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Athens Journal of Architecture

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Diagramming Urban Fragments: Collage City and the 'Vest-pocket' in the Case Study of Canberra

By Viktoria Holmik[*] & Milica Muminovic[±]

Written as part of the reaction to Modernist planning in the late 1970s, Collage City by Colin Rowe and Fred Koetter proposes an urban design theory which applies collage as a method from art, shifting the focus from the scale of the totality down to the 'fragments' of the city. As design theory, Collage City focuses on the relationships between different elements in space through space and time, and it is through this multi-dimensional approach to the understanding of the city and its fragments that Collage City theory has the potential to generate a different approach. This paper starts by outlining the aspects of Collage City theory to generate the framework for the analysis of the 'vest-pocket' fragments and proposes the use of diagram as the main tool to examine the relationships between various scales, alongside a diachronic study of change and persistence of the urban fragment. Canberra's early civic precinct will be utilised as a case study, mapping its context over time and the relationships of urban fragments to the city. The paper concludes that the diagram complements the reading of the city through its multidimensional relationships and the level of abstraction which contributes to the spatio-temporal collage.

Introduction

Most of the urban theories that were developed in the second half of the 20th century discarded utopian planning as one of the major reasons for neglecting the human scale and urbanity of the city. Written as part of the reaction to Modernist planning, the text *Collage City* emerged as a design theory that advocated for the adoption of utopia as part of an urban design approach, albeit through the small-scale intervention of the "vest-pocket utopia."[1] This vest-pocket idea is developed through a series of five arguments, beginning with a criticism of Modernism and the classical utopia, and ending with the introduction of the collage technique from art as tool that can be applied in the urban context to overcome the problems associated with total design. The vest-pocket fragment is essentially a miniature utopia, sitting between the scale of the city and the fine-grain, human scale. The traditional Utopia was dismissed due to its totalising nature, however, recent discussions around the fragmented nature of the urban fabric, as well as the complex nature of cities, have brought back into focus questions around the need

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1. D. G. Shane, *Recombinant Urbanism: Conceptual Modeling in Architecture, Urban Design and City Theory* (Chichester, England: Wiley & Sons Ltd, 2005), 129.

for holistic framework for understanding and planning cities.[2] Therefore, in this paper we build on the potential that *Collage City* theory offers, instead of completely dismissing the utopian approach to the city, it reinterprets Utopia through the fragmentary vest-pocket scale as a design approach for the application of utopian theory to the city. Although not fully explored after the initial publication by Rowe and Koetter, in this research we argue that the vest pocket aspect of the city would provide a new light for the analysis of utopian cities.

Collage City applies collage as method from art to develop a design theory which focuses on the relationships between different urban elements through space and time. The vest-pocket approach of this design theory creates an in-between scale that connects the large-scale vision for the city and the fine-grain of the streets and human dimension, and it is through this multi-dimensional aspect that a methodology based in collage theory has the potential to generate a new approach. Thus, this paper's overarching question is how can we apply *Collage City* theory as a framework to analyse utopian planned cities to capture both the ideals of the plan and human scale fragmentation? This broad question is approached through experimentation with the figure ground mapping and diagramming process that focuses on two types of relationships: between the scales of the plan and the human dimension (exploring relationships synchronously) and over time (diachronic diagramming). Canberra as a twentieth century planned city striving towards a utopian ideal has been chosen as a case study to test the application of the vest-pocket approach to the analysis of the city.

The paper starts by introducing *Collage City* theory and the vest-pocket fragment, followed by an overview of the diagram and abstraction in architectural theory. The case study of the Civic Centre in Canberra is outlined, and results from the case study and mapping and diagramming process discussed.

***Collage City* Theory**

Published in the late 1970s by Colin Rowe and Fred Koetter, *Collage City* was part of the Postmodern response to Modernist planning and its perceived disavowal of history and tradition.[3] Unlike other nostalgic approaches during this period, the focus of the book is the proposal of an urban design theory which applies collage as a method from art, moving away from the totalitarian approach down to the 'fragments' of the city. While planning theory after the 1950s did not consider cities as a holistic design, *Collage City* challenges dominant approaches of 1970s urban design with its treatment of urban fragments.[4] This collage-based design process allows the existing city to be layered into, rather than completely

2. N. Coleman, "Recovering Utopia," *Journal of Architectural Education* 67, no. 1 (2013): 24; O. Romice, A. Feliciotti, and S. Porta, "The Road to Masterplanning for Change and the Design of Resilient Places," *Architectural Research in Finland* 1, no. 1 (2017).

3. S. Hurtt, "Conjectures on Urban Form: The Cornell Urban Design Studio 1963-1982," *The Cornell Journal of Architecture* 2 (1983): 71-78; C. Rowe and F. Koetter, *Collage City* (Cambridge, Mass.: MIT Press, 1978), 11-31.

4. Coleman, "The Problematic of Architecture and Utopia," *Utopian Studies* 25, no. 1 (2014): 6-10; N. Ellin, *Postmodern Urbanism* (New York: Princeton Architectural Press, 1999), 280-281.

redesigned, as the existing vest-pocket fragments are identified and utilised within the new urban composition.[5] The text synthesises several arguments, suggesting that a collage technique may be the only way to overcome the problems created by the determinism of Modernist planning and its utopian impulses, as a way of extracting objects from their context, to superimpose them in different spaces to create new references and meanings.[6] Importantly, Rowe and Koetter suggest the use of utopia as metaphor rather than as prescription, that is, they argue for utopian poetics rather than utopian politics. This distinction is achieved through the fragmentary approach they propose, as the 'means of permitting us the enjoyment of utopian poetics without our being obliged to suffer the embarrassment of utopian politics.'[7] Through the collage technique, the *Collage City* can utilise fragments of different utopias and ideals (the poetics), without having to apply the one totalitarian model (the politics). The word utopia is used in the same way in this paper and thus, utopia is considered in terms of utopian poetics.

Collage City theory is developed using three techniques of (I) City as Museum metaphor, the role of the (II) bricoleur and the (III) vest-pocket scale, which all approach the city and its history from varying perspectives and scales. The focus of this paper is the technique of the vest-pocket scale which allows utopia and the city to be treated in "fragments" rather than "in toto."[8]

The 'Vest-pocket' Fragment

While the utopian fragments exhibit this totalitarian design on the individual scale, the contextual relationships created through their juxtaposition and placement within the collage demands a "geometrically multiplying double reading of each element", thus negating the static nature of the composition as a whole.[9] *Collage City* theory was written as a design theory, therefore when applied in this way, these fragment utopias will create friction in their relationships as they collage and collide within the urban composition. The essence of collage is in a process of abstraction, enacted through the distancing the fragment from its context, and through the relationships created within, and between, fragments in the new collaged composition. The strength of this technique lies in this agglomeration of relationships and reference created through the collaging of the vest-pocket fragments. Through this collaging of meaning, it creates dynamism, revealing its potential as a tool for those planning in the rapidly changing and developing cities of the contemporary era.[10] As the "fragmentation of urban space" becomes a more

5. J. Barnett, *The Fractured Metropolis: Improving the New City, Restoring the Old City, Reshaping the Region* (New York: HarperCollins, 1995), 185.

6. A. McIntyre, *Contemporary Australian Collage and its Origins* (Roseville, NSW: Craftsman House, 1990); Rowe and Koetter, *Collage City*, 1978, 138-139.

7. Rowe and Koetter, *Collage City*, 1978, 149.

8. Ibid, 149.

9. K. Vaughan, "Pieced Together: Collage as an Artist's Method for Interdisciplinary Research," *International Journal of Qualitative Methods* 4, no. 1 (2005): 32.

10. J. Farah, and J. Teller, "Bricolage Planning: Understanding Planning in a Fragmented City," in *Urban Development* (ed.) S. Polyzos (Croatia: In-Tech, 2012); T. Hatuka, and A.

dominant characteristic within the city, it offers opportunities for these fragments to be identified and the vest-pocket scale to be applied, while leaving the city as an open-ended work that can further change and develop.[11]

In this research we interpret the vest-pocket fragments as intermediary scale between that of the city and the fine grain of the streets and human scale. The vest-pocket fragment is the *Collage City* equivalent to the urban "field" described by Shane, fragments that are perceived through the patterns that emerge within city plans through different stages of development.[12] In this research the vest-pocket is interpreted as a legible spatial fragment that maintains its coherence through time and creates a historical reference through its formal characteristics. The two vest-pockets identified within the case study both exhibit these two features; these are the elements that have persisted through the developments of the Civic Centre of Canberra. The Sydney and Melbourne Buildings and the Civic hexagon have retained their identity through changes to the plan and to the context of the city, revealing an ability to withstand a degree of change. In addition to this, they hold the notion of the history of the city, through the associations they bring by transposing a historical reference into the new urban context. In the case of the Sydney and Melbourne Buildings it is achieved through the formal precedent, the detailing of the colonnade creates references to Brunelleschi's Ospedale degli Innocenti in Florence which inspired its design.[13] For the Civic hexagon it is the geometry itself which creates the reference, by applying the radiating geometric framework to the city centre a reference is created to urban planning ideals and movements, namely the Garden City. While the vest-pocket fragment is defined by these two characteristics, it is spatially flexible in that it can be either building, street, or public space of varying scales. It is bounded by the morphology of the area as well as the character, but not limited to the singular block or district, creating the perceptual level between the city and the street. The collaging of all the elements within the composition creates relationships across the various scales of the urban fabric. Thus, the vest-pocket fragment technique creates a multi-scalar approach to the analysis of the city, looking at the relationships between the scales, rather than at the elements, to help understand the complexity of the city. To explore this method to read the city, we propose to focus on 'unrefined' tensions in the existing relationships. This paper suggests that those relationships can be found in between the scales, especially between the utopian vision for the whole city and realised vison(s) for the individual fragments. By examining the relationships within and between these vest-pockets, the tensions can be uncovered. In addition, the paper argues that we can find those relationships by analysing the places and their development over time, as the layering of time and history of the city.

D'Hooghe, "After Postmodernism: Readressing the Role of Utopia in Urban Design and Planning," *Places* 19, no. 2 (2007): 20-21; Shane, *Recombinant Urbanism*, 2005.

11. M. Balbo, and F. Naves-Bouchanine, "Urban Fragmentation as a Research Hypothesis," *Habitat International* 19, no. 4 (1995): 573; J. Ockman, "Form Without Utopian: Contextualizing Colin Rowe," *Journal of the Society of Architectural Historians* 57, no. 4 (1998).

12. Shane, *Recombinant Urbanism*, 2005, 129.

13. D. Marshall, G. Butler, J. McCann, and B. O'Keefe, *Sydney and Melbourne Buildings Conservation Management Plan* (Canberra, ACT Economic Development Directorate, 2011), 27-35.

Methodology and Methods

Methods: Testing

The analysis is separated into two stages. The first stage is based on the reverse collaging method. While in the collage design method the process of taking elements from different contexts and moving them into new relational assemblages is considered to design a new reality, here in the analysis stage, we recognise the fragment and trace it back to the original stage. Thus, the first stage applies recognition and definition of urban fragments that we can recognise in the city and their description. These fragments can be of various scales from the scale of the building all the way to the whole city. The scale and boundary of each vest pocket is defined based on their virtual qualities.

The second stage focuses on the development of the precinct over time, applying the figure ground mapping and selection of the individual vest-pocket fragments in the city. It is comprised of the diagramming and recognition of the relationships between the selected vest-pockets fragments over time following the level of persistence over time (Figure 1).

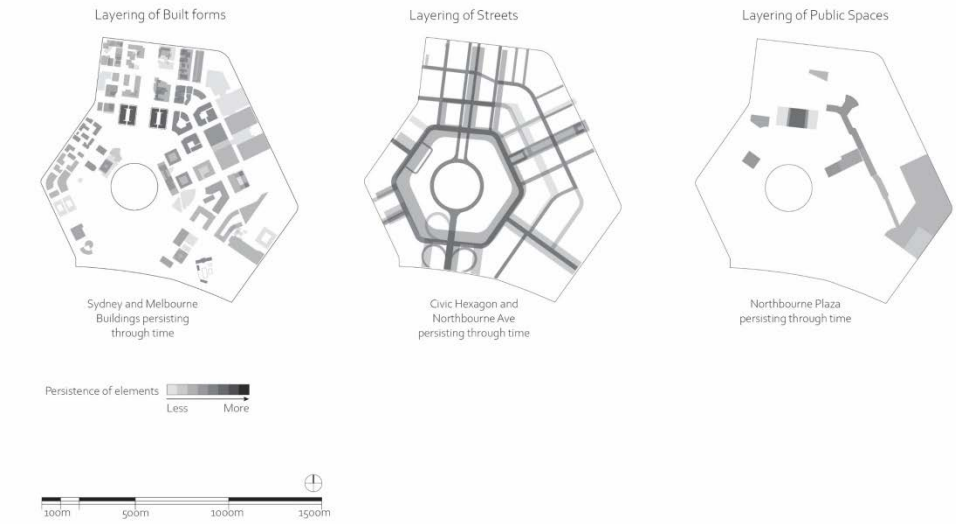

Figure 1. *The Selection of the Vest-Pocket Fragments through the Diagramming of Elements over Time. The Layering of Buildings, Streets, and Public Spaces Making Visible the Persistencies within the Urban Fabric*

Collage City applies the figure ground plan as a strategy for reconciling the divergent approaches of the pedestrian-oriented urbanism of premodern cities with the Modernist approach of the object-building.[14] Acknowledging that there are limitations to the figure ground, we have chosen this representation as it offers understanding between built and unbuilt spaces in the city, particularly for the

14. M. Hebbert, "Figure-ground: History and Practice of a Planning Technique," *Town Planning Review* 87, no. 6 (2016): 714.

diachronic study. The analysis is based on Conzen's approach in which streets and street system, plots and plot systems and building footprint are essential in understanding morphogenesis of urban landscape.[15] Based on Conzen's analysis of Alnwick a method has been developed for the analysis of Canberra that focuses on the building footprint, streets and street system, and public spaces.[16] The selection of plots has been omitted as they have not played important role in the development of the city's urban core. Furthermore, the emphasis of the public spaces has been added as the most important aspect of the civic nature of the selected case study area.

While the figure ground is an extremely useful tool in investigating the changing morphology of the city, the simplification of the city required for a two-dimensional representation "results in a flattened city, where difference and complexity (beyond the formal) are rendered invisible" by the graphic dominance of black on white.[17] As such, in addition to the figure ground, this analysis explores the diagramming method to further understand urban relationships and interfaces.

The etymology of the word diagram reveals important parts of its definition. Deriving from the Greek words *dia*, referring to the relationship between the two and across, and *gramma*, defining something that is drawn, figure and outline.[18] Thus, diagrams represent a method of focusing on the relational characteristics of an object or a thing, rather than focusing on the thing itself. Furthermore, diagrams are not representations of the physical characteristics of the thing or its form. For Peter Eisenman (1932-) diagrams are the "…representation of something in that it is not a thing itself."[19] They should be differentiated from images and signs. Furthermore, in assemblage theory they have "neither substance nor form, neither content nor expression."[20] Gilles Deleuze (1925-1995) and Félix Guattari (1930-1992) refer to them as a "real yet to come, a new type of reality" as they define not just the current relationships between elements but also potential relationships.[21]

The important aspect of the diagram for this research is that it emphasizes elements or characteristics that are not necessarily directly visible, but elements that are implied or virtual.[22] This does not mean that diagrams are less real, however they represent the understanding of what is hidden behind the immediate visible world, and thus they could be defined as virtual. Diagrams are often defined as both real and ideal, reductive and generative, objective and subjective.[23]

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15. M. R. G. Conzen, and Institute of British Geographers, *Alnwick, Northumberland: A Study in Town Plan Analysis, Transactions and Papers* (London: G. Philip, 1960).

16. Ibid.

17. B. D. Wortham-Galvin, "The Woof and the Warp of Architecture: The Figure-Ground in Urban Design," *Footprint* 07 (2010), 66.

18. A. Vidler, "What is a Diagram Anyway," in *Peter Eisenman Feints* (ed.) S. Cassara (Milan: Skira Editore, 2006), 16.

19. P. Eisenman, *Diagram Diaries* (London: Thames and Hudson, 1999), 27.

20. G. Deleuze, and F. Guattari, *A Thousand Plateaus Capitalism and Schizophrenia* (trans.) B. Massumi (Minneapolis: University of Minnesota Press, 1987), 14.

21. Ibid, 142.

22. Vidler, "Diagrams of Diagrams: Architectural Abstraction and Modern Representation," *Representations*, no. 72 (2000): 6.

23. Vidler, "What is a Diagram Anyway?" 2006, 25.

Furthermore, diagrams are not simple illustrations of the objects, which implies that they are not necessarily a static representation of the essentialist characteristics of an entity or its static relationships but depict processes and relationships as dynamic understandings of an entity.[24] This aspect of the diagram offers a potential in application of the diagram as spatio-temporal exploration of the collage.

Diagramming method applied in this study is aiming to connect the figure ground and plan exploration as introduced in the collage city with the sectional and façade qualities of the elements. It uses the process of abstraction to explore the hidden relationships between selected elements. Several types of diagrams have been developed to explore the case study, requiring the extraction and representation of key pieces of visual information to explore the formal characteristics of the vest-pocket fragments and the layering and change of urban elements through time. This process of abstraction and layering can start to the expose the unseen or virtual characteristics of the spaces being explored, uncovering the relationships that are hidden, as in the tracing of the historical precedents or the layering of the elements to show the persistent elements. Thus, through this application and use of diagram, the elements of the spatio-temporal collage are further revealed and understood, as are the relationships between them.

The façade and interior courtyard spaces of vest-pocket buildings have been selected for further study, as these are the elements which interface with other built forms to create connections within the urban fabric. Plan and section diagrams have been used to create a deeper and more multi-dimensional analysis. The use of plan drawings through both methods is important for the analysis as it refers back to the original plan by the Griffins and reveals the changes over time to the urban fabric.

Case Study of Canberra: The Civic Centre

Chosen as the winning entry of the Federal Capital Design Competition in 1912, Canberra was planned as the National Capital by the husband-and-wife architectural team Walter Burley Griffin and Marion Mahoney Griffin. They planned "an ideal city – a city that meets my ideal of the city of the future," thus embedding the utopian aspirations into the city plan.[25] Thus Canberra's history as a planned city with utopian influences from the Garden City Movement, City Beautiful and Organic City makes it particularly suitable for study in relation to Collage City as the urban design theory was devised specifically to address utopian cities. This planned nature gives a unique opportunity in relation to the study of the relationships of urban fragments through time, due to the developments that lead to both change and persistence within the plan through its history. The Griffin Plan is centred on a geometrical framework that embeds the city into the

24. M. Muminovic, "Place as Assemblage: Abstracting, Diagramming and Mapping," *Athens Journal of Architecture* 5, no. 1 (2019): 61-76.

25 W. B. Griffin, *American Designs Splendid New Capital for Australia* (The New York Times, June 2, 1912).

existing contours of the landscape.[26] The National Triangle is one of the primary organising elements that distinguishes the Canberra plan, alongside the Land Axis and the Water Axis. The Land Axis originates at Mount Ainslie, crosses through Kurrajong Hill, connecting to Mount Bimberi in the south. Crossing perpendicular to this is the Water Axis, starting at Black Mountain and following the approximate line of the Molonglo River. The National Triangle is anchored on the two axes – the northernmost apex at City Hill, the southern at Kurrajong Hill and the eastern at Russell Hill. Each of these apexes had an intended role: located around City Hill was the Civic Centre, Kurrajong Hill housed the symbolic centre of the city and the nation, and Russell Hill was simply defined as the Market Centre (Figure 2).[27] The connectedness of this geometric framework, in conjunction with surrounding radial star patterns, emphasises the integrated intentions for the plan, and the connection at different scales. At the scale of the city, the National Triangle and the axes connect the whole plan to the site, following the natural features of the terrain, the hills and valley. Moving down a level, the pattern of the radial creates coherent fragments, yet maintains connection to the city scale through the primary avenues.

26. P. Reid, *Canberra Following Griffin: A Design History of Australia's National Capital* (Canberra: National Archives of Australia, 2002).

27. Ibid, 62-64.

Figure 2. *The 1912 Griffin Plan with Overlay of Geometric Framework*

While the geometry of the National Triangle and the Land and Water Axes have remained the backbone of the Canberra plan, it has undergone numerous changes since the beginning of construction in 1913, all of which have affected the order and legibility of the different scales and relationships within the city. Thus, Canberra is a good example for analysis of vest-pocket scale, with the traces of

various approaches to the plan, and the reinterpretation of the original plan and new ideas, demonstrating instances of both change and spatial coherence.

The Civic Centre in Canberra has been chosen for the case study as an example to test the approach to analysis, leading to a more detailed exploration of the relationships within the urban fragment. A sampling strategy was applied to the selection of the embedded case study unit, focusing on the identification of an area within the Canberra plan which can deepen the understanding of relationships across various scales through time. Three principles have informed the selection of the Civic Centre embedded unit through the sampling strategy. Firstly, this unit has been designed to create connections across multiple scales within the plan, the hexagonal geometry creating a coherent urban fragment within the wider plan, while maintaining the connection to the broader geometry of the Canberra design. Secondly, this is one of the most established areas within Canberra, creating opportunity to explore the changes and persistencies through time. Thirdly, the design of the Civic Centre in its current form continues to respond to the layout and intentions of the original Canberra plan. As such, the Civic Centre demonstrates the two characteristics of the vest-pocket fragment through elements of the plan and the urban fabric.

The Civic Centre is located within central Canberra, to the north of Lake Burley Griffin (Figure 3). Its hexagonal geometry radiates around City Hill, which forms the northernmost apex of the National Triangle, connecting it to the geometric framework that is the backbone of the Canberra plan. The intention for the Civic Centre site to be the civic and metropolitan heart of the city has remained consistent from the 1912 competition plan designed by the Griffins, with visions for a vibrant and connected urban fabric.[28] While the earliest developments in the city centre began in the 1920s with the construction of the Sydney and Melbourne Buildings, it was not until the 1960s that Civic began to take its current shape. The 1959-1964 Planning Report published by the National Capital Development Commission (NCDC) outlined the first stage of significant developments, with the aim of creating civic, commercial and public spaces for the growing city.[29] This civic and public focused development continued through to the 1980s with the Civic Centre Policy Plan published by the NCDC.[30] Since then, it has seen a slight decline in development with predominantly office buildings constructed and commercial trade moving to the Canberra Centre mall. However, recent years have seen increased focus on urban renewal within Civic, with an emphasis on pedestrian connections and bringing residential architecture to the edges of the city to create a lively and interconnected civic realm.

28. Reid, *Canberra Following Griffin*, 2002.

29. National Capital Development Commission, *Planning Report Covering Proposals for the Five Year Period 1959-1965* (Canberra: NCDC, 1959), 13-15.

30. National Capital Development Commission, *Civic Centre Policy Plan Implementation Plan* (Canberra, NCDC, 1987).

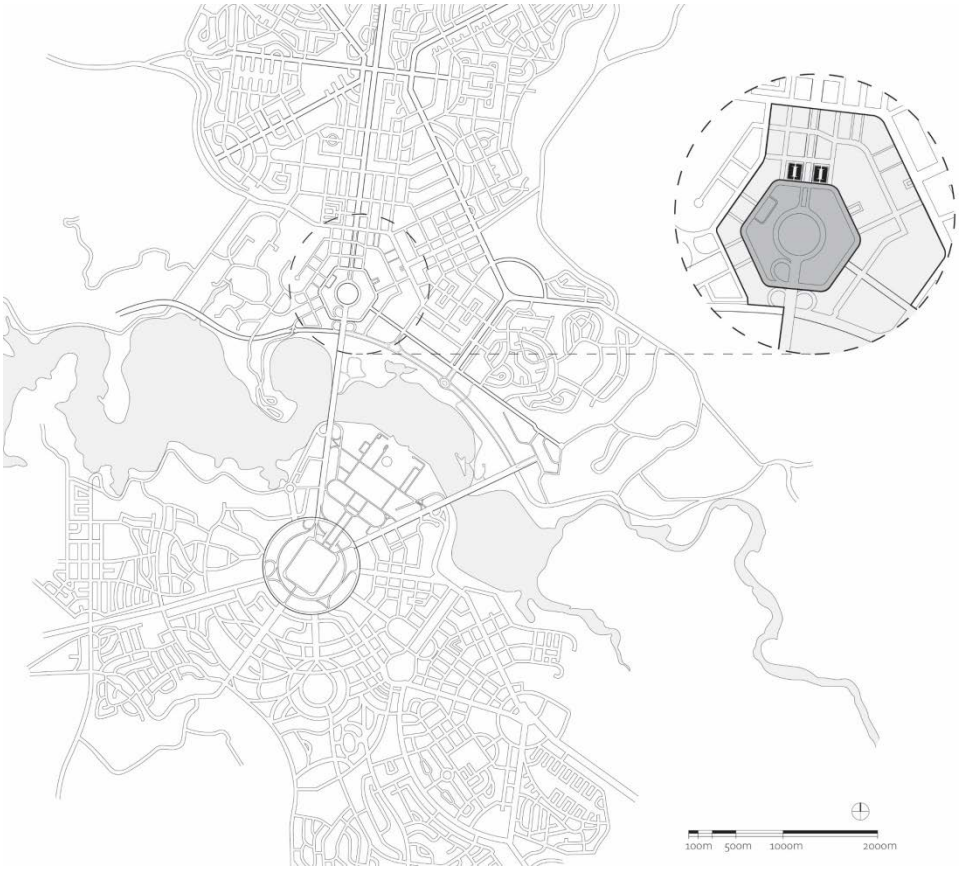

Figure 3. *Location of Civic Centre and National Triangle with Highlight of the Vest-Pocket Fragments in Context*

Results

Vest-pocket Fragment 1: Sydney and Melbourne Buildings

The analysis of the Civic Centre has identified the Sydney and Melbourne buildings as one of the most important vest-pocket fragments. These are two of the oldest structures in Canberra and remain significant fragments within the Civic Centre due to their role in defining the character and scale of the city's retail area in the early developments (Figure 4). They exemplify this characteristic of persistence and spatial coherence that is central to the vest-pocket through their architectural and urban language. Construction began in 1926 with the Sydney Building completed in 1927 for the official opening of the Civic Centre in December 1927. The completion of the Melbourne Building was delayed until 1946 due to the events of the Great Depression and Second World War.[31]

31. Marshall, Butler, McCann and O'Keefe, *Sydney and Melbourne Buildings Conservation Management Plan*, 2011, 27-35.

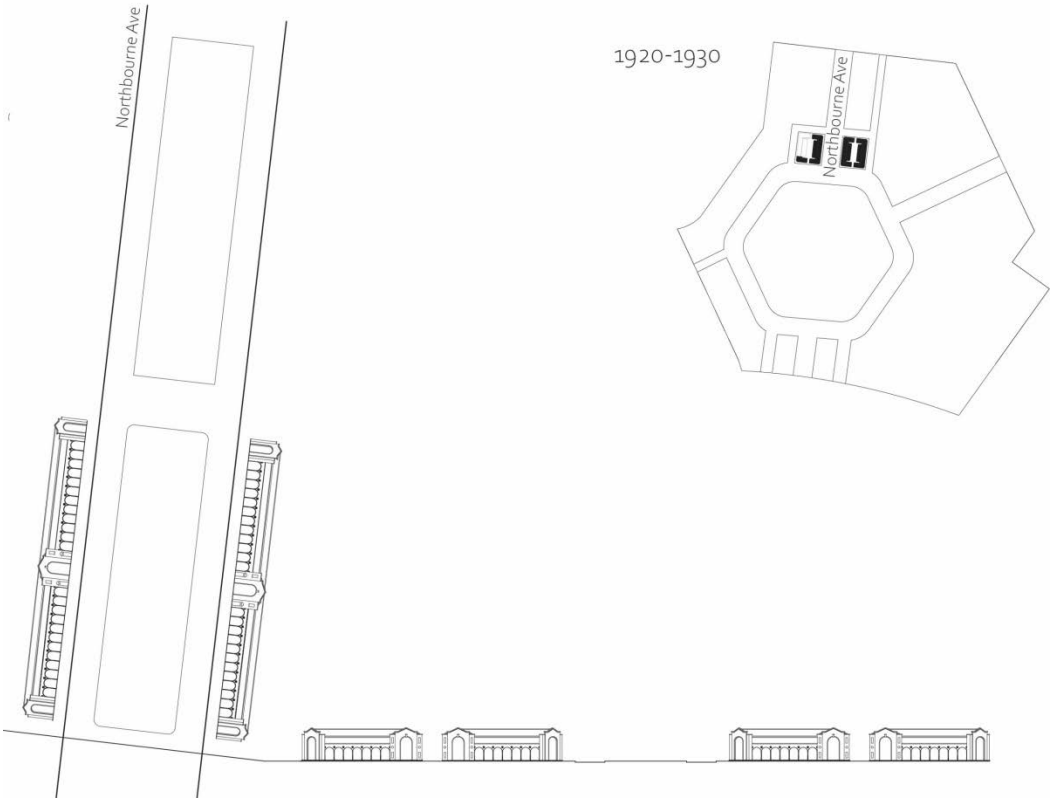

Figure 4. *1920-1930 Construction of Civic Centre. Completed Sydney Building on the Right and Melbourne Building to the Left of Northbourne Avenue*

Positioned along Northbourne Avenue, adjacent to the City Hill apex, they act as gateway buildings to the National Triangle, offering a sense of arrival to the urban core.[32] This placement creates direct links to the geometric framework of the city. The architectural concept is attributed to J.S. Sulman, primarily the continuous ground level colonnade that generates perimeter block. The buildings as they appear today were designed by J.H. Kirkpatrick in the office of the Federal Capital Commission from Sulman's concepts.

32. City Renewal Authority, *Sydney and Melbourne Building Precinct* (ACT Government, 2021); Reid, *Canberra Following Griffin*, 2002.

Figure 5. *View of Sydney and Melbourne Buildings from City Hill and Northbourne Avenue Intersection*

Figure 6. *The Sydney and Melbourne Buildings in their Immediate Surroundings*

While the external form is generally unchanged since construction, their role as markers of the civic identity of Canberra has greatly changed. They continue as landmarks within the city, but their commercial role diminished from the 1950s onwards with the development of suburban shopping centres and the opening of the Monaro Mall in the city in the 1960s.[33] They remain integral fragments from the era as they create and hold relationships across the fine-grain and city scales, in contrast to the original development of large footprint blocks which was focused on creating the large-scale geometry of the "urban uses framework."[34] However, with lack of maintenance and the move of pedestrian retail foot traffic to the mall

33. Marshall, Butler, McCann, and O'Keefe, *Sydney and Melbourne Buildings Conservation Management Plan*, 2011, 40.

34. National Capital Authority, *The Griffin Legacy: Canberra, the Nation's Capital in the 21st Century* (Canberra: NCA, 2004), 54.

the types of tenancies were not in keeping with the civic premise of the original intention and their positioning as gateways to the city.[35] This has changed in last couple of years with the introduction of the light rail along Northbourne Avenue, and the revitalisation of empty shopfronts which are now bustling with life, introducing new coffee places, restaurants, and event venues (Figure 7). With these changes the Civic Centre is developing more of an urban character while still maintaining its role as the civic heart of the city.

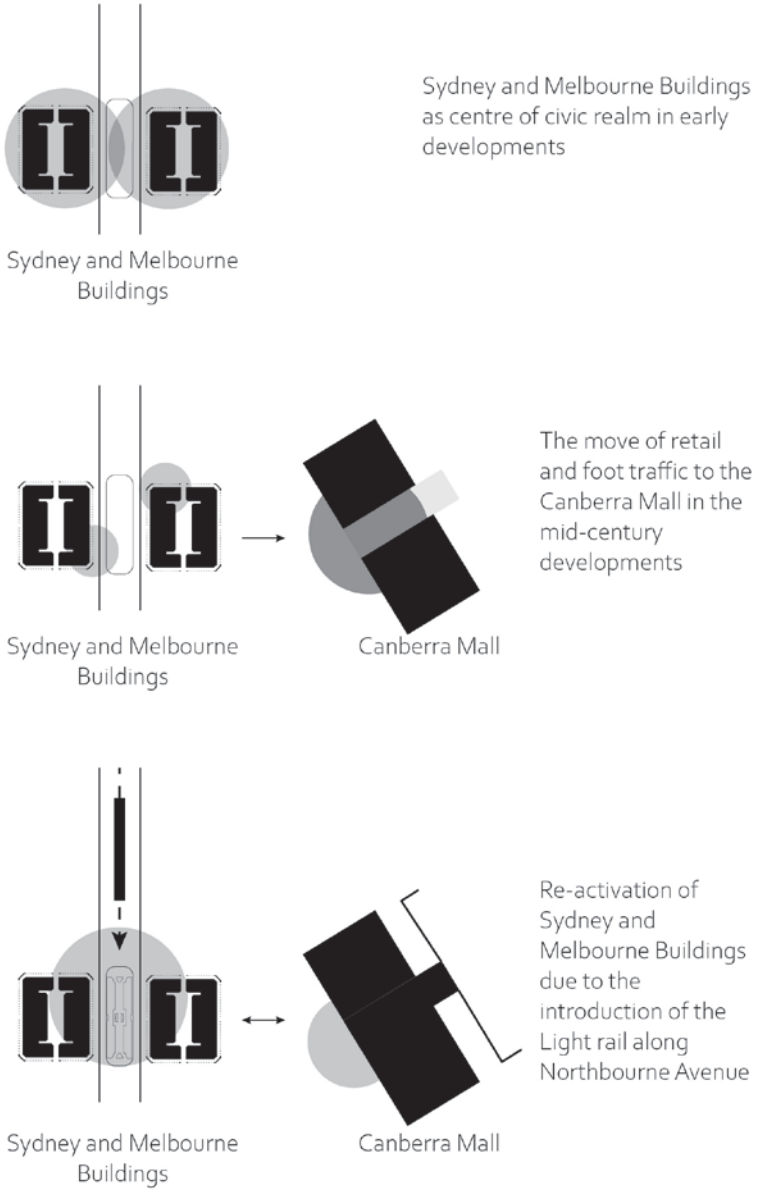

Figure 7. *The Changes to the Retail and Pedestrian Traffic around the Sydney and Melbourne Buildings*

35. Marshall, Butler, McCann, and O'Keefe, *Sydney and Melbourne Buildings Conservation Management Plan*, 2011.

The colonnaded façade of the Sydney and Melbourne Buildings was inspired by and creates a direct reference to Brunelleschi's Renaissance design of the Ospedale degli Innocenti in Florence (Figure 8).[36] This influence is significant due to the historical associations made by transposing this classical motif to the context of the new civic developments, and thus reflects the second feature from the vest-pocket fragment definition. The continuous arcade was intended to encourage perambulation and mimic famous European shopping streets while negating the local climate conditions. The arcade form is a critical precedent, creating familiarity within a newly developing city, while also generating the street and pedestrian scale interface within the larger context. This virtual quality of the vest-pocket is recognised as the main element that defines its character and boundaries.

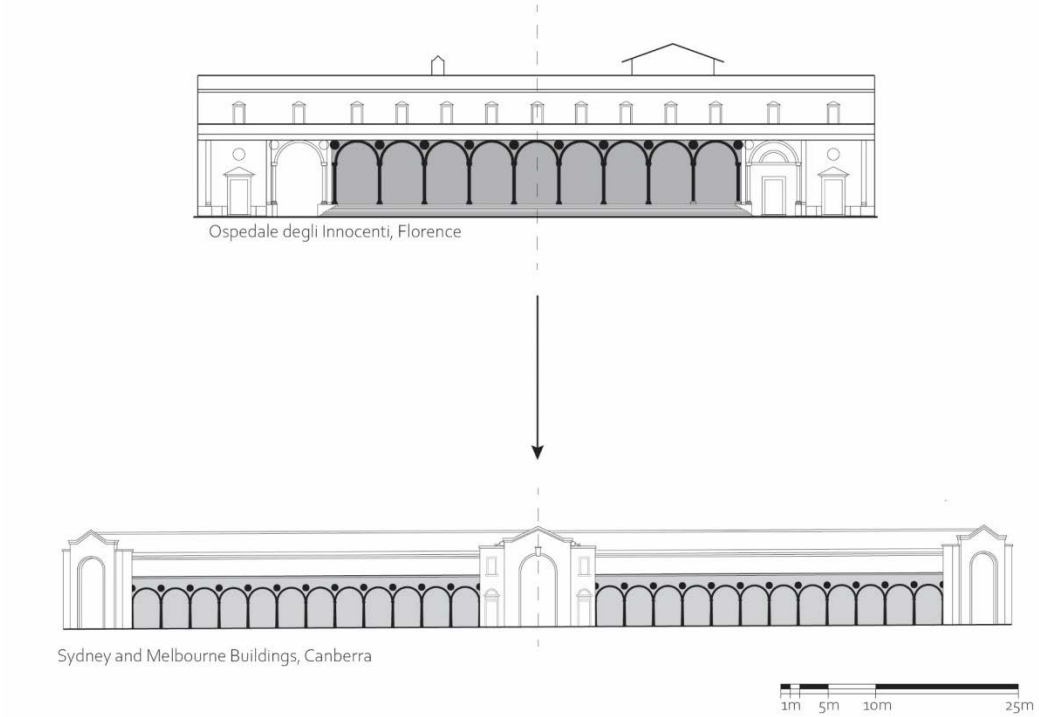

Figure 8. *The Formal Precedent of the Sydney and Melbourne Buildings in the Colonnade of the Ospedale degli Innocenti*

Vest-pocket Fragment 2: Civic Hexagon

The analysis of the Civic Centre has also identified the central hexagon as another vest-pocket fragment, exhibiting the two characteristics of spatial coherence through time and historical reference that define the vest-pocket. It has remained a constant element within the plan, throughout numerous changes over the years. The avenues radiating from the core on City Hill symbolically connect Civic to the

36. Ibid, 98-99.

various districts within the plan.[37] The most significant change has been in the shift from what was an architectural urban core in the 1912 Griffin Plan, to a predominantly landscape character in subsequent plans.

This fragment strongly echoes the principles and layout of the Garden City by Ebenezer Howard, where the radial nature becomes basic principle of the organisation, and the polycentric idea of the city (Figure 9). The central place in both ideas is taken by the nature and centralised radial geometry unfolds commercial and residential zones.

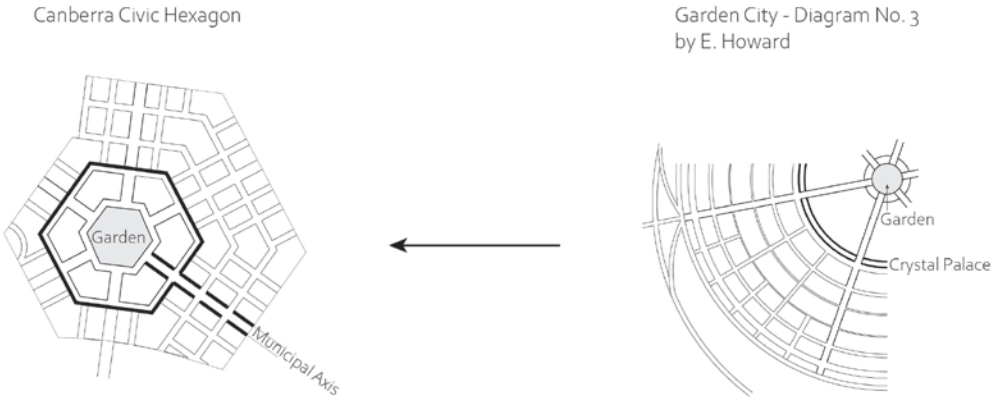

Figure 9. *The Geometric Precedent of the Civic Hexagon in the Centralised Radial Geometry of the Garden City. Central Garden and Commercial Streets Highlighted*

Diachronic Analysis of Civic Hexagon and Sydney and Melbourne Buildings

The analysis of the development of Canberra is focused on the figure ground analysis. The changes to the Canberra plan at four major points in its development have been selected for this analysis (Figure 10). The 1912 Griffin Plan with its highly geometric and connected urban framework is followed by the 1927 plan, and the first phase of construction in the Civic Centre. This is followed by the 1964 map, characterised by the introduction of the parkway road system, another significant phase of civic development. The fourth point in time is 2020, the city as it currently stands. In this series of diagrams, the persistence of the hexagonal geometry of the Civic Centre becomes evident.

The changes in the connectivity to the City Hill core become evident, as does the size of the streets and blocks (Figure 11). In the 1912 plan, the six radiating streets all connect to the most internal hexagonal core, however this connectivity unravels in subsequent iterations of the plan. In addition, from initial hexagon geometry, that has been preserved at the Civic centre, the plan has been changed to the circular geometry, particularly at the southern part of the city. The permeability of the hexagon has also changed over the time, planned as permeable, it has decreased its accessibility in the actual realisation of the plan (Figure 11).

The initial prominence of the Sydney and Melbourne buildings through the first half of the twentieth century is then overshadowed by the large footprint

37. National Capital Authority, *The Griffin Legacy*, 2004.

development of the mall on the eastern side of civic, built as separate blocks and then connected between the years 2000 and 2010 (Figure 12). The prominence of self-contained and freestanding forms is visible, connected to each other by the pattern of streets. However, by separating the different urban elements (building, streets and public spaces) and re-layering the information, the spaces and places which have persisted through the city's history become evident (Figure 1). Of note is the space held between the Sydney and Melbourne buildings, straddling Northbourne Avenue. The mirroring of the two facades across the avenue was planned to create a coherent spatial connection and urban relationship, clearly defining the space between. However, with the development of Northbourne Avenue as a primary traffic corridor, the urban connectivity has been interrupted and as a result the Northbourne Plaza space is used foremost as pedestrian walkway rather than public space (Figure 5, 11).

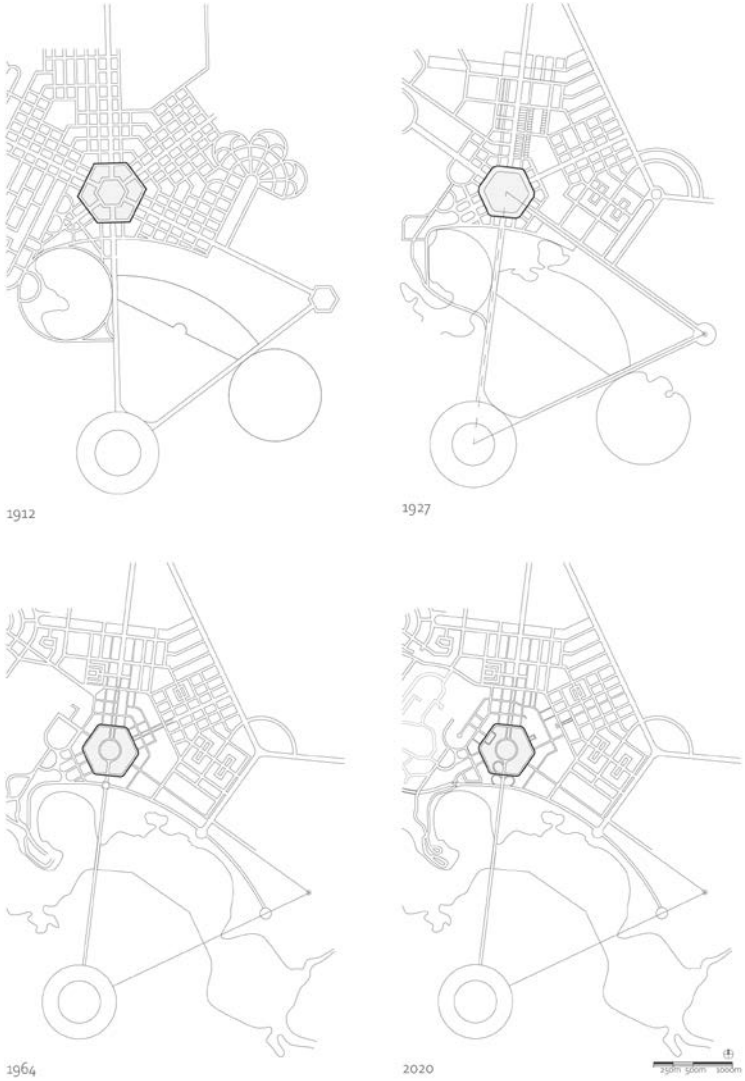

Figure 10. *The Civic Vest-pocket in Context through Time*

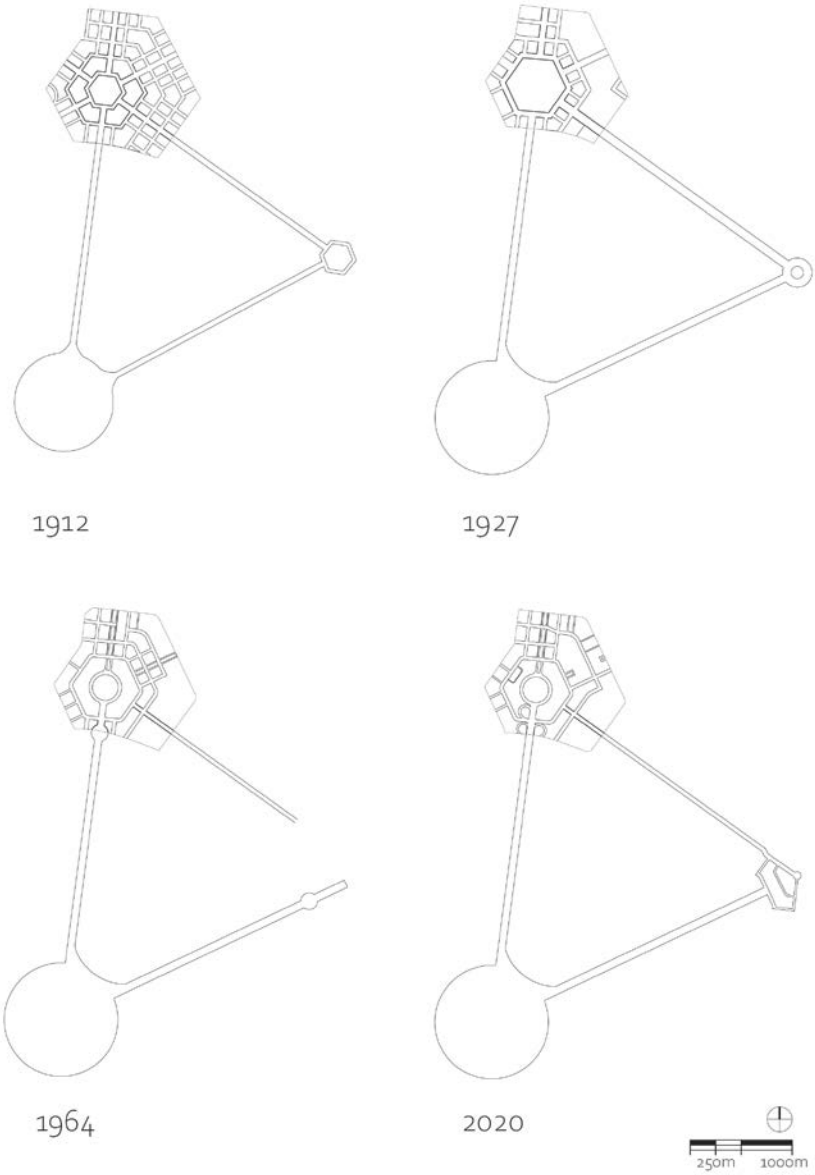

Figure 11. *Civic Hexagon Vest-Pocket Detail through Time*

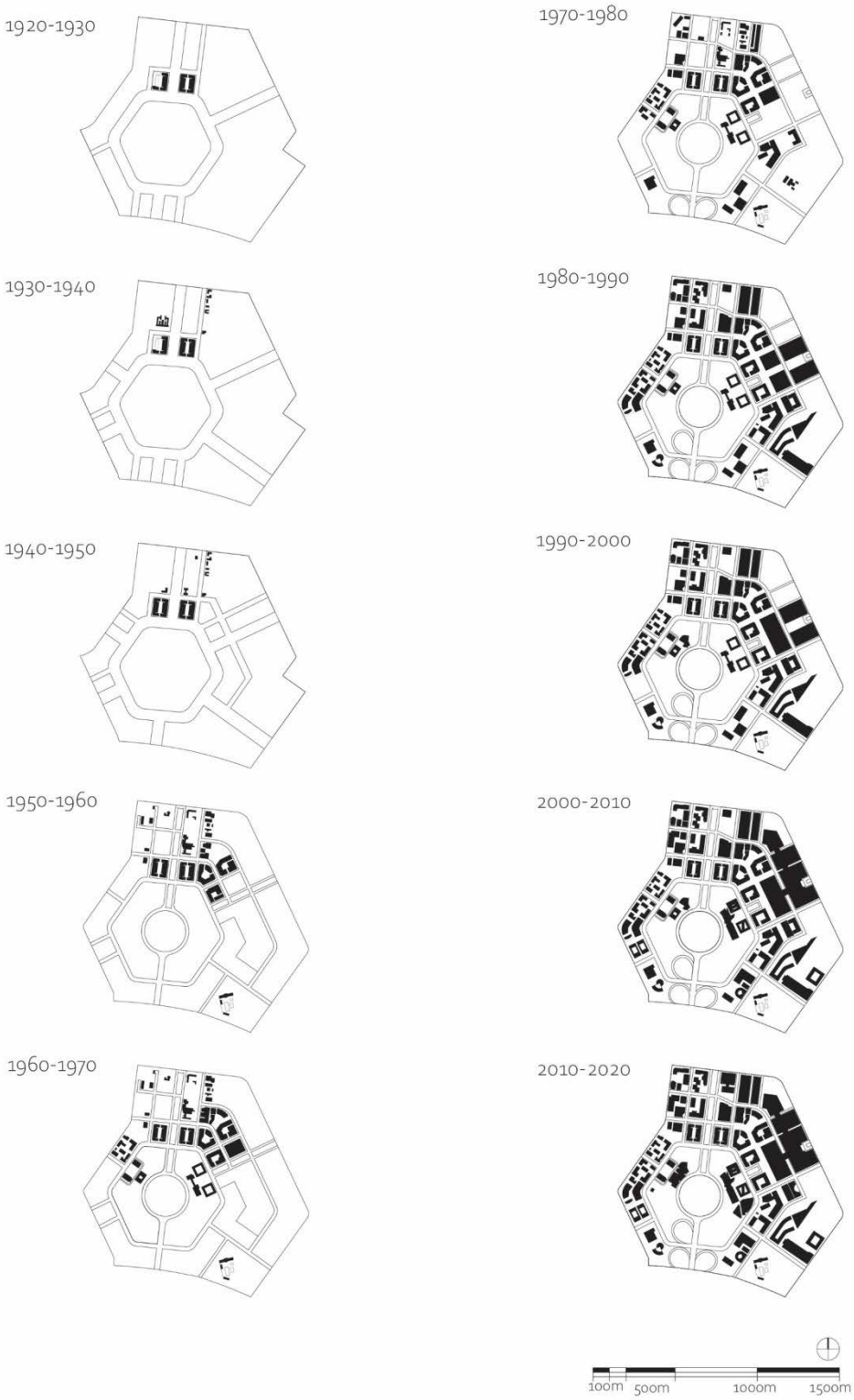

Figure 12. *The Sydney and Melbourne Buildings in Context – Civic Urban Development by Decade*

Conclusion

The diagramming study reveals two scales of the vest-pocket fragment within the Civic Centre of Canberra: the scale of the buildings (Sydney and Melbourne buildings) and the internal hexagon of the Civic Centre. The Sydney and Melbourne buildings, embody the human dimension through their design, and act as gateways to the urban core through their placement along Northbourne Avenue. This positioning, adjacent to the Civic Hexagon, also connects them to the geometry of the National Triangle and the wider plan. The persistence of these two vest-pocket fragments reveals an interesting juxtaposition of relationships. One fragment refers to Italian cities and plazas, connecting to the fine grain and human scale nature of the city, and European urban tradition while the other ideal, the Garden City connects urbanity to its opposite, nature. On the one hand, this relationship could be considered as a 'friction' between the two extremes. One relationship that focuses on the urbanity and compactness of traditional European medieval cities and the other that that integrates nature into planning as part of the reaction to the early twentieth century overcrowding. On the other hand, this relationship between the two extremes generates interesting tension on which this operates, aiming to be the city of the human scale but also the city that embraces the open sky and nature. This tension exists in the differing focus of the scales within the two ideals, and in how the human dimension is reconciled to the landscape scale of the plan. The vest-pocket is a useful tool to examine this tension through the diagramming of these multi-dimensional relationships within the urban fabric. While understanding of the friction becomes visible through this analytical approach, visualisation of this condition becomes challenging. Fragmentation and searching the origins of each fragment has led to a different reading of the city and potential understanding of the unfinished identity of the Civic area.

The diachronic analysis has shown that both vest-pockets are the most persistent elements in the urban fabric. The superimposition of different elements within the urban fabric through space and time, reveals the relationships between the plan, its interpretation, and the current and future meaning in the layered history of the city. It also emphasises those virtual qualities that complement the reading of the city and its urban spaces as a spatio-temporal collage. Furthermore, the persistence of these elements shows the potential role that the vest-pocket fragment plays in development of the city. The process of tracing back to the original fragments of the collage has revealed important friction in the development of the city and thus provided us with different reading of the Canberra, generating a new approach to analysing and understanding urban relationships through scale and time that can lead to further developments within the city as a multi-dimensional urban collage.

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Assessing the Quality of Open Spaces in Mass Housing Projects: The Case of Alexandria

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Rising population numbers across the globe are putting pressure on the housing supply, which is leading governments to resort to social housing. However, the governments of developing countries are more prone to address pressing shortages through standardized mass housing projects, which results in significant mismatches between the attributes of the housing and the needs of the residents. The evaluation of open spaces is a topical research approach, and open spaces are significantly responsible for the quality of mass housing projects. However, years after their construction, it may be seen how their selected urban form has led to very different living situations. A comparison of the quality of open spaces is made possible by identifying a typology for the urban form selected for each project. In this research, we will assess the quality of open spaces in mass housing projects based on the spatial configuration of the project on the urban scale. Identifying a typology of the urban form adopted by similar-scale mass housing projects will guide the evaluation of the open spaces in each project. The physical attributes of the open spaces are the focus of the assessment. The simultaneous analysis of all the physical attributes permits a final assessment of each mass housing project's open spaces quality.

Introduction

This paper targets urban quality and especially open spaces, which is a revisited focus of study emerging from the literature on the topic. Preceding researchers have considered urban issues in broad terms.[1] The most unresolved disputes in these studies to date are inaccessibility, single-functional use, and obscurity in urban density.

According to Perez, the open space layout substantially affects the urban quality of housing projects. Regardless of the vagueness of the term "quality",[2] Carmona identified certain features that improve open spaces, and the most relevant of these features are described as being diverse, engaging, social, balanced, and resilient.[3] These values are based on the concept that urban design has great responsibility in the promotion of more livable, secure and inclusive

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1. P. Hall, "Regeneration Policies for Peripheral Housing Estates: Inward- and Outward-looking Approaches," *Urban Studies* 34, no. 56 (1997): 873-890.

2. J. Perez-Igualada, "The Idea of superblock in Modernist Housing Estates of Valencia (1956-1971)," ZARCH 8 (2017): 132-143.

3. M. Carmona, "Principles for Public Space Design, Planning to Do Better," *Urban Design International* 24, no. 1 (2019): 47-59.

neighborhoods. The responsibility of urban design and its direct impact on the development of public spaces with quality is in line with the international urban agenda.[4] This research approach, debated by other researchers,[5] is a consequence of a methodology based on the prospective users of the open spaces. Between the various aspects that can cause discrepancies in the way each housing project develops, it is valuable to investigate the physical dimension of the urban quality of open spaces of housing projects.[6]

Existing urban analysis methods are only partially applicable when addressing the questions posed by open spaces in mass housing projects. Many of these methods concentrate on incomplete results,[7] and are not adjusted to the specific features of mass housing projects.[8]

To deal with this issue, this research will utilize hybrid methodology called UR-Hesp presented by Sergio García-Pérez.[9] This approach uses current methodologies yet adjusts them explicitly to mass housing projects.

Methodology

The research starts with the identification of a mass housing project classification method based on urban form taxonomy. By clarifying the categorization proposed by Berghauser,[10] which used a multivariable density calculation to identify different urban forms, the research analyses three representative case studies using the methodological approach presented by Sergio García-Pérez[11] to diagnose the quality of open spaces. Through the basic elements that define the open spaces, the proposed methodology works with nine 'physical' variables.

4. UN-Habitat, *Global Public Space Toolkit. From Global Principles to Local Policies and Practice* (UN-Habitat: Nairobi, 2015).

5. F. Wassenberg, *Large Housing Estates: Ideas, Rise, Fall and Recovery* (Amsterdam: IOS Press - Delft University Press, 2013).

6. C. Díez Medina, and J. Monclús, "Dealing with Mass Housing Estates Legacy: The Need of Specific Diagnoses from an Urban Design Perspective," in *Proceedings 24th ISUF 2017 - City and Territory in the Globalization Age*, 309-322 (Valencia: Universitat Politècnica València, 2017).

7. B. Hillier, *Space is the Machine: A Configurational Theory of Architecture* (London: Space Syntax, 2007).

8. M. Berghauser Pont, and P. Haupt, *Spacematrix: Space, Density and Urban Form* (Rotterdam: nai010 Publishers, 2010).

9. S. García-Pérez, V. Oliveira, J. Monclús, and C. Díez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," *Cities* 103 (2020): 102657.

10. Berghauser Pont and Haupt, *Spacematrix: Space, Density and Urban Form*, 2010.

11. Perez-Igualada, "The Idea of superblock in Modernist Housing Estates of Valencia (1956-1971)," 2017.

Urban Form Classification

Berghauser[12] presented a methodology using four variables to measure built density, the four variables are globally acknowledged in urban development practice: floor space index (FSI), illustrating the built environment intensity; ground space index (GSI), defining the compactness of an urban block or area based on the coverage of the area with buildings; building height (L), i.e., the average number of stories; and open space ratio (OSR), also referred to as spaciousness, a measure of the intensity of unbuilt spaces. Each spatial solution or urban form develops a distinctive pattern of the density variables and therefore has an exclusive position in the Spacemate diagram (Figure 1).

A Spacemate diagram is a graph that can show all four variables with FSI on the y-axis and GSI on the x-axis; OSR and L are slopes that spread out at the top of the diagram. By plotting a large number of observations (i.e. neighborhoods) on a Spacemate diagram, Berghauser (2019) credibly displayed that different urban forms cluster on the graph (Figure 1).[13]

Spacemate methodology revealed that the multivariable density concept composed of four density variables offers a method to define urban forms, which, separately, these variables are incapable of doing. The variables used are recognized indicators of density and their calculation method is explained here.[14]

1- $GSI_x = B_x/A_x$

where B = footprint (m^2), A = area of site (m^2), x = scale level

2- $FSI_x = F_x/A_x$

where F = gross floor area (m^2), A = area of site (m^2), x = scale level

A third variable can be developed using FSI and GSI: average building height (i.e., number of floors) (L), using the following equation: $L_x = FSI_x/GSI_x$

Another variable that can be derived from FSI and GSI is spaciousness (also called open space ratio, OSR), which provides an indication of the intensity of use of the unbuilt space, and it may be calculated using the following equation: $OSR_x = (1\text{-}GSI_x)/FSI_x$

12. Berghauser Pont and Haupt, *Spacematrix: Space, Density and Urban Form*, 2010

13. Berghauser Pont, J. Forssén, M. Haeger-Eugensson, and A. Gustafson, "Increasing Cities' Capacity to Manage Noise and Air Quality Using Urban Morphology," in *ISUF 2019 XXVI International Seminar on Urban Form: Cities as Assemblages.*

14. Berghauser Pont and Haupt, *Spacematrix: Space, Density and Urban Form*, 2010.

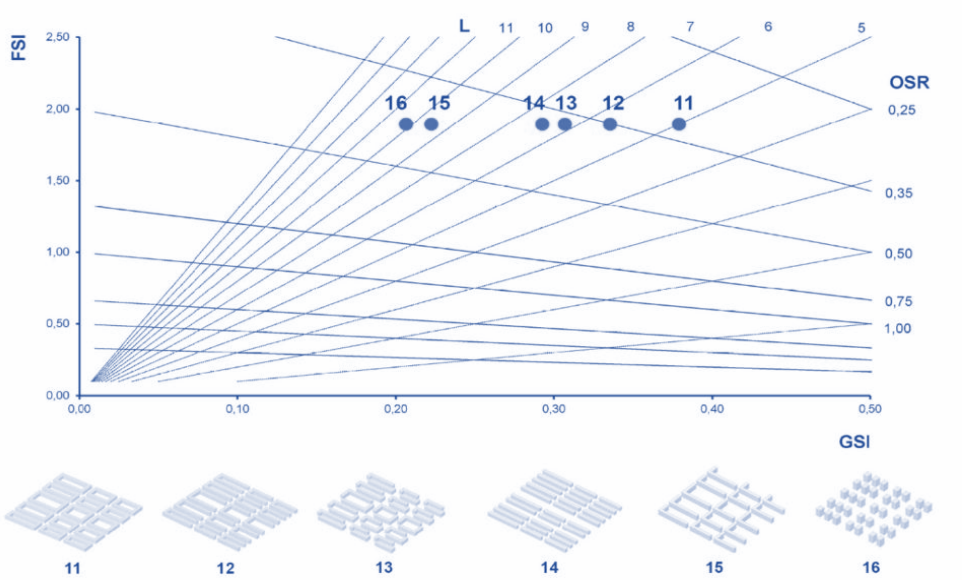


Figure 1. *Spacemate Diagram Showing Different Urban Forms*
Source: Berghauser 2019.

The theoretical cases selected for the study are the three archetypes: semi-closed perimeter building blocks (case 13), slab buildings (case 14), and point buildings (case 16). From earlier empirical studies[15] we know that these types are found in different positions in the Spacemate diagram, where the closed building block (case 11) has the highest GSI and the point building (case 16) has the lowest GSI (Figures 1 and 2).

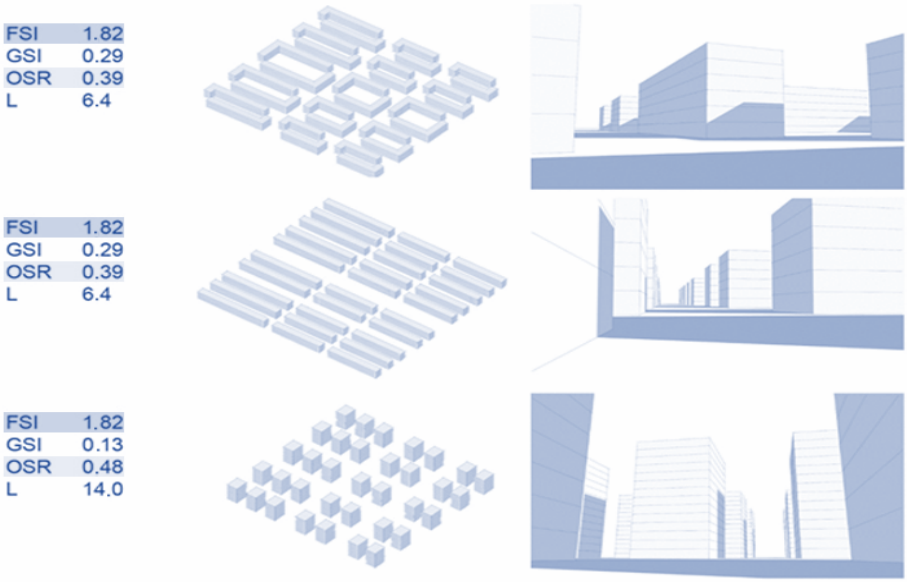


Figure 2. *Density Variable Calculations for the Three Archetypes*

15. Ibid.

Selection of Case Studies

The selection of the case studies was based on the following considerations:

1- Size factor: the three selected cases are developments including over one thousand residential units, which is typical of mass housing projects.[16]
2- Representativeness factor: as the reviewed literature shows how open spaces are categorized into three archetypes[17] the researcher selected the three case studies as representatives of each type.
3- Socioeconomic factor: all three cases are projects built on state-owned land and implemented by public-private partnerships for low-middle income Egyptian families.[18]

Case Study

In this paper, three mass housing projects were selected in the city of Alexandria in Egypt. These three projects are representative of the market-oriented approach, in which the state cooperated with private companies/banks to supply housing units for a targeted market segment.

1-Mostafa Kamel Complex (Housing for Military Officials)

Built-in the early eighties, the complex is a mass housing project basically built for middle-class military officials, but later remaining units were sold to the public. The project is suitably located in the central district, with clear views of the Mediterranean Sea for the first two rows of apartment towers (Figure 3). The project is composed of 97 towers, where all towers have 16 floors, and each floor is composed of 4 residential units, which totals more than 6,000 housing units on 58 feddans (approx. 244,500 m^2) of state-owned land.[19]

Figure 3. *Photos of the Mostafa Kamel Complex*

16. F. Urban, *Tower and Slab: Histories of Global Mass Housing* (Routledge, 2013).
17. Berghauser Pont and Haupt, *Spacematrix: Space, Density and Urban Form*, 2010
18. CAPMAS, *CAPMAS - Online Data Management System*. 2021; Y. Shawkat, *Egypt's Housing Crisis: The Shaping of Urban Space* (Cairo: AUC Press, 2020).
19. CAPMAS, *CAPMAS - Online Data Management System*, 2021.

2-Faisal City (Bank-Financed Housing)

The project was built in the early eighties after the establishment of the Faisal Islamic bank in Egypt (a Saudi-owned bank) in 1979. The project was built on 36 feddans (approx. 151,000 m^2) of state-owned land and unit ownership was financed through the bank for low to middle-income classes. The project is composed of 82 towers, where all towers have 11 floors, and each floor is composed of 6 residential units (Figure 4). The project includes more than 5,000 housing units.[20]

Figure 4. *Photos of Faisal City Project*

3-Borg Al-Arab - District 1 (Agricultural Engineers Housing)

Borg Al-Arab's mass housing project for industrial workers and agricultural engineers is one of the very few relatively successful housing projects built in the desert. The project was developed to encourage industrial workers and agricultural engineers to move closer to the state's wide agricultural desert reclamation project in Borg Al-Arab (Figure 5). The project is composed of 73 apartment buildings, where all buildings have 5 floors, and each floor has 4 residential units, which totals more than 1,400 housing units on 55 feddans (approx. 233,000 m^2) of state-owned land.[21]

Figure 5. *Photos of Borg El-Arab - District 1*

20. Ibid.
21. Ibid.

Adaptation of the UR-Hesp Methodological Approach

Unlike other social or public housing open spaces assessment methodologies, the UR-Hesp methodology aims to minimize the number of variables used to assess the physical features of open spaces within housing projects. Sergio García-Pérez[22] organized the nine selected variables around the fundamental urban fabric morphological components, which are roads, plots and buildings. These variables are combined based on international debate on the methods of assessment of open spaces. Quantitative approaches use the variables: integration, permeability, density and building diversity, while Qualitative approaches use local choice, functional mix, eye level design, plot structure, and type of open space.

Contrasting the original UR-Hesp methodology, which evaluates urban transformation by taking a chronological approach tackling the project from its initial design to its current status. In this paper the methodology takes an urban form taxonomy perspective to assess the quality of the open spaces of the mass housing project, as the three selected Alexandrian projects were not transformed from an urban morphological perspective.

Based on the UR-Hesp assessment technique, all nine physical qualities were evaluated for each of the case studies, employing field research and observation to gather data necessary for the evaluation of each physical quality.

As a conclusion to the methodology, the simultaneous analysis of all the variables permits a final assessment of each mass housing project's open spaces either as Obsolete, which represents inconsistency between supply and demand, or as Resilient, which is when the physical features are able to adapt to current and future demands.

Integration

Integration investigates the location of a mass housing project within the urban fabric on the city scale. It analyses the configuration of roads and streets and the urban accessibility level of the project. Space syntax theory and physical approach were adapted in the original UR-Hesp methodology, however, in this study we adapt Location-based dimensions, which assess the journey time and/or costs between locations of activity.[23] Based on Hillier[24] locations that tend to be considered as outlying in the city's central urban fabric cause connectivity problems, which entails that the less peripheral a housing project is, the more quality it offers.

Housing project integration scores are first calculated on the city scale, considering the average journey time from the project to the city center using different modes of transport according to five categories ranging from 'very short' to 'very long'. Afterwards, the quality of integration is categorized as 'good' (very short and short trips), 'standard' (average trips) or 'poor' (long and very long trips).

22. García-Pérez, Oliveira, Monclus, and Diez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," 2020.

23. Geurs, K. and Bert Wee, *Accessibility Evaluation of Land-Use and Transport Strategies: Review and Research Directions*. *Journal of Transport Geography* 12 (2004): 127-140.

24. Hillier, *Space is the Machine: A Configurational Theory of Architecture*, 2007.

Average journey times for each location to the city center were estimated using Google Maps at different times of the day and then the average was obtained. The mean journey time in Alexandria is 25 minutes.[25] Accordingly, poor integration quality was achieved in Borg El-Arab with average travel times at 55 minutes (very long trips). While Faisal City residents had to travel around 30 minutes on average to reach the city center (average trips). And Mostafa Kamel residents could reach the city center in less than 10 minutes, which represents good integration quality.

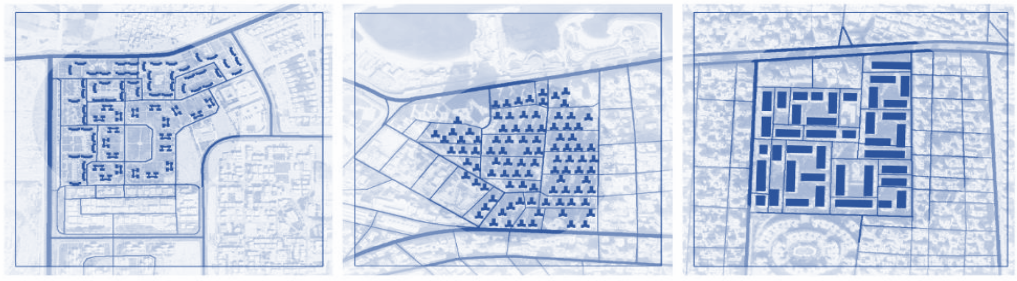
Permeability

Permeability evaluates the degree of a housing project's connectivity with the surrounding urban fabric. It studies the configuration of barriers, represented in natural or man-made peripheries, and entry points or axes that allow access to the housing project.

Permeable housing projects have fewer urban barriers and more opportunities for development around the project's peripheries, which facilitates the approach of resources, encouraging social inclusion.[26]

Permeability is the outcome of compounding a qualitative approach, which compares the result with its district scale average integration, and a quantitative approach, which acquires the number of connections between the housing project and the rest of the urban fabric on the perimeter.[27]

Similar to the categorization of integration above, the result is presented on a scale of five categories from 'very high' to 'very low' (Figure 6). The scale of cases discussed in this study range from those with a permeable connection every one hundred meters, classified as having a 'very high' permeability value, to those that have a 'very low' permeability value. In this way the quality is classified as 'good' (very high and high permeability), 'standard' (average permeability) or 'poor' (low and very low permeability).



Borg El-Arab: Poor Mostafa Kamel: Standard Faisal City: Good

Figure 6. *Permeability Quality in the Three Selected Case Studies*

25. CAPMAS, *CAPMAS - Online Data Management System*, 2021.

26. G. Sun, C. Webster, and A. Chiaradia, "Ungating the City: A Permeability Perspective," *Urban Studies* 55, no. 12 (2018): 2586-2602.

27. García-Pérez, Oliveira, Monclus, and Diez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," 2020.

Local Choice

Local choice outlines the type of spatial structure consisting of the road and pedestrian network and its arrangement within the local network on the neighborhood scale.

The urban theories based on the separation of vehicular and pedestrian traffic have had a fundamental impact on urban complexity.[28] However, although in many mass housing projects there is a clear hierarchy in their vehicles road networks, their internal spatial structures are not so hierarchically planned, as they form spatial grids very close to the hierarchical logic of the traditional city. Consequently, the examination of the internal road and pedestrian network is based on current research projects that consider hierarchy not as a problem in itself, but how it corresponds to the final configuration. This arrangement can affect the co-presence of inhabitants in the open space and can encourage more social encounters between residents.[29]

The quality of the local road network can be assessed using the Space Syntax methodology, the study focuses on the ability of the network to generate local betweenness centrality, that is, the ability of the road network to be chosen as origin and destination points in local pedestrian movements. The result is presented on a time, context and dynamic scale. In the scale used in this research, local choice calculation delimits a radius of 800 m, which is the distance that a person can walk in 10 min (Figure 7). Again, five categories have been set up for each time and context situation, from 'very high' to 'very low', with the quality being classified as 'good' (very high and high), 'standard' (average) or 'poor' (low and very low) local choice.[30]

Borg El-Arab: Poor local choice Mostafa Kamel: Standard local Faisal Citv: Good local hoice

Figure 7. *Local Choice Quality in the Three Selected Case Studies*

28. C. Buchanan, *Traffic in Towns: A Study of the Long Term Problems of Traffic in Urban Areas* (Routledge, 2015).

29. L. Marcus, "Spatial Capital and how to Measure it: An Outline of an Analytical Theory of the Social Performativity of Urban Form," in *Sixth International Space Syntax Symposium*, 5-1. Istanbul Technical University, 2007.

30. García-Pérez, Oliveira, Monclus, and Diez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," 2020.

Functional Mix

Functional mix in the context of this research is a method to quantitatively and qualitatively demonstrate use patterns through the study of residential and non-residential plots. Higher functional diversity induces activities performed by inhabitants that help to create vitality in an open space.[31]

Assessment of functional mix in housing projects can be performed by applying the Simpson index to locations built for private (residential use) and public (non-residential uses) through the classification of mutually exclusive categories (Figure 8).[32]

The outcomes present the existing status of both the functional mix and of their type and locations (facilities and services inside or outside the housing project and non-residential activities in specific areas or ground floor commercial premises). The level of variation on the Simpson index ranges from 'very high' – less than 0.6 – to 'very low' – more than 0.9. Subsequently, quality of the functional mix is evaluated as 'good' (very high and high) 'standard' (average) and 'poor' (low and very low).[33]

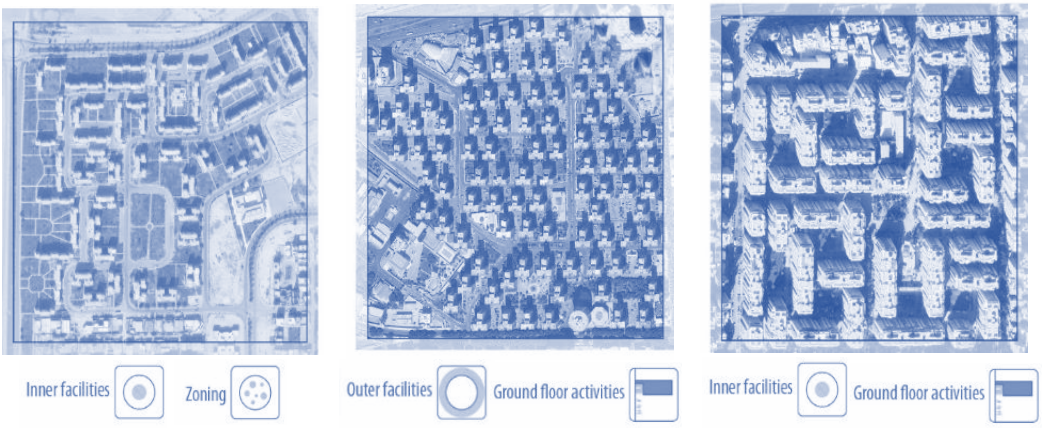


Figure 8. *Functional Mix Quality in the Three Selected Case Studies*

31. B. Mashhoodi, and M. Berghauser Pont, "Studying Land-Use Distribution and Mixed-Use Patterns in Relation to Density, Accessibility and Urban Form," in *ISUF 2011: 18th International Seminar on Urban Form: Urban Morphology and the Post-Carbon City* (Montreal, Canada, 26-29 August 2011).

32. K. Dovey, and E. Pafka, "What is Functional Mix? An Assemblage Approach," *Planning Theory & Practice* 18, no. 2 (2017): 249-267.

33. García-Pérez, Oliveira, Monclus, and Diez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," 2020.

Typology of In-Between Spaces

This physical attribute quantitatively analyses the area provided for in-between spaces and categorizes it through separate types. A balanced degree of open space is able to encourage social interactions, which is related not only to the extent of the space, but also to its alignment, more detected open space has more quality.[34]

The categorization of open spaces in this research is quantitatively performed with the 'spaciousness' variable (Open Space Ratio), which compares the open space area for public use to the floor area ratio.[35] This suggests a viewpoint of not only the extent of open space but also of its sufficiency with respect to the total built area. The empirical studies on urban fabric state that acceptable values of spaciousness fall between 0.06 and 0.3.[36] The results are classified in five levels that range from 'very high' (under 0.3) to 'very low' adequacy (over 0.9). Then, as Minoura[37] proves empirically, the enclosure of open spaces can affect their use, sense of ownership and management. To specify the degree of enclosure, the structure of open spaces is analyzed through the exclusive definition of three archetypes of residential open space ('closed or semi-closed', 'inter-block', and 'indeterminate' spaces, from the highest to the lowest level of enclosure). 'Good' quality is reached if both very high or high levels of spaciousness and enclosure happen concurrently (Figure 9). Housing projects reach 'standard' quality if at least their spaciousness and enclosure score average levels. All other possibilities achieve 'poor' quality values.[38]

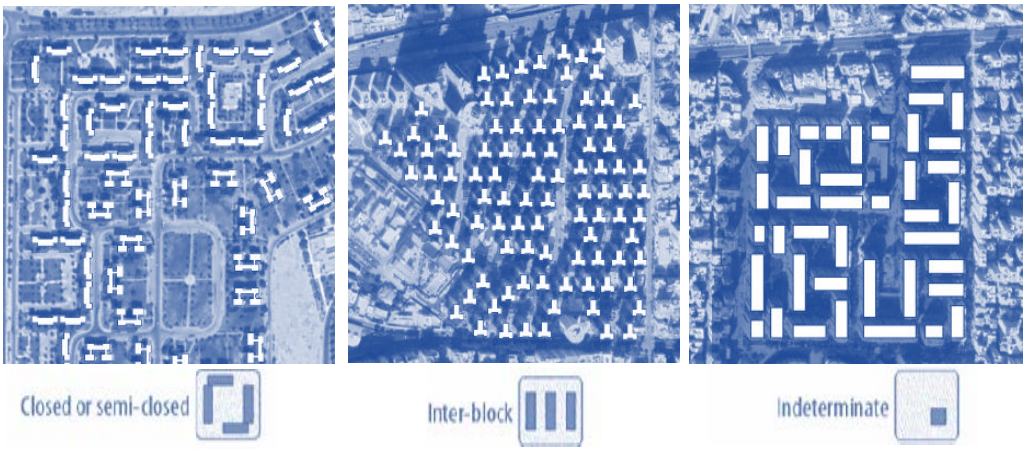


Figure 9. *Typology of In-Between Spaces in the Three Selected Case Studies*

34. Wassenberg, *Large Housing Estates: Ideas, Rise, Fall and Recovery*, 2013.

35. Berghauser Pont and Haupt, *Spacematrix: Space, Density and Urban Form*, 2010.

36. García-Pérez, Oliveira, Monclus, and Diez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," 2020.

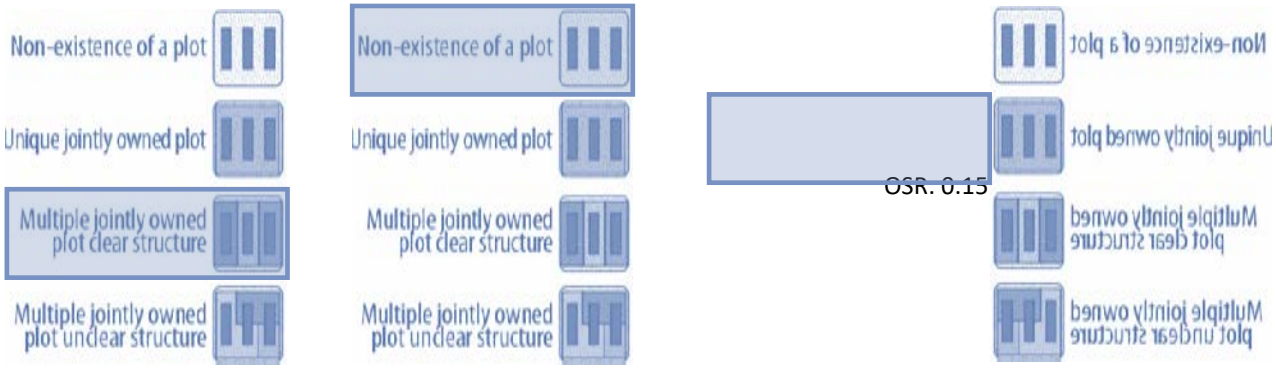
37. E. Minoura, *Uncommon Ground. Urban Form and Social Territory* (Stockholm: KTH Royal Institute of Technology, 2016).

38. García-Pérez, Oliveira, Monclus, and Diez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," 2020.

Plot Structure

As a physical attribute plot structure refers to the plot division selected and to monitoring how its spatial outline impacts the use and management of the open space. Well-defined physical boundaries and manifest property facilitate in maintaining the open space, which affects the comfort level of potential users.[39] The plot structure of mass housing projects is typically intangible, which results in vast spatial uncertainty between use and ownership.[40] This is the reason why plot structure directly affects open space quality.

Plot structure studies are regulated in Egypt using land registry records kept in each district's registration division. This facilitates the categorization of both the numerous owners and the assorted current plot situations by using four separate definitions. The owner is categorized as public, private, or unknown in each land plot. The plot conditions are the common space as the absence of a plot, the common space as a single jointly owned plot, the common space as a multiple jointly owned plot with a clear structure, and the common space as a multiple jointly owned plot without a clear structure (Figure 10). If both well-defined spatial structure and well-defined ownership occur, 'good' quality is realized. The quality is 'standard' if only a well-defined structure occurs; all other possibilities are rated as 'poor' quality.[41]



Borg El-Arab: Good Plot Structure

Mostafa Kamel: Poor Plot Structure

Faisal City: Standard Plot Structure

Figure 10. *Plot Structure in the Three Selected Case Studies*

39. Ibid.

40. K. Kropf, "Plots, Property and Behavior," *Urban Morphology* 22, no. 1 (2018): 1-10.

41. García-Pérez, Oliveira, Monclus, and Diez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," 2020.

Density

Density in the context of this research quantitatively classifies the physical density of the urban form through the definitions presented by Berghauser of building intensity (FSI: Floor Space Index), compactness (GSI: Ground Space Index) and Spaciousness (OSR: Open Space Ratio). In general, More intense and higher physical densities bring richer social interactions and economic opportunities.[42]

The literature has revealed a debate between authors who consider mass housing projects to be mostly low-density developments compared to the organic urban fabric,[43] and others who stated that high densities of mass housing projects are what distinguish them.[44] Accordingly, it is imperative to improve the calculation of existent densities, with regards to the degree of diversity in the selected mass housing projects. Nonetheless, all authors agree that mass housing projects exemplify a more open and fragmented form compared to the organic urban fabric of the city, and this is exactly one of the main features that cause obsolescence.[45]

Calculations for the three selected projects are done using Berghauser's[46] methodology (Table 1). Next the results categorize housing projects by type of physical density depending on the relative position they occupy on the Spacemate graph. Housing projects with similar spatial characteristics are classified together based on: coverage (from 'very low', under 15%, to 'very high', over 50%); floor area ratio (from 'low', under 1, to 'high', over 2); and, lastly, average height (from 'low', under 3 floors, to 'extreme', over 7 floors) (Figure 11). Considering the quality assessment approach,[47] 'good' quality is achieved when physical density is intense (high FSI) and compact (high coverage) without reaching extreme values. 'Standard' scores are given if at least FSI or coverage are not rated with a low value. 'Poor' is given to all remaining cases.

Table 1. *Calculations for the Density Variables for the Three Selected Case Studies*

DENSITY INDICATOR	FAISAL CITY	BORG EL-ARAB DISTRICT 1	MOSTAFA KAMEL COMPLEX
B: FOOTPRINT	56100	29400	57600
A: AREA OF SITE	151000	233600	244500
F: GROSS FLOOR AREA	618000	147000	921600
L: AVERAGE HEIGHT	11	5	16
GSI: GROUND SPACE INDEX (COVERAGE)	0.372	0.126	0.236
FSI: FLOOR SPACE INDEX (BUILDING INTENSITY)	4.093	0.629	3.769
OSR: OPEN SPACE RATIO (SPACIOUSNESS)	0.154	1.389	0.203

42. Berghauser Pont and Haupt, *Spacematrix: Space, Density and Urban Form*, 2010.

43. D. Sims, *Egypt's Desert Dreams: Development or Disaster?* (Cairo: The American University in Cairo Press, 2014).

44. Wassenberg, *Large Housing Estates: Ideas, Rise, Fall and Recovery*, 2013.

45. MIT, *The Density Atlas*, 2011.

46. Berghauser Pont, Forssén, Haeger-Eugensson, and Gustafson, "Increasing Cities," 2019.

47. García-Pérez, Oliveira, Monclus, and Diez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," 2020.

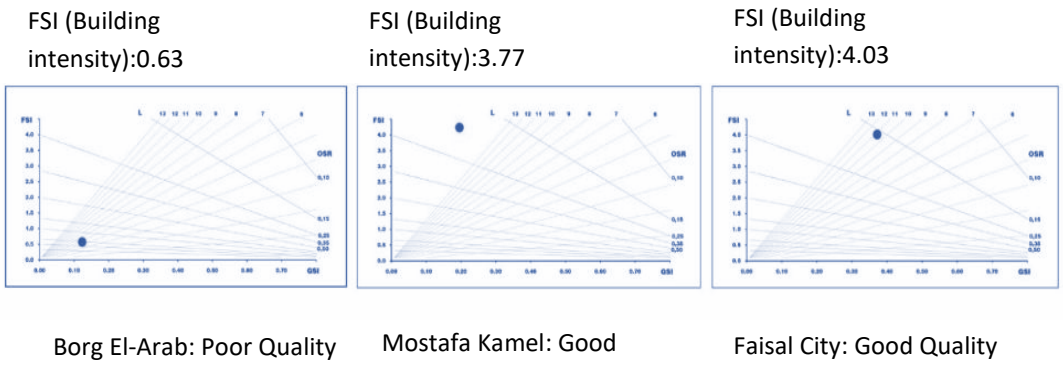


Figure 11. *Density Quality in the Three Selected Case Studies*

Building Diversity

Building diversity categorizes the similarity of the selected building types in each mass housing project and their replication. More diverse housing types are able to stimulate more social blending between inhabitants by evading standardized designs.[48]

Mass housing projects were commonly portrayed as a formal standardized physical arrangement with low diversity in terms of the building types offered and the executed urban solutions. This was a result of essentially economic circumstances and the relevance of specific ideological principles. These conditions usually produced projects that were labeled as monolithic.[49] However, diversity is presently received as a positive characteristic capable of creating more inclusive spaces by providing inhabitants the opportunity to choose that did not exist before.[50] While diversity can be apprehended from various aspects (social, economic, etc.), in this research we are only seeking the physical dimension.

Diversity is evaluated through the Simpson index using the same method of assessment as the functional mix.[51] This index can be summarized in just one variable: the abundance of building types. First, the index values are represented on a scale of five classes from 0 to 1, from the most 'diverse' (values between 0 and 0.2) to the most 'standardized' (values between 0.8 and 1). Then quality is evaluated as 'good' (very high and high) 'standard' (average) and 'poor' (low and very low) building diversity.[52]

48. Buchanan, *Traffic in Towns: A Study of the Long Term Problems of Traffic in Urban Areas* (Routledge, 2015).

49. L. Lees, "Commentary," *Environment and Planning* A, 42, no. 10 (2010): 2302-2308.

50. MIT, *The Density Atlas*, 2011.

51. Dovey and Pafka, "What is Functional Mix? An Assemblage Approach," 2017.

52. García-Pérez, Oliveira, Monclus, and Diez Medina, "UR-Hesp: A Methodological Approach for a Diagnosis on the Quality of Open Spaces in Mass Housing Estates," 2020.

Eye Level Design

Eye level design investigates the physical features in the assemblage between a building and an open space. The suitability of this assemblage to the human scale, its dimension, and mobility improve the comfort of inhabitants and an appealing built environment facilitates the occurrence of social interaction.[53]

The classification of 'eye level' design is based on the detailed study of typical spaces inside housing projects. The study of eye level design is centered on the human dimension of each space between the housing blocks, regarding the height/width ratio ('horizontal' if they have a substantially wide proportion; 'balanced' based on a 1:1 ratio; and 'vertical' if they have a substantially narrow proportion).[54] Furthermore, it focuses on the porosity of the built edge on the ground or street level; the results are categorized based on the size of the edge per unit area and the edge's quality, from 'active' (over 15 doors every 100 meters) to 'inactive' (from 0 to 2 doors every 100 m). 'Good' quality of 'eye level' design is realized when a balanced height/width ratio, a close distance and >20% of active façades appear. 'Standard' quality is realized if at least one partial variable is 'good' (scale and distance or porosity of the built edge), whereas the other possibilities are rated as 'poor' quality (Figure 12).

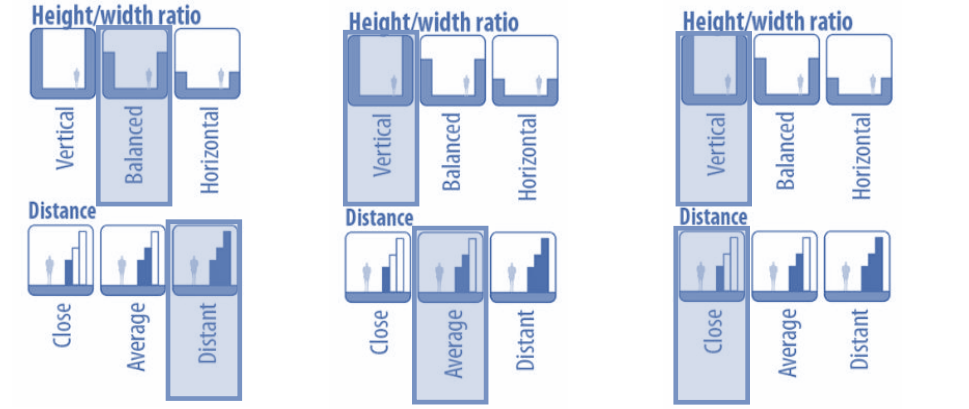


Figure 12. *Eye-Level Design Quality in the Three Selected Case Studies*

53. Urban, *Tower and Slab: Histories of Global Mass Housing*, 2013.

54. V. Oliveira, *Urban Morphology. The Urban Book Series* (Cham: Springer International Publishing, 2016).

Table 2. *A Comparative Table Combining the Nine Physical Variables and the Quality Results*

Comparative Discussion

Summarized in Table 2, the following discussion provides the essence of the adopted methodology as a process of forming comparative views of multiple case studies and investigates the possibility of using the methodology for decision-making.

Regarding integration, Borg El-Arab illustrated the lowest integration as it was part of a much bigger unsuccessful development in the desert, while the other two projects were adequately integrated within Alexandria's urban fabric. Again, the lack of permeability in the case of Borg El-Arab lent the feeling of a ghost town to the streets and paths of the project, but the other two projects were tolerably permeable for the surrounding urban fabric, even though both of them were outlined from the north by a strong edge (The railway line in the case of Faisal, and the coastal highway in the case of Mostafa Kamel).

The local choice of roads in Faisal was the clearest and showed the highest connectivity with the surrounding urban fabric, while in the case of Mostafa Kamel the roads were arranged to have more internal connectivity and Borg El-Arab had an additional, separate arrangement of roads. Concerning 'plots', both Borg El-Arab and Mostafa Kamel exhibited a low level of functional mix as in both of these projects non-residential functions were mostly allocated separate zoning. However, in the Faisal project, non-residential functions were arranged proportionately in the site, beside the ground floor retail activities.

The plot structure of open spaces in all three case studies was a crucial aspect in the management and maintenance of the open spaces. Although Borg El-Arab is a low-income class project, and most of the units are rentals, the open spaces are well maintained due to the clear well-defined structure of the plots. To the contrary, the middle-income well-situated project of Mostafa Kamel showed no clear plot structure, which resulted in a no man's land feeling and that was reflected in the quality of the open spaces.

The three case studies were selected essentially as a representative of the three archetypes of in-between spaces: Semi-enclosed, Inter-block and Indeterminate. Hence, the open space ratio (OSR) of each project was calculated as an indicator of spaciousness of the open spaces. All three projects are considered spacious compared to the surrounding urban fabric, yet Borg El-Arab is spacious to the extent that it impaired the quality of the open space.

With regard to density, Mostafa Kamel and Faisal displayed similar values with good placement on the Spacemate density graph as their coverage (GSI) and building intensity (FSI) match reasonably with their spaciousness (OSR). Nevertheless, Borg El-Arab's density values were lacking because of the low building intensity and the too high spaciousness. It is imperative to consider this attribute as one of the significant points, as the value of density could have a crucial impact on decision-making based on objective data regarding possible intensification improvements. Borg El-Arab could benefit from such an intensification strategy keeping in mind the question of integration as a priority. Most state-led mass housing projects in Egypt lack building diversity, which was clearly illustrated in Mostafa Kamel with only one model being replicated 97 times to form the project.

Concerning the eye level design analysis, the research was concerned only with the human scale and the porosity of building boundaries at ground level. As both Mostafa Kamel and Faisal include towers of more than ten floors, in narrower streets the view to the sky is limited. Additionally, in Faisal ground floor activities are plenty, which causes unwanted social interaction in some areas due to the proximity between residential and non-residential activities.

Based on the extensive assessment of the nine physical attributes for the three selected case studies, it is clear from the comparative discussion how each attribute negatively affected each case. Following the adapted UR-Hesp methodology, a final evaluation for each representative case should be presented while highlighting which attribute influenced the project the most.

Even if all the nine physical attributes critically impact the quality of open space, some attributes had a strong negative impact on each case study. Borg El-

Arab was profoundly affected by the lack of integration and permeability due to the selection of the project location. The future intended plan was that surrounding developments would improve the quality, but due to the fragile success of the project, the acclaimed future never happened. Mostafa Kamel is a prototype of how current mass housing projects are being built in Egypt, the standardized apartment building that is repeated and indeterminately arranged in the site, which harms eye level design and building diversity directly. The lack of a clear plot structure decreases the sense of ownership for the residents, which directly affects the maintenance of the open space. The Faisal project has satisfactory open space quality even if the eye level design was affected by the height and proximity of the towers. For these reasons, the Borg El-Arab and Mostafa Kamel projects are both evaluated as obsolete because of their substandard quality of open spaces, while Faisal's project is finally appraised as resilient (Table 3).

Table 3. *Results Obtained by Applying the UR-Hesp Methodology on the Three Case Studies*

		Borg El-Arab		Mostafa Kamel		Faisal City	
		Partial result	Final result	Partial result	Final result	Partial result	Final result
Integration		Very low, Q1	P	High, Q4	G	Average, Q3	S
Permeability		Very low, Q1	P	Average, Q3	S	Average, Q3	S
Local choice		Low, Q2	P	Average, Q3	S	High, Q4	G
Functional mix		Very low	P	Low	P	High	G
Typology of in-between space	OSR* Archetype	Very low, 1.39 Semi-closed	P G	Very High, 0.20 Indeterminate	G P	Very High, 0.15 Inter-Block	G S
Plot structures		Clear physical structure but not clear property	S	Not clear physical structure	P	Clear physical structure	S
Density	FAR COV	Very low, 0.63 Very low, 12%	P	High, 3.77 Average, 23%	G	High, 4.09 Average, 37%	G
Building diversity		Average, 0.50	S	Very low, 0.99	P	Average, 0.50	S
'Eye-level' design	Scale and distances Boundaries	Balanced / Distant 11% active	G	Vertical / Average 2% Inactive	P	Vertical / Close 65% active	P

P: Poor quality, S: Standard quality and G: Good quality.

Conclusion

This research presents a methodological adaptation of the UR-Hesp methodology, where the focus of assessment was to compare mass housing projects based on the urban form implemented, aiming only at the physical attributes defining open spaces within mass housing projects. The methodology merges qualitative and quantitative approaches on diverse scales. Verification of the methodology was performed through three Egyptian case studies. The representativeness characteristics of the case studies are adequately balanced to allow for future replications of the methodology.

Likewise, this research is not lacking limitations. The application of this methodology shrinks the complexity of reality to a simplified analytical model dealing only with physical attributes. This approach based on quality assessment

of various urban forms could help decision makers to build better future physical environments. However, physical improvements are not an assurance of success, but changes in other dimensions can be generated by these improvements.

The results of this research should be revisited after future studies have been performed that tackle social vulnerability, socio-economic indicators analysis and environmental concerns. Since there are many features that can affect the quality of mass housing projects, open space quality should not be the only factor when analyzing urban quality, but it is an important element that can act as a trigger of improvement for urban regeneration projects or future urban developments.

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Shopping Mall Parking Lot as/is a Meeting Place: Typologies and Strategies for a New Polarity in Architectural and Landscape Design

By Claudio Meninno[*] & Adriano Venudo[±]

This article presents the results of a study developed around the general theme of the future of large shopping centers in relation to the current transformations of territory and city in Italy. Specifically, the research deals with outdoor spaces, those enormous technical and service spaces strictly connected to the commercial "big-boxes". The focus of the research is therefore on the large parking areas, the roads, the manoeuvring and service areas for sales: the large asphalt slabs that surround the commercial volumes. The research starts from the specific case study of the large shopping center "Tiare" in Villesse, Gorizia (one of the largest in the Friuli Venezia Giulia Region) and then extends to the development of a more general and scientifically articulated modelling. The objective was to translate the initial retrospective study (origins and development of shopping centers) and the design explorations developed in the academic sphere and through workshops on the potential of the case study into strategies, exportable to other contexts. The spaces involved are considerable, amounting to 2-3 times the sales area, i.e., parking lots of 30-40-60 hectares, the same extension of an entire town. From this it is easy to understand the importance of the architectural design on other disciplines, and the need to question "if and how" these spaces can also become something else, if they can also have a social role due the dimensional-territorial entity, and specifically, recovering the American tradition from Gruen onwards, if they can assume the role and function of a meeting place. The research allowed the identification of methodologies for the transformation of car parks into meeting points: the creation of a landmark, densification and screening. In addition, the results obtained offer possible new developments for these places that can be identified in the following macro-strategies: the re-urbanisation of peripheral commercial nodes, neural development between city and shopping centre, parallel and autonomous development of shopping malls and cities, commercial development and urban erosion.

Introduction - From Mall to Shopping Center Mall … by Car

The research focuses on shopping centers and in particular the large open spaces around them, technical places resulting from a planning characterized by a manual approach and mainly used as parking lots.

Huge areas often used only to leave the car parked but with great architectural, landscape, environmental and even social potential.

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If in the beginning the places dedicated to the creation of social relations resided in the open and vital spaces of the city, such as squares and markets, with the passage from the pre-industrial to the modern phase of capitalist society, other types of places begin to appear, expressions of the need to create an indoor, large dimensioned, air-conditioned and safe space.

At first the *passages* and the *grands magasins*, but also the hyper-interiors of the universal exhibitions, define the genealogy that leads to the creation of the shopping center as a specific manifestation of the society of mass consumption according to two main models of reference: on the one hand the mall, emblem of the American sprawl, which transforms the outdoor commercial space into an air-conditioned commercial strip, easily accessible by car and with a large availability of parking spaces; on the other, an approach that comes from the ashes of Europe undergoing reconstruction, where the commercial facilities concretize the effort to rebuild the torn cities through multifunctional, experimental interventions and, in some cases, expression of the desire to build a new modern citizenship.

The logic of late capitalism led to an exasperation of the proliferation and hybridization of these models within urban systems and especially in peripheral territories. Today these realities seem to be put in crisis by the virtualization of the forms of distribution and sale of goods and, as in any crisis situation, the outcome of the possible evolutions is not obvious and will involve very different scenarios: from the re-urbanization of major commercial systems to the exploitation of gaps that the virtual currently presents, probably passing through a range of hybridizations in continuous evolution.

Today it is very clear that shopping is an indispensable phenomenon to understand the urban[1] and that, beyond good intentions and trivializations, it is a vital and recurring question in the architectural discourse.

What role does architecture play in shaping those spaces, neither strictly public nor generically private, but enjoyed collectively? And how does the architectural project actually shape the multiple faces of the community? And more specifically, is it possible to transform the external areas of a large shopping center into a collective meeting place?

If perhaps it is easier for buildings and structures, what could be the fate of the huge open areas dedicated to traffic and parking of thousands of cars? Today, they are still predominantly technical and service areas, but research has made it possible to investigate case studies and design tools to convert them or to associate these spaces with new social, ecological and even new functional values.

The study was developed by a group of researchers from the University of Trieste and had a dual purpose: a theoretical-methodological and an operational practice, applied to the specific case study of "Tiare" shopping center in Villesse, in the province of Gorizia, owned by Ingka Centers. A large commercial platform with a catchment area that covers the entire Friuli Venezia Giulia region, the Veneto region, Slovenia and Austria. Study and project workshops were organized with students, as well as conferences and in-depth seminar days and part of the results were collected in scientific publications.

1. C. J. Chung, J. Inaba, R. Koolhaas, and S. T. Leong, *The Harvard Guide to shopping* (Köln: Taschen, 2001).

The analysis of the historical evolution of these places, the in-depth analysis of the case studies and the design experimentation conducted have made it possible to build a theoretical-operational methodology that outlines the design approaches to transform the large technical spaces around the shopping centers into real meeting places, in such a way as to define the strategies for a greater integration of commercial platforms with the territories and with the problems connected to them, both in a contemporary and future perspective.

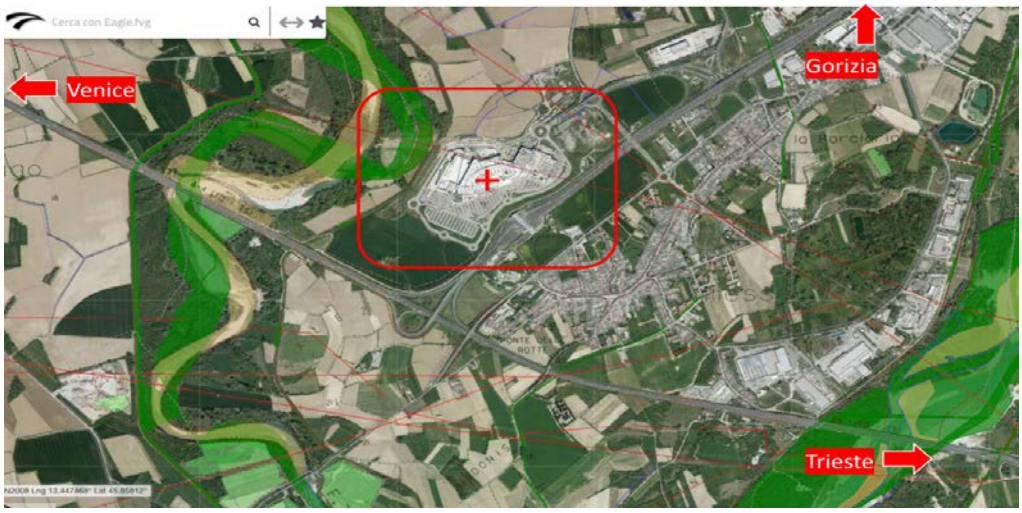

Figure 1. *Location of the Case Study*
Source: EagleFVG 2021.

Figure 2. *The Case Study: The Shopping Center and the Parking Lot of the "Tiare Shopping Mall" in Villesse - Gorizia (Italy)*
Source: EagleFVG 2021.

Literature Review - Origins and Development

In order to stimulate investment, the United States Congress in 1954 issued a series of measures that artificially accelerate the aging of industrial and commercial buildings by increasing the depreciation allowances that can be deducted from taxes.

Before this act, in 1953, there was only one regional mall in the whole of the United States.[2] Three years after the issue of this scrapping incentive there were twenty-five. If we then consider all types of shopping centers, open, closed, linear (along the roads), etc. the increase was 500%.[3]

At the same time as this accelerated depreciation of real estate, the United States focused on the growth of the large infrastructure network with the "Interstate Highway Act", and within 10 years the "world's largest highways" would be built, facilitating the fast automobile connection of an entire continent.[4]

These two laws, like the ingredients of a magic potion, triggered and favored the suburban growth of American cities, transforming them into metropolis or rather territorial cities. In this context, new forms of commerce were born and developed, all to be experienced and consumed by car: first the shopping malls and later the Edge Cities were almost naturally located in the interchange infrastructures of the great road arteries.[5]

In this context of infrastructural development and commercial growth, especially with the birth of large-scale distribution, the theories and projects of Victor Gruen find great success. One of the first case studies of this new architectural typology was the project for the Southable mall in 1954. And it is precisely the Architectural Record magazine that in the mid-1950s begins to deal with this new phenomenon of commercial cities, giving space to Victor Gruen's projects. Bruno Zevi, albeit in a very concise way in his "History of modern architecture" of those years, is one of the first in Italy and Europe to dedicate space to Gruen's professional experiences, highlighting the novelties of urban and infrastructural layouts, and above all of inclusion of recreational aspects in these commercial mini-cities.[6] Richard Longstreth,[7] some years after Zevi, analyzes the “Gruen case”, with a focus on Southdale's mall as a paradigmatic project. The book is completed in chapter IX by a comparison of the design experiences of Victor Gruen with those of Clarence Stein, another important protagonist among the pioneers of shopping center designers. As we said previously, it is a crucial moment for the United States, but also for the architectural culture which sees the birth of real new typologies: Southdale is the first enclosed mall, an introverted shopping center, which contains complexity and functional articulation to build an artificial urban world and which responds to the logic of the market and the

2. F. Bottini, *I nuovi Territori del Commercio. Società locale, grande distribuzione, urbanistica* (Firenze: Alinea, 2005), 43.

3. M. Gladwell, *The terrazzo jungle. Fifty years ago the mall was born. America would never be the same* (The New Yorker, 15 March 2004).

4. Ibid.

5. Ibid, 162-175.

6. B. Zevi, *Storia dell’Architettura moderna* (Torino: Edizioni di Comunità, 1975), 302.

7. R. Longstreth, *City center to regional mall. Architecture, the automobile, and retailing Los Angeles* (Cambridge: MIT Press, 1997).

strategies of large retailers and which, at the same time, is totally indifferent to what is outside, to the context: these are the prodromes of Wall-Mart's big boxes.

This type was born in the United States in the mid-50s and then developed until the early 90s, from here it evolved into big-boxes as a response to a general decline and the crisis of large-scale distribution, which began precisely at the beginning of the 90s. This collapse was considered by scholars as physiological:[8] omnivorous commercial plates, ever larger and more and more introverted, but above all for single use. "People are moving towards the greatest and easiest-to-reach concentration."[9] The corpses of a lost battle remain on the field: huge malls with stretches of asphalt around them, parking spaces and roads that occupy 2-3 times the covered surface of the mall.

This also represents the end of a society idea based on the brutal live-work-shop triad. Accomplice of this decline in the evolution of shopping malls on the street was the birth, as a reaction to the first signs of decline, of new types and forms of large-scale retail trade. And so, in the late 1980s and mid-1990s, discount department stores, category killers, outlet stores and warehouse clubs appeared. The surfaces are in dizzying growth, enormous volumes and surfaces for trade: from 10,000 sqm super-centers arrive in a short time (late 90s) to 30,000 sqm, which means outdoor spaces for parking and service roads equal to more than double, that is, surfaces of asphalt around 60-90,000mq. The category killers, shops that offer sector-specific products at very low prices, reducing profit to almost zero but focusing on quantity, start at 2,000 sqm and after a few years, in the mid-90s, soon reach sales surfaces around 20,000 square meters together with the outdoor spaces that grow accordingly. The growth of these malls outside the cities, which is recorded in less than 10 years, especially for the sales surfaces and consequently for the outdoor spaces, is in some cases of an exponential type. The impact is huge. In about 40 years, the forms of trade redesign territories and landscapes and extend the city, contributing to making them, first in the United States and then in Europe, metropolises, territorial cities. Infrastructures play a decisive role in this race towards gigantism and, in fact, the Freeway business centers were born in the early 90s. Malls that cater exclusively to traveling motorists, with diversified services that range from fuel, to parking and annexes (bathrooms and bars), to catering, to various trade (food, spare parts, cosmetics, clothing, household goods, appliances, etc.) up to the large-scale distribution trade that affects all product categories in a global way. A common feature of this new typology, the Freeway business centers, is the total extraneousness to the context and, on the other hand, the complete integration with the infrastructure: they are in fact conceived as real extensions of the street space.

8. R. L. Nelson, and F. Aschman, *Conservation and rehabilitation of major shopping districts* (Washington: Urban Land Institute, Inc., 1954), 8-9.

9. W. J. Reilly, *Manuale per la progettazione dei Centri Commerciali* (New York: Urban Land Institute, 1950).

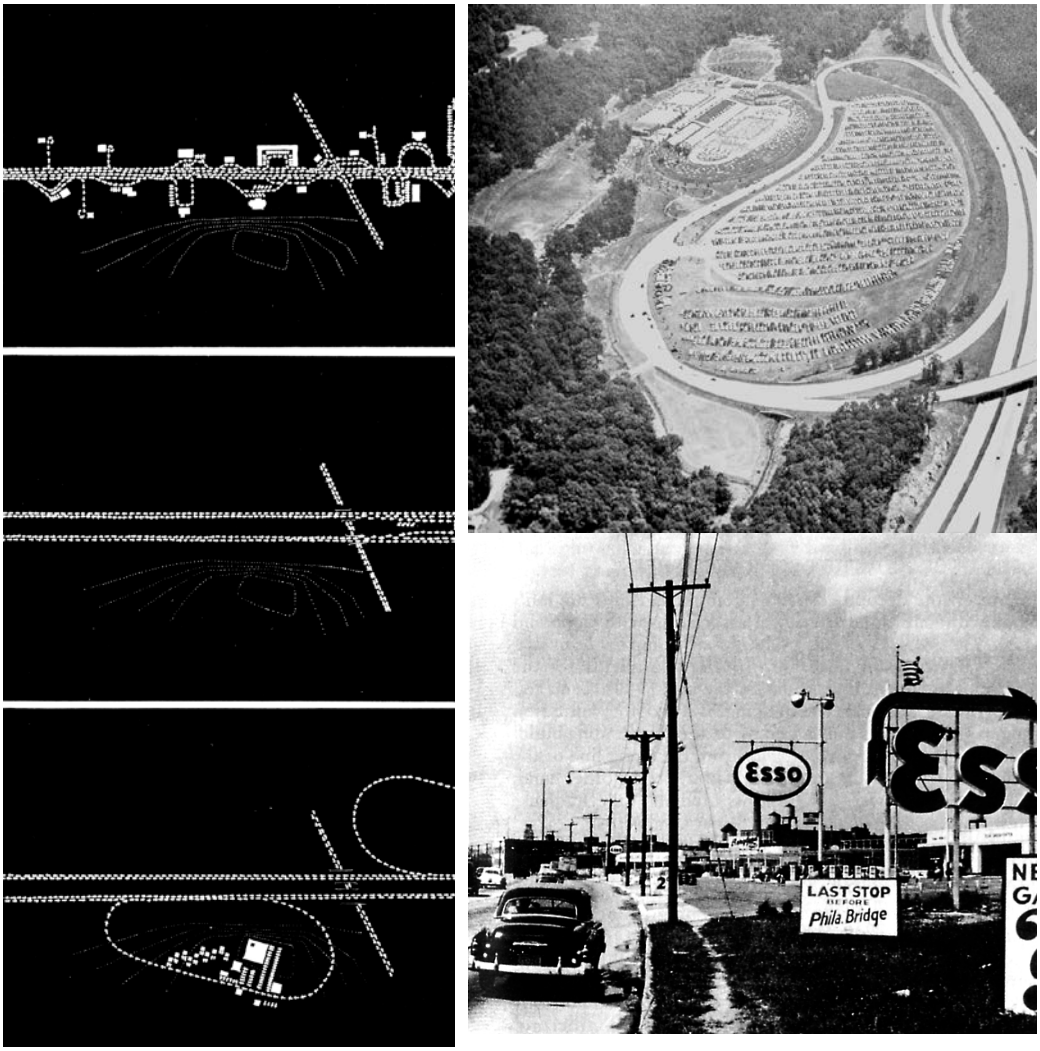

Figure 3. *Infrastructure, Cars, New City-Territory (Sprawl Town). Early Commercial Street Car Diagrams in USA (Man Made America, C. Tunnard, B. Puskarev); One of the First Suburban Shopping Centers Accessible Only by Car (Man Made America, C. Tunnard, B. Puskarev); Las Vegas' Strip (R. Venturi, D.S. Brown, S. Izenour, Learning from Las Vegas)*

The great typological invention of the twentieth century and - as Kevin Lynch[10] argues - the only major American contribution to the development of the city is the strip, that is, the street market.

This new typology, the result of spontaneous dynamics and self-organizing processes celebrated in the famous text "Learning from Las Vegas"[11] by Venturi, Scott Brown and Izenour, probably expresses the first true character of the street market for automobiles. The strip is a market on the scale of the city or the territory, designed to be lived, used and consumed with the car.

10. K. Lynch, D. Appleyard, and J. R. Myer, *The view from the road* (Cambridge: The MIT Press, 1964).

11. R. Venturi, D. S. Brown, and S. Izenour, *Learning from Las Vegas* (Cambridge: MIT Press, 1972).

It is a sort of natural evolution of the historic urban mall of American cities of the early 1950s which has then evolved into the big-box which since the end of the '80 begin to populate the edges of the city and then gradually in areas often completely to be urbanized, but close to motorways and infrastructural interchanges.[12] Thus were born the American regional malls, large slabs in the middle of nowhere, huge commercial boxes with nothing around them but huge surfaces of asphalt for parking lots.

Shopping, thanks to the car, acquires a new dimension linked to simplicity and freedom of movement.[13]These new forms of commerce, suburban retail, which soon became the trend of large-scale distribution, are made exclusively for cars:[14] organized by large specialized plates along the main interstates, the large boxes of Wall-Mart draw the new imaginary of the American consumerism that after twenty years will also arrive in Europe. This second phase marks the leap of species, the genetic variation: we are at the beginning of the 90s and the commercial space takes on the dimension of the territorial scale,[15] the reference is no longer the architecture, the building in the city, nor the isolated but it is the big box. The big-boxes speak the language of infrastructures, deal with the extension of the highway and measure the extent of the desert territory. Hence, the famous Oregon Trail Syndrome.[16]

Shopping follows a syncopated rhythm, entering and exiting the various malls by car along streets lined with large sign-buildings, goods on display, large parking lots, in which "[...] there are no benches, protected spaces, public toilets, trees. It is difficult to recognize objects and orient yourself, everything is very large, huge, colorful and above all shouted to catch the driver's attention".[17] Both in the American strip and in the European street-market, the most evident fact is the lack of a continuity of the collective space, the one on a human scale, to which we are ordinarily used since the streets belonged to people[18]. This absence is the result of a new relationship of direct permeability between the traffic lanes of the road, cars and shopping centers.

Everything is thought in automotive terms, including open space (only parking lots and maneuvering areas), and in this new world the car becomes the necessary extension of the body, of man himself. The scale, size and texture of the public collective space are determined by speed, radii of curvature, visibility and dynamic perception. This type of commercial-associated automobile infrastructure has

12. F. Bottini, *I nuovi Territori del Commercio. Società locale, grande distribuzione, urbanistica* (Firenze: Alinea, 2005), 43.

13. R. Banham, *Los Angeles l'architettura delle quattro ecologie* (Genova: Costa e Nolan Editions, 1983).

14. F. K. Benfield, M. D. Raimi, and D. D.T. Chen, *Once there were greenfields. How suburban sprawl is undercoming America's environment, economy and social fabric* (New York: National Resource Defence Council, 1999).

15 . "Big Box Retail", Planning Memo, December 1995, Office of State Planning – Department of treasury, New Jersey.

16. C. Dardi, *La sindrome dell'Oregon Trail* (Spaziosport n.3, 1985).

17. K. Lynch, M. Southworth, *Design and Managing the strip* (London: The MIT Press, 1990), 582

18. B. Rudofsky, *Strade per la gente, architettura e ambiente umano* (Roma-Bari: Laterza, 1981.

resulted in a specific degree of permeability between the road, the urban context and the landscape that has produced a new type of public open space, exclusively linked to movement: modern shopping centers.

The forms of permeability that characterize the strips, and in general all the street-markets, have produced the loss of the idea of urban space as a continuous experience, as a sense of belonging since spatial perception is characterized by two speeds: the one about a landscape seen as a set of heterogeneous objects, the contrast of which restores uniformity, and the other about a precise knowledge, characterized by thrusts, with specific and targeted objectives inside the car parks and commercial boxes. Permeability - vector of belonging - is built up of interface elements: fences and signs, asphalt surfaces of car parks, envelopes, shape, architectural skin of malls, often transfigured into real icons or commercial brands.

The space of movement is a public space with uncertain boundaries, in which road edges, maneuvering areas, car parking areas and showcase facades take on the role of a new threshold space.

They replace the function that once, in the historic city, the arcades and continuous fronts of shops, bazaars and cafes performed.

The bibliography and case studies collected in this research tell an interesting story ranging from Victor Gruen to Bob Venturi, from urban malls to regional malls, from street markets to Freeway business centers. But the protagonist is always the automobile. In this way a historical-urban route and an architectural and landscape evolution of shopping centers can be reconstructed.

Shopping malls were born in the city, moved to the suburbs and then further and further out, into the territory, along the great arterial roads and near infrastructural nodes, to then today, after 70 years, show the first signs of a process of re-entry into urban centres, but with new forms, new typologies, and above all leaving empty giants (big-boxes) and huge expanses of asphalt, hectares of parking and roadways in the territory.

The proposed research has attempted to reconstruct this path, an evolution or involution, which first in the United States and then in Europe, has taken place and is still taking place. Perhaps in the United States it is already at an end, but in Europe and Italy it is still going on.

> What to do with these large commercial areas, how to make them attractive and re-functionalise them?
> How and what to transform them into once the mall is back in town?
> How to convert asphalt areas of 80,000-100,000sqm, always located outside cities and close to motorways and junctions? How to manage the transition period?

The shopping center car park is a newly formed space, yet to be explored and investigated. Especially considering the profound changes in the forms of large-scale retail trade that have occurred in the last 70 years and in relation to the new dynamics that are emerging for large malls outside the cities.

Figure 4. *Evolution of the Shopping Center, Case Studies and Reference Figures*
Source: research team.

"Forecourt or part of an urban street where cars can be parked, within special spaces delimited by strips", this is the dictionary definition of parking. At first reading, the car park is definitely described only as a space serving the car. It was born as a technical space that spreads and develops in parallel and necessarily with the expansion of infrastructures, in particular roads, as a service space for mobility and pedestrian-motorist modal exchange.[19] The main feature of these places, unlike the other urban materials that make up the open space of the city (street, square, park, etc.), is the rigidly monofunctional nature: by definition, the car park was born exclusively as a space dedicated to parking the automobile, it is almost impossible to think of reconciling other activities and functions, so that its technical nature has often compromised the presence of aesthetic contents, limiting and discouraging design and compositional explorations.

However, from a certain historical moment onwards thanks to some conscious American design experiments of the 70s, first of all those of the SITE, and some initial attempts related to the development of the large-scale distribution sector starting from the 50s with Victor Gruen,[20] work began, both on a theoretical and a

19. L. Ponticelli, and C. Micheletti, *Nuove infrastrutture per nuovi paesaggi* (Milano: Skira, 2003).

20. V. Gruen, and L. Smith, *Shopping town USA. The planning of shopping centers* (New York: Reinhold Publishing Corporation, 1960).

design level, on the intrinsic aesthetic potential of the car park, as an open space, interface of buildings and architecture of the city, to then develop on a wider dimension and in relation to the city and with the systems that make it up, and therefore as a new theme for the urban design.

The revolutionary text by Bob Venturi,[21] who taught us to look at Las Vegas and, more generally, the spaces of the city, the street and the new urban landscape, as ephemeral as it is structural for the new forms of sprawl, is only a few years earlier. These are the years in which the American vocation to open spaces "leaps overwhelmingly in the work of the SITE in the form of reaffirmation of the organic nature of man's home".[22] In the book on SITE edited by Cristiano Toraldo di Francia we find the synthesis of the cultural approach and the experimental and visionary legacy of this innovative research that focuses on the spatiality of infrastructures. But it is also the narration of an effervescent climate in which the new paradigms of public space were born, that of the "place that is no longer a place", of the "super-place", of "hyperplaces", up to the *terrain vague*.

These experiences in Italy have found a theoretical metabolization about twenty years later than in the United States, as Mirko Zardini or Aldo Aymonino and Valerio Paolo Mosco tells us in "Asphalt"[23] in the innovative theming "Contemporary Public Spaces. Zero volume architecture"[24] or Serena Mafioletti and Stefano Rocchetto in the systematic collection "Infrastructures and contemporary landscapes".[25] Just to mention some of the most significant texts that through design experiences build a sort of *a posteriori* theory of the new public spaces of the city: the spaces of mobility, of infrastructures, of roads, of parking lots.

Over the past 20 years, an extensive bibliography has proliferated on parking as a theme and place of urban, architectural and landscape design. This is the indicator of a fertile line of research that has also found in Italy, especially in the University of Pescara, Rome and Venice,[26] a sort of beginning with three texts, all published in 1996: the first two, "Crossings. The new territories of public space",[27] curated by Paolo Desideri and Massimo Ilardi, and "Hybrid landscapes. A journey into the contemporary city" by various authors including Mirko Zardini, more focused on building a theory of infrastructure spaces as public spaces and on the analysis of urban phenomena and of the anthropological and social dynamics connected to these spaces, and finally another book, always coeval, "The space of motion. Design and project"[28] by Nico Ventura, more focused on the research of

21. R. Venturi, D. Brown, and S. Izenour, *Learning from Las Vegas* (Cambridge: The MIT Press, 1972).

22. C. Toraldo di Francia (Ed.), *SITE architetture 1971-1988* (Roma: Officina Edizioni, 1989), 10.

23. M. Zardini (Ed.), *Asfalto: il carattere della città* (Milano: Electa, 2003).

24. A. Aymonino, and V. P. Mosco, *Spazi contemporanei. Architettura a volume zero* (Milano: Skira, 2006).

25. S. Mafioletti, and S. Rocchettto, *Infrastrutture e paesaggi contemporanei* (Padova: Il Poligrafo, 2002).

26. A line of research developed in Italy between the Universities of Architecture of Pescara, Rome and Venice, by Pippo Ciorra, Aldo Aymonino, Peppe Barbieri, Carlo Gasparini, Rosario Pavia, Alberto Clementi, Antonino Terranova.

27. P. Desideri, and M. Ilardi, *Attraversamenti. I nuovi territori dello spazio pubblico* (Genova – Milano: Costa & Nolan, 1997).

28. N. Ventura, *Lo spazio del moto. Disegno e progetto* (Roma – Bari: Laterza, 1996).

case studies and on the construction of an idea of spatiality of infrastructures connected to the design-architectural experiences and to the artistic-visual experiences born between Europe and America between the 60s and 90s.

The car park, which evolved in these dimensional terms during the last century thanks and because of the shopping centers, has acquired numerous and diversified functional roles and architectural meanings over time from being a road service device, reaching in some situations to play a symbolic value. Not only in commercial areas, but in general for the design of the urban scene, for the construction of the image of the city up to the very structure of the public space.

After this founding nucleus, the research continued following various experiments that focus the parking lot as the fifth elevation of the architecture, until it assumed the role of the main subject in treatises on the urban project and the landscape project. Connected to this more project-based bibliography on the new role of parking there is also that of an anthropological and social nature, including "Non-places"[29] by Marc Augé.

In the empty spaces of the metropolis"[30] and "The individual in revolt. A reflection on the misery of citizenship"[31] both by Massimo Ilardi.

The car park was therefore born as a technical space and soon assumed an architectural and urban role. The evolution has not ended and even today, in an increasingly conscious way, projects and experiments are being carried out around the architecture of the parking that oscillates between two and three dimensions, in a continuous (creative) imbalance between structure and infrastructure and in constant search for architectural identity and technical form, always within the dialectic between the paradigm of path, sign on the ground, and the paradigm of artifact, volumetric object.[32]

Among the case studies identified in this research, the SITE group and in particular the work of James Wines are among the most emblematic, for the design explorations and for the ideas that are developed between the 80s and 90s of the twentieth century. Their projects have profoundly contributed to changing the image of these huge commercial plates, transforming the big boxes into architecture and the asphalt deserts (parking lots of shopping centers) into landscapes, sometimes into gardens (in the classical sense).

Even today, their experiences are still very useful keys to thinking and rethinking the mall in a different way and that, years later, it is important to study and recover - with a historical perspective of the evolution of the city and the territory and a critical distance from urban phenomena and architectural fashions - their projects and theoretical work for at least three reasons:

29. M. Augè, *Nonluoghi. Introduzione a una antropologia della surmodernità* (Milano: Eleuthera, 1993).

30. M. Ilardi, *Negli spazi vuoti della metropoli. Distruzione, disordine, tradimento dell'ultimo uomo* (Torino: Bollati Boringhieri, 1999).

31. M. Ilardi, *L'individuo in rivolta. Una riflessione sulla miseria della cittadinanza* (Genova – Milano: Costa & Nolan, 1995).

32. V. Gregotti, "La strada: tracciato e manufatto," *Casabella* no. 553-554 (1989): 2-5.

1. Jame Wine was the first to glimpse the narrative potential of shopping center car parks (whether it is ironic or alienating, provocative and denouncing), both as an interface-filter and as real architecture, able to speak its own language and referring to environmental art, he leaves the purely technical and service space dimension;
2. "The Rest Stop Platte River", "Best parking lot building" and "Ghost parking lot" projects by SITE for the first time show that a parking lot cannot be just a banal single-purpose space dedicated only to parking cars, thus introducing the dimension of flexibility, multifunctionality and temporality of use. A line of research and experimentation that today is successfully practiced by many European and American studios (Topotek, Big, Tom Matton, West8, Adrian Geuze, MVRDV, Smaq Architectes) that propose hybrid architectural solutions and mixed functional structures, transforming the parking lot into parks, market areas, spaces for events, play areas, sports areas, squares, museums, meeting places;
3. SITE's work made it possible to understand, perhaps for the first time, that the shopping centre car park is one of the spaces of contemporaneity, like a park, a square or an avenue, and that it must therefore be thought of as an urban or landscape fact, with its own characteristics and architectural significance. This is why, after the SITE experiments, it is no longer possible to think of the car park merely as a technical fact to be concealed, a service space to be mitigated, an asphalt esplanade to be contextualised, but it is itself the protagonist of the landscape scene.

In the SITE projects, but above all in the theoretical writings of James Wines, words such as Indetermination, Inversion, Ritual, Irony, Humor, Entropy, Disorder frequently recur, which are the key to interpreting a new approach to the architecture of the city, an important contribution that between the mid-1970s and the mid-1980s, allowed the overcoming of traditional thinking that saw the form as an extension of function (dogma of modern architecture that the SITE helped to unhinge), towards a new vision into which the content of the form is an extension of the context and architecture is no longer just a question of form and space, but of information and thought, narration of the landscape, of the habitat of man, which is why after the SITE ... it was no longer alone a parking: "NOT SEEN and / or LESS SEEN of …"[33]

33. M. Duchamp, *NOT SEEN and/or LESS SEEN of…* (The New Yorker, 6 February 1965), 37.

Figure 5. *SITE and James Wines, Ghost Parking Lot, Hamden Plaza Shopping Center, Connecticut (USA), 1977*
Source: Web of SITE Architects.

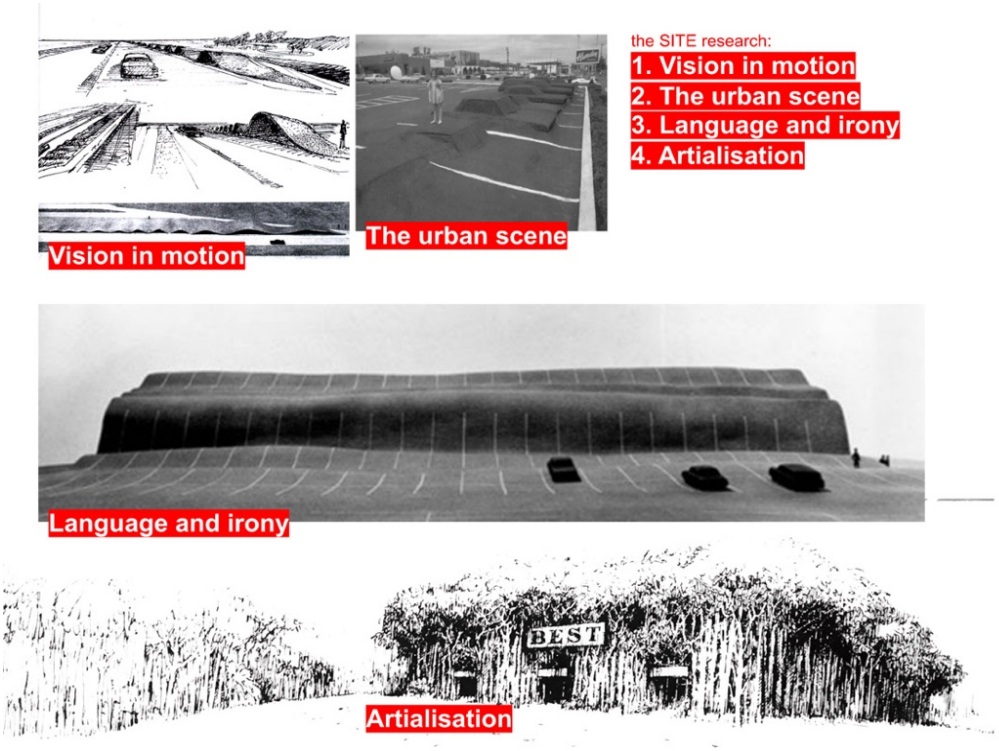

Figure 6. *SITE and James Wines Research*
Source: Research Team.

The Case Study: The Tiare Shopping Center in Villesse

Giving new life to these mono-functional areas in order to transform them into multipurpose and attractive places for urban areas located in the vicinity of shopping malls, areas that are usually already characterised by a polycentric structure. The objective is to bring back value and architectural character to a space such as the car parking lot developed from a purely technical and regulatory point of view. The methodology adopted is that of the educational workshop/competition with the involvement of the area's stakeholders during the design process and a subsequent phase of critical analysis of the design results functional to outlining the recurring invariances and lines of strategic development.

The case study from which this operational research started is a large commercial infrastructure located in the Friuli Venezia Giulia Region, in Villesse, in the province of Gorizia. It is a large shopping center called Tiare. The study was promoted in collaboration with INKGA Centers[34] precisely to redesign all the outdoor spaces, parking lots and roads in order to make them a place of greater attraction and a more integrated technical space in the landscape. The large shopping center is located near two major highways, the A4 (Trieste-Venice-Milan) with the A37 (Villesse-Gorizia-Lubjana) which are part of two European corridors (Baltic-Adriatic and Mediterranean).

The location is strategic. However, there is nothing around, only the countryside, it is a sort of cathedral in the desert and access, today, is only possible by car. The shopping center is almost equivalent in size to the urban center of the nearby village of Villesse or that of Romans d'Isonzo. It is therefore perfectly in line in terms of location, size and layout with the type of large American malls mentioned above. In addition to seeking solutions for the conversion of large uncovered areas, the research also questions the future of these large commercial infrastructures present in supernumerary within the Friuli Venezia Giulia Region, also in consideration of the fact that one of the medium-long term strategies of IKEA is guided by the intention to implement a return to major urban centers and abandon these extra-urban sites.[35]

This phenomenon is very similar to what already happened in the United States 20-25 years ago and which Mirko Zardini talks about in "Hybrid Landscapes. A journey into the contemporary city and Hayden Dolores in "Building suburbia fields and urban growth".[36]

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34. INGKA Centers is part of the IKEA universe and owns the shopping centers where the IKEA blue-box is connected.

35. IKEA's pilot project was recently inaugurated in Vienna for the so-called return to the urban heart of cities. "Starting from a study that records a radical change in purchasing behavior, the maxistore will be a seven-storey building, each of 3,000 square meters, in the center of Vienna just a few meters from the Westbahnhof station. The store will not have parking spaces, but logistics that promises home delivery" radically changing the business model underlying the architectural concept. From A. Giorgi, *La nuova Ikea di Vienna, in centro e senza auto* (Domusweb, February 2020).

36. H. Dolores, *Building Suburbia. Green fields and urban growth: 1820-2000* (New York: Pantheon Books, 2003).

This shopping center, like many others in Italy and Europe, as well as the American ones of 30-40 years ago, represents the hub of a territory dominated by the automobile. Shops surrounded by parking lots rather than by neighborhoods which together have strongly contributed to the spread of sprawltown[37] and to the consolidation of the suburban territory, between globalization and localism.[38]

The relevant bibliography (see the bibliographical apparatus of Fabrizio Bottini's book "The New Territories of Commerce") suggests numerous solutions for these problems, ranging from infill development to mixed use, from smart growth strategies to total abandonment and consequent renaturalisation or agri-urbanisation.

Figure 7. *Tiare Shopping Center in Relationship to the Nearby Town of Villesse. Dimensional Comparison: Research Team*

37. R. Ingersoll, *Sprawltown* (Milano: Meltemi, 2004).
38. C. Gasparini, *Passeggeri e Viaggiatori* (Milano: Meltemi, 2003), 63.

Methodology - Operative Research

The introduction to Costantino Dardi's book "Simple, Linear, Complex",[39] although far removed in time from today, encapsulates the attitude that accompanies us in much of our operational research. In this case too, the research did not start from a pre-established theoretical assumption to be verified within a given field of investigation, but used the project itself as a tool for understanding the context and also as an element for prefiguring possible futures.

The project, from the Latin *pro* (forward) and *jacere* (to throw), represents what is thrown forward, projected into the future and subjected to verification.

It is with this in mind that the research conducted on the subject, first of all, saw the organization of an intensive workshop with the participation of the students of the Integrated Design Laboratory of the academic year 2018/19 of the Degree Course in Architecture of the University of Trieste together with professors and researchers of the Department of Engineering and Architecture of the same university.

After analyzing the physical and socio-economic context, eleven projects were developed where the students freely interpreted the conditions and proposed a series of solutions that aim to prefigure solutions - to the expectations deriving from both the shopping center and the reference territories - and to anticipate visions, suggest portions of the future, letting us glimpse how people will be able to experience these places in the next few years.

Subsequently, the first laboratory phase of the workshop began, which led to the definition of the design concepts, an expression of the work of the design groups formed by the students.

The eleven projects presented proposed as many solutions for transforming the external areas of the business park into a place dedicated to meeting, entertainment and experimentation. The result is a variegated picture of ideas from which to draw in order to transform the outdoor area of the shopping center under consideration

39. "At the end of the journey backwards, through the fifteen years of my work as an architect, I realize that the relationship between theoretical elaboration and design research can, in my case, be paradoxically reversed.

The area of theory, in fact, appears much more appropriately covered by drawings, projects and the underlying system of references: the idea of architecture that you face, the methodology I have used, the unchanged ones that are highlighted.

This probably derives from the fact that, upstream of my experimental activity, an accurately preformed theoretical design cannot be traced, but rather some trend lines emerge from it, correlated with each other by an internal dialectic and intertwined with the contributions that architectural culture has developed over the years.

The area of the project, on the other hand, by explicitly assuming the positions of the field, by the deliberately oriented approach to the foundation of a base of references, of a critical apparatus, of a historical background, of a cultural location, it seems to me that is more correctly filled by written contributions. Critical projects, therefore, whose legitimacy is always the daughter of time and passions: which inevitably appear to me all the theoretical propositions of the architects, always deeply imbued with programmatic contents, conditioned by the objectives pursued in design research, inevitably derived from the choices that (with greater historical truth and with less cumbersome ideological apparatus) descend from the sheet of drawing paper, always disputed between wanting to be the subterranean conscience of the project and not being able to be anything other than tools of operational criticism." - C. Dardi, *Semplice, lineare, complesso, l'acquedotto di Spoleto* (Roma: Kappa Edizioni, 1987), 15-16.

into a large meeting place. The construction of the resulting imagery is a rich and heterogeneous picture that originates from a series of programmatic approaches of both a temporary and permanent nature. Here are the projects and their brief description:

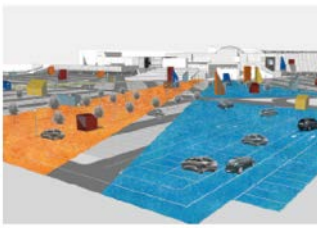
- The "2x2" project (group 1 - Angela Bertoni, Lorenzo Kratter, Giada Lesizza) proposes the construction of a landscape through the punctual insertion of only three scenographic elements: the tower, the arena and a double connecting strip. By overlapping the existing infrastructural layer of fast mobility with a new one with a distinctly public and cycle-pedestrian vocation, the project conquers the large scale by shifting from the second dimension of the vast surface to the third dimension, rising in height.
- "Park (ing) bridge" (group 2 - Virginia Fabbro, Silvia Musini, Arianna Santarsiero) instead focuses on the transformation of residual green spaces into a continuous, changeable and adaptable connective park: an internal green ring, partly raised, connects the entrances to the Tiare and IKEA generating opportunities for singularity such as the green hill and a large multifunctional arena. Here the landscape dimension and that of an extra-urban enclave merge and exasperate each other, using greenery as a material for spectacle.
- The third project (group 3 - Giorgio Conforto, Eleonora Di Stefano, Debora Paulin) changes the paradigm and reads the vast parking lot of the shopping center as a game board: the creation of a playscape or artificial landscape is entrusted to the little boxes, microarchitectures protagonists in this new commercial interior. The physical and virtual boundary between the internal and external space of the commercial box is pulverized by redefining the figure-ground relationships, in fact these colored boxes, in addition to representing the temporary extension of the commercial surface outside, become a perspective device that captures the gaze of the subjects- consumers.
- "Diagram Park" (group 4 - Sofia Artico, Federica Ferrigno, Lara Slavec) determines an instability designed through an effective design in which program and diagram tend to coincide. By directing the existing functions and those that can be simply implemented along a band connecting the main entrances with variable section that rejoins the incoming cycle and pedestrian flow, the project constitutes a linear park or strip which, in addition to recognizing the logic of the context in which it is inserted, empowers them and makes them visible.
- A landscape generating flow is the constitutive principle of "The Flood project" (group 5 - Stela Guni, Giulia Piacente, Vittoria Umani). The landscape narrative recognizes water and its motion as a force capable of destabilizing the entire soil design and overturns the technical-functional data linked to four-wheeled mobility in favor of the experiential dimension

of the project, in which the automobile becomes one of the many materials, at least as much as the green of this highly experimental linear park.

- On an even larger scale, the "Global blue box" project (group 6 - Vlad Maricel Martinas, Semir Skenderovic) is aimed, which, reading the infrastructural advantage in which the project area is inserted, exasperates the paradigm of the program beyond its borders physical and exploits the virtual context. The logistic vocation of the project does not translate exclusively into an intangible infrastructure - in the software - but also in the actual hardware, in which the Venturian lesson is shrewdly evoked.
- On site (group 7 - Ivan Bello, Jesku Franklind) recognizes the boundary between the commercial enclave and the context in which it is inserted a threshold to be designed. By redefining the zero project altitude below the parking level, a semi-underground path is created, delimited by a metal interface which, in addition to circumscribing the public cycle-pedestrian area, wraps around itself, creating towers. The medieval and defensive metaphor is translated here into a project that invokes Edoardo Tresoldi's ephemeral cathedrals of light.
- Complexity is the protagonist of the "Yellow Boxes" project (group 8 - Matteo Savron, Elwira Wòjcicka, Monica Bidoli), with an openly metropolitan breath. Extreme and paradoxical in order to bring the living dimension - however ephemeral and in fact translated into consumption - inside the business park, the project reinterprets the logic of the internal space and rewrites them in the external areas. The stratification of flows, activities and events is ordered by an infrastructural grid that rigorously declines each element of the project, in a multiple dialogue between homogeneity of image and specific variations.
- The "Bölle" project (group 9 - Michela Contin, Valentina Devescovi) conquers the outdoor areas by playing on the autonomy of the parts and the strong pop iconicity of the overall image. The spaces for relations, parking and the actual park are fenced and juxtaposed. In this project, too, the tendency to make the functional program coincide with the design of the commercial park translates the operational needs into a potentially exportable model.
- Returning to the logic of the linear park, the "Zig Zag" project (group 10 - Matteo Ros, Milisav Stankovic, Enrico Vidulich) introduces the technological and energy theme in the project of a roofing system developed along a broken line, that is a path that can be used at different altitudes and which connects the entrances and the arena for the shows.
- The "Blue Islands" project (group 11 - Giacomo Caporale) is part of another trajectory working on the perspective gaze and on a vision of the world that derives from the tradition that sees the garden as a place of criticism of the city, and in this case of the shopping center itself. The experimentation of a new relationship between man and nature is here entrusted to water, already a protagonist on the landscape scale, and here declined in water squares, canals and swimming pools capable of hosting

the playful and entertainment parts of the functional program. These water figures are immersed in a vast green background that represents a waterscape.[40]

1)



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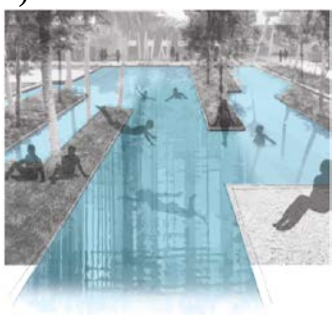

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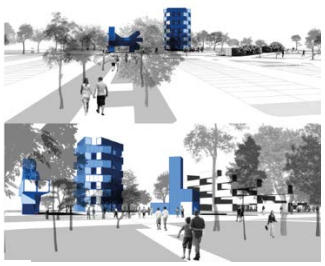

6)

4)

40 V. Rodani, "Confronto all'americana," in *The shopping center as/is a meeting place* (Eds.) C. Meninno, and V. Rodani (Trieste, Edizioni Università di Trieste, 2020), 205-211.

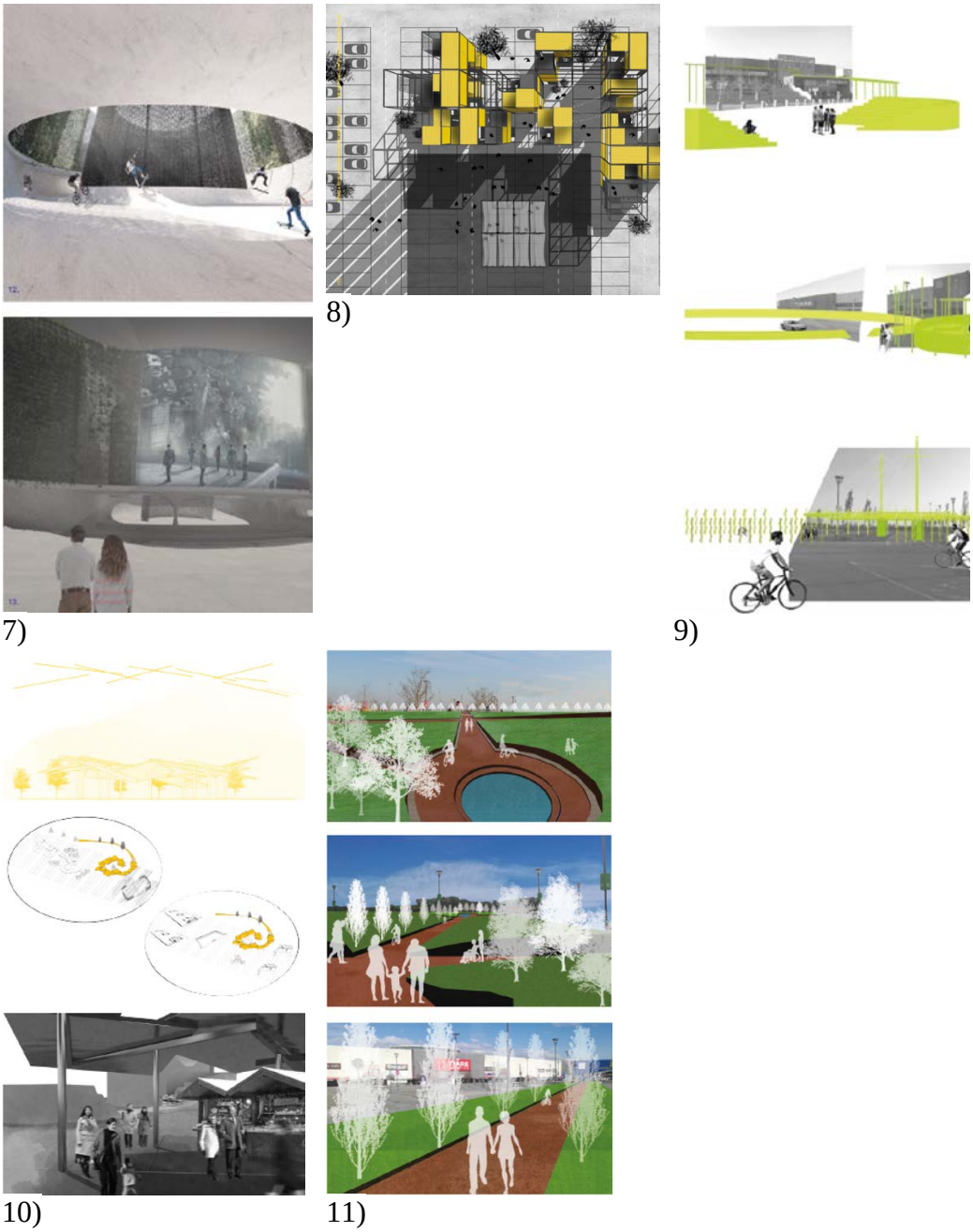

Figure 8. *Visions. Photosimulations of the 11 Parking Projects of the Shopping Center Transformed into a Meeting Place*

Source: 1. Angela Bertoni, Lorenzo Kratter, Giada Lesizza; 2. Virginia Fabbro, Silvia Musini, Arianna Santarsiero; 3. Giorgio Conforto, Eleonora Di Stefano, Debora Paulin; 4. Sofia Artico, Federica Ferrigno, Lara Slavec; 5. Stela Guni, Giulia Piacente, Vittoria Umani; 6. Vlad Maricel Martinas, Semir Skenderovic; 7. Ivan Bello, Jesku Franklind; 8. Matteo Savron, Elwira Wòjcinka, Monica Bidoli; 9. Michela Contin, Valentina Devescovi; 10. Matteo Ros, Milisav Stankovic, Enrico Vidulich; 11. Giacomo Caporale.

From this variety of projects, an attempt was then made to identify common traits that could represent trends in approaching this type of place.

From the analysis carried out, the projects were grouped into three macro-categories through the identification of as many recurring design invariants. The result is a typological case study which can represent a useful tool for interventions in similar contexts.

Parallel to this work concentrated on the external part of shopping centers, some members of the teaching and research staff have dedicated themselves to a critical research on historical case studies relating to architectural envelopes dedicated to the large-scale distribution trade.

An in-depth study that has allowed to bring out architectural approaches that have marked the history of architecture and cities, constituting real stages in the design evolution of this type of artefact and which can represent a cognitive background of a certain importance, complementary compared to the outcomes of the project research described above.

Figure 9. *Schematic Synthesis of the 11 Projects Developed During the Workshops to Transform the Parking Lot of the Shopping Center into a Meeting Place*

Source: 1. Angela Bertoni, Lorenzo Kratter, Giada Lesizza; 2. Virginia Fabbro, Silvia Musini, Arianna Santarsiero; 3. Giorgio Conforto, Eleonora Di Stefano, Debora Paulin; 4. Sofia Artico, Federica Ferrigno, Lara Slavec; 5. Stela Guni, Giulia Piacente, Vittoria Umani; 6. Vlad Maricel Martinas, Semir Skenderovic; 7. Ivan Bello, Jesku Franklind; 8. Matteo Savron, Elwira Wòjcinka, Monica Bidoli; 9. Michela Contin, Valentina Devescovi; 10. Matteo Ros, Milisav Stankovic, Enrico Vidulich; 11. Giacomo Caporale.

Results - Strategies and Models for the Architecture of the Shopping Center Parking Lot

The expressive richness found in the projects produced - which in turn draws on other design references - both theoretical and practical has been analyzed in order to trace invariants within the different design syntaxes adopted.

The criteria adopted for the evaluation of the projects concern economic aspects, aspects related to functionality at both local and large scale, the level of territorial connectivity and, finally, issues related to the composition and character of the architecture.

Macro families have been recognized that become real design geographies, able to place the design of the shopping center park within a territorial system, rich in relationships and positive effects, such as to lead to a rewriting of the relationship that it has with urban realities, with road infrastructures and pieces of agricultural and natural territory that can be found nearby. These project geographies are:

1. Landmark - FFrom the search for a relationship with the context of reference, it is possible to note how some projects seek the creation of a landmark or at least an iconic architecture capable of standing up to the territorial scale. Generally speaking, the element that most defines this type of approach is the tendency towards elevation in order to establish a new visual relationship from and to the context. Through this type of operation, a new design element is proposed with respect to the current visual panorama of the built, starting an additive landscape that could have further future developments.
2. Densification - The creation of a park capable of rewriting the relationship between the two main entrances and the surrounding area instead starts from a desire to densify the use of outdoor spaces. Like the places inside the shopping center, there is a tendency here to massively increase the presence of a series of new functions in a space initially dedicated only to vehicular use. The increase in the complexity rate also brings with it situations of conflict between the different functions, here read as design opportunities on which to graft detailed designs.
3. Shielding - The need, imposed by the legislation, to create a shield towards the motorway infrastructure, has led to a third series of projects where the visual mitigation of the shopping center becomes the fundamental theme of the project. Through this approach, a buffer space is created between the shopping center and the outside, which thus acquires innovative and unusual spatial characteristics, offering the possibility of proposing design landscapes that are radically different from what we are used to. The shielding, in turn, in some cases becomes itself as a landmark, redefining the spatial and perceptive relationships with the surroundings.[41]

41. C. Meninno, A. Venudo, and T. Bisiani, "Geografie progettuali: lettura e riscrittura di un' infrastruttura," in *The Shopping Center as/is a Meeting Place* (Eds.) C. Meninno, and V. Rodani (Trieste: Edizioni Università di Trieste, 2020), 219-220.

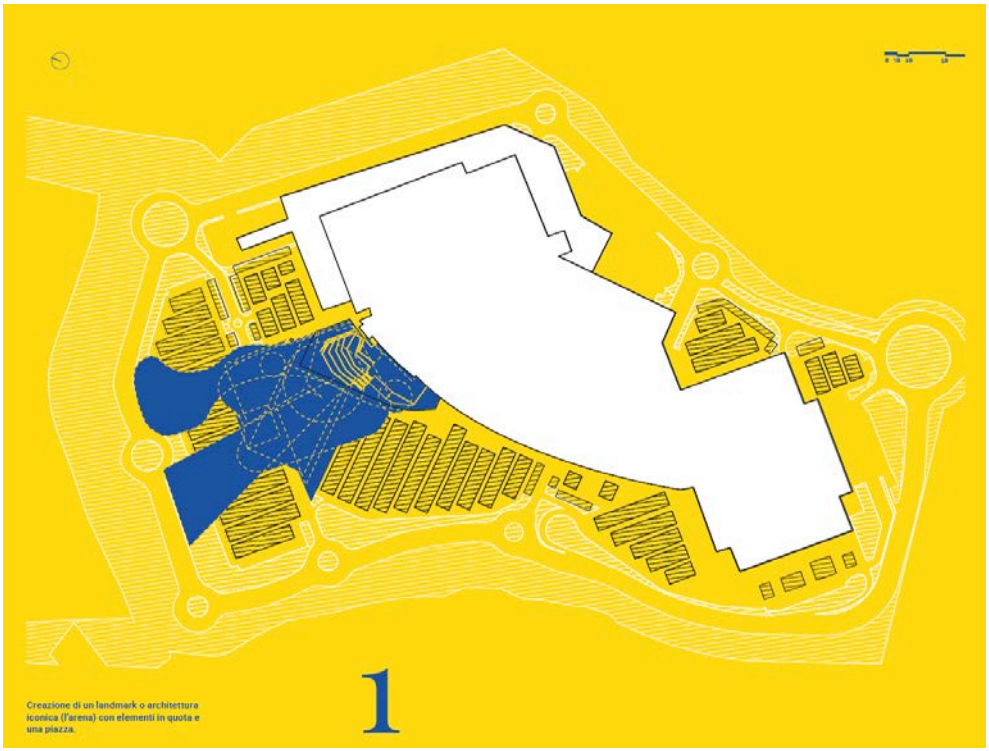

Figure 10. *Synthesis of the Design Morphologies. Concept for New Functions and Activities for the Shopping Center Parking Lot. Macro Families 1: Landmark*
Source: Research Team.

Figure 11. *Synthesis of the Design Morphologies. Concept for New Functions and Activities for the Shopping Center Parking Lot. Macro Families 3: Densification*
Source: Research Team.

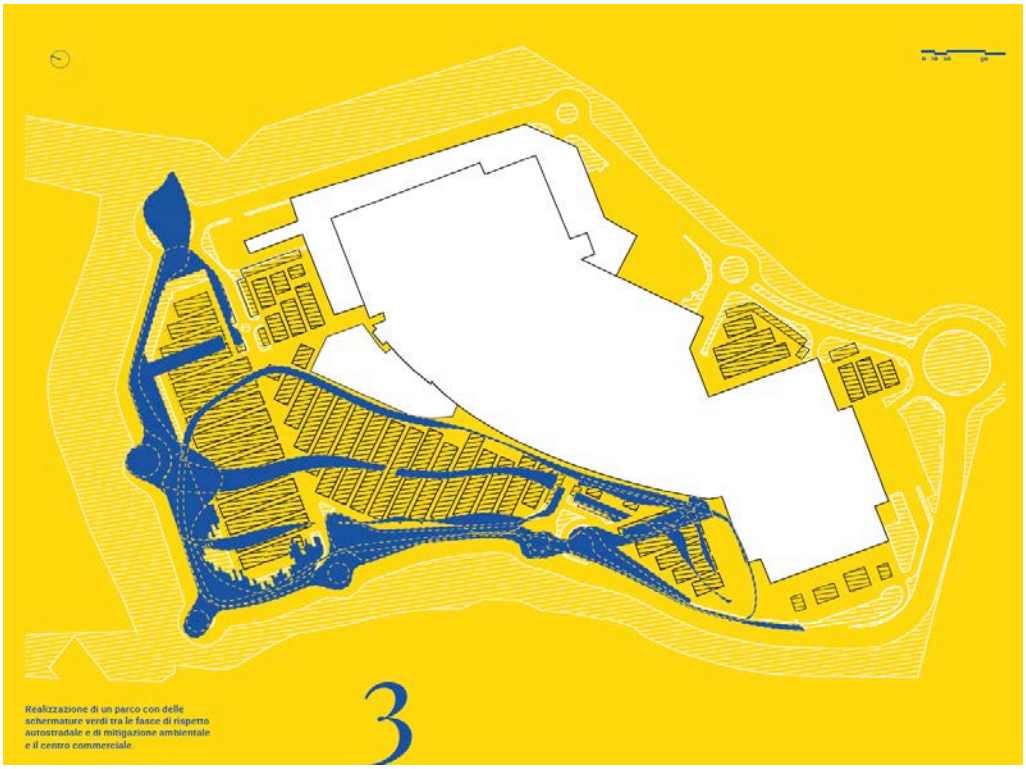

Figure 12. *Synthesis of the Design Morphologies. Concept for New Functions and Activities for the Shopping Center Parking Lot. Macro Families 3: Shielding*
Source: Research Team.

The diversity and richness that can be found in the details of individual projects offer the opportunity for further readings, capable of grafting additional categories of reasoning.

In any case, it is evident how the reasoning on the transformation of an urban and territorial space of this magnitude can lead to the redefinition of relationships between the constituent elements of the infrastructured landscape, proposing new design research to understand the evolution of these places also in view of a probable future mutation of the ways in which the inhabitants of the city and the peripheral contexts acquire goods.

In fact, all the projects propose an architectural and landscape reconfiguration of the large system of uncovered parking lots, of the roads and of all those appurtenant areas that relate to the large commercial box constituted by IKEA-Tiare, to the road-infrastructural node of Villesse and to the huge void of the surrounding countryside. A perfect context for the contemporary widespread city, a non-place, towards which none of the projects arises with a trivializing or stereotyped attitude.

The urbanized voids around the big boxes are often much larger than the building to which they refer and are designed with a banal approach, where the mere application of current legislation applies without realizing that their bigness deserves more, it is however an important opportunity to offer something more to people, to the territories.

From the eleven projects emerges a search for a contextual relationship capable of rewriting the meaning of these spaces. There is no search for a new independent

identity but a sort of extremization of the ordinary that expresses the desire to search for a new image, always in relation to the object that acts as a primary catalyst. Some with dry composure, some with irony, some through a provocative approach, all have managed to transfigure the technical banality of the parking lot into an evocative narrative, each with its own characters and stories.

All this proves the initial intuition: the parking space of a shopping center cannot only be understood as a regulatory, secondary, service space but has the potential to become a new polarity in the large commercial project and as such it should be understood and exploited, for the benefit of everyone. Furthermore, the re-use of these spaces both when the shopping center is still alive, and when it is dying or dead, can trigger very important urban re-use dynamics. Depending on the urban location they have, they can become elements of urban transformation within the city or territory on a large scale. As happened over the centuries for the open spaces inside cities, where squares and markets were supplanted by built blocks, parks, large public buildings, they too could be elements of the transformation: undergone by the places if not adequately studied and designed or favorably triggered if the object of appropriate and intelligent studies such as to define an architectural and landscape added value.

If considered in their entirety, the parking areas of a given region represent a significant dimension, with a huge impact on the territory that hosts them. For this reason, the issue should be further explored and the transformation actions should be carefully evaluated.

Discussion – Shopping Mall Parking Lot between Landscape and Architecture

The case study of this research, the Tiare shopping center, with its huge parking lot is one of the largest commercial parks in Friuli Venezia Giulia. In addition to accommodating around 150 shops of all kinds, the complex boasts a varied offer of bars and restaurants, a multiplex cinema, a gym, meeting rooms, workshops and play areas for families and their pets. It hosts local trade shows, sporting events and shows for a total of 1.3 million users per year. It is also the only shopping center in the region and the first in Italy to host an IKEA store inside it.

In 2018, the province of Udine won the Italian record for the ratio of large-scale distribution to the number of inhabitants, which is dizzyingly close to 1 (938 square meters per 1000 inhabitants), followed by the province of Gorizia (825 square meters per 1000 inhabitants),[42] where is located the Tiare. The pulverized and multipolar settlement structure of Friuli Venezia Giulia lends itself well to the

42. According to the Quarterly Observatory of the Tertiary edited by Ires FVG and Format Research and published by the Bilateral Tertiary Body of Friuli Venezia Giulia, between 2007 and 2018 the retail space of the large-scale distribution in the region increased by over 60%. From: <https://www.ebinter.it/>; site accessed on 05/11/2020.

analogies with the American model,[43] in which the way of life is conditioned by the car and leisure time by the shopping center.

The evolution of the American paradigm of the enclosed mall surrounded by huge parking areas has now seen numerous evolutions: from the theories of Victor Gruen to the Ciam debate on the heart of the city,[44] from the experiments on the shopping center as an engine of urban development,[45] up to the variegated hybridizations typological, functional and settlement.

In the United States, the phenomenon of deadmall, ghostboxes and related greyfields, or shopping centers in a state of abandonment, emerged in the mid-nineties to reach its peak around the early 2000s. In Europe and in Italy the scenario presents some differences. In Italy, for the moment, there is a strong growth and development of commercial formats. This is also true in the case of Friuli Venezia Giulia. But the trend is already marked, the American dynamics precede those of Europe by 20 years.

In summary, the scenario that lies ahead is that of the retail apocalypse. And all this, more than producing urbanity, has produced the trivialization of the city, with a design aesthetic that is generally of little value, which alternately and trivially draws on vernacular forms, from an impoverished version of the contemporary and which gives birth to reproductions of itself.

On the one hand, the autochthonous megamall becomes the ideal complement to suburban life.

On the other hand, the intrinsic instability of the global market makes it a dangerous prototype of urbanity in perpetual risk of obsolescence. It is from these local/global results and comparisons that the research could continue. In fact, the Los Angeles Forum for Architecture and Urban Design has promoted the “Dead Mall" competition to investigate theoretical issues and design practices capable of experimenting with the potential for reconversion of abandoned big boxes.[46] Among the results, many of the remedies proposed to shopping centers affected by illness or death proposed a greater integration of the mall with its context, offering not only economic and commercial resources, but also social, cultural and landscape resources.

The paradoxical and perhaps open aspect of this research lies precisely in the question of whether it is possible for the business park to become a place for socializing and meeting beyond the mere mercantile relationship between supply and demand.

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43. T. Crosby, *Il monumento necessario* (Bari: Dedalo Libri, 1980), 16; F. Tentori, *Abitare nella pianura friulana. L'Insediamento, il sedime, la casa* (Venezia: I.U.A.V. Dipartimento Progettazione Architettonica, 1987), 45.

44. "The heart of the city" was the theme of the eighth International Congress of Modern Architecture, held in Hoddesdon in 1951.

45. V. Gruen, *The heart of our cities. The urban crisis: diagnosis and cure* (New York: Simon and Schuster, 1964).

46. W. Techentin, *Dead Mall* (Los Angeles: Los Angeles Forum for Architecture and Urban Design, 2004).

In the twenty-first century it is clear that shopping has now become an inevitable and in some ways indispensable practice of the city experience.[47]

So on the one hand the images of abandoned and demolished malls can be read as the process of continuous market expansion, but on the other they loom as a warning to remind us of the lesson of Las Vegas. The invention of one world always starts with the exclusion of another.

This research has made it possible to identify, study and make general the trends described above, more closely linked to the open spaces around shopping centers, but also involved disciplinary investigations that led to the definition of possible evolutionary strategies relating to the dialectic between shopping center and city, evolutionary scenarios which can be summarized as follows:

1. Re-urbanization of peripheral commercial hubs.

The reintegration of the large shopping center within the city can be an interesting option, it is necessary to meet the needs that have determined its success: ease of reaching and parking, a large range of goods in a single, easily accessible space. Understanding how to combine the needs of the shopping center with the dimensional and organizational limitations of the urban space is not an easy challenge, but one with implications full of potential. The issue of infrastructures and mobility as a whole will have to be addressed seriously, to propose alternative solutions and accommodate the significant flows generated by such a presence within the urban fabric of the city without this distorting the very essence of the project sites.

2. Neural development between city and commercial center.

The further development of the shopping centers and the city could be configured as polarity capable of creating connective filaments at the territorial level, real clusters of functions and buildings. This type of scenario could be the prelude to a polycentric metropolitan city capable of exercising an attractive power towards the most marginal suburbs.

3. Parallel and autonomous development of shopping centers and cities.

In this configuration, both the city and the shopping centers develop, increasing their importance and size but maintain independent characteristics between them, without giving rise to further connective developments and becoming independent attraction poles towards the periphery and the territory according to their respective specificities. In this case, the intermediate space does not provide for the establishment of an organized planning and remains characterized by the exclusive presence of sprawl and by the connective infrastructures.

4. Commercial development and urban erosion.

This last scenario represents the worst case scenario for the city as it is known today. The initial commercial depopulation contributes to the erosion of the inhabited center by encouraging depopulation and weakening the city as a catalyst.

47. C. J. Chung, J. Inaba, R. Koolhaas, and S. T. Leong, *The Harvard Guide to shopping* (Köln: Taschen, 2001).

In turn, the commercial nucleus is enriched with other experiential elements to the point of assuming characteristics of attraction typical of the urban condition. This scenario raises profound questions regarding the urban destiny of some territories.

> Will living and the other aspects of collective life still have catalytic polarities or will involution push towards an acentric diffusion?
> What developments can be seen in the coming decades?
> What will be the prevailing relationship between city and commercial center?

The in-depth study of the reference contexts and of the dynamics in progress could offer prefiguration's capable of anticipating and guiding the evolutionary directions of this dialectic, helping us to better understand a piece of our near future.

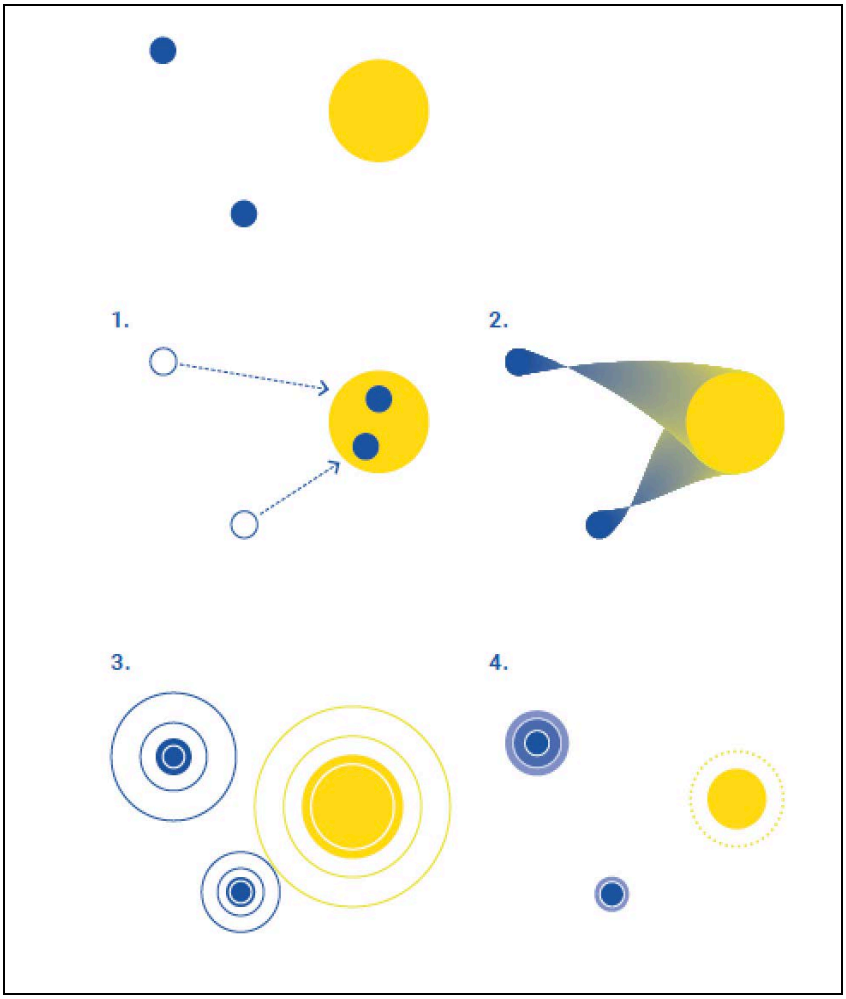

Figure 13. *Diagrams of Dynamics "Shopping Center - Territory – City": 1. Re-urbanization of Peripheral Commercial Hubs; 2. Neural Development between City and Shopping Center; 3. Parallel and Autonomous Development of Shopping Centers and Cities; 4. Commercial Development and Urban Erosion*
Source: Meninno 2020.

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Environmental Features of Vernacular Architecture: The Case of Cyprus

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The sustainability of vernacular dwellings is closely connected with the fulfilment of the daily needs of the inhabitants, as well as the incorporation of multiple environmental features into their design. These environmental features ensure a climate responsive approach and improve the thermal performance of the dwellings. The vernacular architecture of Cyprus follows the main principles of vernacular architecture in the eastern Mediterranean region as a whole, and thus it is considered as a typical case study, suitable for in-depth investigation. The research findings presented here are an overview of systematic research carried out over the last ten years at the University of Cyprus, mainly through two multidisciplinary research programmes. Specifically, various environmental aspects were thoroughly investigated, starting from the selection and investigation of rural and urban settlements in different climatic areas (urban scale), moving to the building scale and to the selection of a representative number of vernacular dwellings for qualitative, as well as quantitative investigation. Following this, the research focuses on the different spaces within the dwellings (such as courtyards, semi-open spaces and subterranean areas), as well as on various passive strategies (such as ventilation and lighting), ending with the investigation of the thermal behaviour of the traditional building materials used for the erection of the aforementioned dwellings. The research reveals the necessity for a qualitative and quantitative assessment of vernacular architecture through a multicriteria process, and indicates a methodology that can be implemented in other similar cases especially around the Mediterranean area.

Introduction-Theoretical Framework

This paper aims to present a systematic, methodological approach towards the investigation of vernacular architecture, with emphasis on its bioclimatic features. It will also briefly touch upon the environmental perspective of the conservation of vernacular dwellings, considering the vernacular architecture of Cyprus as a typical case study.

Vernacular architecture has been growing over time with continuities, changes, transformations and adaptations to the different socio-economic conditions of each period.[1] According to Paul Oliver, vernacular architecture is the architecture of the people. This type of architecture is also closely related to the environmental context and available resources, as it is built using local materials and following traditional techniques. All of its forms are closely connected with

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1. M. Philokyprou, "Continuities and Discontinuities in the Vernacular Architecture," *Athens Journal of Architecture* 1, no. 2 (2015): 111-120.

the satisfaction of the daily needs of the inhabitants, accommodating the values and ways of life of the different cultures that produce them.

Throughout the ages, vernacular dwellings have been reused, adapting to changing conditions and thus providing a direct link with the previous era. The sustainable identity of these dwellings comes from the incorporation of many environmental features into their design, as well as the use of local materials and resources, and the simple ways the inhabitants' needs are met. The environmental features ensure a climate responsive approach, improving the thermal conditions inside the dwellings. The vernacular architecture of Cyprus incorporates the same principles of Eastern Mediterranean vernacular architecture, thus may be considered a typical case study of vernacular architecture, suitable for the investigation described in this paper.

It is worth noting that the preservation and rehabilitation of vernacular dwellings contributes to local economies in a very positive way, generating local demands, preserving building crafts, and safeguarding the cultural identity of traditional settlements. Thus, the adaptive reuse of vernacular dwellings is an extremely sustainable method of development, as it covers all aspects of sustainability.

In Cyprus, vernacular architecture and its environmental features were not studied and documented in a systematic way until recently. Meanwhile, many vernacular buildings are being conserved and restored without taking the preservation and enhancement of their environmental elements into consideration, instead giving more emphasis to their aesthetic values and appearance. For this reason, there has been particular need for the documentation of vernacular architecture and its environmental features.

Literature Review

Different methodologies were diachronically implemented so as to investigate the environmental features and thermal performance of vernacular structures in different climatic areas.[2] A large number of qualitative studies were carried out evaluating various architectural parameters and bioclimatic characteristics,[3] sometimes focusing on socio-cultural issues,[4] as well as on geographical diversity.[5] Many studies involve the preparation of charts – either

2. T. Cardinale, D. Colapietro, N. Cardinale, and F. Fatiguso, "Evaluation of the efficacy of traditional recovery interventions in historical buildings. A new selection methodology," *Energy Proc* 40 (2013): 515-524; X. Casanovas, *RehabiMed method traditional Mediterranean architecture* (Barcelona: Collegi d'Aparelladors i Arquitectes Tecnics de Barcelona), 2007.

3. A. M. Vissilia, "Evaluation of a sustainable Greek vernacular settlement and its landscape: architectural typology and building physics," *Build Environ* 44 (2009): 1095-1106.

4. A. Ghaffarianhoseini, U. Berardi, N. D. Dahlan, and A. Ghaffarianhoseini, "What can we learn from Malay vernacular houses?" *Sustainable Cities Soc* 13(2014): 157-170.

5. S. Bodach, W. Lang, and J. Hamhaber, "Climate responsive building design strategies of vernacular architecture in Nepal," *Energy Build* 81 (2014): 227-242.

bioclimatic,[6] or psychrometric.[7] In addition, many quantitative[8] studies include field measurements[9] in order to investigate the thermal performance of vernacular dwellings. Among other researchers, Foruzanmehr and Velinga[10] highlighted the significance of adopting a holistic approach that engages the different variables of vernacular dwellings, thus allowing the drawing of solid conclusions about their long-term viability and sustainability.

More specifically, regarding the area of Mediterranean, the environmental characteristics and strategies of vernacular dwellings have recently been studied in a qualitative and quantitative way.[11] Some research studies deal with the urban scale of vernacular settlements, such as the compact, often continuous building system of dwellings attached to each other. Meanwhile, other studies focus on the building scale[12] of vernacular dwellings, and more specifically on their architectural layout,[13] as well as on special bioclimatic aspects and features.[14]

6. V. Olgyay (Ed.), *Design with the climate: bioclimatic approach and architectural regionalism* (New Jersey: Princeton University Press, 1963).

7. B. Givoni (Ed.), *Man, climate and architecture* (Amsterdam/London/New York: Elsevier Publishing Co. Ltd, 1969); M. Milne, and B. Givoni, "Architectural design based on climate," in *Energy Conservation Through Building Design* (ed.) D. Watson (New York: McGraw- Hill, 1979), 96-113.

8. A. S. Dili, M. A. Naseer, and T. Zacharia Varghese, "Passive control methods for a comfortable indoor environment: comparative investigation of traditional and modern architecture of Kerala in summer," *Energy Build* 43 (2011): 653-664.

9. V. Shastry, M. Mani, and R. Tenorio, "Impacts of modern transitions on thermal comfort in vernacular dwellings in warm-humid climate of Sugganahalli (India)," *Indoor Built Environ* 23 (2014): 543-564; M. N. A. Saïd, W. C. Brown, C. J. Shirtliffe, and A. H. P. Maurenbrecher, "Monitoring of the building envelope of a heritage house: a case study," *Energy Build* 30 (1999): 211-219.

10. A. Foruzanmehr, and M. Velinga, "Vernacular architecture: questions of comfort and practicability," *Build. Res. Inf.* 39, no. 3 (2011): 274-285.

11. M. Vellinga, "Vernacular architecture and sustainability: Two or three lessons," in *International Conference on Vernacular Heritage, Sustainability and Earthen Architecture* (Valencia: Taylor & Francis, 2014), 3-8.

12. N. Cardinale, G. Rospi, and P. Stefanizzi, "Energy and microclimatic performance of Mediterranean vernacular buildings: the Sassi district of Matera and the Trulli district of Alberobello," *Building Environment* 59 (2013): 590-598.

13. A. Ghaffarianhoseini, U. Berardi, and A. Ghaffarianhoseini, "Thermal performance characteristics of unshaded courtyards in hot and humid climates," *Building and Environment* 87 (2015): 154-168; M. A. Kristianto, N. A. Utama, and A. M. Fathoni, "Analyzing indoor environment of Minahasa traditional house using CFD," *Proc Environ Sci* 20 (2014): 172-179; A. Almhafdy, N. Ibrahim, S. S. Ahmad, and Y. Yahya, "Thermal performance analysis of courtyards in a hot humid climate using computational fluid dynamics CFD Method," *Proc Social Behav Sci* 170 (2015): 474-483; X. Du, R. Bokel, and A. van den Dobbelsteen, "Building microclimate and summer thermal comfort in free-running buildings with diverse spaces: a Chinese vernacular house case," *Build Environ* 82 (2014): 215-227.

14. A. Oikonomou, and F. Bougiatioti, "Architectural structure and environmental performance of the traditional buildings in Florina, NW Greece," *Build Environ* 46, no. 3 (2011): 669-689; S. Saljoughinejad, and S. R. Sharifabad, "Classification of climatic strategies, used in Iranian vernacular residences based on spatial constituent elements," *Building and Environment* 92 (2015): 475-493; M. S. Sozen, and G. Z. Gedik, "Evaluation of traditional architecture in terms of building physics: old Diyarbakir houses," *Build. Environ.* 42, no. 4 (2007): 1810-1816; Vissilia, "Evaluation of a sustainable Greek vernacular settlement and its landscape: architectural typology and building physics," 2009, 1095-1106.

These features include orientation, shading using movable external shutters and other devices for protection against solar radiation, the size and arrangement of openings, vegetation and other elements (water etc) in the yards and the use of light-coloured surfaces for external walls.[15]

Open spaces in the form of courtyards surrounded by walls and rooms are very often incorporated in vernacular dwellings in the Mediterranean area, and have been investigated by a large number of researchers.[16] These studies have shown the environmental values of private open spaces in the form of courtyards, and their contribution to the surrounding spaces, as well as to the overall performance of vernacular dwellings.[17]

A large number of studies investigate the environmental role of semi-open spaces (open areas with a roof, closely connected with the courtyards) that constitute a characteristic and very important bioclimatic element of vernacular dwellings in the Eastern Mediterranean.[18] These elements respond to the mild climatic conditions of their locations, while at the same time reflecting the society and way of life,[19] as they offer a more suitable space for social activities compared to closed or fully-open spaces.[20]

Two architectural elements that researchers have investigated in detail – and which are also connected to the environmental character of vernacular dwellings – are the *portico* (semi-open space in the middle of a house in the form of a wide

15. I. Canas, and S. Martin, "Recovery of Spanish vernacular construction as a model of bioclimatic architecture," *Build Environ* 39 (2004): 1477-1495; M. Kolokotroni, and A. N. Young, "Guidelines for bioclimatic housing design in Greece," *Build Environ* 25, no. 4 (1990): 297-307; K. Van Den Wymelenberg, "Patterns of occupant interaction with window blinds: a literature review," *Energy Build* 51 (2012): 165-176.

16. E. Andreou, and K. Axarli, "Investigation of urban canyon microclimate in traditional and contemporary environment. Experimental investigation and parametric analysis," *Renew. Energy* 43 (2012): 354-363; Sozen, and Gedik, "Evaluation of traditional architecture in terms of building physics: old Diyarbakir houses," 2007, 1810-1816; A. Rapoport, "Vernacular design as a model system in vernacular architecture," in *Vernacular* A*rchitecture in the Twenty-First Century: Theory, Education and Practice* (eds.) L. Asquith, and M. Vellinga (England: Taylor and Francis, 2006), 179-198; M. Salman, "Sustainability in vernacular architecture: rethinking what identity is," in *Urban and Architectural Heritage Conservation within Sustainability* (IntechOpenn, 2018); S. Yannas, and W. Weber (Eds.), *Lesson from Vernacular Architecture* (London: Routledge, 2014); Ghaffarianhoseini, Berardi, and Ghaffarianhoseini, "Thermal performance characteristics of unshaded courtyards in hot and humid climates," 2015, 154-168.

17. N. Das, *Courtyards Houses of Kolkata: Bioclimatic, Typological and Socio-Cultural Study* (s.l.:Kansas State University, Department of Architecture, College of Architecture, Planning and Design, 2006); A. Petruccioli, "The courtyard house: typological variations over space and time," in *Courtyard Housing: Past, Present and Future* (eds.), E. Brian, M. Sibley, M. Hakmi, and P. Land (Taylor and Francis, 2005); A. Rapoport, "The nature of courtyard house: a conceptual analysis," *Traditional Dwellings and Settlements Review* 18, no. 2 (2007): 57-72; J. Reynolds, *Courtyards: Aesthetic, Social and Thermal Delight* (New York: John Wiley, 2002).

18. M. Achenza, G. Chiri, and I. Giovagnorio, *The Microclimatic Design of Southern Sardinian Loggias in Italy* (London: Taylor and Francis, 2014); M. Sinou, *Design and Thermal Diversity of Semi-enclosed Spaces*. (Cambridgeshire: Melrose Books, 2007).

19. B. Rudofsky, *Architecture without Architects: a Short Introduction to Non-pedigreed Architecture* (New York: Museum of Modern Art, 1964).

20. A. Foruzanmehr, "People's perception of the loggia: a vernacular passive cooling system in Iranian architecture," *Sustainable Cities and Society* 19 (2015): 61-67.

corridor) and the *sachnisi* (a light structural projection on the main façade of vernacular dwellings with a large number of windows). The environmental values of *porticos* have been documented extensively by Vellinga et al.[21] and Oikonomou and Bougiatioti.[22] The same authors also give an overview of the environmental values of these timber projections in northern Greece, showing their contribution to ventilation and daylighting, thus underlining their suitability for many household activities. The combined effect of these two spaces – *portico* and *sachnisi* – on the enhancement of ventilation is also mentioned by the same two researchers. The arrangement of the openings in these two areas helps towards the achievement of cross ventilation.

Many studies focus on the investigation of the ventilation strategies to achieve thermal comfort in vernacular dwellings in the Mediterranean region. Field research revealed the positive contribution of these strategies.[23] According to Santamouris and Wouters,[24] night ventilation is very effective, especially in areas with high daily air temperature fluctuations and low night temperatures. The decrease in interior temperatures due to the application of night ventilation is also discussed by Blondeau, Spérandio, and Allard.[25] Many researchers refer to the necessity for external daily air temperature fluctuations in order to achieve a satisfactory cooling effect in the interior of the vernacular dwellings during night.[26] Many factors regarding the architectural layout of a dwelling can reinforce ventilation by increasing air velocity, such as the arrangement of small openings high up on the walls just below roof level, due to the stack effect.[27]

Researchers[28] have also investigated the thermal behaviour at different periods of the year, in various spaces within the vernacular houses. They have also explored human interaction regarding window opening operations, showing how occupant behaviour was adapted for optimal thermal comfort. According to the aforementioned studies, during the winter season, living spaces were situated on

21. M. Vellinga, P. Oliver, and A. Bridge, *Atlas of Vernacular Architecture of the World* (London: Routledge, 2007).

22. Oikonomou, and Bougiatioti, "Architectural structure and environmental performance of the traditional buildings in Florina, NW Greece," 2011, 669-689.

23. A. Mochida, H. Yoshino, T. Takeda, T. Kakegawa, and S. Miyauchi, "Methods for controlling airflow in and around a building under cross ventilation to improve indoor thermal comfort," *J Wind Eng Ind Aerodyn* 93 (2005): 437-449; A. Aflaki, N. Mahyuddin, Z. Al-Cheikh Mahmoud, and M. R. Baharum, "A review on natural ventilation applications through building façade components and ventilation openings in tropical climates," *Energy Build* 101 (2015): 153-162.

24. M. Santamouris, and P. Wouters (Eds.), *Building ventilation, the state of the art* (UK: Earth Scan, 2006).

25. P. Blondeau, M. Spérandio, and F. Allard, "Night ventilation for building cooling in summer," *Solar Energy* 61 (1997): 327-335.

26. B. Givoni, *Passive and low energy cooling of buildings* (Hoboken: John Willy & Sons, 1994); Blondeau, Spérandio, and Allard, "Night ventilation for building cooling in summer," 1997, 327-335; E. Shaviv, A. Yezioro, and I. G. Capeluto, "Thermal mass and night ventilation as passive cooling design strategy," *Renew Energy* 24 (2001): 445-452.

27. Kristianto, Utama, and Fathoni, "Analyzing indoor environment of Minahasa traditional house using CFD," 2014, 172-179.

28. Oikonomou, and Bougiatioti, "Architectural structure and environmental performance of the traditional buildings in Florina, NW Greece," 2011, 669-689.

the ground floor of the dwelling. This floor was characterised by increased thermal mass due to the thickness of the walls and the limited number of openings. Summer living spaces were located on the upper floor (including the area of the *sachnisi*), where ventilation could be achieved due to an increased number of windows.

Regarding the materiality of the structures, many studies demonstrate the positive impact of using massive structural elements made from local materials (mainly stone and adobes) with high thermal mass in vernacular dwellings. This method constitutes a common bioclimatic technique in traditional Mediterranean architecture in areas such as Italy[29], Portugal[30], Turkey[31], Spain[32] and Greece.[33] When studying the thermal properties of earthen walls, Collet et al.[34] focused on the thermal inertia, as well as on the time delay of the thermal wave dissemination in traditional masonry. Researchers[35] relate the effectiveness of the thermal mass to many factors, i.e., the thermal properties of materials, thermal insulation, ventilation and occupancy.

Regarding the vernacular architecture of Cyprus, many qualitative and quantitative studies have been carried out recently.[36] More specifically the UCY research team has investigated a large number of cooling and heating strategies in detail.[37] These investigations cover both urban[38] and rural areas of the island.[39]

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29. Cardinale, Rospi, and Stefanizzi, "Energy and microclimatic performance of Mediterranean vernacular buildings: the Sassi district of Matera and the Trulli district of Alberobello," 2013, 590-598.

30. J. Fernandes, R. Mateus, L. Bragança, and J. Júlio Correia da Silva, "Portuguese vernacular architecture: The contribution of vernacular materials and design approaches for sustainable construction," *Architectural Science Review* 58, no. 4 (2015): 324-336.

31. T. Basaran, "Thermal analysis of the domed vernacular houses of Harran, Turkey," *Indoor Built Environ* 20 (2011): 543-554.

32. S. Martin, F. R. Mazarron, and I. Canas, "Study of thermal environment inside rural houses of Navapalos (Spain): the advantages of reuse buildings of high thermal inertia," *Construction of Building Materials* 24 (2010): 666-676.

33. C. A. Balaras, "The role of thermal mass on the cooling load of buildings. An overview of computational methods," *Energy Build* 24 (1996): 1-10.

34. F. Collet, L. Serres, J. Miriel, and M. Bart, "Study of thermal behaviour of clay wall facing south," *Building Environment* 41 (2006): 307-315.

35. H. Cagnon, J. E. Aubert, M. Coutand, and C. Magniont, "Hygrothermal properties of earth bricks," *Energy Build* 80 (2014): 208-217.

36. M. Philokyprou, A. Michael, E. Malaktou, and A. Savvides, "Environmentally responsive design in Eastern Mediterranean. The case of vernacular architecture in the coastal, lowland and mountainous regions of Cyprus," *Build Environ* 111 (2017): 91-109; M. Philokyprou, A. Michael, S. Thravalou, and I. Ioannou, "Thermal performance assessment of vernacular residential semi-open spaces in Mediterranean climate," *Indoor and Built Environment* 27, no. 8 (2018): 1050-1068.

37. M. Philokyprou, and A. Michael, "Evaluation of the environmental features of vernacular architecture. A case study in Cyprus," *Int J Heritage Digital Era* 1 (2012): 349-354; M. Philokyprou, A. Savvides, A. Michael, and E. Malaktou, "Examination and assessment of the environmental characteristics of vernacular rural settlements. Three case studies in Cyprus," in *Vernacular Heritage and Earthen Architecture: Contribution to Sustainable Development* (eds.) M. Correia, G. Carlos, and S. Sousa (London, UK: Taylor & Francis Group, 2014), 613-618.

38. M. Philokyprou, A. Michael, S. Thravalou, and I. Ioannou, "Evaluation of sustainable design elements in the historic centre of Nicosia, Cyprus," in *Vernacular Heritage and Earthen Architecture* (eds.) M. Correia, G. Carlos, and S. Rocha (London: Taylor & Francis Group, 2013), 631-637; M. Philokyprou, A. Michael, and S. Thravalou, "Assessment of the bioclimatic elements

The research also covered the urban scale of settlements such as streetscapes,[40] as well as the buildings' architectural scale,[41] specific architectural spaces and characteristics such as courtyards,[42] subterranean spaces,[43] semi-open space typologies and façade projections.[44] Some of the passive design strategies recorded at architectural and district level include the dense fabric of settlements, the massive stone and adobe walls, the appropriate orientation, the arrangement of spaces around the yards, the semi-open areas, the shutters, the vegetation and the lightweight shading structures (*pergolas*). Many studies have shown the environmental adaptability of Cyprus' vernacular dwellings in different climatic regions of the island.[45] The significant role of the size, as well as the arrangement and operation of windows in the vernacular dwellings of Cyprus were also noted. At the same time special studies were carried out to investigate the positive impact of night ventilation in different urban and rural areas,[46] and the thermal mass of adobe walls through the investigation of time lag.[47] The lighting level of

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39. E. Malaktou, M. Philokyprou, A. Michael, and A. Savvides, "Architectural design and environmental behavior of traditional buildings in mountainous regions. The case of Askas settlement, Cyprus," in *International Conference Biocultural 2015, Sustainability in Architectural Cultural Heritage* (Limassol, Cyprus, 11-12 December 2015), 77-86; E. Malaktou, M. Philokyprou, A. Michael, and A. Savvides, "Environmental behavior of semi-open spaces in Mediterranean vernacular architecture. The case of rural traditional dwellings of Cyprus," *Renew Energy Power Qual J* 14 (2016): 599-604.

40. A. Savvides, A. Michael, E. Malaktou, and M. Philokyprou, "Examination and assessment of insolation conditions of street-scapes of traditional settlements in the Eastern Mediterranean area," *Habitat Int* 53 (2016): 442-452.

41. Philokyprou, Michael, Malaktou, and Savvides, "Environmentally responsive design in Eastern Mediterranean. The case of vernacular architecture in the coastal, lowland and mountainous regions of Cyprus," 2017, 91-109.

42. M. Philokyprou, and A. Michael, "Social and Environmental Aspects of Courtyards in Vernacular Architecture in Cyprus," Special Issue on Vernacular Architecture, From Tradition to the Future, *Serbian Architectural Journal SAJ* 8 (2016): 75-90.

43. E. Malaktou, M. Philokyprou, A. Michael, and A. Savvides, "Thermal assessment of traditional, partially subterranean dwellings in coastal and mountainous regions in the Mediterranean climate. The Case of Cyprus," *J Sustainable Architect Civil Eng* 3, no. 16 (2016): 82-96.

44. S. Thravalou, and M. Philokyprou, "Urban design considerations in the environmental assessment of vernacular buildings with timber projections (*sachnisi*): The case of Nicosia's historic center," *Frontiers of Architectural Research* 10, no. 1 (2021): 176-189.

45. Philokyprou, Michael, Malaktou, and Savvides, "Environmentally responsive design in Eastern Mediterranean. The case of vernacular architecture in the coastal, lowland and mountainous regions of Cyprus," 2017, 91-109.

46. A. Michael, D. Demosthenous, and M. Philokyprou, "Natural ventilation for cooling in mediterranean climate: A case study in vernacular architecture of Cyprus," *Energy and Buildings* 144 (2017): 333-345; S. Thravalou, M. Philokyprou, and A. Michael, "Natural ventilation performance of heritage buildings in the Mediterranean climate. The case of a two-storey urban traditional dwelling in Nicosia, Cyprus," in *Proceedings of the 9th International Conference on Making Comfort Relevant* (Windsor, UK, 7-10 April 2016), 328-339.

47. A. Michael, M. Philokyprou, S. Thravalou, and I. Ioannou, "The role of the thermal mass of adobe walls in the thermal performance of vernacular dwellings," in *XIIth world Congress of Eastern Architectures* (Terra, Lyon, France, 11-14 July 2016).

closed areas and semi-open spaces was also investigated.[48] Furthermore, a holistic investigation regarding sustainability in the conservation of vernacular dwellings was carried out and published very recently.[49]

Methodology

Initially a general investigation into the vernacular architecture of Cyprus was carried out through the development of a digital database. This database constitutes the first effort to include all available information regarding the traditional settlements and dwellings of Cyprus, in digital form.[50] More detailed research findings presented in this paper derive mainly from two multidisciplinary research programmes (BioVernacular and BioCultural) carried out at UCY that examine the passive design features of traditional settlements in Cyprus. The BioVernacular programme focuses on the historic urban area of Nicosia, while the BioCultural programme focuses on traditional rural settlements.

Within the framework of the two aforementioned projects, the following procedure was followed for the investigation of the vernacular dwellings and settlements (Figure 1).

48. A. Michael, C. Herakleous, S. Thravalou, and M. Philokyprou, "Lighting Performance of Urban Vernacular Architecture in the East Mediterranean Area: Field Study and Simulation Analysis," *Indoor and Built Environment* 26, no. 4 (2017): 471-487.

49. M. Philokyprou, and A. Michael, "Environmental Sustainability in Conservation of Vernacular Architecture. The case of rural and urban traditional settlements in the Mediterranean area," *International Journal of Architectural Heritage: Conservation, Analysis and Restoration* 15, no. 11 (2021): 1741-1763.

50. M. Philokyprou, "The VernArch Digital Database Project: Documentation and Protection of the Vernacular Architecture of Cyprus," in *Proceedings of the International Conference on Cultural Heritage. Digital Heritage. Progress in Cultural Heritage Documentation, Preservation and Protection (Euromed 2014)* (Limassol, Cyprus, 3-8 November, 2014), 635-642.

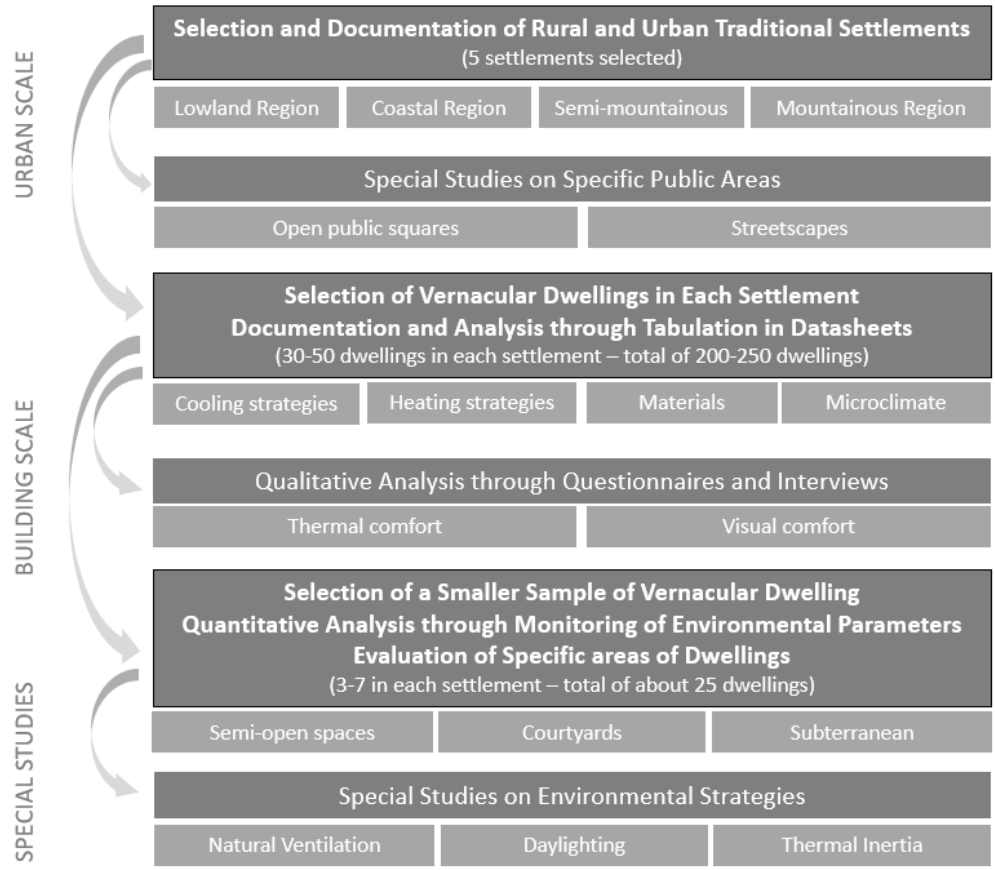

Figure 1. *Diagram Showing the Methodology Followed and the Different Steps of the Procedure from the Urban Scale to the Building Scale*

a) Initially five settlements were selected and investigated in detail (Figures 1 and 2), situated in different climatic areas – coastal, lowland, semi-mountainous and mountainous.[51] These selected settlements were situated either in rural or urban areas with different geomorphological characteristics. Specifically, two urban settlements situated in the lowland areas and three rural settlements – namely Maroni in the coastal area, Pera Orinis in the lowland area, and Askas in the mountainous region – were selected as case studies. The research initially included a qualitative investigation of various bioclimatic elements through a field survey.

51. M. C. Katafygiotou, and D. K. Serghides, "Bioclimatic chart analysis in three climate zones in Cyprus," *Indoor Built Environ* 24 (2015): 746-760.

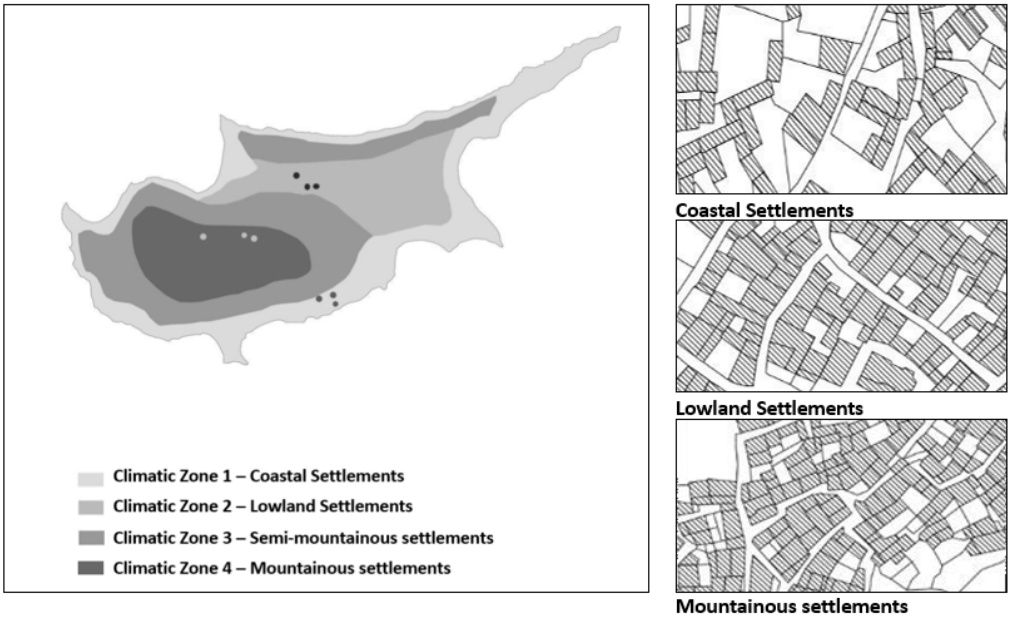

Figure 2. *Map of Cyprus Showing the Different Climatic Zones (Left) and Maps of Characteristic Settlements Located in Coastal, Lowland and Mountainous Areas (Right)*

b) In each case study settlement, a representative number (30-50) of vernacular buildings were selected in order to record and tabulate all of the environmental features of each dwelling in data sheets (Figure 3). The passive heating and cooling strategies, as well as strategies for outdoor microclimatic regulation, were recorded for each of the selected buildings. The data sheets also included architectural and urban characteristics for each case study. Overall tables were also prepared for each area under study, as well as comparison tables between the settlements situated in different climatic zones.

c) The above procedure was followed by a quantitative analysis through in situ monitoring of the various environmental parameters on a smaller sample of dwellings (about 3-7 dwellings in each of the 5 areas). Data loggers for recording temperature and relative humidity were placed inside the dwellings, as well as in semi-open spaces. Simultaneously, external environmental stations were placed in the different areas under investigation, in order to gather climatic data of the outdoor conditions for comparison reasons.

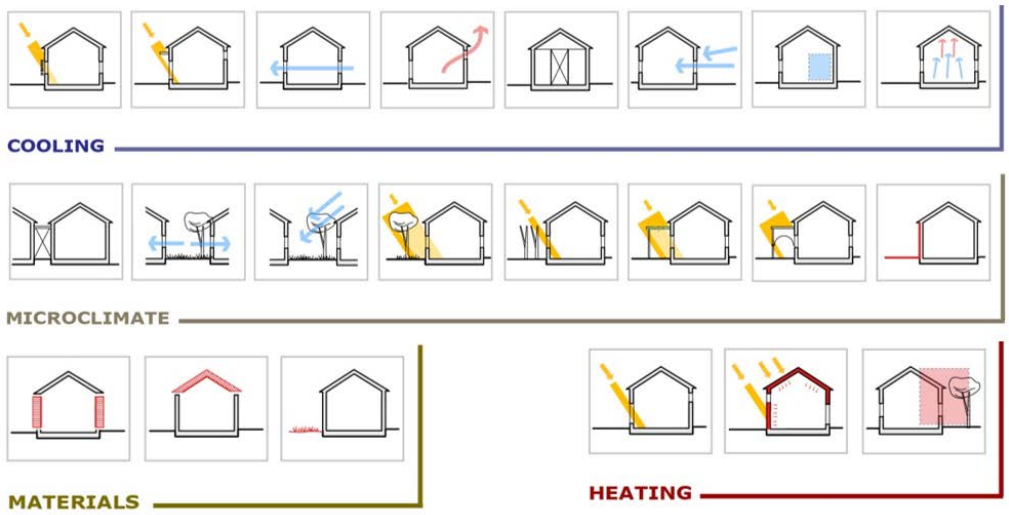

Figure 3. *Cooling and Heating Strategies, as well as Strategies Related to the Improvement of the Microclimatic Conditions and Materiality Investigated in Traditional Settlements*

d) The impact of the human behaviour on achieving thermal comfort inside vernacular dwellings has been also investigated through questionnaires and interviews.

e) At the same time special studies were undertaken (Figure 4) focusing on urban public open spaces (squares and streetscapes[52]) in the rural settlements mentioned in paragraph (a). In addition, special studies were carried out for specific spaces in the vernacular dwellings selected for quantitative investigation in the second phase of the investigation (paragraph c), such as semi-open spaces,[53] courtyards[54] and subterranean areas,[55] as well as on specific fields and environmental strategies such as ventilation[56] and lighting.[57]

52. Savvides, Michael, Malaktou, and Philokyprou, "Examination and assessment of insolation conditions of street-scapes of traditional settlements in the Eastern Mediterranean area," 2016, 442-452.

53. M. Philokyprou, A. Michael, and E. Malaktou, "A typological, environmental and socio-cultural study of semi-open spaces in the Eastern Mediterranean vernacular architecture: The case of Cyprus," *Front. Archit. Res.* 10, no. 3 (2021): 483-501.

54. Philokyprou, and Michael, "Social and Environmental Aspects of Courtyards in Vernacular Architecture in Cyprus," 2016, 75-90.

55. Malaktou, Philokyprou, Michael, and Savvides, "Thermal assessment of traditional, partially subterranean dwellings in coastal and mountainous regions in the Mediterranean climate. The Case of Cyprus," 2016, 82-96.

56. Thravalou, Philokyprou, and Michael, "Natural ventilation performance of heritage buildings in the Mediterranean climate. The case of a two-storey urban traditional dwelling in Nicosia, Cyprus," 2016, 328-339; Michael, Demosthenous, and Philokyprou, "Natural ventilation for cooling in mediterranean climate: A case study in vernacular architecture of Cyprus," 2017, 333-345.

57. A. Michael, C. Heracleous, E. Malaktou, A. Savvides, and M. Philokyprou, "Lighting performance in rural vernacular architecture in Cyprus: Field studies and simulation analysis," in

Results

The research revealed very interesting results regarding different aspects of vernacular settlements and dwellings situated in various areas around the island. The results presented here cover different scales of investigation – the urban scale of the settlements and the building scale – as well as the structural system of the dwellings and their materiality. This paper is a comprehensive overview of recent research on the various environmental aspects of vernacular dwellings. The aim of this article is the presentation of the methodology that was followed in different areas, as well as on different scales, using various tools and methods – both qualitative and quantitative.

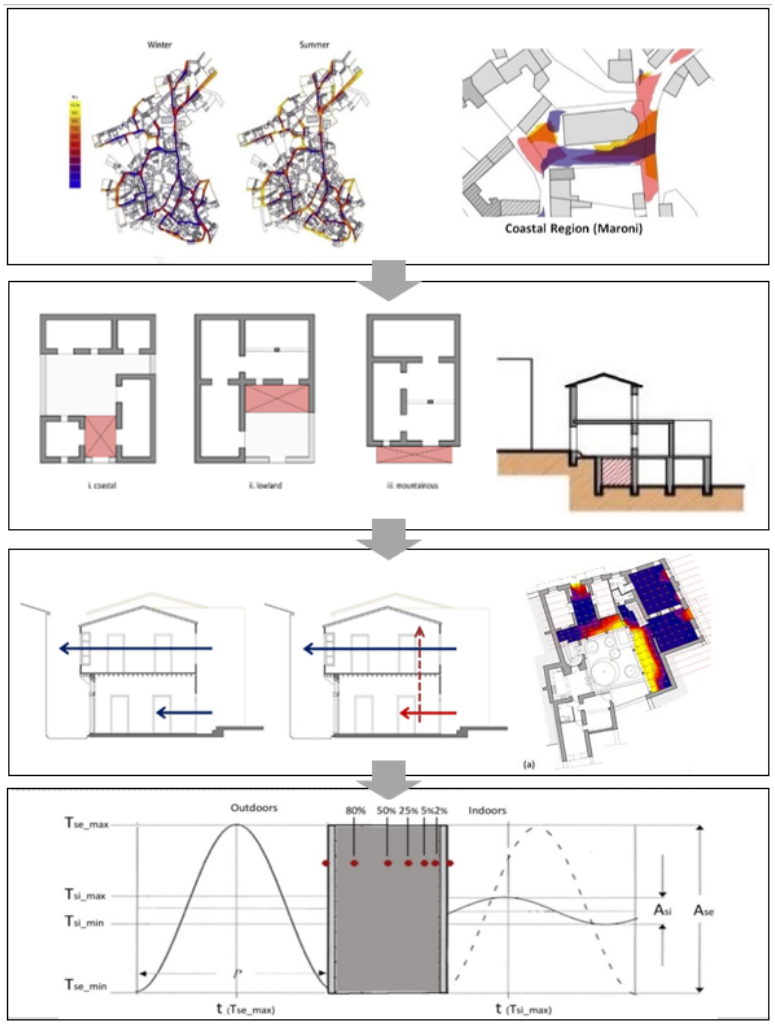

Figure 4. *Different Studies Undertaken on Urban Public Open Spaces, Private Dwellings, Specific Fields (Ventilation, Lighting) and Materiality*

The studies that focus on urban public open spaces such as open public squares and streetscapes (Figures 4-5), show the different environmental characteristics of the areas selected in different climatic zones. The study that examines the solar conditions of streets in three rural vernacular settlements (Maroni, Pera Orinis and Askas) situated in three different climatic zones, revealed the different shading patterns of each case. Through the investigation of the monthly insolation conditions of the streetscapes, with the help of software simulation in terms of sunlight hours, incident solar radiation, shading percentages and sky view factors,[58] it was revealed that the mountainous settlement increases shading patterns due to the dense fabric and deep street corridors. This in turn offers significant potential to improve the outdoor thermal comfort conditions during the cooling period (summer). The worst shading conditions of the three settlements investigated were found in the settlement in the lowland area, and especially in areas at the boarders of the settlement where wider streets can be found.

Figure 5. *Street Canyons in Rural (a, b) and Urban Settlements (c, d)*

In the same context, the outdoor microclimatic conditions of traditional public squares in all three rural settlements were investigated. An innovative methodology based on seasonal image processing techniques of solar, sky view factor and wind, was applied for this investigation. The mapping of the spatial thermal diversity of the squares is illustrated by overlaying the aforementioned microclimatic factors. A comparison between the three squares in the three case study settlements, based on results taken during winter (heating period), reveals that the square located in the lowlands performs best due to the combination of the southern aspect, high sky view and wind protection.

Moving now from the open to the built part of the settlements, the research carried out focusing on settlement pattern, as well as on building scale revealed different layouts of the built fabric across the three different climatic areas of Cyprus. The analysis of the urban fabric showed the protection of the spaces inside the dwellings from exterior environmental conditions due to the continuous attached building system (Figure 6) that is a very common characteristic in traditional settlements. Specifically, this building system entails the losses of heat during winter (heating period) and heat gains during the summer (cooling period).

58. Savvides, Michael, Malaktou, and Philokyprou, "Examination and assessment of insolation conditions of street-scapes of traditional settlements in the Eastern Mediterranean area," 2016, 442-452.

Figure 6. *Settlement Pattern (Continuous Attached Building System)*

The typological analysis of vernacular dwellings in the different areas of study which followed, showed the common and different characteristics of the traditional dwellings in all of the settlements. The dwellings situated in the coastal areas typically combine single, elongated rooms that have a wide façade (Figure 7). These rooms are called *platimetopa makrinaria*. These elongated and shallow layouts enhance natural ventilation, reinforcing passive cooling during the summer (cooling period), and appropriate insolation and daylight penetration during the summer (heating period). Double-space rooms called *dichoro*, with high ceilings and single-banked rooms, are the most common rooms of the dwellings in the lowland regions (Figure 7). Passive cooling is enhanced in the aforementioned rooms, due to their high ceiling. Rooms with narrow deep plans (single-banked) called *stenometopa makrinaria* prevail in the mountainous settlements. The compact, low-ceilinged spaces of these areas offer protection from the cold.

The research showed that courtyards constitute important environmental features in all areas under study (Figure 8). In coastal regions, spacious interior courtyards can be observed. In the lowlands, courtyards have a compact form due to the denser layout of the areas. In the mountainous regions, courtyards if existent, are very small due to restrictions of topography and climate. The courtyard offers several environmental benefits in all periods of the year. The existence of a yard in the plot's centre offers direct solar gains in the heating period (winter), and ensures cross ventilation during summer in the surrounding rooms. The relatively small size of the courtyards, in combination with suitable plants, offer shading of the spaces surrounding the yard, as well as the floor surface of the yard during the summer. In addition, courtyards allow solar gains into the different spaces of the dwellings during winter, leading to a very successful bi-seasonal passive result.

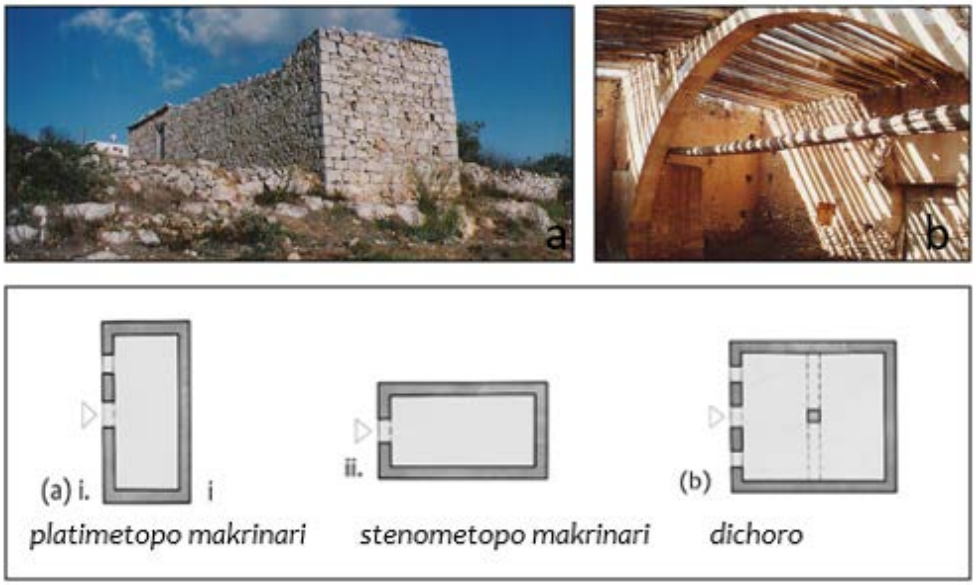

Figure 7. *The Two Main Typologies of Traditional Rooms (Makrinari – Platimetopo and Stenometopo and Dichoro)*

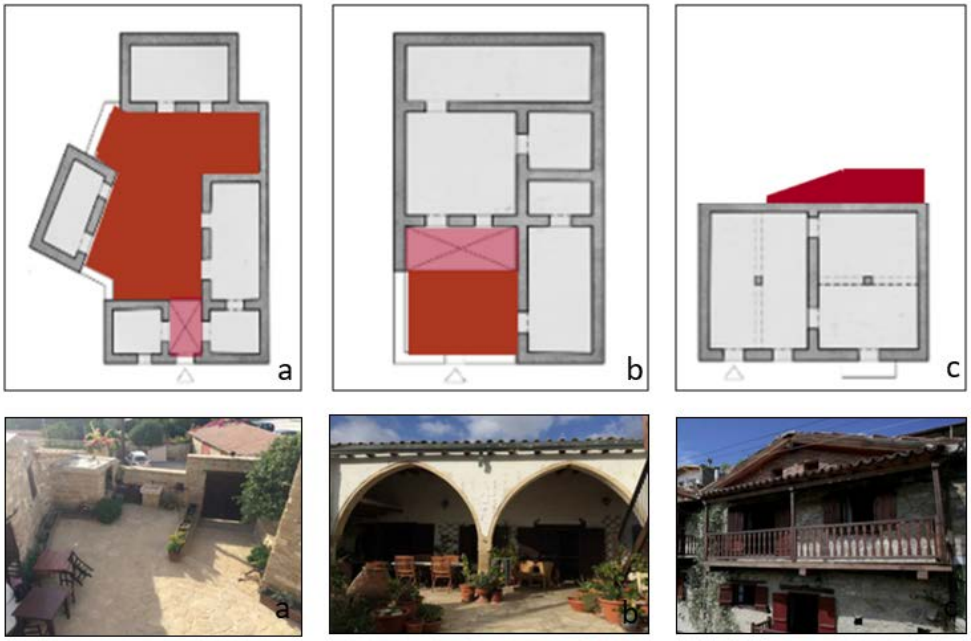

Figure 8. *Different Sizes and Layout of Courtyards in Different Climatic Zones (a. Coastal Areas, b. Lowland Areas, c. Mountainous Areas)*

The intermediate semi-open areas very often seen in lowland (rural and urban) regions and less in coastal and mountainous areas, constitute another very important environmental, social and functional element (Figures 4, 9-10). The *iliakos* – a semi-open space with a linear layout found adjacent to the indoor spaces and covering their main façade towards the yard – is very often observed in

lowland settlements. This is related to the high summer temperatures, as well as the solar radiation values that provide suitable shaded outdoor spaces. The *iliakos* offers shaded spaces, and serves circulation purposes, while also hosting several households, agricultural and social activities. Another type of semi-open space in the form of a through passage is the *portico,* located within the dwelling itself (Figure 9). This structure is more often found in rural coastal and urban lowland settlements. It permits sufficient cross ventilation, as well as sufficient air flow inside the dwelling. A common semi-open space found in dwellings in the mountainous areas and located on the upper floor, is the called *hayiati* (Figure 10). The existence of semi-open spaces on the upper floor in these areas is connected to the limited available land at ground level. Moreover, *vine pergolas* are quite common in all different climatic regions and provide either shade or sunlight entry in the summer and winter respectively (Figure 10). Following a holistic multicriteria approach, the positive attributes of the semi-open spaces in different climatic areas and topographies were identified and evaluated.[59]

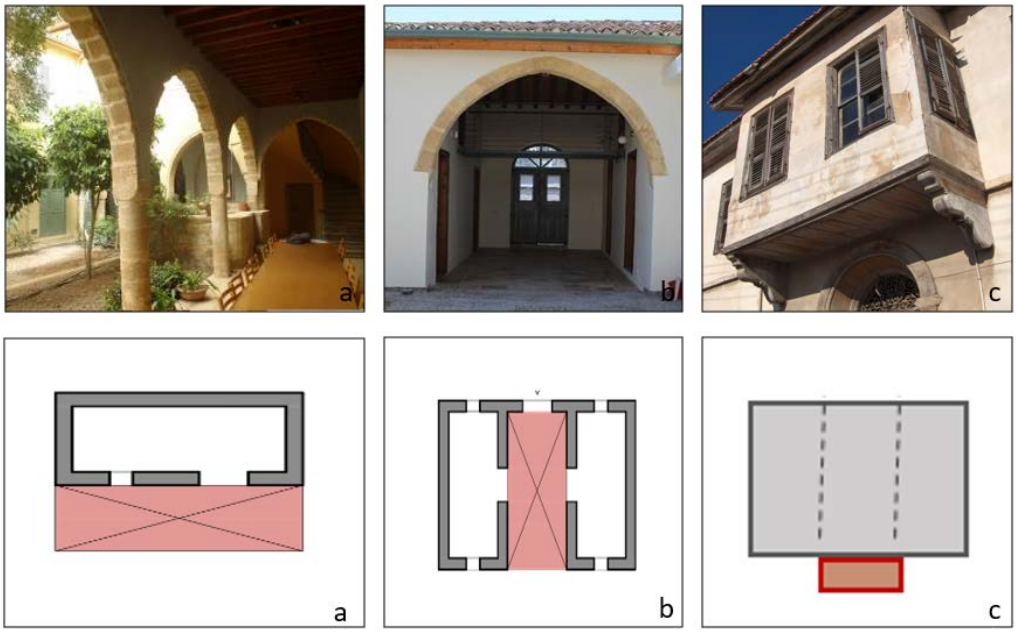

Figure 9. *Semi Open Spaces (a. Iliakos, b. Portico) and Light Structured Projections (c. Sachnisi)*

The role that semi-open spaces play in improving the thermal comfort of urban vernacular dwellings was studied in detail through field monitoring. Special attention was given to the impact of contemporary interventions carried out in these spaces (Figure 11). The research results show the positive contribution of these areas to the thermal comfort of the interiors of vernacular dwellings, especially during summer. The records of the temperatures showed the positive

59. Philokyprou, and Michael, "Environmental Sustainability in Conservation of Vernacular Architecture. The case of rural and urban traditional settlements in the Mediterranean area," 2021, 1741-1763.

impact when converting south oriented semi-open spaces into closed areas during the heating period. During the summer, extensive overheating phenomena can be observed. The analysis of recorded temperatures in semi-open areas with different orientations which had been converted into closed areas, showed very different thermal behaviour. North oriented areas act better during summer, whereas south oriented areas show a better thermal behaviour during winter.[60]

Figure 10. *Different Typologies of Semi-Open Spaces in Rural Traditional Settlements*

In the same context, systematic research examining partially subterranean coastal and mountainous vernacular dwellings was performed. Such spaces are very rare in lowland and urban areas due to the geomorphology of the areas. Air temperature and relative humidity were monitored. The results indicate significant cooling effects in partially subterranean areas during summer, especially in mountainous areas. During the heating period, air temperatures are higher compared to the temperatures of the spaces that were above ground. Overall, the research results highlight the environmental benefits of partially subterranean spaces resulting from the earth's high thermal inertia.

Figure 11. *Semi-Open Spaces Preserved in Their Original Character (Left) or Converted into Closed Areas with the Use of Glass Surfaces (Three Examples to the Right)*

Special studies focusing on ventilation were also carried out. Ventilation strategies are linked to the general layout of the dwellings and the arrangement of the openings. In vernacular settlements of all areas, the small number and size of the openings protect the interior space of the vernacular dwellings from external conditions, but at the same time offer opportunities for ventilation. The cross

60. Philokyprou, Michael, Thravalou, and Ioannou, "Thermal performance assessment of vernacular residential semi-open spaces in Mediterranean climate," 2018, 1050-1068.

arrangement of the openings is a very common feature of settlements situated in coastal and lowland areas and allows for natural ventilation (Figure 12).

In order to investigate natural ventilation, its influence on thermal conditions inside a vernacular dwelling during the summer was closely studied. The investigation involved different ventilation strategies assessed through field study. Specifically, ventilation during the day and night was monitored (Figures 4, 12). Moreover, in the case of night-time ventilation, different patterns of window openings – i.e., single window, single-sided and cross ventilation – were also examined. The very positive impact of night-time cross ventilation was demonstrated through this study. This strategy proved to be most effective compared to the other ventilation strategies.[61]

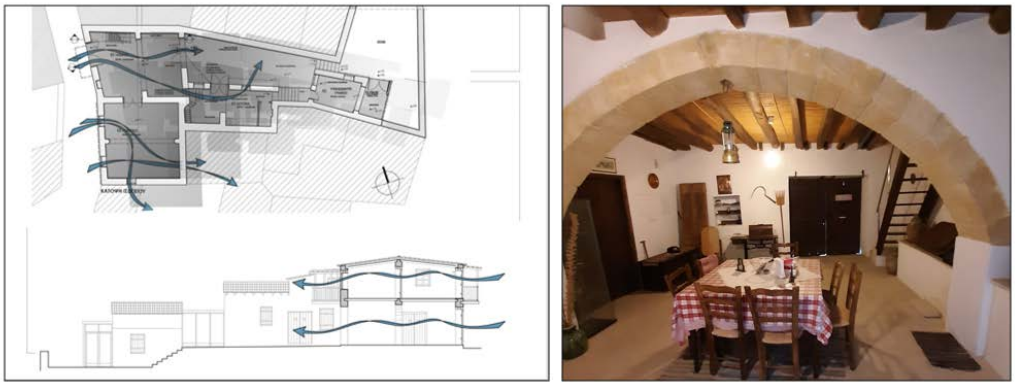

Figure 12. *Cross Ventilation in a Characteristic Rural Vernacular Dwelling*

Natural ventilation was also investigated in urban vernacular buildings in Nicosia. This study focused on the way that occupants interact with the building envelope in order to achieve thermal comfort. The investigation was conducted through software simulations on different window-operation patterns, which once again confirms the effectiveness of night-time cross ventilation.[62]

A special feature of urban vernacular dwellings related to ventilation strategies, is the *sachnisi* – a projection on the upper level of two-storey dwellings (Figure 9). This element plays an important environmental and social role, mainly due to the incorporation of a large number of openings in its structure.[63]

In addition to their role in ventilation, the openings (specifically their size and arrangement) also play a vital role in lighting. Within the same context, a detailed lighting performance investigation was carried out in an urban dwelling in a typical traditional complex in Nicosia. Field measurements and software simulations were carried out in selected indoor and semi-open spaces. The results

61. Michael, Demosthenous, and Philokyprou, "Natural ventilation for cooling in Mediterranean climate: A case study in vernacular architecture of Cyprus," 2017, 333-345.

62. Thravalou, Philokyprou, and Michael, "Natural ventilation performance of heritage buildings in the Mediterranean climate. The case of a two-storey urban traditional dwelling in Nicosia, Cyprus," 2016, 328-339.

63. Thravalou, and Philokyprou, "Urban design considerations in the environmental assessment of vernacular buildings with timber projections (sachnisi): The case of Nicosia's historic center," 2021, 176-189.

showed that lighting levels in the first-floor rooms are quite sufficient, whereas the ground floor spaces demonstrate insufficient lighting levels due to the dense urban fabric.[64] On the other hand, the study verifies the contribution and positive role of the central courtyard on the lighting levels of indoor as well as semi-open areas in the dwellings. At the same time, a detailed study was carried out of rural dwellings in the three different climatic zones.

A detailed investigation was carried out into the structural system of dwellings whose load bearing walls were mainly 50cm thick (with stone at the lower part and mudbrick at the upper parts – Figure 13). The research shows that the high thermal mass of the walls leads to a very small temperature fluctuation inside the vernacular dwellings compared to larger temperature fluctuations of the external environment during all different periods recorded. Some interesting conclusions regarding thermal comfort were reached using a structured questionnaire.

Figure 13. *Traditional Masonries (Stone, Adobes) in Rural Settlements*

In order to investigate the thermal inertia of the masonry walls in detail, a 50cm thick mudbrick wall was monitored (Figure 4). Recording the time, as well as the corresponding minimum and maximum values of temperature during the cooling period (summer), it was revealed that maximum temperature in the internal surface of the wall was recorded around 8pm. On the other hand, the maximum temperature recorded at the external surface occurred at 3pm. The aforementioned observation indicates a time lag of about five hours over the period of a day (24-hour).[65]

In the framework of a graduate study, the thermal properties of mudbricks were examined through experimental and literature research. The investigation showed that the thermal resistance, as well as the time lag of mudbricks, is increased when a wall becomes thicker. Another outcome of this research is related to the effect of the density of mudbricks on their thermal properties. It

64. Michael, Heracleous, Malaktou, Savvides, and Philokyprou, "Lighting performance in rural vernacular architecture in Cyprus: Field studies and simulation analysis," 2015; Michael, Herakleous, Thravalou, and Philokyprou, "Lighting Performance of Urban Vernacular Architecture in the East Mediterranean Area: Field Study and Simulation Analysis," 2017, 471-487.

65. Michael, Philokyprou, Thravalou, and Ioannou, "The role of the thermal mass of adobe walls in the thermal performance of vernacular dwellings," 2016.

verifies that the increase in the density of earth materials leads to an increase in their thermal conductivity and heat storage capacity. On the other hand, the increase in density also leads to a decrease in the time lag. The investigation shows that the addition of lightweight fibres into mudbricks can lead to an improvement in their thermal insulation capacity.[66]

The hydrothermal performance of a stone masonry wall was also investigated in detail. For the purpose of this study, a wall was monitored with temperature and moisture probes installed at various locations along its thickness and height. The graphical overview of the moisture content pattern shows that the moisture content differentiates along the height of the wall. Specifically, the wetting indicator decreases as the distance from ground level increases.[67]

The analysis of the environmental features and strategies of vernacular buildings, as described previously, shows the implementation of a variety of cooling and heating strategies. In coastal settlements, the hot climate along with high humidity and strong solar radiation, has led to the incorporation of a large number of cooling strategies. Contrarily, in the mountainous settlements the cold winters, with low temperatures and relatively mild summers, led to the incorporation of a large number of heating rather than cooling strategies in order to maximise solar exploitation. Finally, in the lowland rural and urban settlements, the equal incorporation of both cooling and heating strategies are the result of high summer temperatures and relatively low winter temperatures.

Discussion & Conclusions

The previously described investigations reveal the large number of environmental design features and strategies (heating, cooling, microclimatic conditions) that are incorporated in vernacular dwellings. The more detailed quantitative examination of vernacular dwellings and settlements through in situ monitoring, has shown the need to maintain these environmental elements when reusing these dwellings.

The research methodology described above shows the complexity of the process regarding the environmental features and strategies of vernacular settlements, and the need for a detailed study and investigation on different levels. Thus, a multicriteria approach is needed in close cooperation with stakeholders and users. In each research team dealing with heritage and sustainability like the project described in this paper, individuals from different disciplines and backgrounds (architecture, conservation, engineering, environmental studies, archaeology, social studies) should participate. All those involved should work in

66. E. Malaktou, I. Ioannou, and M. Philokyprou, "Investigating the Thermal Properties of Earth-based Materials. The case of Adobes," in *Proceedings of the 10th International Symposium on the Conservation of Monuments in the Mediterranean Basin* (Athens, 20-22 September 2017. Springer), 95-103.

67. C. Heracleous, I. Ioannou, M. Philokyprou, and A. Michael, "Hydrothermal Performance of a Stone Masonry Wall in a Traditional Building in Cyprus," in *Proceedings of the 33rd PLEA International Conference on Passive Low Energy Architecture, Design to Thrive,* Volume III (Edinburgh, 3-5 July 2017), 5030-5037.

groups in order to have a holistic overview of the research. Interdisciplinary cooperation between the researchers from different disciplines is essential. Such projects often have a duration of 1-2 years in order to extract environmental data from all the different periods of the year.

The procedure of this research can be followed in similar cases. This methodological approach should include the investigation of: a) the urban scale of selected settlements in different climatic and geomorphological areas and b) the building scale of representative vernacular dwellings in each settlement. Qualitative as well as quantitative studies should be carried out in the various types of dwellings and in different areas of a selected number of case studies, such as closed, semi-open and open spaces. The in-depth analysis of specific traditional passive strategies such as ventilation is essential, as this is related to human behaviour and to the comfort inside the dwellings. The investigation of the materiality of the structures is also very important in order to have a holistic view of the thermal performance of the dwellings.

In conclusion, the necessity of following such holistic approaches towards the study of vernacular architecture should be underlined, taking into serious consideration all the different values that each approach involves (tangible and intangible). It should also be noted that the connection of heritage values with aspects of environmental technology gives this field of investigation a multidisciplinary character, offering opportunities for further research and innovation.

Acknowledgments

This paper is based on the evaluation promotion presentation of Maria Philokyprou as well as on two research programmes carried out in the University of Cyprus (Biovernacular and BioCultural) and coordinated by Maria Philokyprou.

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Future Directions in Architectural Practice[1]

By Christo Vosloo[*]

The period since the middle of the second decade of the 21st century has seen dramatic changes in the global scientific and socio-economic environment: while the COVID-19 pandemic might have had the biggest impact on what our futures might look like, there are other changes such as the war in Ukraine, rapid developments taking place in the spheres of communication and information technology with the onset of the so-called 'Fourth Industrial Revolution' which will have an impact on how architects practise their profession. In addition, globalisation and new liberalism have suffered some form of (temporary?) setback and we see large-scale human migration towards wealthy countries – Western Europe in particular. At the same time the balance of economic power is shifting. And then there is the threat of global warming and the urgent need to change the way we live and do things. The future direction of architectural practice has been a topic in the professional conversation for some time, with architectural professional bodies such as the Royal Institute of British Architects (RIBA) commissioning a study on the future of the profession, focusing on the questions: "Who will design our built environment in 2025; what roles might those trained in architecture have then and how might architectural practice have changed as a result?"[2] *Much has changed since then and the 2025 concerns suggested by the RIBA's study are looming on the horizon. Hence, this study aimed to identify some of the possible directions into which the practice of architects could possibly develop in the next five to ten years and the opportunities that may well arise from the previously mentioned developments. Practitioners might thus be enabled to prepare themselves for possible future opportunities while educators develop and adapt education programmes in order to ensure that their graduates are empowered to flourish amidst the unfolding opportunities.*

Introduction

The end of the Plague in the 17th century brought a labour shortage that forced landlords in Western Europe to accede to demands for better treatment of their labourers. After 20 million Indians died as a result of the influenza pandemic, the resultant misery helped kick-start Mahatma Gandhi's campaign to end British rule in India:[3] Pandemics can result in political and socio-economic changes in society and economic systems. How will the COVID-19 pandemic influence society?

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1. Disclaimer: This paper was completed in middle May 2022 and is based on the situation as it existed at that point in time.

2. C. Jamieson, *The future for architects?* (London: Royal Institute of Architects: Building futures, 2010), 6.

3. R. Guest, *The aftermath of the pandemic will make politics more turbulent: Political unrest tends to peak two years after an outbreak starts* (The Economist, 8 November 2021), 2.

Across the world, civil unrest rose by 10% in 2020 despite the restrictions on movement and public gatherings that were in place.[4] The disparity in vaccination rates between rich and poor countries will mean that income levels in poorer countries will remain low, leading to higher rates of sickness and death in these countries.[5] In addition, medical experts warn that we should learn how to adapt and learn to live with the virus,[6] and it appears that society could be in for an extended period of upheaval. Arundhati Roy, Indian author,[7] argues: "Historically, pandemics have forced humans to break with the past and imagine their world anew. This one is no different." Manyika[8] believes that the world beyond the COVID-19 crisis will not return to what it was before the pandemic. Russia's invasion of Ukraine on 24 February[9] and the continuing war between the two countries have proven these predictions correct, and as will be shown later, this aspect alone will result in long-term changes in global affairs, the economy and socio-political relationships.

It follows that the architectural profession, like our urban environment and lifestyle, cannot remain unaffected and must actively form part of the process to "imagine their world anew" as foreseen by Roy.

Nature – or to be more precise, humankind's mistreatment and mismanagement thereof – has also reached a point where drastic changes are required to restrict the negative impact of climate change. The recent 26th Conference of the Parties (COP26) summit agreed that countries will meet again in 2022 to promise additional cuts to their emissions of carbon dioxide (CO_2) in an effort to try to restrict temperature rises to less than the 1.5 degrees Celsius required to prevent a "climate catastrophe". Pledges made at this year's summit, if met, will only limit global warming to about 2.4 degrees Celsius.[10] Buildings generate about 40% of all emissions and carbonised carbon generated by the manufacture and transportation of construction materials is responsible for approximately 11% of emissions.[11] "In a post-pandemic world, concern for our health and the health of the planet has grown …"[12] Undoubtedly, the architectural profession has a major role to play, and the buildings architects design have to change dramatically.

Equally, developments in communication systems, mobile connectivity, computing, sensors, robotics, artificial intelligence, three-dimensional printing and advanced materials are drastically changing manufacturing and production

4. Ibid.

5. N. Loder, *What to expect in year three of the pandemic: New antibody and antiviral treatments, and better vaccines, are on the way* (The Economist, 8 November 2021), 1-2.

6. S. Mahdi, *Omicron is new Covid kid on the block: five steps to avoid, ten to take immediately* (News 24, 30 November 2021).

7. Cited by D. Susskind, J. Manyika, J. Saldanha, J. Burrow, S. Rebelo, and I. Bremmer, "Life Post–COVID-19," *Finance & Development* 57, no. 2 (2020): 3.

8. In Ibid.

9. J. Psaropoulos, *Timeline: A month of Russia's war in Ukraine* (Aljazeera, 2022), 1.

10. British Broadcasting Corporation, *COP26: What was agreed at the Glasgow climate conference?* (BBC News, 15 November 2021), 1.

11. A. Cohen, "Green the supply chain with better building materials," *Architect; The Journal of the American Institute of Architects* (2021), 1.

12. Nissenbaum inC. Parker, *Twenty views on how to rebuild better after the pandemic* (World Economic Forum, 13 November 2020), 4.

systems. The Fourth Industrial Revolution has thrown up the requirement for new business models. New models, based on systems and platforms, will result in businesses developing the ability to offer new services that will change the ways in which organisations operate.[13] Due to these changes, there is a growing need to change how infrastructure, buildings included, are designed, realised and managed as urbanisation, digitalisation and climate change increasingly change the world. To build better, the World Economic Forum suggests that the building and construction industry will have to adopt digitalisation, develop new working practices, and increase collaboration with among others, the public sector.[14]

All the while, the architectural profession is under pressure and change is forced upon its members continuously. This is also true for all the statutory professions. Davis cites the Susskinds' belief that technology is slowly dismantling the traditional professions, including architecture.[15] TMD Studio agrees by stating that architectural practice as we know it is set to change or disappear and that the future role of architects may be dramatically different to what it is at present.[16]

After stating the research methodology employed, this paper considered and analysed predicted socio-economic and socio-political changes, predicted changes to the business environment, predicted technological developments, predicted environmental changes and changes predicted for the built environment and architectural industry and profession. This is followed by an analysis, discussion and statement of findings followed by conclusions and recommendations. The study aimed to determine how these changes will affect the profession and where architects might find new business opportunities and roles in our changing society.

Research Methodology

Boote and Beile and others contend that "[a] thorough, sophisticated literature review is the foundation and inspiration for substantial, useful research".[17]

Thus a qualitative approach comprising a desktop or literature review was used. Since the nature of the topic is strategic with a strong focus on future

13. Zurich, *Advanced Manufacturing and Production* (World Economic Forum), 1.

14. P. Delorme, and M. Haigh, *Why the world needs a fresh take on smart and sustainable infrastructure* (World Economic Forum, 2021), 1.

15. D. Davis, *What 'The Future of the Professions' reveals about the future of architecture* (2019), 1.

16. TMD Studio: Architecture and Visualisations, *Emerging trends that will shape the future of architecture* (TMD Studio, 2017), 2.

17. D. N. Boote, and P. Beile, "Scholars before researchers: On the centrality of the dissertation literature review in research preparation," *Educational Researcher*, 34 no. 6 (2005): 3-15; including J. Combs, R. Bustamante, and A. Onwuegbuzie, "An interactive model for facilitating development of literature reviews," *International Journal of Multiple Research Approaches* 4 (2010): 159-182; A. J. Onwuegbuzie, K. M. T. Collins, N. L. Leech, A. B. Dellinger, and Q. G. Jiao, "A meta-framework for conducting mixed research syntheses for stress and coping researchers and beyond," in *Toward a broader understanding of stress and coping: Mixed methods approaches*, edited by G. S. Gates, W. H. Gmelch, and M. Wolverton (Series Eds.) & K. M. T. Collins, A. J. Onwuegbuzie, and Q. G. Jiao (Vol. Eds.), *The Research on Stress and Coping in Education Series* (Vol. 5) (Charlotte, NC: Information Age, 2010), 169-211.

developments, the research mostly considered current views, knowledge, and future changes. Therefore, the literature reviewed was mostly internet-based research and professional portals since these types of resources best reflect the latest thinking and the ongoing discourse.

The literature was analysed, and themes were identified and synthesised into mega-themes which were combined with the results of the desktop review. This was done in order to draw conclusions and make recommendations regarding suggested changes to the business strategies employed by practices and changes in architectural programmes at schools of architecture.

Research Aim

The study aimed to identify some of the possible directions into which the practice of architects might develop in the next five to ten years and the opportunities that might come about as a consequence of the previously mentioned developments.

Research Questions

The primary research question was aimed at determining what some of the possible directions are into which the practice of architects might develop in the next five to ten years and what the opportunities are that might arise as a consequence of the previously mentioned developments.

In order to answer this question, the following research questions were pursued:

1. How will changes in the socio-economic and socio-political environments affect architectural practice?
2. How will the Fourth Industrial Revolution change the way we practise?
3. How will the need for more climatically appropriate cities change the way we practise?
4. How will developments in building and construction technologies change the way we build?
5. What will the identified changes mean for architectural practice during the next five to ten years?

Literature Review

This review contains predictions regarding foreseeable socio-economic and socio-political changes that are anticipated in the next five to ten years.

Socio-Economic Changes Predicted due to the COVID-19 Pandemic

The current COVID-19 pandemic has drawn the injustices and inequalities that exist throughout the world into sharp focus.[18] While the pandemic might still be a factor for some time, many of the challenges we will have to deal with after the pandemic phase, will be exacerbated versions of the problems that existed before the pandemic. The most prominent of these challenges are to reconcile efficiency and resilience, humanise capitalism, and densify economic activity and living areas while adjusting to climate change.[19] Bremmer[20] regards the main trends that existed before COVID-19 as de-globalisation, a growing nationalism ('my nation first') and China's geopolitical rise.

In the post-pandemic phase, when COVID-19 will hopefully no longer pose a significant threat to human life[21] and we enter the endemic phase, the world will not return to what it was before.[22] One example of how things have changed since the start of the pandemic is how many existing trends such as the transition to a cashless society, the increase in remote work, the decline of brick and mortar retail businesses and the move to online retail[23] have been accelerated. While Neeley[24] believes that levels of remote work are unlikely to rise to the extent of mid-2020, this phenomenon is here to stay and might even increase. Sneader and Singhal[25] foresee that it will develop into what they call "hybrid work" where employees are expected to work from the office on a regular basis and from home for the rest of the time. One change that has been speeded up is the Fourth Industrial Revolution.

Consequently, the power imbalances as manifested in global institutions must be re-balanced.[26] The world will have to become more inclusive, resilient and sustainable.[27] Asonye[28] asserts that what was 'normal' has not worked for the majority of the world's population and that we should instead use our current discomfort to forge a new paradigm. Nissenbaum[29] points out that during the pandemic, concern about the health, not only of humans but also that of the planet, has grown and with it a willingness to support sustainable ways of doing and the use of materials that support nature and natural systems. Rossiello[30] believes that

18. Suskind *et al.* (2020), 2.
19. Manyika in Susskind *et al.* (2020), 3.
20. In Susskind *et al.* (2020), 5.
21. J. Guzman, *Top health expert declares 'the end of the pandemic' now in sight; The pandemic could come to an end in the U.S. by early next year* (Changing America, 5 November 2021), 1.
22. Manyika in Susskind *et al.* (2020), 3.
23. A. Powell, *What will the new post-pandemic normal look like? Outbreak forced changes big and small, some of which are here to stay* (The Harvard Gazette, 24 November 2020), 2.
24. cited by Parker (2020), 4.
25. K. Sneader, and S. Singhal, *Trends that will define 2021 and beyond: Six months on* (McKinsey & Company, 2021), 8.
26. Saldanha in Susskind *et al.* (2020), 4.
27. Burrow in Susskind *et al.* (2020), 4.
28. C. Asonye, *There's nothing new about the 'new normal'. Here's why* (World Economic Forum-My Forum, 2020), 1.
29. cited in Parker (2020), 4.
30. cited by Parker (2020), 2.

those who are innovative, flexible and energetic while being persistent will emerge strongest after the pandemic

In January 2021 Sneader and Singhal[31] projected the following trends to emerge beyond 2021:

How the COVID-19 crisis and the subsequent recovery are shaping the global economy:

- The return of confidence unleashes a consumer rebound.
- Leisure travel bounces back, but business travel lags behind.
- The crisis sparks a wave of innovation and launches a generation of entrepreneurs.
- Digitally enabled productivity gains accelerate the Fourth Industrial Revolution.

How businesses are adjusting to the changes prompted by the COVID-19 crisis:

- Pandemic-induced changes in shopping behaviour forever alter consumer businesses.
- Supply chains rebalance and shift.
- The future of work arrives ahead of schedule.
- The biopharma revolution takes hold.

The authors reviewed their prediction in July 2021[32] and found that, at that time, indications were that they were fairly accurate in providing us with a fairly clear indication of what we might expect going forward. Unfortunately, they did not include environmental concerns in their predictions.

Najam's interviews[33] identified the following additional characteristics: disruption will accelerate, politics will become more turbulent, habits acquired will persist and each new crisis will bring new opportunities,

Another useful prediction of socio-economic changes to be anticipated is provided by Dondi, Klier, Panier and Schubert who, after a survey of 18 000 people, found that there will be a reduction in the need for manual and physical skills, that the need for basic cognitive skills will decrease, while the demand for technological, social, emotional and higher cognitive skills will increase.[34] These authors further identified 56 foundational skills (or Deltas) that could assist people in functioning well in the future economy. These are illustrated in Figure 1.

31. Sneader and Singhal (2021), 2.

32. Ibid.

33. A. Najam, *I spoke to 99 big thinkers about what our 'world after cronavirus' might look like-this is what I learned* (The Conversation, 12 January 2021), 2.

34. M. Dondi, J. Klier, F. Panier, and J. Schubert, *Defining the skills citizens will need in the future world of work* (McKinsey & Company, 2021), 2.

Figure 1. *Foundational Skills Required by the Future Economy*[35]

Following research, the Pew Research Centre found that many experts believe that the changes we face will make life worse for the majority due to rising inequality, authoritarianism and the spread of misinformation.[36] However, they also found that a minority believe that the new 'tele-everything' society will have many advantages relating to improved family time, health care and social activity.

The demise of the pandemic will bring with it a societal challenge that might be far greater than the pandemic: Sternfels, Francis, Madgavar and Smit[37] believe that to counter this challenge, a strategy that is inclusive, sustainable and growth-based is non-negotiable. They argue that growth will bring economic opportunity and prosperity while inclusion will spread the advantage created across society. They further state that sustainability is a prerequisite if the advantages gained are to be carried over to the next generation.

35. Source: Dondi *et al.* (2021), 4.

36. Pew Research Center, *Experts say the 'new normal' in 2025 will be far more tech-driven, presenting more big challenges* (Pew Research Center, 2021), 1.

37. B. Sternfels, T. Francis, A. Madgavkar, and S. Smit, *Our future lives and livelyhoods: Sustainable and inclusive and growing* (McKinsey & Company, 2021); Najam (2021), 2.

Changes Predicted due to the Ukrainian-Russian Conflict

Commentators predict that the Ukrainian war could end by the end of 2022 or early 2023.[38] While it remains to be seen how and when this terrible war will end, it is predicted that it will influence future developments across the globe, but to varying degrees depending on region.[39] The main changes that will flow from this conflict are as follows: economic growth will slow down while inflation will rise due to higher food and energy costs.[40] Neighbouring countries will be particularly hard hit because of disrupted supply chains, trade routes and refugee-related pressures.[41] It is most likely that the war will bring an end to globalisation as we knew it: The global economic and geopolitical order could be fundamentally altered. This could be a turning point for the world's security system[42] because Russia's integration into the international economic fraternity will end, and large-scale sanctions could remain in place.[43] Furthermore, an overview will reveal that the shape and timing of energy reform have already been changed while the prices of commodities are likely to remain high[44] while energy policies move towards secure access and source diversification.[45] The foregoing could have an impact on sustainability targets. In addition, the competition for scarce but essential materials, equipment and other commodities will increase.[46] This will add to pressures for greater efficiency and localisation. The reconfigurement of security relations, continued sanctions and localisation could also result in the separation of global technology standards and independent development of technologies.[47]

The massive humanitarian crisis that has resulted from the war will require massive humanitarian spending[48] while massive defence spending and military aid will mean that funding will be diverted from pre-war targets, resulting in a slowdown of socio-economic spending. As always, it is the poor and the vulnerable who will suffer the most.[49] Ultimately, greater volatility and uncertainty will be the order of the day.[50]

38. TimesNow World Desk, *When will Ukraine-Russia war end? Here's what US officials have to say* (TimesNow World Desk, 2022).

39. M. Antelme, *The eye of the storm: The economic repercussions of the war in Ukraine are likely to be unevenly distributed across economies* (Coronation Fund Managers, 2022), 2.

40. A. Krammer, J. Azour, A. S. Selassie, I. Goldfajn, and C. Rhee, *How war in Ukraine is reverberating across world's regions* (IMF Blog, 2022), 1.

41. Ibid.

42. Ibid, 3; N. Katser-Buchkovska, *The consequences of the war in Ukraine will be far-reaching* (World Economic Forum, 2022), 3.

43. Antelme (2022), 1.

44. Ibid, 2.

45. S. Smit, M. Hirt, K. Buehler, O. White, E. Greenberg, M. Mysore, et al., *War in Ukraine: Lives and livelihoods, lost and disrupted* (McKinsey & Company, 2022), 3.

46. Ibid.

47. Ibid.

48. Ibid.

49. Ibid.

50. Ibid, 4.

Technological Changes Predicted

"The pandemic highlighted the power of technology and digitalisation." Paredes[51] points to the reality that companies that had previously invested heavily in technology and digital transformation dealt with the pandemic and associated lockdowns much more effectively than those who did not. She highlights that the earlier than anticipated onset of the Fourth Industrial Revolution and its reliance on digitalisation has the potential to change our world for the better by bringing diversity and creativity to the process, if it is driven by a broad range of innovators.

The Fourth Industrial Revolution, while primarily a technological revolution, will dramatically alter our socio-economic context. Some describe the change as a transformation. Sneader and Singhal[52] see this move as one that starts transformation throughout all business ecosystems, placing people in the centre of innovation by creating an empowered workforce while boosting productivity in the midst of an overarching concern for environmental sustainability. This implies drastic change and continuous upskilling, with those who are not doing so falling behind.

Fleming cites McKinsey's view that there will be more technological progress in the next 10 years than in the preceding 100 and suggests that 10 technological trends will play the major role in this transformation. They are process automation and virtualisation, advances in connectivity, distributed infrastructure, advances in computing (enhanced analytic and other capabilities), applied artificial intelligence, enhanced programming, enhanced data safety, advances in biological science, the development of new and superior materials, and a strong drive towards cleaner technologies. In the building environment, new materials such as carbon-reinforced concrete and other products that utilise waste materials are coming into use.

Environmental concerns and the need to restrict climate change will spur its own technological advances: Taylor[53] refers to developments such as the replacement of concrete heavy infrastructure with alternatives such as mangrove forests, and lists the following advantages for nature-based infrastructural alternatives:

- They bring about initial cost savings and infrastructure that is cheaper to maintain.
- These activities result in an improvement in the conservation and management of natural areas such as parks and oceans.
- They safeguard the ecosystems humankind depends on, thus limiting global warming and change.

51. D. Paredes, "Better support for innovation and creativity," in *20 views on how to rebuild better after the pandemic* (2020).

52. Sneader and Singhal (2021), 2.

53. M. Taylor, *Turning infrastructure green offers huge savings on top of climate benefits* (Reuters, 25 October 2021).

The architectural profession cannot remain unaffected by these changes. The way we think and work cannot remain unchanged: we will have to adapt and develop ways of working with these changes, and benefitting from them.

In summary: people will benefit from being able to add value over and above what automated systems and intelligent machines can do, being able to operate in a digital environment and continually adjust to new ways of working and in new occupations. This highlights the need for life-long learning, personal development, and growth. If one adds to this the need for inclusive action to address the socio-economic inequalities while reorganising our cities to become healthier environments for a digitally supported population that works in a hybrid fashion while being resilient and environmentally focused in an increasingly changing world, a picture emerges of the society within which architects will have to function.

Predicted Changes in the Business Environment

How will the business environment in which many architects must function change during the next few years? Behrendt, Karlson, Kasah and Swan[54] reported that manufacturers regard digitisation, artificial intelligence and automation as the main drivers that will lead to an increase in productivity and profitability. Significantly, they also found that many manufacturers regard people and their organisation, as well as resilience and operational agility, as highly important.

De Boer, Giraud and Swan[55] hold that, the effects of the Ukrainian war ignored, the following will be major business disruptors in the next few years: the Fourth Industrial Revolution, sustainability, transformation, and people-centredness coupled with higher productivity and efficiency. Environmental impact will be critical for the sustainability and viability of a business. Technological development will be key to achieving these sometimes opposing goals. They cite the statement by Tricoire (Chief Executive Officer at Schneider Electric) that the aim is not only about energy consumption: "It is about reducing any consumption of resources by making everything much more efficient." This focus on efficiency is a recurring theme found in a range of literature.[56] It is an aspect that must hold important implications for architects, the buildings we design and the urban form in which they are situated.

Sustainability in the broadest sense, but particularly adopting to the challenge posed by environmental change, will be a major topic in business in the future: Robinson believes that those who manage to move first to reduce emissions will

54. A. Behrendt, A. Karlson, T. Kasah, and D. Swan, *The CEO: Architect of the new operations agenda* (McKinsey & Company, December 2021), 6.

55. E. De Boer, Y. Giraud, and D. Swan, *CEO dialogue: Perspectives on productivity and sustainability* (McKinsey & Company, 3 November 2021), 1.

56. Sneader, and Singhal (2021), 6; P. Bernstein, *Ten thoughts on the future of practice* (The Architect's Newspaper, 20 April 2020), 1-4; Delorme, and Haig (2021), 2; De Boer *et al* (2021), 1; S. Fleming, *Top ten tech trends that will shape the coming decade, according to McKinsey* (World Economic Forum, 12 October 2021), 7.

be the first to have a more viable economy.[57] Nissenbaum (in Parker)[58] suggests that leaders will support the use of materials and systems that support environmental sustainability. McKinsey and Company[59] foresees that in an effort to grow, businesses will respond to sustainability goals and technological change. This includes investment in nature-based opportunities.[60]

Krishnan, Samandari, Woetzel, Smit, Pacthod, Pinner, Nauclér, Tai, Farr, Wu and Imperato[61] suggest that the net-zero transition we have to work towards would be universal, significant, and front-loaded. Furthermore, it will have uneven effects on sectors, geographies and communities, but it will create substantial growth opportunities despite causing significant disruption and a need for large-scale adjustment and rearrangement including reskilling. The new pursuit of these opportunities will not be painless. However, they were identified as the aspects that are of importance for this study.

Survival will force businesses to turn to automation, artificial intelligence robotics and globalisation[62] but Akella[63] believes that the focus should rather be regional. However, the Pew Research Centre quotes Chudakov [64] when warning that "we have reached a tipping point with our tools: They are now more sophisticated than our ability to fully appreciate their effects." The World Economic Forum believe that almost 50% of current work activities can be automated in the next decades, supported by faster digital connections and next generation computing. Fleming[65] continues by pointing out that new developments in material science could possibly transform various market sectors. Another important reason why businesses are turning towards technology is the ambition or need to grow; to build new business. McKinsey and Company[66] reports that business leaders foresee that five years from now half of their income will derive from parts of their businesses that presently do not exist.

The above indicate significant change and new knowledge requirements. In response, Baig[67] points to the need for all businesses and business leaders to embrace training and life-long learning for all members of staff and for chief information officers to "become the fastest learner". This statement underlines the importance of knowledge management as an aspect of human resource

57. K. S. Robinson, *I imagined earth's future, and now COP26 honchos are curious* (Business Day, 28 October 2021).

58. Nissenbaum in Parker (2020), 4.

59. McKinsey and Company, *2021 Global report: The state of new business building* (McKinsey and Company, 2021), 2.

60. Hopman in McKinsey Blog, *Ahead of COP26: Seven sustainability trends to watch-and why they matter* (McKinsey Blog, 25 October 2021), 21.

61. M. Krishnan, H. Samandari, J. Woetzel, S. Smit, D. Pacthod, D. Pinner, et al., *Six characteristics define the net-zero transition* (McKinsey Sustainability, 25 January 2022).

62. Pew Research Center (2021), 5.

63. in Parker (2020), 3.

64. Pew Research Center (2021), 12.

65. Fleming (2021), 3.

66. McKinsey and Company (2021), 2.

67. A. Baig, *The CIO agenda for the next 12 months: Six make or break priorities* (McKingsley Digital, 1 November 2021), 6.

management. John Caulfield[68] supports this prediction and foresees that skilled labour will be scarce and will come at a cost.

Dondi *et al.*[69] predict that the proficiencies that have the potential to offer the best outcomes for individuals can be grouped according to their ability to generate employment, income and job satisfaction, as illustrated in Figure 2. These are proficiencies companies should develop in their workforce in the face of the shortages predicted by Caulfield.[70]

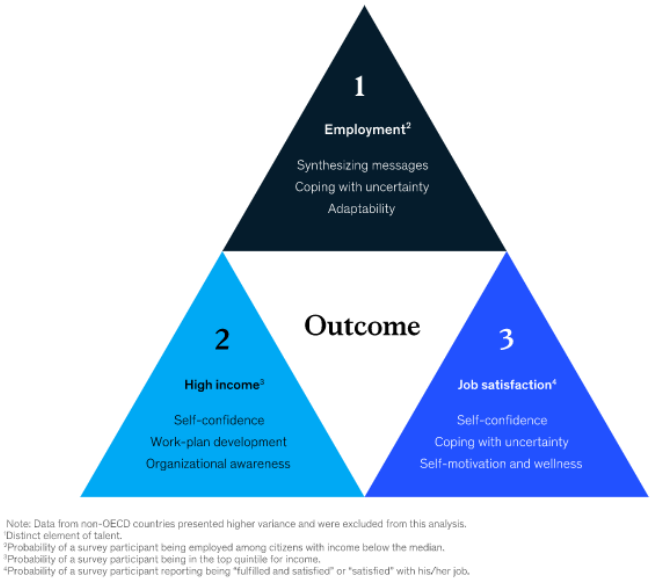

Figure 2. *Proficiencies Linked to Individual Advancement*[71]

This leads to the question of how companies will work in future. Davis[72] suggests that offices could adopt one or more of the following models:

- As it was (back to the 'old normal' with increased use of sanitisers).
- Clubhouse (a hybrid model where employees visit the central office when they need to but continue working from elsewhere).
- Activity-based working (employees work from the office but don't have a fixed workplace – instead they move around or work from home, depending on what they do and who they work with).
- Hub and spoke (instead of having one main office, firms have a number of smaller satellite offices scattered in areas close to employees' homes).

68. A. Caulfield, *10 Predictions for the Construction Industry in 2022: Our prognostications focus on how AEC firms will streamline and modernize their projects and operations* (Building Design and Construction, 9 November 2021), 4.

69. Dondi *et al.* (2021), 11-12.

70. Caulfield (2021), 4.

71. Dondi *et al.* (2021), 12.

72. Davis, *Five models for the post-pandemic workplace* (Harvard Business Review, 3 June 2021), 3.

- Fully virtual (employees work from where it suits them with no main office).

Architectural practices, being businesses, will have to take note of these changes, firstly in order to consider how they can leverage these changes to provide better value to their clients, and secondly how they can proactively acquire the skills and specialisations that will be required. They will also have to adopt many of these aspects in order to keep up with the demands of a changing practice environment.

Predicted Changes in the Built Environment, the Building Industry and Architectural Practice

Predicted Changes in the Built Environment

The priorities listed earlier in this paper must spill over into the nature of our cities as we prepare for future pandemics while recovering from COVID-19. Bernstein[73] predicts that the effects of the current pandemic, including health concerns and supply stream instability, will force contractors to turn to automation on site and increasingly to pre-fabrication, a change that is in line with the drive for greater efficiency. He continues that this change will rely on tools and processes that require digital processes, and role players (including architects) that can answer this need. The 'Smart City'[74] that will arise will be the result of pressures for greater efficiency particularly in terms of the use of resources.

Bernstein suggests that we might see the emergence of design and construction version of the so-called 'gig' economy where the focus will change from full projects to discrete tasks and that new priorities, driven by epidemiological concerns, will emerge. Questions will be asked regarding ease of cleaning, health implications, and performance during lockdown restrictions. This implies that the urban form must change to provide for proximity and density while maximising the use of natural ventilation and space that will allow for social distancing through the provision of wider sidewalks. This implies greater emphasis on pedestrianisation and with that walkways, generous public open spaces and outdoor facilities that will aid the natural environment and the drive towards carbon neutrality.[75] Our homes will also need reorganising to allow for longer periods of home-stay and remote working. Likewise, the rise of the sharing economy and shared spaces combined with new developments such as driverless cars could result in infrastructure becoming the dominant feature of cities.[76] Land pressures could encourage higher densities and the so-called 'vertical city'. TMD Studio also foresees an increase in the rise of inclusive spaces and buildings offering a range of diverse functions (mixed use or multifunction buildings).

73. Bernstein (2020), 2.
74. TMD Studio (2017), 4.
75. Bernstein (2020), 2.
76. TMD Studio (2017), 10.

Because of the need to have cities that are more environmentally and climate friendly our cities will have to work towards creating a more sustainable environment. In this the integrated goals of Yeang's partitioned matrix[77] (see Figure 3) can be used as a guideline for what must be achieved.

Not only will the need to address the issue of proximity influence the location of workplaces, but as described earlier, the functioning and thus layout of these spaces and changing purposes will influence our urban form in ways that will depend on the model chosen by most companies.

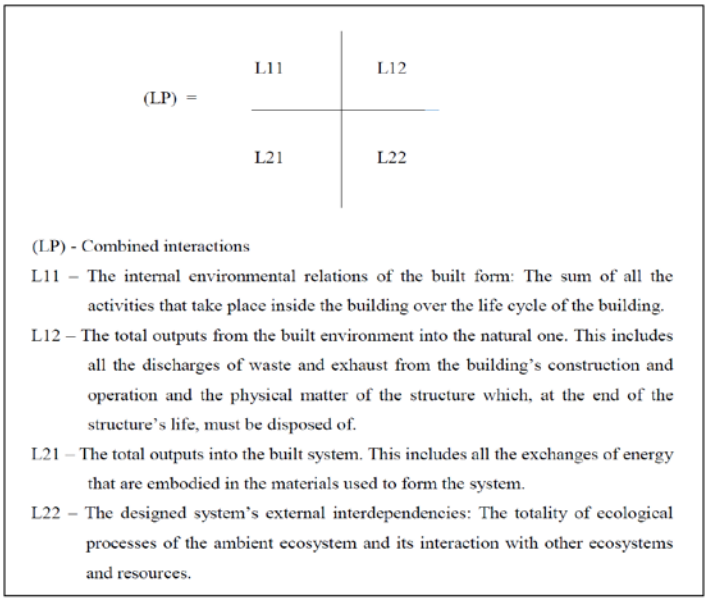

Figure 3. *Yeang's Partitioned Matrix*[78]

Predicted Changes in the Building Industry

Research by Building Design and Construction[79] has led to the following predictions regarding changes that the construction industry will undergo during 2022:

- Construction activity should increase.
- Supply chain disruptions might continue to cause delays.
- There could be a shortage of skilled labour.
- The nature and function of offices are changing, which should cause an increase in refurbishments and alterations.
- Environmental concerns and 'net-zero' building will become a definite priority.

77. K. Yeang, *The green skyscraper: The basis for designing sustainable intensive buildings* (Munich: Prestel Verlag, 1999), 65.
78. Ibid.
79. Caulfield (2021), 1-11.

- Mass timber (and other new environmentally friendlier materials) will increasingly be developed and used; the development of carbon sequestrating concrete and ultra-high-performance concrete are examples of such developments.[80]
- Technology will play an increasingly important role in the building industry, and buildings will increasingly incorporate systems to monitor how buildings perform or are used.
- As mentioned above, greater use will be made of new and more environmentally sensitive materials such as carbon-reinforced concrete, three-dimensional printing[81] (refer to Figure 4), hydroceramics, self-cleaning materials[82] and hemp boards.[83]
- There will be an increased focus on the need for greater diversity, equity and inclusion to correct past imbalances.
- Greater digitisation and expanded digital facilities will facilitate and result in the seamless connection between digital twins and fabrication plants as well as the widespread use of sensors that will measure aspects across the industry. This includes jobsite efficiency and post-occupation building performance in the quest for greater efficiency, a quest that is ultimately driven by the need for environmentally friendly buildings.

Figure 4. *Three-Dimensional Printed Houses in Nacajuca, Mexico*[84]

As a result of climate change, particularly the possibility that the increase of more than 1.5 degrees Celsius above preindustrial levels by 2030 ensuing from a

80. B. Brownell, "Post-COP26, how green can we make concrete?" *Architect; The Journal of the American Institute of Architects* (2021): 2-4.

81. D. Kamin, *In a tiny village on the outskirts of Nacajuca, Mexico, builders are creating new homes using a novel tool: an oversize 3-D printer* (The New York Times, 28 September 2021).

82. Equipe ArchDaily Brasil, *What are the smart materials in architecture?* (Equipe ArchDaily Brasil, 2022).

83. Brownell, "Hemp: The next disrupter in construction after wood," *Architect; The Journal of the American Institute of Architects* (2021).

84. Kamin (2021). Photo by Alejandro Cegarra/The New York Times

lack of conclusive commitments at the COP26 (see introduction), almost half of the world's population could be subjected to a climate hazard in the form of heat stress, drought, flood or another form of water stress in the next decade.[85] In view of the likelihood of this environmental stress, built environment designers will need be pro-active and will have to go even further than Yeang's recommendations (see above) in order to create environments that are resilient enough to withstand the possible implications of climate change.

Predicted Changes in the Architectural Profession

As with any major crisis, those architectural firms that adapt best to the situation will emerge as some of the best firms of the decade.[86] What are the changes and opportunities that architects can respond to?

Afshar[87] foresees that after the pandemic "every business will become a digital business". Along a similar line, Baig[88] suggests that principals in all types of businesses should place technology at the forefront of the business. Furthermore, that they will have to acquire high levels of digital technological skills in order to maximise the benefits of new digital platforms and that they adopt an expansive view of learning and skills development. This suggests accepting life-long learning as part of the firm's business strategies. It applies equally to architecture: Pandero in Archipreneur[89] believes that technological advancement will help architects resolve many of the challenges currently facing the profession.

De Boer *et al.*[90] believe that the global concern with climate and the environment has made a focus on and prowess in sustainability an essential requirement for any business. Fabris[91] reports that according to the United States of America Green Building Council's 2021 World Green Building Trends Report, building industry firms have chosen the construction of net-carbon-zero and/or net-carbon-positive buildings as their top priority. Also, on the topic of sustainability, Cohen[92] suggests that the climate crisis offers architects the opportunity to redefine the building sector by shifting their focus to the use of sustainable and low-carbon building materials. He believes that in this way architects can contribute to the quest for lower carbon emissions and help create a more resilient global supply chain, thereby creating a more sustainable future.[93]

85. H. Bowcott, L. Fomenko, A. Hamilton, M. Krishnan, A. Mysore, A. Trittipo, et al. *Protecting people from a changing climate: The case for resilience* (McKinsey & Company, November 2021), 2.

86. Bernstein (2020), 2.

87. in Najam (2021), 4.

88. Baig (2021), 5-9.

89. Pandero (Archipreneur, *Real estate in the digital age: An industry in transition* (Archipreneur, 30 December 2019), 1).

90. De Boer *et al.* (2021), 2.

91. P. Fabris, "Creating net-zer/net-positive buildings is top priority in green building trends 2021 report: Findings also demonstrate compelling business case for building green," *Building Design and Construction* (2021): 2.

92. Cohen (2021), 1.

93. An estimated 40% of all carbon emissions can be attributed to the harvesting, manufacturing and transport of building materials (Cohen, 2021, 1).

Environmental-related concerns and the quest for greater efficiency are said to be the cause a resurgence of prefabricated modular buildings because of this building method's reduction in material wastage, greater consistency and fewer weather-induced delays.[94] Digitisation will allow designers to vary panel design and size easily to avoid the monotony that characterised buildings of this nature in the previous century.[95]

Increased collaboration on projects is one of the changes in the way architects practise[96]. Other changes predicted by TMD Studio is an increase in the use of virtual reality and immersive architecture (including building information modelling or BIM), relying on so-called 'big data' for design decisions in order to increase building efficiency, the rise of parametric architecture and buildings built by robots and 3D printers to construct buildings. Stanton[97]reinforces TMD's views by predicting that the focus will shift towards innovative solutions and how they benefit their users. He points out that clients increasingly demand more information and detail – which new software applications can provide. He predicts that many of the traditional aspects of architecture, for instance drawings, are going to fade away to be replaced by various digital outputs such as the building twin created by BIM software. However, Stanton argues that the heightened role of technology cannot take the place of the human component of architectural practice and can only replace some manual and more mechanical processes. Therefore, he encourages architects to embrace the use of technology in their practices. He holds that adaptability, flexibility and the earliest possible incorporation of digital and technological processes will ensure that the profession remain an important and fundamental component of the built environment professions.[98]

Since the onset of the COVID-19 pandemic architects have adopted a range of technologies in order to adapt to the changed circumstances. Ahmad[99] refers to LePage's statement that available technologies can provide architects with opportunities that did not exist previously. She lists a number of software applications that architects have incorporated into their normal processes in order to continue creating. These include Bluebeam, Google Workspace, Miro's (a digital whiteboard), Procore and PlanGrid. Like all businesses, remote work has proved to have both advantages and disadvantages. As mentioned earlier, new protocols will be needed to incorporate the advantages into whatever new style of work is adopted since a survey among American practices found that 93% preferred a hybrid work model.[100]

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94. D. Davis, "Modular architecture is back. Is it better?" *Architect; The Journal of the American Institute of Architects* (2020): 2; B. Stanton, *What is the future of architecture as a profession?* (Building Design and Construction, 30 July 2019), 4.

95. Davis (2020), 4.

96. TMD (2019), 2.

97. Stanton (2019), 3.

98. Ibid, 4.

99. F. Ahmad, "Has remote work changed the architectural profession for good?" *Architect; The Journal of the American Institute of Architects* (2021): 2.

100. M. Bernard, "CMG surveys AEG employers and employees on remote and hybrid work," *The Journal of the American Institute of Architects* 2021), 3.

Bingham and Porter[101] report on a study that found that embracing artificial intelligence technology in addition to heuristic techniques can help architects reach a better understanding of client requirements. The study also found that the role of the architect will remain critical but that it will be altered. They cite Reif's 2018 assertion that by 2020 creative thinking would have become the third most important skill needed in order to survive (and thrive) during the Fourth Industrial Revolution and also Osborne's statement that creativity could be the most difficult human ability to automate.

Stanton states that the focus is changing from purely architectural to the creation of an environment that is also user-focused and enhanced by electronic systems that will measure performance. According to him life-cycle costing will become increasingly important.[102]

Not everyone regards the increased reliance on technology as entirely positive. While Susskind and Susskind[103] see this change as inevitable, they foresee that it will not only drastically change the profession but will also lead to its decline, a situation that applies to all the traditional professions. According to Davis[104] the Susskinds believe that design is going to become less bespoke and more systematised. Davis does not agree with this view and points out that previous attempts to systematise design did not prevail: what did happen was that the design process was standardised and not the designs produced. The Susskinds also foresee that with the increasing use of the internet, professional expertise will become more widely distributed and available elsewhere (such as websites that sell generic house designs as a product), thus bypassing the need for an architect.[105] Smaller firms will be affected more detrimentally since large firms will be able to invest in technology that will allow them to cut costs and provide the type of digital support clients will insist on. They suggest that smaller firms should specialise for them to survive.[106] One of the biggest anticipated changes is the forced transition from an intuitive design process to one that is driven by (big) data. The challenge will be to collect data on how past designs are performing, and to organise, analyse and finally extract value from the results:[107] knowledge management will become a key aspect of practising architecture. Furthermore, according to the Susskinds, architects will no longer be able to use charisma and impressive visuals to sell their designs: employers will demand rational justification for decisions taken. Computers will no longer function as dumb tools applied by the architect: computers will take over certain design functions and will work collaboratively with architects. Also, the drive for greater efficiency will mean that

101. K. Bingham, and G. Porter, *The preparedness of Master of Architecture graduates for the fourth industrial revolution (4IR)* (South African Council for the Architectural Profession Newsletter number 9, 22-31 July/September 2021), 22.

102. Stanton (2019), 4.

103. R. Susskind, and D. Susskind, *The future of the professions: How technology will transform the work of human experts* (Oxford: Oxford University Press, 2017), 95-100.

104. Davis (2019), 3.

105. Davis (2019), 5.

106. Davis (2019), 6.

107. Davis (2019), 7.

production schedules and stricter safety and sustainability regulations[108] will become more demanding and complicated. The higher performance criteria for buildings will lead to specialised design processes and increasing specialisations and an ever more product-based approach. There will be a need for a more entrepreneurial outlook where architects increasingly offer services outside the traditional scope of architectural practice, for instance designing business strategies, branding and even product design.[109] This could be possible but in order to diversify in this manner, architects will have to undertake further learning.

Richards[110] confirms that there will always be a need for architects. He bases his position on what he describes as the intrinsic value architects have for "society as creators of healthy, safe and beautiful buildings and spaces" as well as on the "relative value of architects to clients, particularly during an economic and public health crisis". Also, the Susskins are disregarding the human aspect associated with most professions. In doing so they are disregarding the abilities, creativity, value judgements and ethical conduct required from professionals.

Other abilities, particularly a range of soft skills, are suggested for architects during the Fourth Industrial Revolution. These include problem solving, communication, project management, systems thinking, improved social skills, and the ability to work with others. This list should be extended to include entrepreneurship, leadership, conflict management, emotional intelligence, mindfulness, and stress management.[111] Many of the aforementioned skills cannot be transferred to intelligent machines. These statements are in line with those mentioned earlier, based on the review by Dondi *et al.*[112]

In addition to the changes outlined above, young architectural practices are also experiencing a range of other challenges:[113] Cutieru relays the concerns raised by a variety of young practices from various part of the world. These practices indicated that their concerns are wide-ranging and numerous. They include:

- Climate change.
- Achieving greater equality in design.
- Fostering inclusion.
- Striking a balance between private and public concerns.
- Remaining relevant in an economy where our agency is diminishing in the face of real estate priorities, political indecisiveness and a variety of new 'specialists' entering the field.

108. McKinsey and Company, *The next normal in construction; How disruption is reshaping the world's largest ecosystem* (McKinsey and Company, 2020), 3.

109. Davis (2019), 9.

110. W. Richards, *Why architects matter in a post-pandemic world* (American Institute of Architects, 2020), 1.

111. Bingham, and Porter (2021), 22-28.

112. Dondi *et al.* (2021), 12.

113. A. Cutieru, *The challenges faced by young practices* (Archdaily, 26 November 2021), 2-3)

While some of these concerns were identified before, many remained hidden in the various reviews above. However, they have to be addressed by the profession as a whole so as not to lose the talents of these young architects.

Bradford Perkins[114] criticises the scant time allocated in most architectural programmes to aspects such as marketing and business development, building and service agreements, managing and directing a design team working on complex projects, cost estimating, task scheduling, working internationally, developing a business plan and other aspects that take up the bulk of a senior architect's time. He is of the opinion that while the practice of architecture is becoming increasingly complex, architectural schools are not preparing their students to address these and future changes:[115]

> Today we are highly dependent on sophisticated technology platforms. More and more firms are competing beyond their local markets; many are working nationally and internationally. There is more competition, and it is far more sophisticated. The size and sophistication of the administrative and technology support personnel at most mid-size to large firms has grown to respond to an increasingly challenging business and technical environment. And the design assignments, project team structures, project delivery methods, and client expectations have become increasingly demanding and complex, requiring much more specialization, larger teams, and a vastly broader array of services.

The point is that if he and others who agree with him are correct, architects already enter the profession underprepared. Because of this, the changes predicted earlier will worsen this handicap. Thus, it is imperative that architectural education and training be reconfigured in order that architects acquire the skills highlighted above.

Analysis

The above was read and codes were assigned to themes as they emerged from the literature. 'Open coding'[116] where the researcher identifies themes from the literature was applied.

The next level of analysis comprised identifying patterns or interrelating themes and grouping related themes to identify meta-themes that might underlie the obvious and more superficial analyses.[117]

114. B. Perkins, *What I wish I had learned in architectural school* (Building Design and Construction, 17 December 2021), 4.

115. Ibid.

116. D. K. Punia, "Multiple case study: my journey-from pure quantitative research to mixed research, and then from mixed research to pure qualitative research," in *Qualitative Research in Management* (Eds.) R. K. Gupta, and R. Awasthy (New Delhi: Sage, 2015), 178.

117. Ibid, 181.

Findings

The analysis revealed a total of eight meta-themes. They are discussed below.

After the Current Pandemic and War Have Passed, Things Will not Return to what they were before their Onset

As the adage would have it, change is a constant. The Ukrainian war will bring a change to the socio-economic and political relations that existed previously, and slow economic growth and reduced socio-economic spending, higher inflation and higher fuel prices can be expected. Similarly, the end of the pandemic will result in societal challenges exceeding those of the pandemic due to the escalation of injustices and inequalities during the pandemic. This will result in an increase in socio-political turbulence. In addition, new ways of doing, developed during the pandemic, will continue. On the positive side, change brings new opportunities that can introduce new business prospects.

Many Pre-Existing Socio-Economic and Political Problems Will Still Exist but they must be tackled with Urgency

The injustices and inequalities highlighted by the pandemic will have to be tackled as a matter of urgency because of the likelihood of more pandemics. A variety of wide-ranging actions will be needed to confront inequalities, improve efficiency and resilience, humanise capitalism, reconfigure supply chains, concentrate economic activity and reconfigure living areas while adapting to climate change. Politically, globalisation must be re-thought, while growing nationalism and power imbalances must be re-balanced: The global economy and society must become more inclusive, resilient, and sustainable. This is required to confront the prevailing socio-economic inequalities. However, the legacy of the Ukraine-Russian war will work against the achievement of these objectives. On the positive side, people who can adjust; those who are creative and innovative, skilled, flexible, energetic, and persistent will emerge strongest after the pandemic. The danger is that such a situation could possibly increase instead of decrease the inequalities that prevail unless actions instituted to address socio-economic upliftment are successful.

There will be Many Changes and New Realities that Will Require Adjustment from Everybody

Other changes will emanate from existing and emerging trends. This will include changes such as the move to a cashless society, the normalisation of remote and hybrid work arrangements and the changeover from brick and mortar to online retail business.

From an economic perspective, the changes will bring new opportunities. Should the aim of inclusion be achieved, it will spread opportunities across society. This will allow more people to benefit because it will add more value than

automated systems and intelligent machines. At the same time, being skilled for work in a digital environment while continually upgrading to new ways of working will open doors to new jobs or occupations. Consequently, changes and opportunities will result from inclusion and the Fourth Industrial Revolution, adapting to climate change and the push for sustainability, transformation, a new people-centredness coupled with higher productivity, and efficiency in all aspects.

For businesses, to remain competitive it will be critically important to stay abreast with technological development. Businesses will need to turn to automation, artificial intelligence robotics, and globalisation. Environmental concerns will compel everyone to focus on reducing any unnecessary consumption of resources by making and doing everything in the most efficient manner possible. The architectural profession should note that construction activity, particularly refurbishments, driven by climate change, health concerns and the changes in the nature and function of buildings should increase and create opportunities.

The Fourth Industrial Revolution Will Dramatically Impact All Spheres of Life, Including Architectural Practice

The Fourth Industrial Revolution is primarily a technological revolution that will dramatically alter our socio-economic context and lead to transformation throughout all business ecosystems. Nevertheless, it will place the people who have adjusted to this new reality at the centre of innovation. It will require an empowered workforce and will boost productivity amidst an overarching concern for environmental sustainability.

An empowered workforce implies drastic change and continuous upskilling, with those who are not able to do so falling behind as there will be a reduction in the need for manual and physical skills. Furthermore, the need for basic cognitive skills will decrease and at the same time, the demand for technological, social, emotional, and higher cognitive skills will increase. The changes we face will make life worse for the majority who could fall behind unless the existing and rising inequality and authoritarianism, as well as the spread of misinformation, can be halted and reversed

Nonetheless, the Fourth Industrial Revolution and its reliance on digitalisation of processes has the potential to change our world for the better by bringing diversity and creativity to the process, if it is driven by a broad range of skilled innovators and if society can remain on top of the latest skill requirements.

The Other Main Driver of Change Will Come from the Imperative for Healthy, Sustainable, and Environmentally Friendly Living

Humankind's negative impact on the planet has become noticeable and commonplace. This has resulted in a willingness to bolster sustainable ways of living and doing and a focus on the use of materials that support nature and natural systems. In addition, the biopharma revolution is growing. The environmental drive is aimed at reducing consumption of resources by making everything far more efficient: sustainability in the broadest sense, but particularly the challenge

posed by environmental change will be a major topic in business in the future. The implication is that those who manage to move first will be the first to benefit from a more sustainable and resilient economy. Because of the pressing need to minimise climate change, leaders will be forced to support the use of materials and systems that support environmental sustainability and will be required to respond to sustainability goals and technological change, including investment in nature-based development.

The review has shown that the net-zero transition we strive for will be universal, significant, and front-loaded; it will have different implications for different sectors, geographies and communities. However, it will create substantial growth opportunities despite causing significant change and a need for large-scale adjustment and reorganisation, including reskilling and refurbishing.

Environmental concerns and the need to restrict climate change will in turn spur their own technological advances. In the building environment new materials such as carbon-reinforced concrete, the development of carbon-sequestrating concrete and ultra-high-performance concrete are examples of such developments. Other products that utilise waste materials are coming into use are different nature-based infrastructural alternatives such as mass timber and other new environmentally friendlier materials. The need for greater sustainability will lead to new, environmentally friendly materials increasingly being developed and used.

The Rapid and Dramatic Developments and Change Will Require that Everyone Adopt Life-Long Learning as Part of our Changed Lifestyle

The previous sections have indicated continuous and significant change and new knowledge requirements as we move into the future. This implies a need for continuous and life-long learning, personal development, and growth for all who wish to stay employable. For businesses and business leaders it indicates a need to embrace training and life-long learning for all members of staff, particularly since skilled labour will be scarce and will come at a cost.

Our Cities Will Likewise Have to Adapt to the Changed Circumstances

The changes foreseen will require the changing of our cities to become healthier environments housing a digitally supported population that functions in a hybrid fashion while being resilient and environmentally concerned in an increasingly changing world, as mentioned earlier.

It is predicted that contractors will turn to on-site automation and increasingly to pre-fabrication as a result of the drive for greater efficiency. This implies the implementation of tools and processes that require digital processes and a demand for architects who can answer this need. The need for greater efficiency will also result in the ‘Smart City’ where building performance is monitored continuously. It is also predicted that in future, when design proposals are under consideration, questions regarding the ease of cleaning, and health implications, including performance during lockdown restrictions, will have to be answered

Add to this that our urban form must change to provide for inclusivity, proximity and density, while maximising the use of natural ventilation, space that will allow for social distancing through the provision of wider sidewalks and walkways, as well as generous public open spaces. Public spaces and outdoor facilities that will aid the natural environment and the drive towards carbon neutrality will be required. There will also be an increase in the demand for inclusive spaces and buildings that offer a range of diverse functions (mixed-use or multifunction buildings). Our homes will also need reorganising to allow for longer periods of home-stay and remote working. Furthermore, built environment designers will need to create environments that are resilient enough to withstand the possible implications of climate change. All of this could increase the demand for architectural involvement.

Architecture and Architectural Practice Will Have to Adjust in Keeping with the Changes in Society

As with any major shift, it is those (firms) that adapt best to the changed situation that will use the new opportunities to emerge strongest – as some of the best firms of the decade. In view of the above-mentioned predictions of the current global shift, the principals in all types of businesses – architectural practices included – should make the incorporation of the latest technology a characteristic of their business. This applies particularly those practices doing commercial work. Architectural practices that wish to work in the mainstream and commercial spheres should therefore acquire first-rate digital and technological equipment and develop high levels of skills in order to maximise the benefits of new digital platforms and to avoid being left behind. The alternative would be for them and those small practices who do not have the required capital to identify and operate within a less technology-intensive field offering niche services of some kind. Nonetheless, this implies accepting life-long learning as part of the firm's business strategies for everyone to stay up to date on the latest materials, software, and equipment and how to use it. It will also be necessary to be able to use the knowledge generated in the process, as well as feedback received for use in future projects. Clearly, knowledge management will become increasingly important.

The need for technological advancement stems from the possibility of using technology to resolve some of the challenges currently facing the profession, for instance not being able to provide accurate estimates of the proposal's future performance (e.g., financial, thermal, energy consumption). Many authors contend that the global concern with climate and the environment has made a focus on and prowess in sustainability essential requirements for any business and that architects will be expected to provide accurate estimates of how their designs will perform from an environmental and investment point of view. This should be understood in the light of reports that building industry firms regard the construction of net-carbon-zero and/or net-carbon-positive buildings their top priority going forward. Hence, for architectural firms, technology and sustainable design can be seen as interrelated and of critical importance.

As found during the literature review, the climate crisis offers architects the opportunity to achieve this objective by shifting their focus to the use of sustainable and low-carbon building materials. Such a shift will also help create a more resilient global supply chain, thereby creating a more sustainable future.

Increased collaboration and the involvement of a wider range of specialists on projects is one change predicted for the way architects practise. Another prediction is an increase in the use of virtual reality presentations and immersive architecture (based on building information modelling or BIM) and relying on the previously mentioned 'big data' for design decisions in order to increase building performance and efficiency. Employing the latest software will be required to this end: many of the traditional aspects of architecture, for instance drawings, will fade away to be replaced by various digital outputs such as the building twin created through the use of BIM software. The danger to smaller practices is that they will struggle to afford such technology thereby being relegated away from projects where such accuracy is required, or that their lack of competitiveness could force their fees lower.

The societal challenges outlined earlier imply that the focus will shift towards innovative solutions and how they benefit their users. Also, as found during the review, creativity will become a most sought-after trait. This is because technology cannot replace the human component of architectural practice and can only replace some manual and more mechanical processes. The review highlighted that creative thinking would have become the third most important skill needed in order to survive (and thrive) during the Fourth Industrial Revolution and as Osborne pointed out,[118] creativity could be the most difficult human ability to automate. However, if creativity is understood as "the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems, communicating with others, and entertaining ourselves and others",[119] creativity will need to be augmented by adaptability, flexibility and the earliest possible incorporation of digital and technological processes. This could ensure that the profession remains relevant. As an example: embracing artificial intelligence technology and combining it with heuristic techniques can help architects reach a better understanding of their clients' requirements. Thus, the study found that the role of the architect will remain critical but that it will be altered: the focus will change from purely architectural aims to the creation of an environment that is user-focused and enhanced by electronic systems that will measure performance, among other things.

The increased reliance on technology could be considered as a positive aspect by some. In this regard a visit to the website of Foster and Partners could be very revealing. However, it must be said that the big firms will also have to recover the cost of the expensive software. What is true, though, is that they will be able to provide an enhanced service and smaller firms will no longer be able to compete. The Susskinds suggest that smaller firms should specialise in order to survive. Here an entrepreneurial outlook could be of great use.

118. in Bingham and Porter (2021), 22.

119. R. Franken, *Human Motivation* (Pacific Grove, CA: Brooks/Cole Publishing Co, 1994), 396.

Other changes are foreseen. One is the forced transition from an intuitive design process to one that is driven by data (big data). Here the challenge will be to collect data on how past designs are performing, and to organise, analyse and finally extract value from the results: knowledge management will become a key aspect of practising architecture.

Computers will no longer function as dumb tools applied by the architect – computers will take over certain design functions and will work collaboratively with architects. All the while, the drive for greater efficiency will mean that production schedules and stricter regulations based on safety and sustainability will become more demanding and complicated and the performance criteria for buildings will lead to specialised design processes and increasing specialisations and an ever more product-based approach.

The review thus revealed a need for a more entrepreneurial outlook (already mentioned above) where architects increasingly offer services outside the traditional scope of architectural practice – for instance, in designing business strategies, branding and even product design (after further training). Some large firms have already added such services to their professional offering. In the light of the social inequalities highlighted earlier, architects should also venture into areas where community upliftment is needed.

The study confirmed that there will always be a need for architects. This view is based firstly on the intrinsic value architects bring to society as creatives, particularly the designers of healthy, safe, and aesthetically pleasing buildings and spaces, and secondly because of the value architects can have for their clients, particularly during and after an economic and health crisis when creativity will be called for on all fronts.

However, together with the need to incorporate knowledge management and an entrepreneurial outlook, architects will need to develop a range of soft skills that will be required during the Fourth Industrial Revolution. These include problem solving, communication, project management, systems thinking, improved social skills and the ability to work with others. This list should also be extended to include leadership, conflict management, emotional intelligence, mindfulness, and stress management. In addition, it emerged from the review that more time should be allocated in architectural programmes to the aspects of marketing and business development, building and service agreements, managing and directing a design team, working on complex projects, cost estimating, task scheduling, working internationally, and developing a business plan, as well as other aspects that take up the bulk of a senior architect's time. This could be so, but if the Fourth Industrial Revolution is going to call for greater creativity, already overfull programmes cannot add these worthwhile topics into the basic architectural courses. Architectural schools will have to introduce more post-professional programmes and short learning programmes.

Conclusions and Recommendations

This study set out to identify some of the possible directions into which the practice of architecture might develop in the next five to ten years and the opportunities that might come about because of the previously mentioned developments. It can be concluded that the practice of architecture will change on several fronts.

The developments and changes that will take place elsewhere in society and the economy will have a direct impact on the profession. Most notable will be the impact of the Fourth Industrial Revolution and climate change. Responses to the COVID-19 pandemic – particularly to bring about changes that will reduce the impact of any future pandemic – will also change the nature and the role of architects. Research has shown that steps to foster an inclusive, sustainable, and growth-based socio-economic realm will be required. It is in responding to these developments where architects – particularly smaller practices – might find future commissions. It has been mooted for many years that architects ought to spread their services to communities that do not yet benefit from the competencies architects have. Fostering an inclusive and sustainable milieu can benefit from architectural contributions. In doing so a more entrepreneurial stance will be of great value.

The most compelling reason for the profession's incorporation into the future socio-economic sphere is the inherent creativity associated with the profession. So, while this outstanding ability must be nurtured in all architectural programmes, there will be an increasing need for architects to adopt a continuous learning stance and to continuously learn new skills as listed in the previous section. While continuous development programmes (CPDs) can play a part, very often more in-depth study will be required.

In order to provide for this need, schools of architecture and professional bodies will need to introduce validated post-professional programmes where architects can learn the additional skills – particularly a range of soft and managerial skills that will be demanded from architects in the future.

While much of the previous section might seem to have negative implications for small and medium-sized practices, this need not be so. An entrepreneurial stance and an agile demeanour can see them develop specialisations and fill the 'gaps' left by bigger firms, particularly if the 'gig' economy predicted by Bernstein[120] materialises, if actions are required to prevent future pandemics, or when the need arises to adapt existing buildings to the changed lifestyles if climate change cannot be contained within reasonable levels.

In summary, the discussion at the end of the previous section has shown that the architectural profession will remain relevant and that current and future developments could mean that new opportunities for architects can ensue from technological developments; both in terms of systems and applications that develop as part of the Fourth Industrial Revolution and through new building materials and building technologies that will be introduced as a result of

120. Bernstein (2020), 2.

technological advancement and the quest for greater efficiency. While larger and capital-rich practices might have an advantage in this context, niche opportunities could develop for application specialists. This could benefit smaller practices.

Adapting existing buildings and the public realm to the changes that global warming, the threat of future pandemics, lifestyle changes, technological developments, and the imperative for greater efficiency will require, is a second broad field in which opportunities for architectural practices might be identified. In this regard, smaller practices might be able to identify niche areas of operation.

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