, crossing the open space between old and new building gives visitors the experience of time travel from the contemporary city back to the African American community founded along a Native American road. In the ghost landscape of the site, road emerges from plant growth, vanishes, and reappears, intensifying the experience of moving between present and past with the heightened awareness of the changing feel of the land as layers of roadbuilding and agriculture reveal themselves over time. When you leave behind the modern city streets to enter Weeksville Heritage Center, you feel the atmosphere change. The noise of cars recedes, and birdsong rises, the smell of pavement gives way to scents of plants and earth, and the unyielding surfaces of concrete and asphalt change to dirt and plants, transporting the visitor back to the area's agricultural past. For city kids, this is a place to immerse in the unfamiliar sights, sounds, smells, and feel of a way of life experienced onsite by long-ago children. Visitors enter along a passageway marked by shadows that evoke African patterns. Returning from their time travels across the site, visitors are brought back to present time as they observe how the shadows' positions changed over the duration of their visit. The new building, too, has become part of the history of the site, with its wooden exterior weathering over its nine-year life span to a quiet grey that takes a supporting role to the painted historic structure. At the Weeksville Heritage Center, the architects told stories of change in context, use, and inhabitants over time as they engaged questions of conservation, preservation, and adaptive reuse.

6. Growth and aging

A building, the ultimate result of architectural design, is completed at a discrete point in time. It opens fully formed, ready for its work to begin. A designed open space, on the other hand, embodies the promise of its future. From its opening day onwards, a designed landscape is characterized by growth and change, in response to human use, nurture, and natural processes over time. Both building and landscape are complex systems with interrelated parts. Building systems tend towards stasis, with movement of building parts occurring within tightly controlled boundaries, often hidden from view in locations such as mechanical rooms. Landscape systems tend towards dynamism, characterized by active processes such as plant growth, water movement, weathering, and habitation by humans and other species. Buildings are typically designed to resist the impacts of use and environmental processes. An exception is the use of building materials such as copper or cedar that weather over time, developing a blue patina (copper) or darkening to grey (cedar). Building maintenance is typically directed towards resisting and reversing effects of use and weathering. Open spaces also require constant maintenance, which may foster our understanding of change over time by revealing processes of growth, maturation, aging, and death or, on the other hand, may seek to minimize effects of time by maintaining the place in a state of arrested development. For example, mowing grass produces a constant appearance over seasons and years. Trees, however, defy human attempts at control.

When buildings are designed to emulate open spaces, they, too, can offer visual cues to passing time. For example, Dominique Perrault's Ewha Womans University blurs the boundaries between architecture and landscape, tucking built form underneath campus open spaces and rendering open space as built form through the use of architectonic materials. As a result, the building participates in seasonal cycles and the longer-term natural cycle of growth, maturation, aging, and death.

7. Comparing and contrasting human perception and experience in buildings and open spaces

We began by considering buildings and open spaces as essentially different settings for human activity, but it is more useful to consider a continuum between exteriority and interiority (Bartorila & Loredo-Cansino, 2021). With phenomenology as our lens, we have proposed a framework

Figure 2. The journey across the rooftop of Antonio Gaudi's Casa Milà is choreographed to involve visitors' eyes, ears, and bodies in marking time as they progress through space. Photo by author.

for understanding how designers of buildings and open spaces can stimulate the senses to situate people in time as they move through space and over days, seasons, and years, making experience of the designed environment richer and accessible to differently abled participants.

Diurnal and seasonal cycles, important indicators of temporal flow, are experienced through multi-sensory perceptions of natural phenomena. Open spaces offer easy access to aspects of nature that signal seasonal and daily cycles. Designers can accentuate these phenomena in the planning of outdoor places to deepen human experience of temporality. Selection of elements and juxtapositions can intensify visual, auditory, olfactory, and haptic perception of change, heightening awareness of time in place and one's place within time. The design of buildings requires even more intentionality to connect those who dwell within to the cycles of days and seasons that situate them within the flow of time because enclosure and mechanical environmental controls and lighting systems tend to suppress building dwellers' awareness of natural phenomena. A variety of design strategies can counteract these tendencies. Opening to nature with elements such as windows, skylights, clerestories, doors, porches, terraces, courtyards and bringing nature in with elements such as green walls, pools, fountains, and fireplaces can connect occupants with sights, sounds, smells, and feelings of seasonality. Incorpo-

Figure 3. The passageway with its spatial compression, descent into darkness, and cold, rough materiality evokes terror and foreboding, transporting visitors back to the time of the Holocaust.

rating passive environmental systems for lighting, shading, heating, cooling, and ventilating can provide sensory experience of time of day and season; involving occupants in opening or closing shades and windows for natural lighting, shading, warming, or cooling, the haptic experience of touching and manipulating elements of building enclosure add to the changing appearance and sensations of light, warmth, coolness, and breeze to intensify awareness of change over the course of the day.

Buildings and open spaces alike can be designed to intensify or suppress our experience of passing time in the moment. Whether in buildings or open spaces, spatialized time can be understood by analogy to music and dance, through rhythm and tempo of footfalls. Whether walking or wheeling through a space, rhythmic markers such as colonnades, pergolas, *allées* of trees, paving patterns, and alternating swathes of light and shade can address senses of sight, sound, and touch to connect time to movement through space. When designers consider how occupants experience the journey through a building or open space, with its side trips along the way, opportunities open to heighten awareness of time as well as space in indoor and outdoor environments.

Historic time can be understood by conservation, preservation, and adaptive reuse of buildings and open spaces and the design of memorials in ways that evoke past times

Figure 4. Passageway at Caples Jefferson Architects' Weeksville Heritage Center. Photo by Nic Lehoux for Caples Jefferson Architects.

through all the senses, transporting us through sights, sounds, smells, touch, and embodied experience of place in other times. It is important to consider that we may be transformed into different personas as we travel through time to experience multiple simultaneous realities.

The category of growth and aging is where we note the greatest difference between the expression of time in buildings and open spaces. Where buildings are typically designed to resist destructive processes such as rain, wind, cycles of expansion and contraction, effects of these natural processes on open spaces are inevitable. Designers of buildings may elect to express some of these phenomena, for example by selecting materials that change color as they weather. Designers of open spaces must make a choice between maintaining spaces in a manner that denies change or embracing changes as an intrinsic aspect that situates place in time.

The author hopes that this framework will be useful to designers of buildings and open spaces as well as to critics of the designed environment as they consider how multisensory experience of time can enrich place for people of varying ages and abilities.

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ArchiDOCT 19, 11 (1) TEMPORALITIES ii

Urban Restructuring of Agricultural Productive Models in Hydrographic Basins Under Water stress. the Case of the Nazas and Aguanaval Rivers

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Keywords: Stream restoration, water urbanism, hydrographic basin, water stress, urban restructuring

archiDOCT

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The history of a town is often the history of its water. Managing and distributing water resources makes a huge impact on the transformation of the territory, even more so in contexts where water scarcity is increasing, either due to site specific geographic conditions, production dynamics or the effects of climate change. The urban and rural cores within the limits of the hydrographic basins introduce alterations to the hydric dynamics through logics of occupation and growth on the territory, and by the interaction of its pieces with the hydrological infrastructure. These logics are configured in a determined space-time, coexist in their current form and as a sequel to the territorial present. It is through temporality that they can be understood to determine their future in the urban-water system.

Fluvial restoration and urban planning must have a boundary-driven, multi-scope approach: on the flows of the productive territory, the large agricultural areas, and the hydrological infrastructure. Dams, wells and canals must be fundamental elements in the restructuring. This article presents the case of the Nazas-Aguanaval hydrographic region. One of the main objectives of this research is to identify the agro-productive models of the basin and its dynamics with the hydrological infrastructure.

The article shows that the water stabilization of the region depends on the urban restructuring of all its populations and its synergies with agro-productive processes, through the analysis of its logics sustained and modified over time. Temporality as a structural tool for analysis is essential to develop fluvial restoration strategies in basins under hydric stress.

a I am architect an town planner, and professor at the Architecture School in Barcelona (ETSAB), in the Urbanism and Regional Planning Department, from 1996. The doctoral thesis “A rediscovered urban experience. Garden Communities in Catalunya” obtained the qualification of Excellent Laude, and also obtained the Extraordinary Doctorate Award of the UPC, which resulted in the publication of the work in a book. The line of research on low-density residency allowed me to deepen my research and the publication of some articles in different indexed journals, and also encouraged my first active participation in a consolidated R+D project on the rehabilitation of monofunctional residential areas, and specifically urbanizations. During this period of intense research, I gave lectures on low-density residency in different countries, including Brazil (Goiânia), Venice, Lisbon, Holland and Mexico. Since 2012 I am part of the Urban Planning Research Group (GRU), a consolidated research group of the Generalitat de Catalunya.
During the last four years I have led a line of research on repopulation and rural development that aims to seek a necessary territorial rebalancing of human settlements and the revitalization of the territory. The period of confinement derived from COVID has generated pressure on rural land, and it is necessary to take advantage of this trend to revitalize the territories and boost their economy, take advantage of the environmental asset and improve the social conditions of rural communities. I have carried out numerous workshops and subjects on rural repopulation, and I have recently led the strategic plan for rural revitalization in Central Catalonia. From the Department of Urbanism and Regional Planning of the ETSAB I’m carrying out numerous research studies on this topic, and several exhibitions have been held on this topic.
In parallel to this line of work, my concern about teaching architecture and improving the learning of university students gradually opened up a new field of research. In order to provide a more solid structure to this concern, in 2012 I founded, together with two colleagues, the new GILDA research group, “Group for Innovation and Teaching Logistics in Architecture”, of which I am director, and is considered an emerging group by the UPC. At the same time, the position of Head of Studies of the ETSAB during 2014-2018 has allowed me to know the real possibilities of the implementation of teaching methodologies in undergraduate courses and to obtain some experiences that have contributed to improving teaching in the following years.
The teaching innovation also involved the participation as PI of the ETSAB in the international project Erasmus+ “Confronting Wicked Problems. Adapting Architectural Education to the New Situation in Europe”, developed between 2015 and 2017, with the participation of different European schools in research on the relationship between university teaching and professional activity, which has resulted in the preparation of a document of criteria that I directed.

1. Introduction

In Mexico, high rates of hydric stress are observed in certain hydrographic basins due to the intense degree of pressure exerted on surface waters in conjunction with the contamination of aquifers. This is a consequence of the low integration of productive processes with the ecosystem, which finally causes alterations in the hydrological cycle. This phenomenon is more evident in mono-productive communities of agricultural and/or extractive scenarios.

In particular, central and northwestern Mexico present a high degree of pressure on water resources. These regions use up to 40% of the available renewable water in the basin for agricultural production. In these areas, in addition to finding kilometers of irrigation canals woven between the agricultural fields that also cross the urban fabric, there are large dams for storage and distribution of water in order to serve the agricultural cycles of the irrigation districts. According to the estimates of the Food and Agriculture Organization (FAO, 2011) Mexico ranks 7th in the world classification of countries with the highest water extraction and percentage of agricultural use with a total of 87,84 thousand million m^3/year. Of this total, 76% is used for agricultural activities (CONAGUA, 2018). According to the projections of the World Water Assessment Program (WWAP) of UNESCO, by the year 2050, agricultural activity will need to increase its production by 60% globally. Developing countries will need to increase production by 100%.

Consequently, the values of virtual water for basic products suggest that the hydrographic basins should be protected and the communities within their limits restructured to safeguard the hydrological cycle. These values include: 15.415 liters needed to produce 1 kilogram of beef, 1.222 liters per kilogram of corn, and 1.000 liters of water needed to procure 1 liter of milk (Arreguín Cortés et al., 2007; CONAGUA, 2018).

By determining water as the guiding axis of urban narrative, this research leans towards a water efficient urbanism. To generate urban proposals compatible with basin restoration, it is necessary to analyze the structure of the territory in all its components. In this field of territorial vision, the contributions of Xabier Eizaguirre (1990; 2019) are a valuable theoretical core, as well as the contributions of Solà-Morales (1973; Manuel Solà-Morales, 1989) and Giuseppe Dematteis (2004). But also, practical approaches in the Mexican context, such as the efforts of Mario Schjetnan (2020) to value the roots of agricultural landscape and more specific analysis such as: Chairez Araiza (2005) in studying the impact of river regulation in the Laguna region. The objective is to combine the cartographic information available on indicators of water quality, degree of pressure on water resources, and agricultural production surfaces, with urban morphological information within the limits of the hydrographic basins, to build hydric-urban indicators and by them generate restructuring strategies for hydro-agricultural infrastructure and urban restructuring plans. The foregoing, to reformulate the agricultural mono-productive models present in the basins under hydric stress, in models that contribute to the objectives of hydric stabilization.

Theoretical approaches to urban planning through the use of the hydrographic basin as a unit of urban analysis are in constant evolution. Regarding analysis and management, the next publications can be cited: (Dourojeanni et al., 2002), (Pallarés Serrano, 2007. From an instrumental view: (Leopold, 1968), (Hernández-Tapia, 2017), (Acosta et al., 2015), (Rotger, 2019), (Suárez López et al., 2014), (Duque & Echeverry, 2015), (Gómez et al., 2011). Also in the urban environment, there are approximations of a more epistemological order such as: (Vian et al., 2020), (Domínguez Serrano, 2013), (Escudé, 2010).

2. Hydrological Region 36, Irrigation District 017 and Irrigation Units

Hydrological region 36[1] is composed by 5 main basins subdivided into 33 sub-basins (Table.01). Together, they contain an area of 90,634.65 km^2, in a perimeter of 3,312.43 km^2. A total of 1.125 towns are located on this area, of which 1.058 are rural and 67 are urban.[2] The sub-basin is the minimum unit of geospatial information provided by CONAGUA,[3] falling outside smaller units such as the micro-basin or the urban basin. The RH36 contains the defined[4] limits of 27 aquifers, of which 9 are overexploited. They are those located in the Laguna region where the largest amount of population in the hydrographic region is concentrated.

The hydrographic system contains the Nazas and Aguanaval rivers. Both endorheic[5] channels flow into the lowlands of the hydrological region where a set of lagoons were once located, now dried up, including the Mayran lagoon (Nazas river) and the Viesca lagoon (Aguanaval river). The lower zone of RH36 lacks a constant flow in the natural courses of the Nazas and Aguanaval rivers, due to the effects of climate change, but mainly due to the construction

1 The hydrographic basins in Mexico (757) are organized into 37 hydrological regions (RH), these regions represent 13 administrative hydrological regions (RHA) (CONAGUA, 2018, p. 30). In this research, the RH is the study area limit because contains units defined by geographic relief and not by political-administrative boundaries such as the RH.

2 In Mexico, the distinction between a rural and an urban town is made by its population size. This indicator, defined by the National Institute of Statistics and Geography of Mexico, specifies that any community with more than 2,500 inhabitants is urban.

3 National Water Commission. Mexico.

4 The limits of the aquifers identified by CONAGUA do not coincide entirely with the limits of the hydrographic basins, however, they are close, making it possible to group them within the hydrographic region.

5 Is a closed basin that drains internally into lakes or swamps. An exorheic basin drains to a river or the ocean.

of hydro-agricultural infrastructure between the decades of 1940-1970, through the incorporation of dams and irrigation canals. The hydro-agricultural infrastructure serves irrigation district 017,[6] located in the RHA Laguna Region VII, which extends over 71.964 has, 49.835 are irrigated with surface water, the rest with groundwater (CONAGUA, 2018, p. 288). Additionally, irrigation units[7] (UR) with a planted area of 295.723 has are added to this irrigated area. Paradoxically, despite the large amounts of water needed to produce milk, beef, or crops to feed cattle, the Laguna region is a large producer of dairy products and derivatives, dominant in Mexico and the American continent. This mono-productive cycle transforms the water resources of the RH36 into export products, compromising the return of the water in the basin to its natural cycle.

The environmental problems of RH36 and DR017 are linked to poor management of water resources at the basin level. In addition to the scarcity of water in the Nazas and Aguanaval riverbeds in the lower basin, the aquifers have been at extreme levels of exploitation for decades that exceed recharge capacities due to the intensification of the pumping volume. The low availability of surface water is concentrated in 75% for small owners and 25% for ejido[8] communities (Cruz & Levine, 1998, p. 23). Under these circumstances, the rural-agricultural and urban-agricultural model of the region, (both of the mono-productive order) cause unsustainable stress for the hydrographic region. It is necessary to establish water balance strategies by reordering their models.

3. Method

Integration of geospatial data with hydric information

Through GIS (Geographic Information System), the main vector data of water quality indicators and the degree of pressure on water resources provided by the SINA[9] are integrated. The superposition and geolocation of these indicators facilitates the observation of basins with high values of hydric stress in their geographical limits. The incorporated data for reading the hydric alterations in the hydrographic basins are listed in Figure 1.

Additionally, the analysis of water quality indicators is complemented by the publications: *Estadísticas del agua en México 2018* and *Atlas del agua en México 2018* in order to obtain a holistic view of the state of surface and groundwater.

Construction of hydric-urban cartography

To build hydro-urban cartographic information compatible with the geospatial data of the hydrographic basins, and the available cultivation surfaces in the Mexican territory, an organization and hierarchy of the information layers is carried out with the help of GIS software, using a multi-scale approach from the geographic to the urban scale. Geostatistical data in vector format provided by INEGI, RAN[10] and SINA are used. The information used is listed in Figure 2.

Building footprint data generation

In Mexico, building footprint vector data is not accessible on the INEGI open data system. At the cadastral level, cartographic information is decentralized,[11] and consequently depends on state and municipal administrations. In the RH36, the geospatial data of the buildings is not available in the majority of the cadastral institutes of the urban localities, nor in the rural communities of the basin. The efforts of the cadastral institutes are concentrated on homologating maps in raster format and do not have cartographic databases under an open data standard.[12] For this reason, for a morphological analysis of all the towns of the basin it is necessary to generate the building information.

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6 *"The DR are irrigation projects developed by the Federal government since 1926, the year the National Irrigation Commission was created, and include various projects, such as storage vessels, direct diversions, pumping plants, wells, canals and roads, among others. To date there are 86 DR" (CONAGUA, 2018, p. 107).*

7 *"URs are agricultural areas with infrastructure and irrigation systems that are different from the irrigation districts and generally have a smaller area. They can be integrated by user associations or other figures of organized producers, who associate with each other to provide the irrigation service with autonomous management systems and operate the hydraulic infrastructure works for the collection, derivation, conduction, regulation and distribution and eviction of national waters destined for agricultural irrigation (CONAGUA, 2018, p. 110).*

8 Developed with the agrarian reform and the agrarian law from 1915, is a type of land demarcation in Mexico. The organization of the ejido is a structure of collective land, undivided and without the possibility of being sold or inherited.

9 National Water Information System of Mexico.

10 National Agrarian Registry. Mexico.

11 *"The different levels of knowledge of the staff of each institution, the unequal allocation of resources, the different purposes of each responsible institution, changes in government administrations, among other situations, have motivated each agency to establish its own rules for the recruitment, generation, integration and dissemination of cadastral information that is within its competence, thereby implying that there is heterogeneous cadastral information, which makes its integration and exchange difficult" (INEGI, 2015a, p. 1)*

12 *"There are municipalities that do not know their information in detail, do not have cadastral administrative records and do not safeguard and/or document their activities with the level of detail that allows composing a cadastral trend or structure at the national level" (INEGI, 2015b, p. 10)*

Indicator	Justification
1. Percentage of degree of pressure in the hydrological-administrative regions 1:250,000	Necessary to identify water contamination in the urban fabric and rural towns.
2. Vector data hydrological regions limits 1:250 000	To identify administrative boundaries of water management.
3. Biochemical Oxygen Demand Indicator (BOD5) 1:250,000	Decrease in dissolved oxygen content in water bodies with municipal discharge, direct impact on aquatic ecosystems. Necessary to determine contamination points in specific areas.
4. Chemical Oxygen Demand Indicator (COD) 1:250,000	increase in the COD values indicates the presence of substances from non-municipal discharges. Important indicator to address industrial contamination areas.
5. Total Suspended Solids Indicator (TSS) 1:250,000	Number of settleable solids, solids and organic matter in suspension, originated by water waste and soil erosion. Necessary to recognize deficient water treatment areas and drought.
6. Fecal Coliform Indicator (CF) 1:250,000	Indicates the concentration of water waste from municipal discharges Necessary to recognize deficient water treatment areas and drought.
7. Total Dissolved Solids Indicator (TDS) 1:250,000	Indicator of the level of salinization in aquifers. useful to recognize underground water contamination.

Figure 1. SINA (Water Quality)

Source: Author. Information from: CONAGUA (2018).

INEGI	
1. Vector data sets space maps 1:20 000	Blocks, streets in vector format
2. National compilation of the 5 updated topographic information layers 1:50,000. Series III 2013-2018	Blocks, streets and open spaces in vector format
3. Topographic information 1:250,000	For evaluation of water discharge
4. Geostatistical framework, population and housing census 2020	Water usage information per capita
6. Hydrographic Network 1:50,000	Main vectors to generate Strahler order
7. Geostatistical Framework[11], December 2021	Water usage information per capita
8. Mexican Elevations Continuum 3.0 (CEM 3.0)	For evaluation of water discharge
RAN	
1. Perimeters of certified agrarian cores	Surface limits of main agricultural communities
2. Cropland areas	Agricultural surfaces per RHA
SINA	
1. Basin system 2019	Basin, sub-basin structure
2. Basin availability 1:250,000	Indicator of water availability per basin
3. Condition of aquifers 1:250,000	Degree of exploitation in the aquifers
4. Irrigation districts nationwide 1:250,000	Main surface of artificial irrigation
5. RHA Irrigation Units 2017-2018	Secondary surface of artificial irrigation
6. Main dams 1:250,000	Nodes of water infrastructure
7. Technified temporary irrigation districts 2020	Temporary surface of artificial irrigation
8. Major rivers 1:250,000	Main water bodies to relate with the limits from communities
9. Municipal drinking water treatment plants in operation registered in the national inventory 1:250,000	Water treatment capacity
10. Municipal wastewater treatment plants in operation registered in the national inventory 1:250,000	Wastewater treatment capacity

Figure 2. Main available geostatistical information for RH36

Source: Author. Information from: INEGI, RAN and SINA.

There are multiple vector generation techniques based on the analysis of high-resolution images in raster format resulting from geospatial information (Gede et al., 2020). These methods include: semantic segmentation,[13] neural networks,[14] machine learning,[15] or artificial intelligence.[16] All these technics can be used, in combination with GIS software for the extraction of vector information in specific geographic markers (Li et al., 2019), (Boos, 2018), (Borba et al., 2021). However, for the implementation of the mentioned tools, it is necessary to have high-resolution satellite images, and in those cases where there are no high-resolution records in the requested coordinates, manual

13 *"Semantic segmentation aims to assign a categorical label to every pixel in an image, which plays an important role in image understanding and self-driving systems" (Wang et al., 2018, p. 1451).*

14 *"Neural networks are a wide class of flexible nonlinear regression and discriminant models, data reduction models, and nonlinear dynamical systems. They consist of an often large number of "neurons," i.e. simple linear or nonlinear computing elements, interconnected in often complex ways and often organized into layers" (Sarle, 1994, p. 1).*

15 *"Machine-learning systems are used to identify objects in images, transcribe speech into text, match news items, posts or products with users' interests, and select relevant results of search. Increasingly, these applications make use of a class of techniques called deep learning" (LeCun et al., 2015, p. 436).*

16 *"It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable" (McCarthy, 2004, p. 2).*

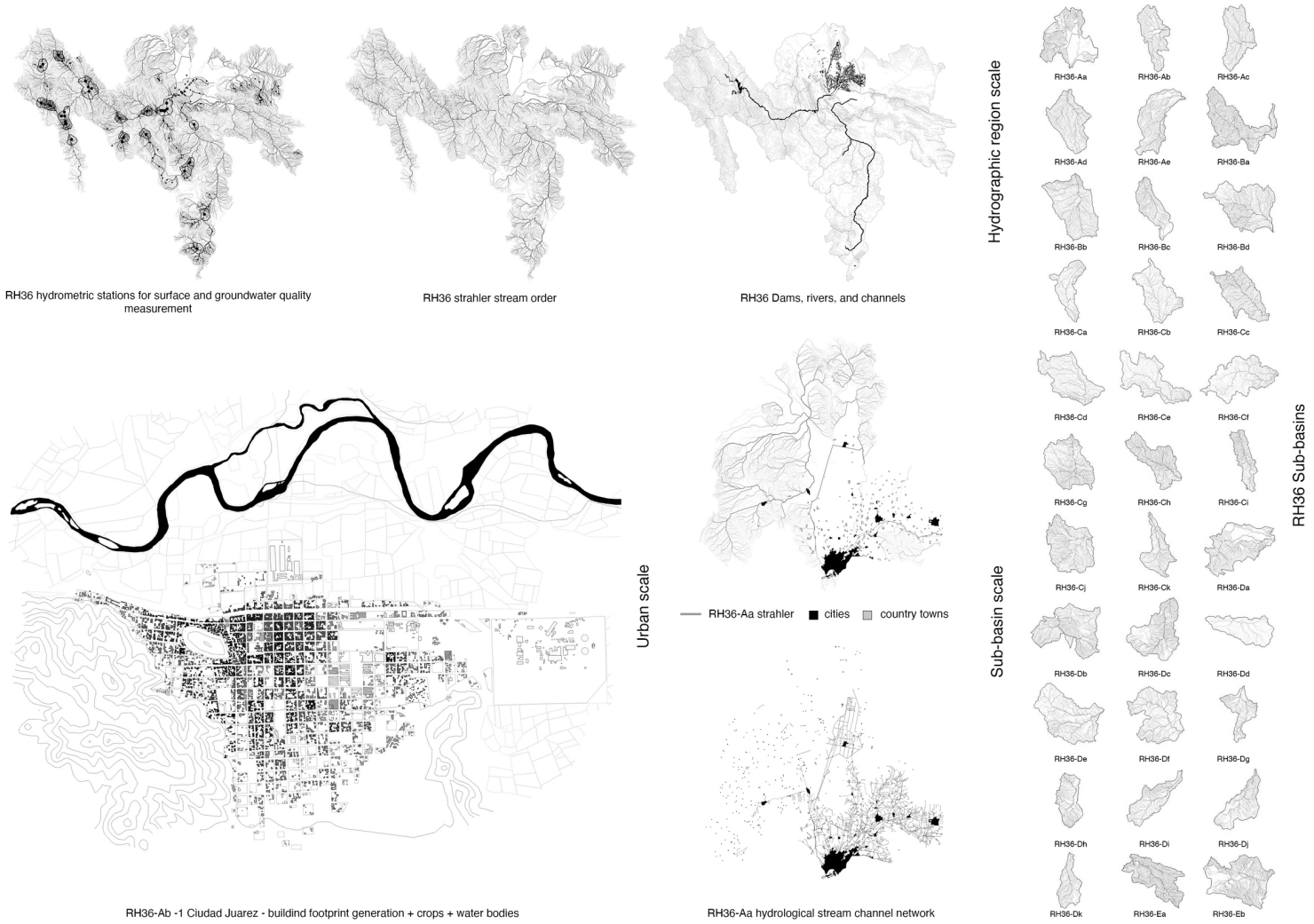

Figure 3. RH36 Multiscale hydro-urban analysis

vectorization is required. In order to generate the building information of the RH36 basins, a hybrid model is chosen, through the manual vectorization of medium resolution raster images and the use of semantic segmentation algorithm OTB-Segmentation included in QGIS this method allows obtaining a vectorial classification based on morphological profiles or basins.

Urban and rural agricultural models

In the context of this research, the *model* is composed by the urban or rural form of the community (streets, parcels, buildings), the productive agricultural surfaces, and their hydrological infrastructures. This composition enables a joint analysis of the productive flows and dynamics related to the consumption of water resources within the limits of the hydrographic basin.

4. Urban restructuring

With all the communities cataloged within the limits of the RH36, indicators are constructed combining the morpho-typological characteristics and the consumptive uses of water. The generation of these hydric-urban markers enables to visualize the territories under greater water pressure with urban and productive dynamics incompatible with a fluvial restoration project. Through this analysis, strategic criteria can be established for regional urban reorganization, in order to reduce the degree of pressure on water resources.

The results of the analysis on the urban and rural communities of the basin, based on the examination of the hydric resources dynamics, enables a geographic-urban approach to urban planning rather than a political-administrative approximation. The local instruments defined by the individual administrations of the states and municipalities should be adapted to the basin regulations, in the processes of city and housing construction.

Finally, it is pertinent to establish that the restructuring must protect the project logics of the communities (Raffa, 2022) that has best combined with the natural context in its temporal dimension (Bartorila & Loredo-Cansino, 2021). To achieve this, it is necessary to analyze the historical urban operations and fundamental transformations through their link with the use of water resources.

Restructuring through analysis of morphological patterns and water availability

The communities belonging to the basin must be restructured, according to their capacities, to provide protection to the regional hydrological cycle, and their importance for the fluvial restoration of the rivers. Agro-productive models must adapt to a regional basin logic. The forms of settlement that mainly affect the riverbeds must be reorganized. For example: to reduce the dynamics of contamination and overexploitation of aquifers, it is necessary to build protection spaces on the riverbanks and main recharge areas of the basin.

Restructuring of hydro-agricultural infrastructure

Storage and distribution structures for water resources have the potential to offer regional ecosystem services. This quality is useful in territories under water stress. For example: protected spaces can be generated in the lower zone of the RH36, these spaces can be planned as controlled areas for aquifer recharge. The modernization of dams, canals and wells is essential to promote water stability. This modernization must be carried out considering the construction dynamics and urban organization models.

5. Conclusions

As can be seen from the results obtained, the methodology developed in this research is applicable to various hydrographic contexts. The quality of the results will be related to the availability and accessibility of the information in each case. It can be concluded that it is possible to integrate the databases of the main indicators of water quality and availability of water resources, with the databases of urban systems, urban equipment, infrastructures and streets to determine the degree of pressure that the models of contemporary city, exert on water resources. The degree of pressure on water resources can be determined with the capabilities of the urban model to offer aquifer recharge surfaces, agro-productive models that allow the return of water to the ecosystem, and water-efficient construction systems for buildings.

In RH36, the proliferation of irrigation canals supported by the hydro-agricultural infrastructure has allowed the development of fluvio-dependent urban and rural models, with mono-productive tendencies, which have pushed the hydrographic reserves to the limit. These forms of anthropic organization are not compatible with a river restoration project for the Nazas and Aguanaval riverbeds, because their productive activities use water resources to generate products that do not allow the return of water to the hydrological cycle of the basin. The restructuring of all the RH36 communities implies the re-densification of their fabrics, the recategorization of productive spaces and the reconversion of obsolete infrastructures on a basin scale.

Understanding the hydrological cycle of each basin allows us to understand the natural elementary units of the fluvial morphology, and it is the task of a reordering strategy to combine the built environment values with the water values, mainly in their materiality. It should also be noted that, although the basins are the unit of study selected for this research, these pieces are related on a larger scale to the contiguous basins, functioning as hydrographic regions, until they reach the continental limits. The hydrological cycle is finally a global cycle, and the elemental functionality depends on the understanding of the stages from its smallest scale to its maximum global levels.

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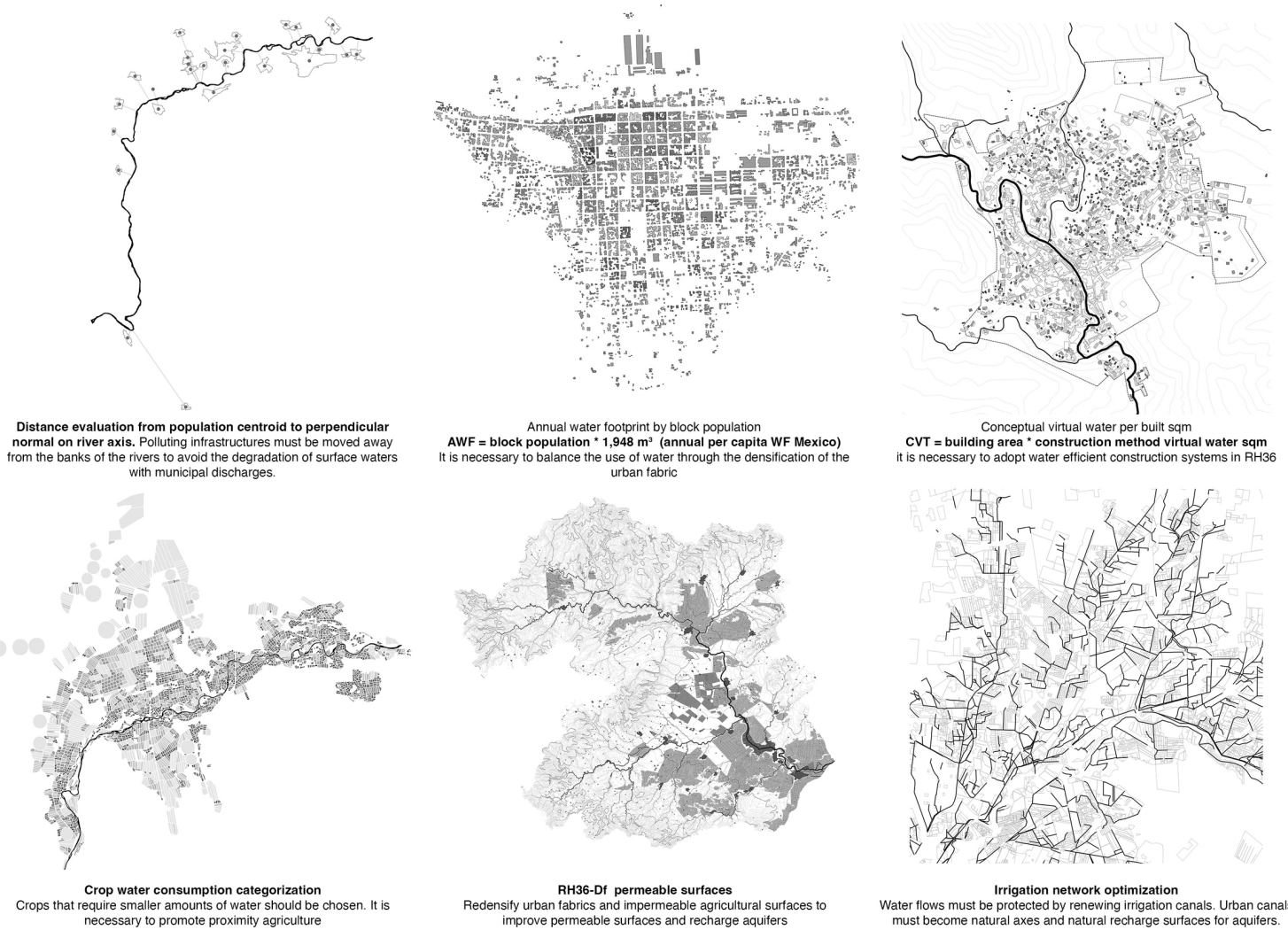

Distance evaluation from population centroid to perpendicular normal on river axis. Polluting infrastructures must be moved away from the banks of the rivers to avoid the degradation of surface waters with municipal discharges.

Annual water footprint by block population
AWF = block population * 1,948 m³ (annual per capita WF Mexico)
It is necessary to balance the use of water through the densification of the urban fabric

Conceptual virtual water per built sqm
CVT = building area * construction method virtual water sqm
it is necessary to adopt water efficient construction systems in RH36

Crop water consumption categorization
Crops that require smaller amounts of water should be chosen. It is necessary to promote proximity agriculture

RH36-Df permeable surfaces
Redensify urban fabrics and impermeable agricultural surfaces to improve permeable surfaces and recharge aquifers

Irrigation network optimization
Water flows must be protected by renewing irrigation canals. Urban canals must become natural axes and natural recharge surfaces for aquifers.

Figure 4. Restructuring based on hydro-urban indicators

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Time as a Design Resource in Architectural Heritage intervention. the Case Study of the Conversion of the Escuelas Pías Church Into a Library

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Intervention in architectural heritage involves reflecting on a pre-existing architecture that has been transformed over time. In turn, the new action raises the need to create a new layer on the inherited architecture that allows it to adapt to new requirements. Therefore, the different stages in a monument's life are fundamental factors in the design process, requiring an understanding of its past through the events of history, recognition of its present as a consolidated material pre-existence, and its possibilities for the future as an adaptation to current requirements that will ensure its survival over time.
Furthermore, this new layer needs to link with the monument's past and present through a specific compositional strategy in which time is presented as a concept that generates interesting resources capable of favouring an effective dialogue between the parts. Precisely because of its historical character, the monument incorporates a whole series of formal and material conditions that are the product of the passage of time. So, the new intervention can refer to them to establish this necessary dialogue.
This research aims to explore these compositional resources used in architectural heritage interventions, in which time emerges as a concept that generates the design process. To this end, the case study of the conversion of the Escuelas Pías church into a library is chosen in which various resources can be found to obtain a wide range of strategies that can serve as a reference for future interventions.
The compositional tools detected cover a wide range of relationship possibilities ranging from integration with a specific time of the monument to the simulation of different strata that respond in a fragmented manner to each specific temporal circumstance present in the monument's pre-existence. Time is materialised through formal or material identification with a temporal stratum present in the monument's history. This way, different possibilities are covered, from identifying with an eternal and immutable time to creating current and ephemeral strata, from creating a timeless architecture to searching for specific stylistic identification.

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This study concludes that working with the time variable as a definer of compositional systems is a resource with great potential for generating tools that allow a suitable dialogue between the pre-existing architecture and the new intervention. These resources have been used successfully throughout history, and their reinterpretation can offer great value solutions for further interventions.

1. Introduction

Time is undoubtedly a factor of great importance in heritage intervention. It is present in the building's history as an object that has been constituted and transformed over the years. It is also present in the new intervention as it establishes a new temporal stratum that must dialogue with the monument's pre-existence.

Furthermore, this new action must be able to relate to the building's history and its present in order to establish an appropriate dialogue with the monument. To this end, the concept of time can be a valuable resource in defining relationship strategies.

This article explores the concept of time as a resource for establishing an appropriate dialogue between old and new. To this end, the concept of time associated with various parameters in heritage intervention is studied.

To illustrate these concepts and make them more comprehensible, the theoretical analysis is accompanied by the study of a specific case of heritage intervention. The case analysed is the conversion into a public library of the former church of the Escuelas Pías located in the Lavapiés district of Madrid, carried out by the architect José Ignacio Linazasoro between 1996 and 2004.

2. Time as a resource for interpretation and action on pre-existing architecture

Time and memory

In the interpretation of pre-existing architecture, the first thing that arises is the need to understand the evolution of the building over time and, therefore, to assign to each part a specific historical moment. In this analysis, a more or less complex process of transformation will be observed, which will have involved the introduction of additions and subtractions to the building. The first reflection is that any intervention involves a transformation, which gives rise to both the gain and the loss of values. As happens with memory in human beings, to think it is necessary to select and, therefore, to remember it is necessary to forget so that we can construct a coherent discourse (Boscarino & Cangelosi, 1999, p. 74). This transformation is required to achieve the permanence of the monument in the present. Therefore an "open conservation" must be considered, in which respect and interpretation of the old are accepted on the one hand, and on the other hand, the capacity of the intervention to give it a contemporary use (Spadolini, 1987).

Past, present and future

Heritage intervention must consider three different moments of the monument: its past understood as historical evolution from its initial configuration, its present situation prior to the intervention, and the possibilities of transformation in the future (Franco & Musso, 2021). As Adriano Cornoldi (2005, p. 10) rightly says, any place is at the same time the host of significant pre-existences, a theatre of lost memories, a deserving subject of expectations. These three different times can be associated with three ways of intervening: recovery of values of the past, consolidation of values of the present and creation of new values.

Recovering lost time: looking back at the past

The desire to recover an element of the past may arise from the need to recuperate a referent of a specific cultural moment. This is the idea introduced by Winckelmann in the 18th century, who tries to explain the reason for the beauty of works of art by distinguishing between the original and the added. The antique work is valued for what it is, directing the actions towards the recovery of the work as a witness document of another era (Jokilehto, 1986, p. 7).

According to this idea, a traumatic loss of a very significant monument may require a reconstruction "dov'era e com'era" [where it was and as it was] (Sette, 2001, p. 110) in order to recover its value as a reference of a historical period. The aim is to make the passage of time disappear to a certain extent, filling in what is missing and maintaining the form, materiality and location. Consequently, it is a question of restoring maximum splendour to an element of great artistic value that has deteriorated over time. However, a reconstruction always involves a reinterpretation of what previously existed and, therefore, a creative act. As Cesare Brandi (1963) says, It is a matter of recovering the evocative efficacy of the building and thus its potential unity.

The reconstruction carried out may also be partial, as in the case of anastylosis, a strategy of repositioning building fragments to recreate the architecture of the past. It is a reconstruction with a partial component, which recomposes an idea of scale and volumetry without losing the idea of the fragment. As Stefano Gizzi (2002) states, the partial image of the restored monument is false because it presents a reality different from the original. For example, the city of Palmyra in Syria, where the forest of raised columns is unrealistically transparent, as they were originally outlined on the walls of the surrounding insulae. It is a partial allusion that didactically seeks to exemplify a part that evokes the whole, a suggestion of what was, through a new reality.

On the other hand, looking at the past can also be interpreted as a recovery of certain elements, traces, and rhythms that can partially recover the memory of the building and interact with the new contributions (Casadei, 2022). The traces in the city tell us about past times; recovering the traces and making them visible helps us understand a past story; they leave the mark of time (Caja, 2021). The traces help to establish rhythms, modulations, and sys-

tems of order that define the constructions that are overlapped and, in this way, survive in the new interventions. There is thus a sort of temporal transposition of the past.

Time paused: looking at the present

The look at the present, understood as a state degraded by the passage of time, talks about unfinished or partially destroyed architecture. It shows the concept of process, of a dynamic object that is projected from the present into the future, open to new actions. A *non finito* that conveys the concept of eternal becoming. Thus, losses can produce new plastic possibilities in buildings; they allow the configuration of new balances.

It recalls the vision of John Ruskin about the picturesque, which he defines as "parasitical sublimity" that can be understood as the beauty of imperfection. The picturesque is present in ruin and decay, in the sublimity of the rents, fractures and stains, "it is an exponent of age, of that in which the greatest glory of the building consists". For Ruskin those external signs are essential characters of the building to the extent of ensuring that restoration is "the most total destruction which a building can suffer". And he adds, "there was yet in the old some life, some mysterious suggestion of what it had been, and of what it had lost; some sweetness in the gentle lines which rain and sun had wrought" (Ruskin, 1925, pp. 351–354).

It can be interesting for the project to capture this instant, to fix it in order to perpetuate its image in time. In this sense, Michelangelo's work of transforming the Baths of Diocletian into a church is a powerful example. Michelangelo conceived the project as a minimal intervention consisting of a slight modification of the interior, maintaining the image of ruin on the outside, giving the image of incomplete work. For Vasari, 86-year-old Michelangelo was deeply concerned about death and the salvation of the soul, something he conveyed with great expressiveness in his last sculpture, the Pietà in Rondaniemi, in which he renounced the idealisation of reality and opted for a more spiritual language (Jokilehto, 1986). Michelangelo admires the beauty of ruin, even dispensing with the need for ornament.

This idea links up with the concept of timeless architecture. The loss of ornamentation due to the degradation of materials over time generates a simplification of form as only the essential structures that define it remain in architecture. In the same way, the layers of cladding that define the finishes deteriorate over time and are lost, bringing the material of the load-bearing construction systems to the surface. The result is an architecture that shows no signs of any particular style that would make it identifiable with a specific historical moment, giving it a certain degree of timelessness.

In the same way, new architectures can be defined by these criteria of material simplification and formal abstraction in order to relate to pre-existing buildings and denote this idea of temporal indefiniteness. This approach involves the idea of temporal continuity. Sometimes, the intention may be to merge the new performance with the pre-existing one, seeking temporal continuity between the two parts. The unity of the whole is prioritised over the idea of temporal overlap. However, the new addition can sometimes be recognised through specific design mechanisms that make it identifiable to the most attentive observer. This idea is clearly present in Souto de Moura's intervention on the monastery of Santa Maria do Bouro, in which he completes and extends the pre-existence by using the stones of its ruins.

Temporal accumulation: looking to the future

Transformation over time produces the accumulation of layers, constructions that are superimposed to meet needs. It can be an exciting resource regarding the contribution of new elements, making these additions evident to show this desire for evolution, the sum of moments from different periods. Additions, employing complex games of analogies and contrasts, seek to generate a coherent whole. In this sense, these additions may seek a certain temporal continuity with one of the existing strata or stand out emphatically to signify their novelty.

The relative position of additions also plays a fundamental role in their relationship with pre-existence. The enveloping architectures protect the remains, adapt them to the new urban needs, and conceal them to a certain extent. Interior architectures respect the temporal perception of pre-existing architectures from the outside but transform their interior spatial conditions. Finally, overlapping architectures seek to blend with each other to achieve greater integration.

In this sense, it is worth distinguishing two concepts that relate to two ways of interacting with the pre-existence: the part and the fragment. Massimo Cacciari (2000, as cited in Cavalleri, 2008) clarifies the difference by indicating that while the part is subordinate to a whole, so that there is an irrevocable relationship between them, the fragment is a piece of something that can acquire multiple interpretations. Thus a variable with an obvious influence is the dimension of the parts, the pre-existing part versus the new addition. Similar dimensions give rise to a balancing act, with both parts having similar importance in relation to the whole.

A concept derived from this idea is that of *simulations in time* present in the works of Carlo Scarpa and Giancarlo De Carlo, who seek to simulate the temporal layering of different construction phases over time, making the expression of these construction phases part of the formal meaning of their works (Purini, 2006, as cited in Carbonara, 2011). A clear example is Scarpa's intervention in Castelvecchio, where he breaks down the pre-existing architecture into its component layers to explain the construction as a superimposition of layers built up over time, and onto which he incorporates new, clearly identified layers.

3. Case study: conversion of the church of the Escuelas Pías into a library

In this work, the architect José Ignacio Linazasoro manages to generate an architecture of great interest by employing various resources in which time is shown as a fun-

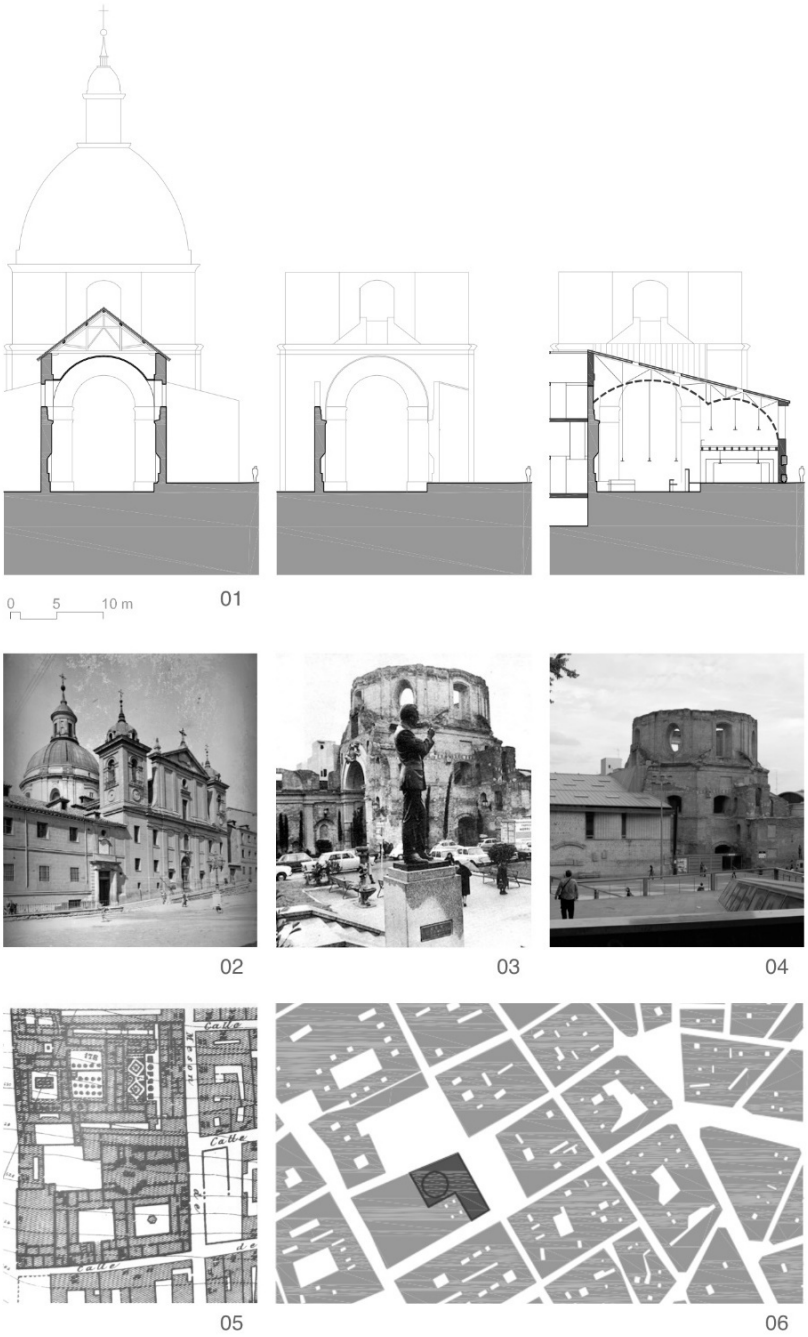

Figure 1. Comparative plans and views of the three periods of the monument.

Credits: 01, 04, 06_Bosch (2013, pp. 286, 287, 254); 02_Passaporte (1927–1936); 03_Jiménez (1977); 05_Guía de arquitectura (1982)

damental concept. We will now attempt to unravel the reasoning behind the tools employed.

The Incomplete Order. The sum of fragments from different times

For Linazasoro (2003, p. 84), architecture is essentially the expression of incomplete Order. While in the past, architecture was the expression of Order capable of explaining the centrality of man in the Cosmos and his relationship with the Sacred, today, however, following a process of secularisation, there is a decentralisation that prevents it from being formulated in the certainty of this complete Order. But since this Order is the foundation of architectural identity, it must be achieved through articulating various partial discourses, the sum of which can evoke the totality.

Therefore, the loss of the canonical Order implies not understanding architecture as something ideal and isolated but understanding it as part of a palimpsest, a sum of fragments where the new is added to what has already been built to form a whole (Presi, 2012, p. 26).

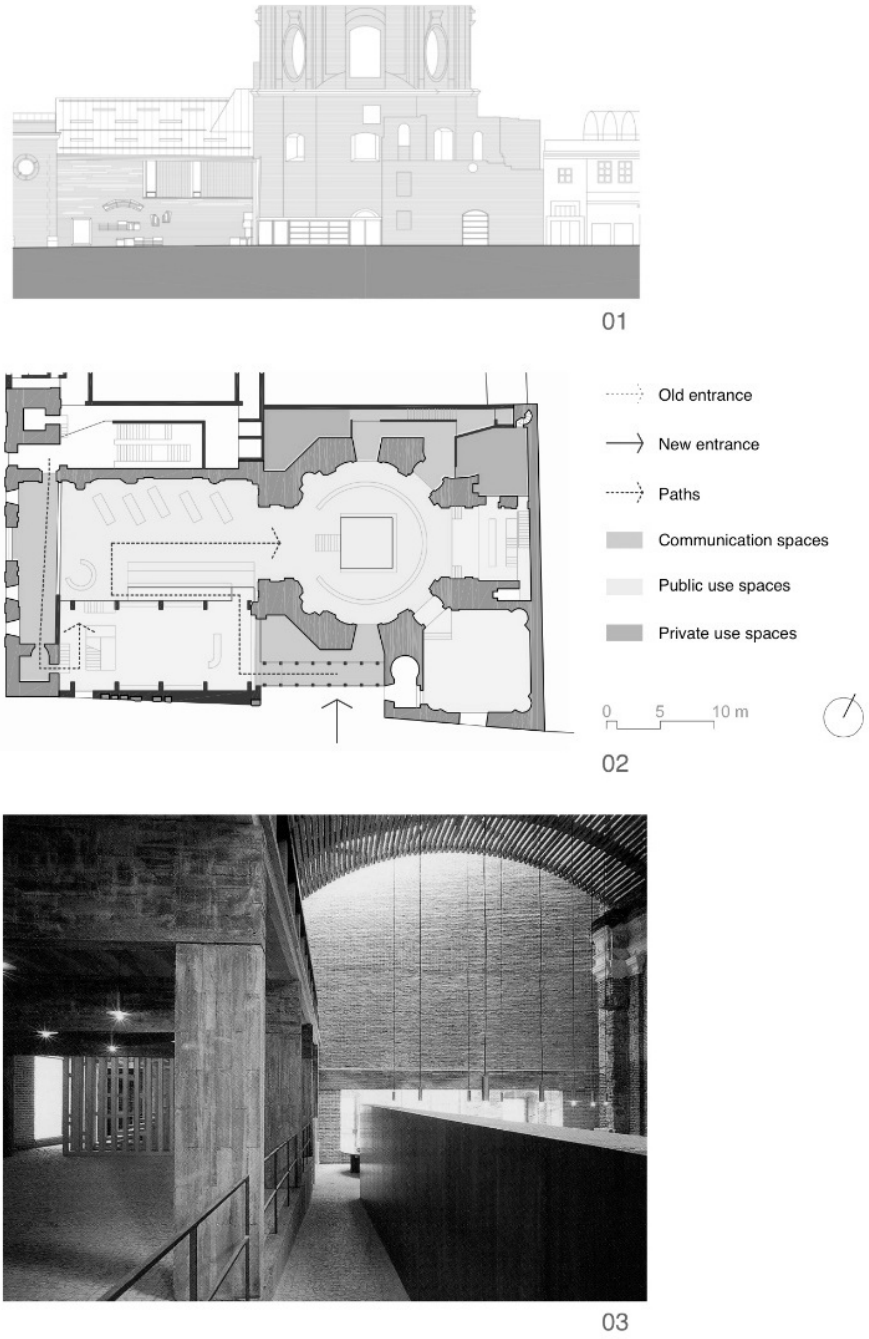

Figure 2. New entrance and the architectural tour through the building.

Credits: 01, 02_Bosch (2013, pp. 279, 276); 03_Linazasoro (2004, p. 58)

Strategies for relating the fragments of the Incomplete Order

Since architecture is therefore understood as a *non finito* composed of fragments, concepts that make it possible to link some elements with others to create a new whole become particularly important.

In the intervention on the pre-existences, Linazasoro does not seek to reproduce the original architecture, as he understands that this would be anachronistic, but neither does he seek to contrast the remains with an openly modern architecture, as this would be banal. He, therefore, opted to direct the new interventions towards transforming the original building to adapt it to the new functional needs and the new demands of the relationship with the place.

In the Escuelas Pías, the pre-existence, far from having a destiny marked by its origin, is shown as an expression of multiple suggestions for its adaptation to a new reality that is different and distant from the initial reality. Thus, Linazasoro interprets the changes in the relationship between the building and the public space and adapts the pre-existence to new accesses and paths. In doing so, he modifies the reading of the original building, constituting a new spatial sequence and relativising the value of an axial route, which has now disappeared and is meaningless.

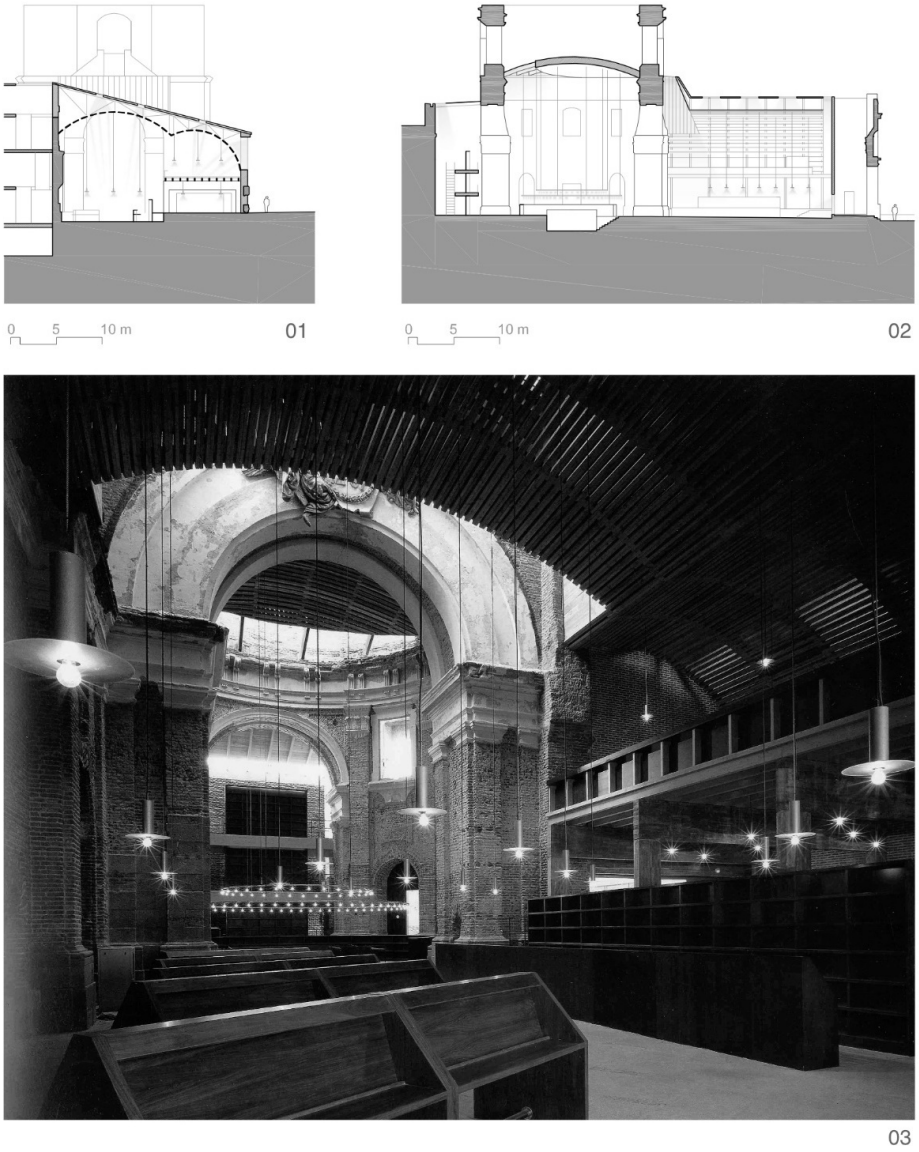

Figure 3. Light fragments the space and connects the interior with the exterior.

Credits: 01, 02_Bosch (2013, p. 280); 03_Presi (2007, p. 181)

In this line of manipulation of the pre-existence also arises the idea of imagining a fictitious past of the place and constructing the buildings on this fiction. Therefore, the past is understood as the memory incorporated into the present and projected into the future, a mouldable past on which to act, what Antonio Machado calls the "apocryphal past" (Machado, 1957 as cited in Linazasoro, 2003, p. 99). In such a way that by intervening in a building, Linazasoro seeks to appropriate it and its past and to rewrite it. The past is "fictitious" in that it is a reinterpretation, a reworking of reality by the subject, which draws on other realities.

This reinterpretation seeks to use references that evoke a totality. It is a matter of understanding architecture as a "virtuality of construction" present, for example, in the capacity of the ruin to evoke the disappeared covered space (Linazasoro, 2003, p. 101), in such a way that the incomplete Order of the fragments that constitute the work is mentally completed through reference to a model.

Thus, Linazasoro's works draw on references taken from architecture throughout history, both classical and modern. However, these references are not chosen randomly but follow what Focillon calls the "famille spirituelle", i.e., families of architects who learn from each other due to a common interest in things, an interest in the same idea of architecture (Focillon, 1934 as cited in Linazasoro, 2003, p. 81).

In the Escuelas Pías, various "correspondences" can be identified with past architectures: for example, the ruin of the transept relates it to the Minerva Medica. Each of these elements acquires a charge of intensity based on personal references or experiences, relating some fragments to others through memory and, in any case, avoiding reconstructing a reality that may have existed in the past (Baudelaire, 1857 as cited in Bosch Roig, 2013, pp. 271, 465).

Linazasoro understands that creating a transitional space between the interior and exterior is necessary to resolve the relationship between parts of an incomplete con-

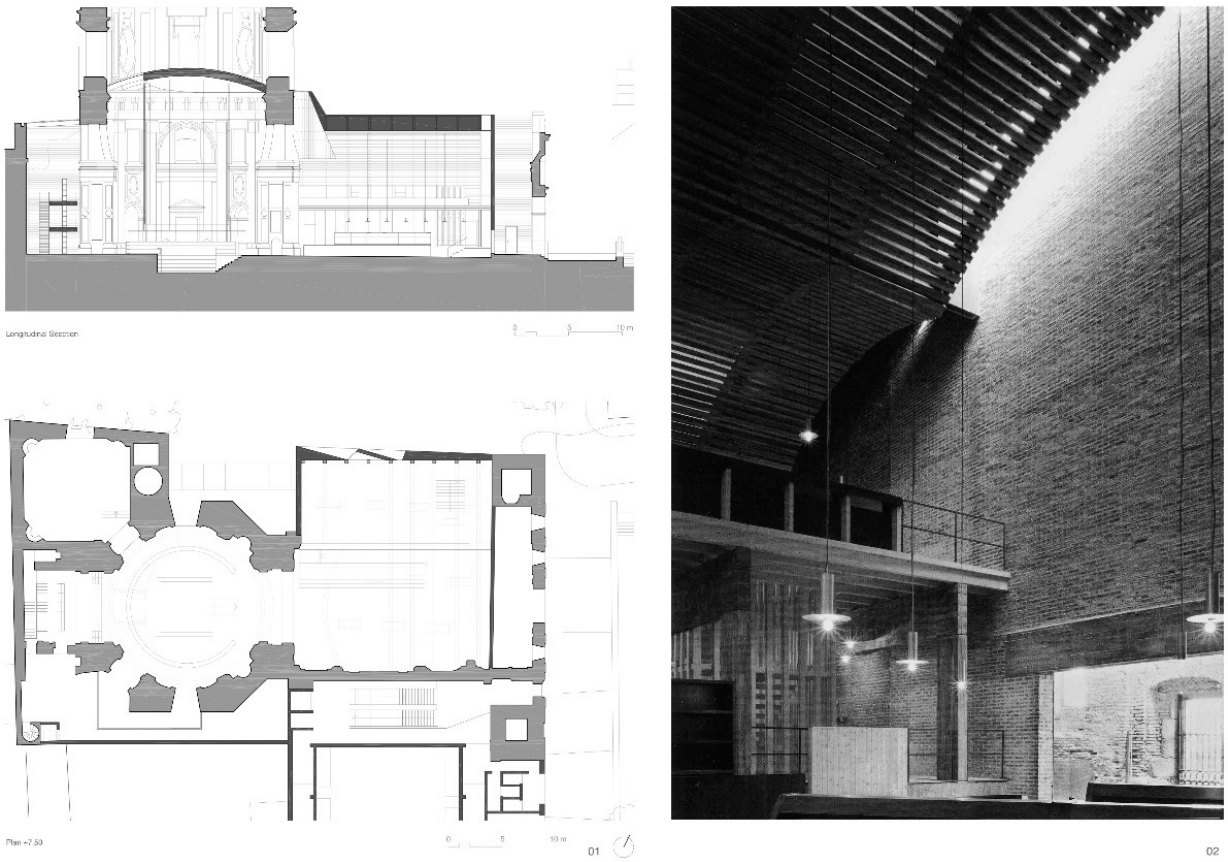

Figure 4. Accumulation of layers inside the building.

Credits: 01_Bosch (2013, p. 278); 02_Linazasoro (2004, p. 59)

text. With this continuity between inside and outside, the idea of the *non finito* is strengthened, where the limit of the building is not in itself but in the city (Presi, 2012).

On the other hand, the new conception of time derived from the incomplete Order introduces perception in sequence instead of static perception, producing an understanding of the totality through the sequential reading of the different fragments that constitute it (Presi, 2007).

In the Escuelas Pías, Linazasoro produces a transitional path between exterior and interior that allows one to escape from the cyclical time of the present and enter a timeless world. Both realities are naturally linked through a succession of spaces of progressively increasing heights and ramps that lengthen movement and materials of an exterior nature.

On the other hand, the new lighting of the space seeks to maintain the uncovered and incomplete atmosphere inherited from its period as a ruin utilising small, scattered skylights on the roof, which emit light filtered through the openwork vaults. The vaults are cut away to allow more light to enter, thus reinforcing the reading of the wall fragments, helping to break up the space and add drama to the environment. Flashes of artificial light create contrasts that enhance the atmosphere of half-light.

Another strategy Linazasoro employs in his projects is a composition based on the relationship between opposing concepts. Adriano Cornoldi comments on the balance Linazasoro achieves in his work through the dialectic between the grid and the arch: the first gives the order, the second identity. "The grid relaxes, the arch polarises: together they synthesise architecture" (Presi, 2007, p. 239).

In this line, Linazasoro understands that in his work, there is a continuous reflection on the superimposition of strata in a way that two situations are produced: on the one hand, a tectonic relationship of an element supported as in a classical linear structure; and on the other hand, an illusionist relationship of suspension of an element in the air, such as a velarium or a Byzantine vault. In such a way that he tries to make the two systems compatible in his projects according to need.

In the Escuelas Pías, the tectonic sense can be seen in the construction of the mezzanines. The new concrete porticoes and wooden structures recall an elementary game of constructive superimposition of linear elements, which has a sense of temporal accumulation, where in the first place would be the support, originally made of wood, which gradually solidifies over time to become a stony material, recalled through the traces of wood in the concrete. Weightlessness can be appreciated in the construction of the dome, which is conceived as a sizeable shady shelter whose materiality seeks to create an atmosphere of mysticism and whose shape suggests natural protection from the weather (2013, p. 466).

On the other hand, Linazasoro uses the concept of temporal superimposition, understood as the result of a process in which the original pure architecture becomes contami-

nated through the accumulation of layers over time, in such a way that the architecture is enriched thanks to the contribution of these impurities.

In the Escuelas Pías, the new elements are integrated with the pre-existing elements, adopting a provisional or permanent character depending on their role in defining the space. The building comprises three different levels of superimposed strata: firstly, there are the brick walls, which constitute a stratum of an immutable time; secondly, there are the structures built with new materials such as concrete and wood, which constitute a stratum of a current and active time; and finally, the ephemeral temporality of the furniture and the user, whose forms and positions can vary without influencing the other levels (Presi, 2012).

Linazasoro understands that the relationship between the fragments can be satisfied by reflecting on the theme of Alberti's *concinnitas*, understood as an interpretation of modernity within the tradition. For Linazasoro this harmony is achieved through the assumption of permanence, of the textured, of the correct scale and not so much through the light, the smooth or the monumental. It is about creating a habitable atmosphere rather than a sum of autonomous objects (Presi, 2012, p. 20).

For the architect, reflection on the materials and techniques with which pre-existences have been built is one of the ways to achieve a positive response to the "tension between nostalgia for the past and the need to break with it" (Linazasoro, 2003, p. 100). In this sense, Linazasoro understands that the passage of time marked on the surfaces of monuments, through patinas and fractures, should be preserved, as these "defects" make the image of the buildings more pleasant.

In the Escuelas Pías, the materiality of the new elements is approached from the essentiality of their construction, being shown without cladding, as a reflection of the expressiveness of the ruins on which they stand. Each new element acquires a different material in response to its constructional function: brick for the walls, grey reinforced concrete and dark grey painted wood for the load-bearing linear structures, light wood for the floors and ceilings, dark wood for the joinery and furniture, stone for the flooring, and zinc sheeting for the roofs and water drainage.

4. Conclusions

Throughout the text, it has been highlighted how past, present and future constitute three moments of any intervention in heritage. The past time provides us with the initial compositional logic; the present time reveals its successive transformations; and the future time proposes a new life adapted to current needs. Each one contributes specific values to the configuration of the whole, but the difficulty lies in defining a discourse that provides unity.

Through the analysis of the work of the Escuelas Pías, we have seen how Linazasoro makes use of a universe of tools that allow him to link the fragments of the different periods of the monument. Materials similar and different to the pre-existing ones, as well as allusions and references to the past and modernity, respond to a play of background and form articulated by the paths connecting the different parts of the intervention. A relationship is thus produced through similarities and differences, analogies and contrasts that make up an incomplete architecture, with the spectator left to re-establish Order.

In the end, it is a question of interpreting the remains as material to be used in the project, seeking to configure a work whose objectives have to do with questions inherent to architecture, where the relationship with the place, materiality, space and light are the variables that act in the Architecture.

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