

Temporalities and the Urban Fabric

Co-Producing Liminal Spaces in Transitional
Epochs

urban temporalities
liminal spaces
augmented reality in urban design
spatial justice
transitional urban epochs

This research critically examines the complex interplay between temporality and urban spaces amidst transitional phases, with a specific focus on the metropolitan areas of Houston and Amsterdam. Recognising these cities as exemplars of urban temporal flux, the study delves into the transient nature of liminal spaces and their impact on urban dynamics and socio-political landscapes. Methodologically, this research innovates by intertwining Augmented Reality (AR) and Gamification with conventional urban studies methodologies, presenting a cutting-edge approach to examining urban temporalities. This interdisciplinary method, which integrates Design Computation, Fabrication, Urban Communities, and Spatial Justice perspectives, allows for a nuanced exploration of the transient and often elusive nature of urban spaces. Moreover, the study critically evaluates the role of Extended Reality (XR) in enhancing both theoretical and practical approaches in urban studies. By leveraging XR, the research not only provides a novel perspective on the subject matter but also redefines methodological frameworks, enabling a deeper understanding of the complexities inherent in urban transformations during transitional periods.

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INTRODUCTION

The research entitled 'Temporalities and the Urban Fabric: Co-Producing Liminal Spaces in Transitional Epochs' embarks on a critical exploration of urban temporalities in two distinct yet interrelated urban contexts: Houston and Amsterdam. The selection of these cities was driven by their illustrative roles in showcasing the multifaceted nature of urban transition and the concept of liminality within diverse socio-economic and cultural frameworks.

Houston, a city emblematic of North America's urban narrative, offers a unique lens to scrutinize the complex interplay between rapid industrial growth, socio-economic diversity, and environmental challenges (Mehan & Casey, 2023). Galena Park, a microcosm within Houston, exemplifies the transformative impacts of industrial expansion. Here historical industrialization has shaped its urban landscape and community dynamics, thereby serving as a potent example of the interplay between economic development, environmental policies, and urban fabric (Mehan & Mostafavi, 2023; Checker, 2005; Boom, 2017). The study of Houston and Galena Park, therefore, provides critical insights into how industrial growth and environmental policies collectively influence the evolution of urban spaces, particularly in terms of socio-environmental justice and spatial transformation (Mehan & Stuckemeyer, 2023; Mehan et al., 2022).

Amsterdam, in contrast, presents a narrative deeply rooted in European urban history, characterized by historical layers and socio-cultural diversity (Novak et al., 2023). The Bijlmermeer area, with its intricate history of immigration and urban redevelopment, offers insights into the challenges of urban planning, socio-cultural integration, and the resilience of urban communities in the face of changing socio-economic landscapes (Nell & Rath, 2009; Heilbron, 2023). Markenplein, embodying the confluence of historical and modern urban dynamics, allows for an exploration of how historic legacies and

contemporary urban policies intersect to shape the city's identity and spatial dynamics.

These areas in Houston and Amsterdam were meticulously selected to illuminate the dynamic interplay between time, space, and society in urban environments. The juxtaposition of these cities, each with their unique temporal narratives and liminal spaces, offers a rich context to explore the evolution of urban spaces against the backdrop of historical significance, current realities, and potential futures (Mehan & Mostafavi, 2022). This comparative approach allows for a deeper understanding of how urban temporalities and liminal spaces influence and are influenced by socio-political and environmental dynamics across different geographic and cultural settings (Williams et al., 2020; Schäfer & van Es, 2017).

In sum, this research seeks to unravel the complexities inherent in urban transformations, highlighting the significance of time and transition in shaping the urban fabric. The exploration of Houston and Amsterdam, with their respective areas of focus, serves as a foundational narrative for understanding the role of liminal spaces in the ongoing evolution of urban landscapes.

METHODOLOGY

The methodology of this study is centred around the integration of digital technologies, specifically Augmented Reality (AR) and Extended Reality (XR), to explore and represent the temporal dynamics of urban spaces.

Augmented Reality (AR): AR technology was employed to overlay digital information onto physical urban models. This approach allowed for the visualization of temporal layers and socio-spatial data directly on the physical structures of the cities being studied. AR facilitated an interactive experience where users could engage with both the physical model and the augmented data, enhancing their understanding of the urban temporalities (Khasraghi & Mehan, 2023).

Extended Reality (XR): XR, encompassing a spectrum of immersive technologies including AR, Virtual Reality (VR), and Mixed Reality (MR), was used to create a comprehensive environment for users to experience urban spaces. This technology was instrumental in simulating different temporal scenarios within urban contexts, allowing users to experience potential future urban developments and changes (Mostafavi & Mehan, 2023).

Phygital Interaction: The term 'Phygital' combines 'physical' and 'digital,' referring to an approach that blends physical experiences with digital innovation. In the context of this study, phygital interaction refers to the engagement with physical models of urban spaces that are enhanced with digital data and simulations through AR and XR technologies. This approach enables a multi-sensory experience, allowing for a more profound understanding of the intricate layers of urban temporality.

Computational Design and Digital Fabrication: Computational design was utilized to create detailed and complex urban models, which were then brought to life using digital fabrication techniques. These models served as the base for phygital interactions, with digital technologies augmenting their functionality and enabling a deeper exploration of urban dynamics.

The methodology is grounded in an interdisciplinary approach, integrating concepts from urban studies, digital technology, and social sciences. By employing these methodologies, the study aims to provide new insights into the temporal dynamics of urban landscapes, offering a nuanced understanding of how cities evolve and respond to socio-political and environmental changes.

TEMPORAL LIMINALITY IN URBAN SPACES

This section delves into the concept of liminality in urban environments,

PHYSICAL + DIGITAL PHYGITAL

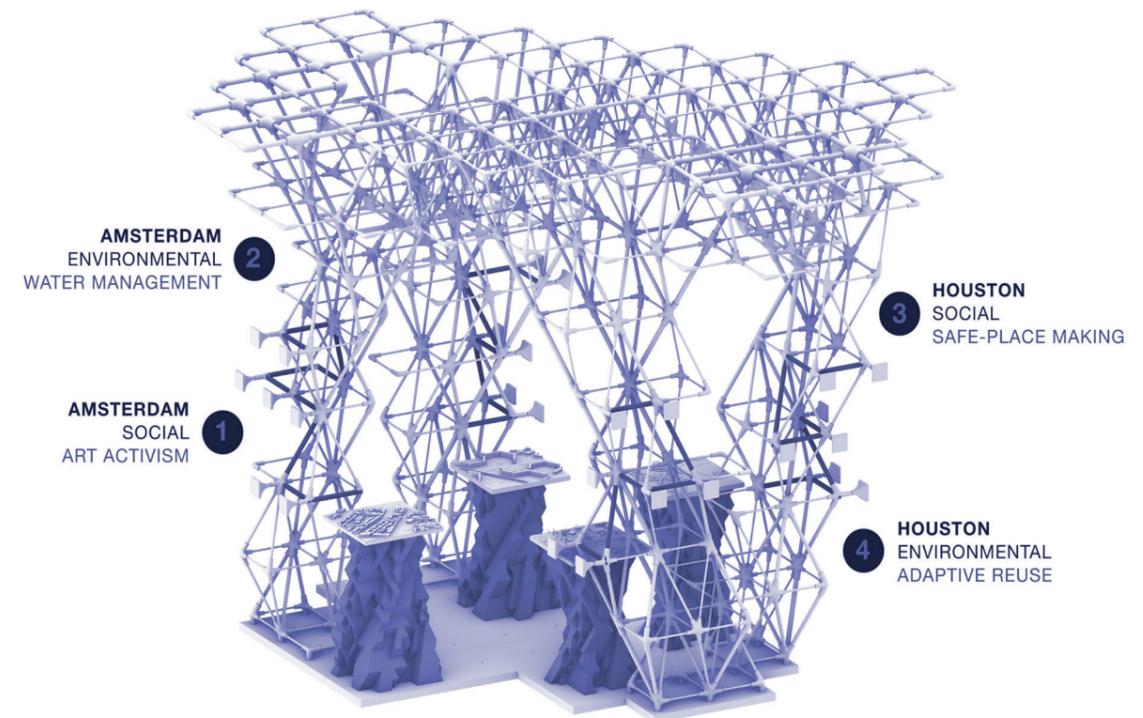


Fig. 1 - Left: Schematic diagram of phygital interactions, right: Final configuration of the installation with four integrated XR trails.

drawing from Victor Turner's seminal work that defines liminality as a transitional phase marked by the dissolution and reformation of social structures (Turner, 1969; Turner & Turner, 1978). Liminal spaces in urban contexts, as identified by Zimmerman (2008), exist as transformative zones straddling the public and private realms, prompting social and cultural interactions while challenging conventional notions of belonging (Auge, 1995; Horvath, Thomassen & Wydra, 2015). These spaces, particularly in cities like Houston and Amsterdam, often reflect and are influenced by prevailing power dynamics, impacting inclusivity and community representation (Shields, 1999; Ratto & Boler, 2014).

The research critically employs a suite of digital tools to analyse and interpret these urban liminal spaces. A key component of this methodology was the innovative use of 3D printing technology, combined with intricate lattice structure designs. This approach was instrumental in materialising the conceptual aspects of liminality into a physical installation. The lattice structures, a metaphor for the interconnected yet transient nature of liminal spaces, provided a tangible representation that facilitated a

deeper understanding of these complex urban phenomena (Bigger, 2009).

Further, the integration of digital interfaces with the physical installation created an interactive 'phygital' experience. This setup allowed for the dynamic presentation of urban data and narratives, thereby enriching the exploration of liminal spaces in Houston and Amsterdam. The digital aspect of the installation played a crucial role in visualising urban temporalities and spatial relationships, fostering a more immersive and informative experience for the audience (Mehan, 2023b) (Fig. 1).

Critically, this methodological approach highlights the potential of digital tools not just for visualization, but also for engaging with the socio-political dimensions of urban spaces. By intertwining physical models with digital data, the research underscores the evolving nature of urban liminality and its implications on community dynamics and urban planning. This intersection of digital technology and urban studies provides a novel lens through which the complexities of liminal spaces can be understood and discussed, emphasising their role as catalysts for socio-environmental evolution

and as platforms for inclusive urban development (Turner, 1967; Thomassen, 2009).

In conclusion, this section provides a comprehensive and critical overview of how digital tools were pragmatically applied in the research to examine and showcase the temporal and transformative characteristics of urban liminal spaces.

TEMPORAL LIMINALITY IN INTERDISCIPLINARY URBAN RESEARCH: TOWARDS A DYNAMIC SOCIO-ENVIRONMENTAL JUSTICE

Urban environments are perpetually evolving entities. This temporal progression, marked by phases of transformation and stasis, evokes Turner's concept of liminality—transitional states from what was to what might be. In this light, the temporal dimension of our interdisciplinary project reveals how urban spaces, and our understanding

of them, undergo constant metamorphosis.

Central to this project's approach is an acute awareness of the temporal flux inherent in urban contexts. The FabriCity XR project navigates the often-transient digital landscape, merging computation-based design with fabrication (Delgado et al., 2020). This oscillation between the digital and physical realms embodies a liminal space of its own. Much like the time-sensitive digital representations in architecture, these computational designs transition from ephemeral digital entities into tangible urban forms, epitomising the transitory nature of urban imaginaries (Kharvari & Kaiser, 2022).

Similarly, the exploration of socio-environmental justice in Houston

and Amsterdam is not static but temporally contingent. Urban landscapes, reflecting historical, social, and political contexts, are always in flux. In this evolving temporal tapestry, notions of spatial justice are constantly renegotiated. These spaces do not just transition physically but also in the collective consciousness, influenced by the tides of time, politics, and socio-cultural dynamics. Bishop (2012) provides a nuanced understanding of participation in these dynamic spaces, underscoring the importance of acknowledging the temporal shifts in communal engagement and perspectives.

Augmented Reality (AR) and Extended Reality (XR) are transformative technologies in urban studies, offering innovative

ways to visualize, interact with, and understand urban environments. AR enhances visualization by superimposing digital information onto physical spaces, providing dynamic and interactive platforms for viewing complex urban data and temporal layers. This capability significantly increases user engagement, allowing for a deeper public understanding of urban projects and planning processes. The integration of real-time data, such as traffic patterns or environmental conditions, through AR, further enriches the understanding of urban dynamics.

XR, encompassing a range of immersive technologies including AR, takes this a step further by creating comprehensive environments for simulating various urban scenarios.

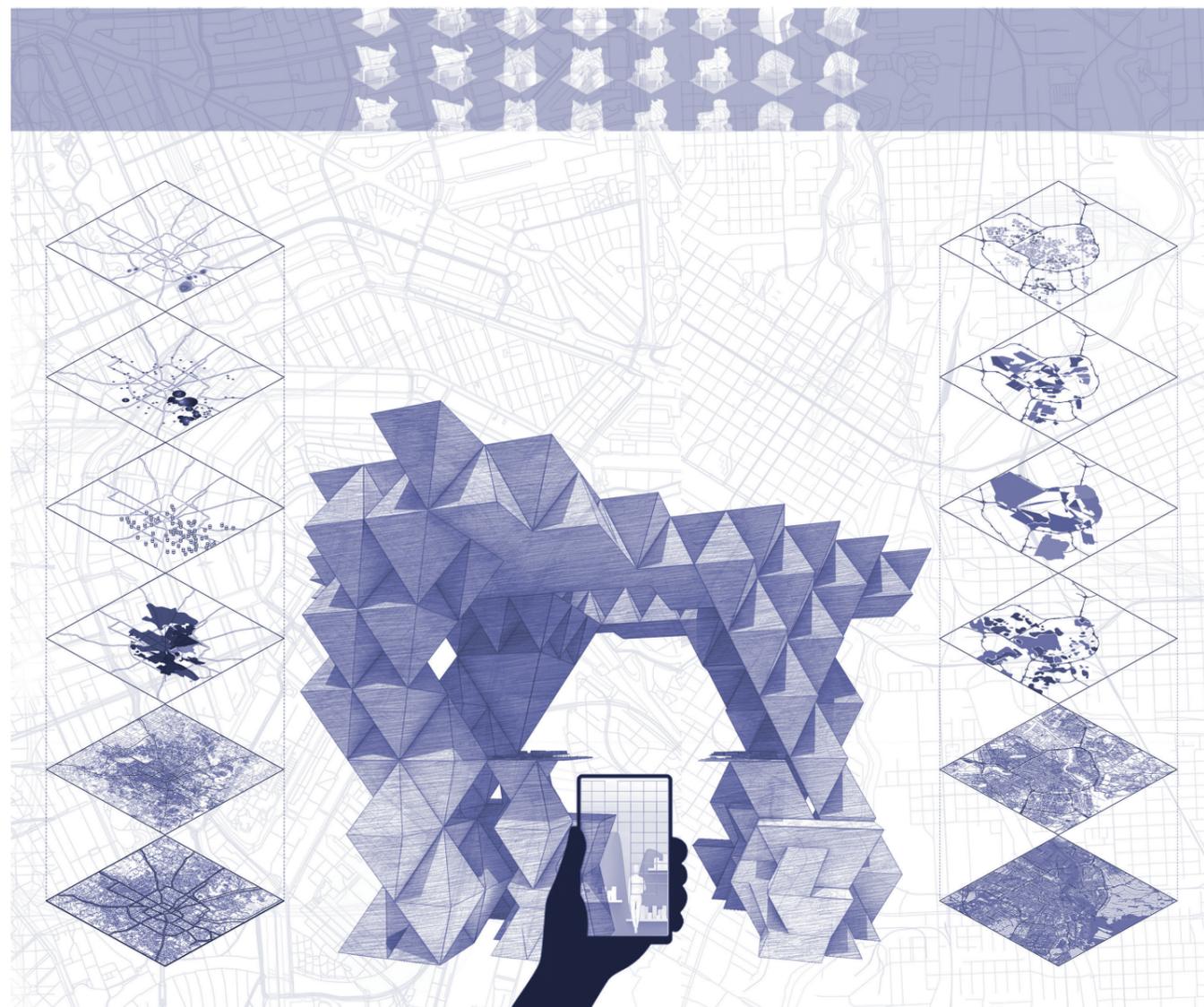


Fig. 2 - This schematic image illustrates the interdisciplinary Collaboration during the implementation of the FabriCity XR Project. Source: Authors.

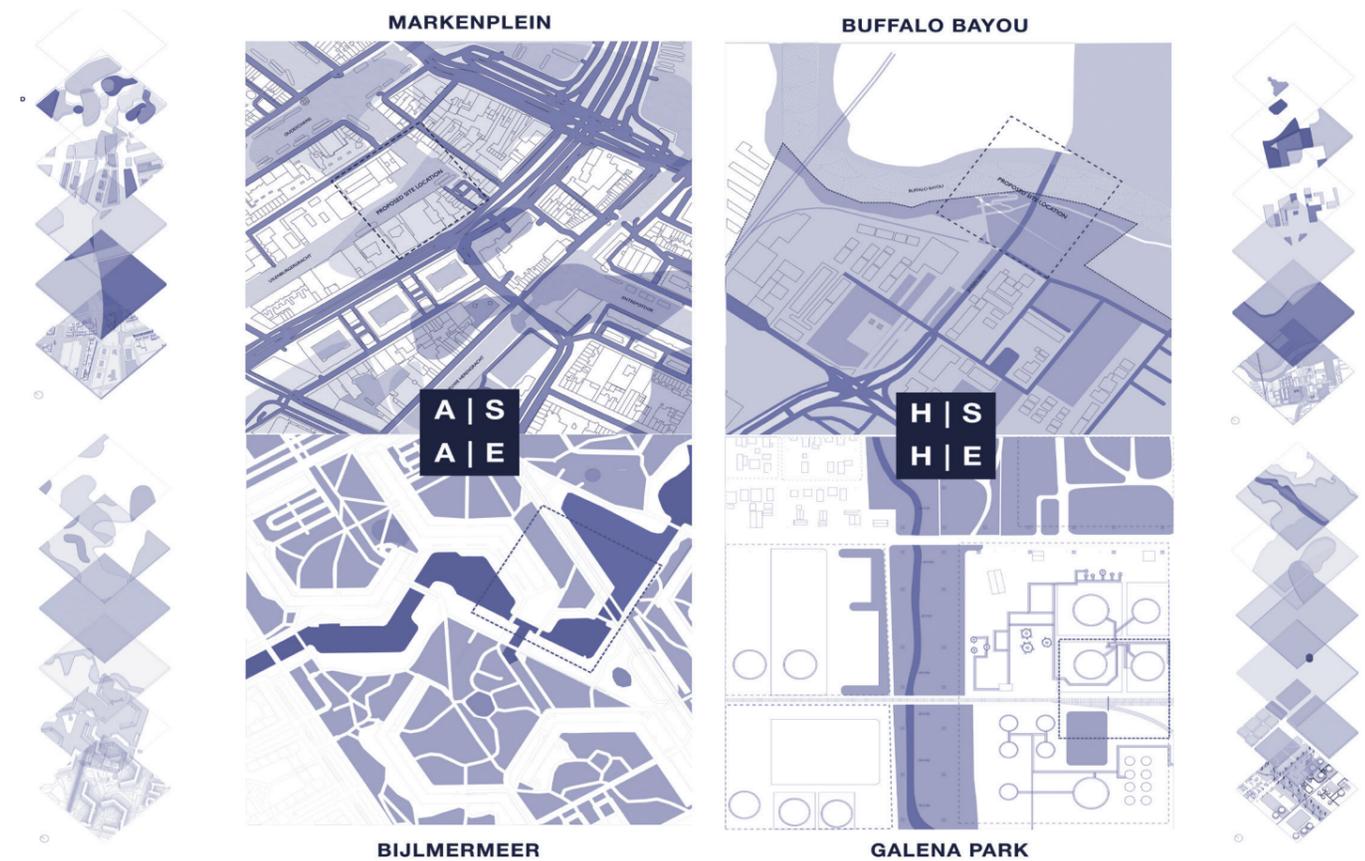


Fig. 3 - Macro maps of selected parcels in Houston and Amsterdam provide a 2D representation, while isometric exploded mapping illustrates the multi-layered analysis from social and environmental justice viewpoints in both cities. Source: Authors.

This immersion is invaluable for urban planning and decision-making, providing a multi-sensory experience that deepens the understanding of spatial and temporal aspects of cities. XR's capacity for collaborative planning, enabling stakeholders to interact within a shared virtual space, is particularly beneficial for inclusive and participatory urban design processes.

However, these technologies come with their own set of challenges. The reliance on AR and XR may limit accessibility for individuals without the necessary devices or technical knowledge. In the case of AR, the potential for data overload and the need for precise and accurate data are critical considerations. The effectiveness of AR visualizations is highly dependent on the quality and reliability of the underlying data and technology. On the other hand, XR's immersive experiences can be resource-intensive, requiring significant investment in both technology and expertise. User experience in XR can vary considerably due to individual

differences in technology usage and perception, which can influence the effectiveness of these tools in conveying complex urban concepts. Additionally, technical issues such as latency, resolution, and user interface design in XR can impact user engagement and the overall effectiveness of these technologies in urban studies.

In the context of this project, the integration of Extended Reality (XR) in Urban Design offers a unique temporal dimension. With XR, time is rendered malleable. Past, present, and potential futures converge, offering users an immersive journey through time. The "Phygital" concept, anchoring the FabriCity XR project, exemplifies this, collapsing timeframes as users navigate between the tangible and intangible (Fig. 2). FabriCity XR develop an interactive web-based platform DEVAR which allows the user to interact with the installation through any personal smart devices such as phones and tablets, without any need for external application. This temporal bridging fosters a more

profound understanding of socio-environmental issues, as they are perceived not as static problems but as evolving challenges within an ever-shifting urban temporality.

In essence, recognising the inherent temporality in urban research allows for a more nuanced, critical examination of urban spaces. Only by acknowledging and embracing these temporal shifts can we hope to design and advocate for a just, inclusive, and dynamic urban future.

TEMPORALITIES IN URBAN SPACES: LESSONS FROM HOUSTON AND AMSTERDAM

Understanding urban landscapes demands an engagement with temporality, for cities are more than mere spatial entities; they are temporal palimpsests bearing imprints of historical occurrences, present-day dynamics, and future aspirations (Mehan, 2023a). This

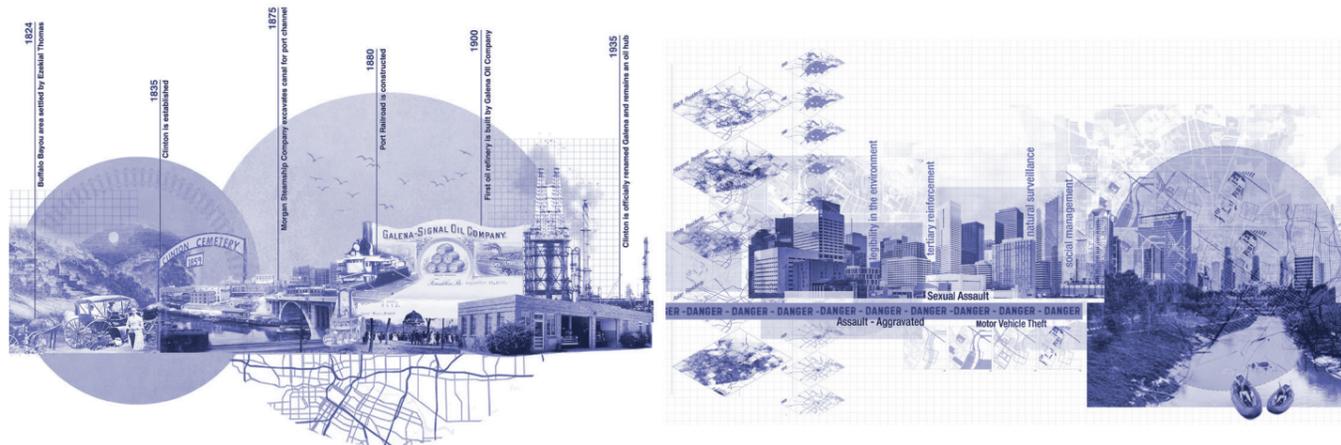


Fig. 4 - Contextual analysis and Historical analysis of Buffalo Bayou and Galena Park neighbourhoods in Houston from the social justice perspectives. Source: Authors.



Fig. 5 - Contextual analysis and Historical analysis of Bijlmermeer and Markenplein neighbourhoods in Amsterdam from the social justice and environmental justice perspectives. Source: Authors.

confluence of past, present, and anticipated futures serves as a backdrop against which the evolving narratives of cities like Houston and Amsterdam can be critically studied, especially in the context of socio-political shifts and environmental challenges.

In Amsterdam, the Bijlmermeer area, known for its immigrant history, particularly the Surinamese influx, has faced a complex set of socio-cultural and environmental challenges. These challenges include integrating a diverse population, managing socio-economic disparities, and addressing urban planning issues that arose from rapid and often unplanned development (Nell & Rath, 2009; Fraser & Howard, 2017). The tragic plane crash of 1992 in Bijlmermeer is not merely a historical footnote but a significant event that brought to light the area's underlying socio-environmental issues and galvanized efforts towards urban renewal and community resilience. In contrast, Houston's

Galena Park illustrates the impact of industrialization and its socio-environmental footprint. This area, with its history of industrial development, has grappled with issues such as pollution, health hazards, and the displacement of communities due to industrial expansion and urban sprawl (Varış Husar et al., 2023; Checker, 2005; Boom, 2017). These challenges are emblematic of the broader issue of how industrial progress, without adequate socio-environmental considerations, can lead to adverse outcomes for local communities (Fig.3).

This project foregrounds socio-environmental justice by adopting a multi-temporal perspective, as advocated by Schlosberg (2013). It emphasizes the importance of understanding the historical legacies of urban spaces and how they influence current and future socio-environmental dynamics. By employing Augmented Reality (AR), the project allows users to engage

with the juxtaposed temporal layers of these cities, fostering a deeper understanding of how past events and policies continue to shape present-day urban realities (Fig. 4 and 5).

Furthermore, the research employs macro maps and isometric exploded mapping (Fig. 4) to provide a comprehensive analysis of social and environmental justice issues in both cities from multiple perspectives. This approach not only critiques traditional architectural and urban planning pedagogies but also champions a temporally aware understanding of urban spaces, aligning with the advocacy of Holifield, Chakraborty, and Walker (2018) for environmental justice. The contextual and historical analyses of neighbourhoods in Houston and Amsterdam (Fig. 5 and 6) are integral to this, highlighting the need for urban planners to consider multifaceted temporalities in their pursuit of equitable urban futures (Swyngedouw, 2004).

TEMPORALITIES AND THE DYNAMICS OF URBAN CHANGE: A CRITICAL REFLECTION ON THE FABRICITY XR PROJECT

The FabriCity XR stands as a comprehensive exploration in urban studies, integrating digital technologies to investigate the evolving temporal dynamics of urban landscapes. This project aims to illustrate how urban spaces, shaped by their temporal, sociopolitical, and cultural contexts, are more than static physical entities; they are dynamic fabrics continuously evolving over time.

Central to the FabriCity XR Project is the innovative use of a lattice structure, which serves as a key element in representing the complexity of urban environments. This structure is not merely a physical form but a metaphor for the interconnected and multifaceted nature of cities, symbolising the mesh of pathways, interactions,

and systems that define urban life. The lattice, therefore, embodies the concept of temporality and liminality in urban spaces.

The project employs a phygital (physical + digital) approach, particularly through Augmented Reality (AR), to create an interactive experience with the lattice structure. This interaction is fundamental in illustrating the dynamic and layered nature of urban temporalities. Users can navigate through various temporal layers of the city – its past, present, and potential futures – facilitated by the AR technology. This phygital interplay enhances the understanding of the city as a living entity, characterized by continuous change and evolution (See Fig. 7).

Computational design and digital fabrication techniques are pivotal to this project. These advanced methodologies enable the precise and intricate realization of the lattice structure, which traditional fabrication methods would find challenging to replicate. The use of these techniques ensures accuracy in embodying the conceptual representations of urban complexities and allows

for adaptability to different urban contexts.

The lattice structure, enhanced by the phygital interaction, offers significant added value to the project. It provides a tangible and immersive platform to explore and understand urban temporalities. This structure transforms abstract urban concepts into a relatable and interactive format, facilitating a deeper engagement with the study of urban dynamics. Moreover, the combination of physical modelling with digital augmentation through AR brings a novel dimension to urban studies, encouraging users to engage critically with the concept of urban transformation.

In summary, the FabriCity_XR project adopts a forward-thinking stance in urban studies, emphasising the significance of temporal factors in shaping urban landscapes. By integrating computational design, digital fabrication, and AR, the project presents a multifaceted exploration of urban temporalities, advocating for an understanding of cities as complex, evolving entities shaped by time and human interaction.

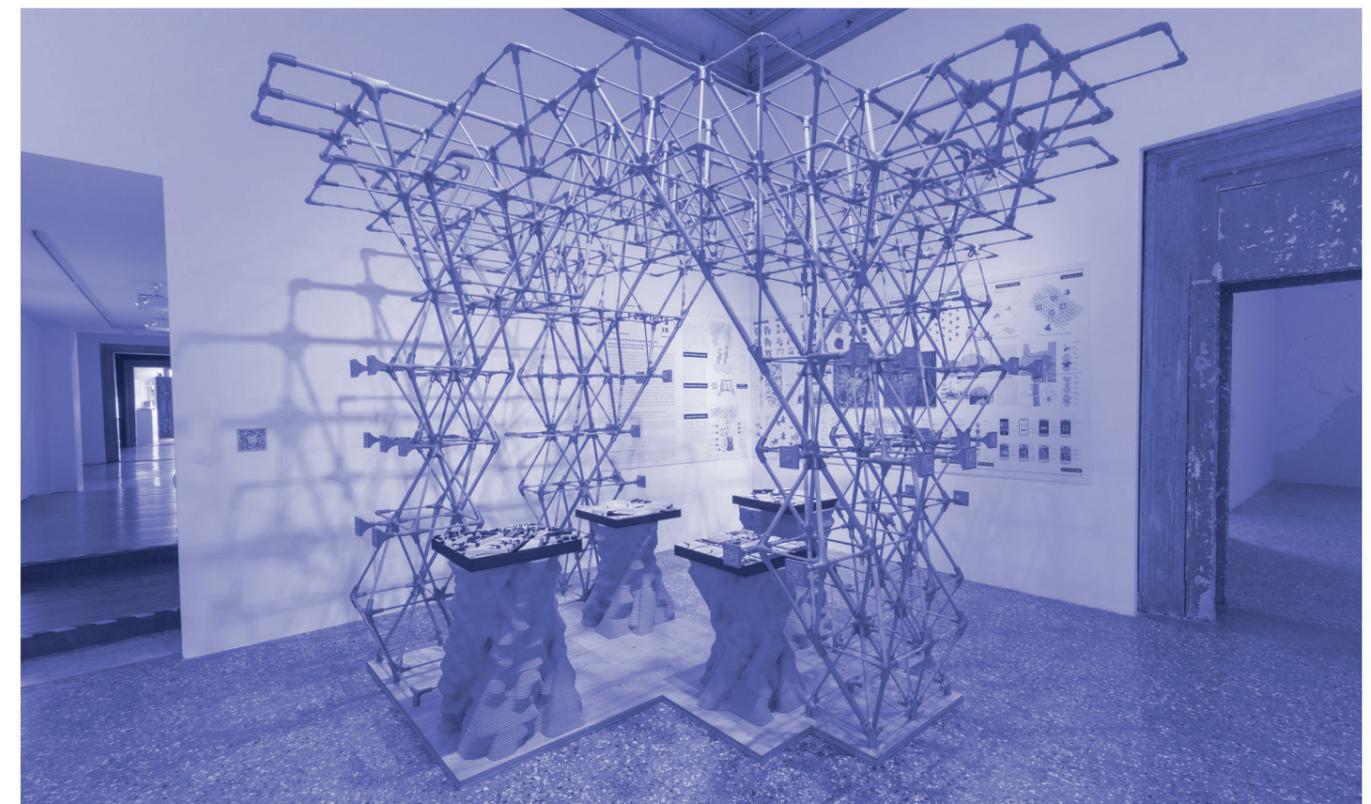


Fig. 6 - FabriCity XR Project, An overview of the assembled one-to-one installation in the exhibition venue, Venice Architecture Biennale 2023, ECC, Italy, Time Space Existence 2023, Palazzo Mora. Photo credits: Federico Vespignani.



Fig. 7 - FabriCity XR: Phygital interaction with urban models and Lattice structure.

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