PERMEABILITIES

2024

HARVARD URBAN REVIEW

EDITOR'S NOTE

Permeabilities - 2024

We are thrilled to present the exceptional work of this year's contributors in Harvard Urban Review: Permeabilities.

Though an oft-discussed subject in urbanism, permeability tends to refer to narrow definition and specific context: water-permeable surfaces in urban environments dominated by concrete and asphalt. Yet, the concept holds far greater potential. At its core, permeability is about movement across boundaries, a framework through which we can understand some of today's most pressing urban challenges. Development creeps into natural spaces. Borders and infrastructure create hard edges restricting the flow of people, determining a city's, state's, or country's openness. And of course, as climate change continues to escalate in both intensity and frequency, the demand for more permeable urban spaces pushes us to reconsider the impervious nature of modern cities.

In this issue, our authors delve into the many facets of permeability, from environmental design to social dynamics, inviting us to rethink the ways we understand and shape urban environments. After all, ideas themselves are permeable, too—they can spread, challenge, and transform.

As we reflect on the content in Permeabilities, we also want to share an exciting update: the Harvard Urban Review will be undergoing a name and design change for our next edition. Stay tuned to our website for details on this new chapter.

We hope you enjoy this year's issue and join us in the ongoing exploration of urban permeability.

Founded in 2018 by Master in Urban Planning students at Harvard Graduate School of Design, Harvard Urban Review serves as a platform for innovative thought in urbanis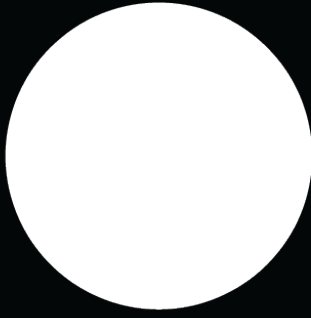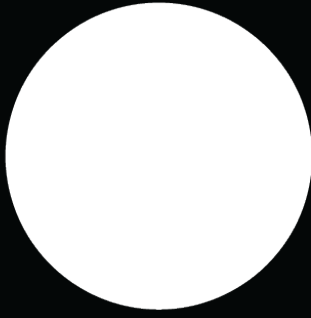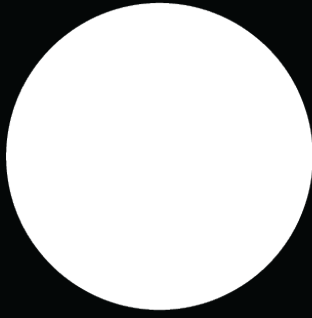m. Our journal brings together the work of students, practitioners, and researchers across planning, design, and architecture, offering diverse perspectives on the most pressing issues in urban planning today

With a commitment to fostering interdisciplinary dialogue, we publish work in a range of formats—encouraging the exploration of new ideas that push the boundaries of urban design and planning. Our goal is to not only reflect the current discourse but also to shape the future of cities through the integration of cutting-edge research and practice.

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Fig. 1: Superpowers' tanks faced off for sixteen hours at the East-West border in October 1961. Source: Landesarchiv Berlin.

Checkpoint Charlie

A Point of Permeability
Andreas Luescher

More than sixty years ago—on August 13, 1961—the Berlin Wall was erected as the culmination of the Berlin Crisis, a face-off between U.S. and Soviet tanks and the most memorable East-West clash of the period barring the Cuban Missile Crisis, a year later (fig. 1). With the building of the Wall came Checkpoint Charlie, which became over the next 28 years a political flashpoint of the Cold War, a daily reminder of oppression, and a deadly urban scar. Checkpoint Charlie remains a cultural icon that stands for the most contentious—and for some, permeable—border crossing in the world.

LOCI

Checkpoint Charlie, a threshold as significant in its grim, utilitarian way as the monumentally scaled ceremonial Brandenburg Tor, was the stalwart personification of the West holding back the forces of repression. It was an icon of freedom to those hoping to escape the East. It is also a place where the crises of modern architecture and urban planning coincide with the crisis of national identity.[1]

Though the physical vestiges of Checkpoint Charlie and its Soviet counterpart have been removed in pieces to museums, stolen, or destroyed, the place remains a genius loci in the world imagination. The East German checkpoint watchtower, the last recognizable symbol of the Cold War, was demolished by property owner Checkpoint Charlie Service Company at the end of 2000. Its systematic erasure provides an instructive summary of the conflicts of in-

terest that have influenced urban form in Berlin during the past half century, particularly during the years since reunification. Two major proposed buildings that were planned to sit directly on the eastern and western thresholds of the Wall at Checkpoint Charlie remain unbuilt, their absence providing a second chance to rethink this historic intersection. For the time being the undeveloped lots form a kind of temporary open-air museum, a market for Soviet memorabilia and souvenir pieces of the Wall, which has passed through several stages to emerge in 2006 as a 300 meter–long wall of edifying portrait gallery (Galeriewand) visited annually by 4 million tourists, its latest addition being a panorama in 2012.[2]

WHERE EAST MEETS WEST

The Wall was a Berlin affair. Its construction in 1961 did not initiate the incarceration of the German Democratic Republic (GDR) population but completed it. For a long time, Berlin was much more open than the rest of the GDR, which had already been practically hermetically sealed off from the West in the 1950s. Before the sealing off the city by GDR authorities, the Eastern and Western Sectors had been freely passable, with only sporadic police controls, over some eighty streets connecting the two parts of Berlin. After August 13, the number of crossing points was reduced to thirteen, and later, seven. On August 22, the East German government announced that foreigners—including Allied personnel—could cross only at GÜSt (denoting a Grenzübergangsstelle, or Border Crossing Point) Friedrich-/Zimmerstrasse and the Friedrichstrasse train station. The East German authority called this a "necessary breach in their anti-fascist protection wall," which was the gateway for most Western visitors to the Eastern side, and Friedrichstrasse was the first street they would experience in the capital of the German Democratic Republic (fig. 2).[3]
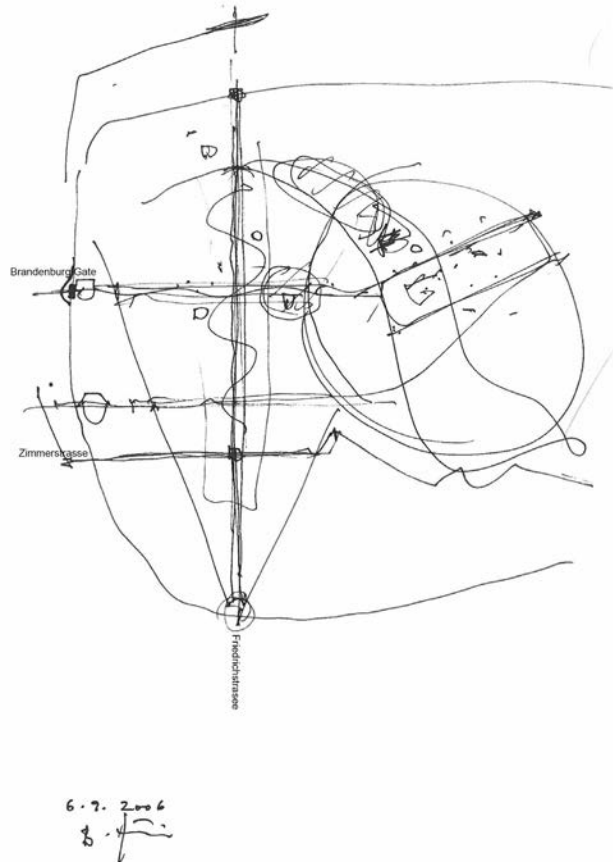

Fig. 2: Sketch of Checkpoint Charlie by German architecture critic Bruno Flierl. Source: Bruno Flierl, 2006.
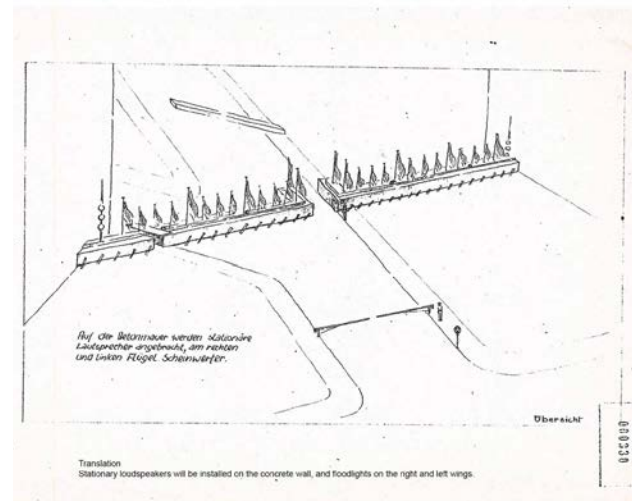

Fig. 3: Original proposal for the Friedrich-Zimmerstrasse border crossing. Source: Stasi-Unterlagen-Archiv, 1961.

Fig. 5: Viewing platform at Checkpoint Charlie. Source: Landesarchiv Berlin, 1968.
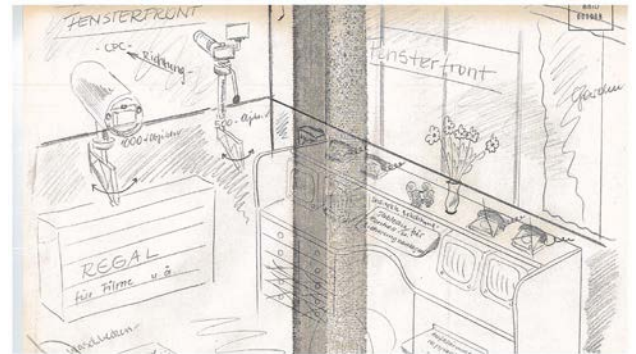
Fig. 6: Interior rendering of the East German guard house. Source: Stasi-Unterlagen-Archiv (BStU), 1980.
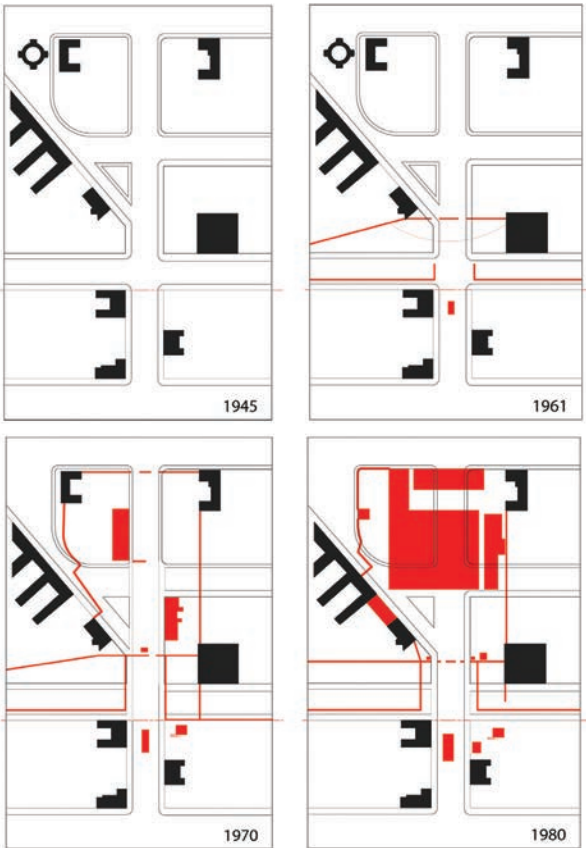

Fig. 4: The evolution of the Friedrich-Zimmerstrasse between 1945 and 1980. Source: Andreas Luescher, 2015.

The checkpoint was curiously asymmetrical (figs. 3 and 4). During its twenty-eight-year active life, the infrastructure on the eastern side was expanded to include not only the Wall, watchtower, and zigzag barriers but also a multilane shed where cars and their occupants were checked (figs. 5, 6, and 7). However, the American authorities, perhaps not wanting to concede that the division of Germany might be anything other than a temporary aberration, never erected any permanent buildings but made do with the iconic wooden shed. During the International Building Exhibition (IBA), 1984–87, the Office for Metropolitan Architecture (OMA) was commissioned to redesign Friedrichstrasse 207 as an apartment building (1984–90) including upgraded street-level military facilities for checkpoint operations.

When the Wall fell, the lower part was reconfigured for commercial use, which, with the opening of a McDonald's in summer 2010, significantly altered its appearance. The flair with which the OMA design introduced color, varieties of shapes, and projecting and receding spaces to Checkpoint Charlie's backdrop was in marked contrast to the drab and empty expanses on the other side of the Wall.

REBUILD THE HEART OF THE FRIEDRICHSTRASSE

Das Business Center, at first called the American Business Center (ABC), at Checkpoint Charlie, was going to be big by any urban standard: the architectural transformation (fig. 8), as it was
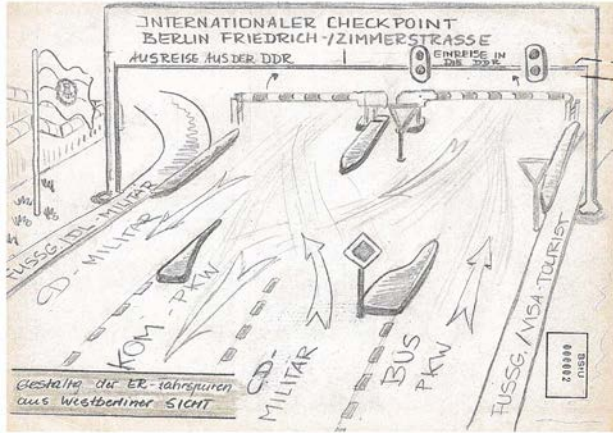
Figure 7. Sketch of traffic pattern at the checkpoint. Source: Stasi-Unterlagen-Archiv, 1980.

billed in the promotional literature, of a million square feet (1,248,350) comprising four blocks on five acres at the epicenter of the city's destruction and division. The site, along Friedrichstrasse, was shaped by both the curving Mauerstrasse, a remnant of the city's pre-Baroque wall that demarcates the project's eastern edge, and Zimmerstrasse, the line of the former Wall. Unlike public land projects, this proposal was not subject to the scrutiny of public planning debates, which are heavily attended by Berliners who, as essayist Jane Kramer points out, have become "amateur semioticians" out of concern that planned buildings might signal the restoration of the wrong kind of German power.[4]

In fall 1992 the Central European Development Corporation (CEDC) invited sixteen architectural firms (four American and twelve German) to submit design proposals for the four blocks or better-known Quartier, except for Quartier 106 (known as the Philip Johnson Building or Friedrichstrasse 200), directly given to Philip Johnson by his friend Ronald Lauder, the American billionaire philanthropist.[5] Berlin is above all a city of rules, and the city fathers wanted the Friedrichstrasse to be as near to the way it was before the Cold War as possible. In the eighteenth century, when the Friedrichstrasse was laid out, the buildings were all the same height, only as high as one could be expected to walk up. The notion of architecturally re-creating the eighteenth-century city, named "the stone Berlin," was conceived by Hans Stimmann, director of Berlin's huge planning bureaucracy from 1991 to 2006.[6] Stimmann's concept was soon refined, with the help of a local philosopher of

planning named Dieter Hoffmann-Axthelm, as a blueprint for the critical reconstruction of the city—and to accommodate the size and density of the eighteenth-century block and the integrity of the stone façade[s]—although much of eighteenth-century Berlin was, in fact, brick, plastered over and painted in the Prussian ochre of the city's sandstone palaces.

David Childs of SOM, New York, who won the Block 105 competition, and Jürgen Engel of Kraemer, Sieverts and Associates (now Engel and Zimmermann Architects), Frankfurt/Main, who won the Block 200 competition, were asked to memorialize the crossing point at Checkpoint Charlie. Childs responded with the symbol of a raised gate strapped prowlike to the facade of

Fig. 8: A model of the critical reconstruction for the Business Center. Source: Andreas Luescher, 1992.

the building. Jürgen Engel chose to weave a narrative by encircling the last standing GDR guard tower with a cylindrical void in his building facade. Child's prow and Engel's vitrine for the watchtower arguably make a lively assertion about the ability of architecture to both represent and support complex weavings of events and structure—arguably because the two structures were never built and so their allowing easy passage through cannot be evaluated (fig. 9).

BANKRUPTCY: THE END OF CHECKPOINT CHARLIE

In 2003 the building permits expired for the project, and the developer Checkpoint Charlie Kommanditgesellschaft (KG) declared insolvency. Those blocks that were built seemed to turn against the actual request—the recovery of the historical outline of the site—destroying the
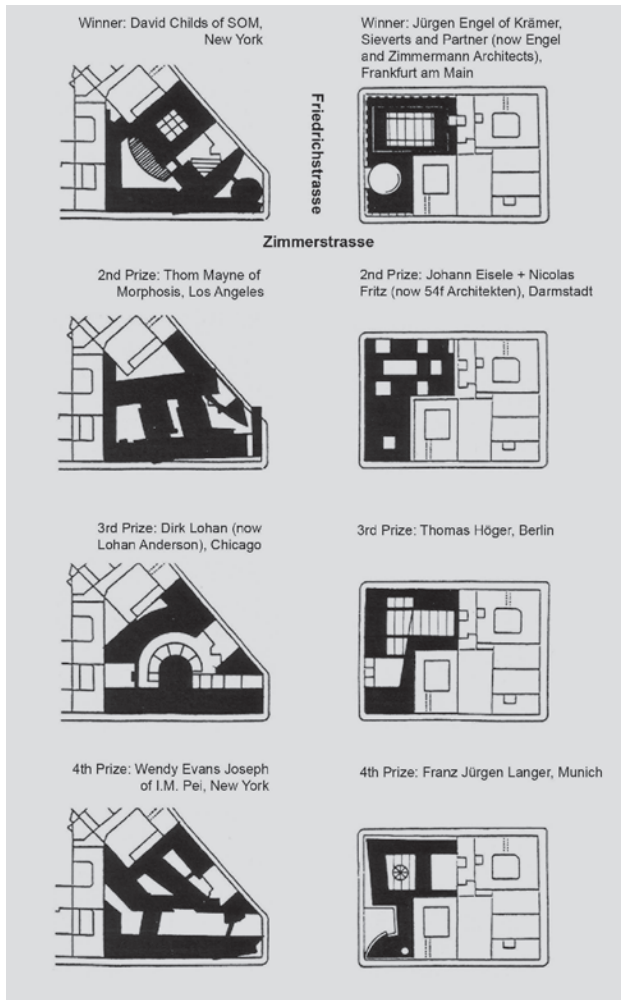
Fig 9: Proposed figure-ground plans for the Friedrich-Zimmerstrasse intersection. Source: Andreas Luescher, 2015.

way in which the place is pictured in the memory of the world public. Former city building director Stimmann commented: "The projects show shortcoming in their design in response to the high claims of the place."[7] The overall impression one gets when visiting Checkpoint Charlie today is one of great confusion, visibly reflecting the many squabbles of Germany's current sectors. This ongoing confusion is a metaphor for the tradition of Checkpoint Charlie as a place of standoff.

Berlin, a cash-strapped city still struggling with the financial costs of reunification, has taken a few steps toward accommodating the rise of "wall tourism" (the great number of visitors to the Galeriewand). But Checkpoint Charlie remains a place of contentious opposition on many levels. Stakeholders, politics, economics, and emotions continue to drive a dramatic, often fraught, decision-making process affecting its

future image. The arguments over how Berlin should preserve historic wall sites are unlikely to disappear. It is not a question of whether the manifest history at Checkpoint Charlie will be remembered, but how it will be remembered. The process needs to go forward. The ideal plan would creatively address its mandate by not only focusing on the preservation of the original structures' footprints, but recognizing individual victims, providing access to bedrock, and also seamlessly reconnecting this site to the fabric of its urban community. Checkpoint Charlie, a former impermeable checkpoint for many, can be reimagined as a place of permeability, where the past and present meet and form a lively passageway.

Notes + References

1. Carolyn Loeb, and Andreas Luescher, "Cultural Memory after the fall of the Wall: The Case of Checkpoint Charlie," in Building Walls and Dissolving Borders, eds. Max Stephenson and Laura Zanotti (London and Burlington, VT: Ashgate Publishing, 2013), 177–91.

2. The artist and architect Yadegar Asisi created a panorama Die Mauer of a no longer existing cityscape of the Berlin Wall on a fictitious autumn day in the 1980s on a 1:1 scale.

3. The Wall was a Berlin affair. Its construction in 1961 did not initiate the incarceration of the German Democratic Republic (GDR) population but completed it. For a long time, Berlin was much more open than the rest of the GDR, which had already been practically hermetically sealed off from the West in the 1950s.

4. Jane Kramer, "Living With Berlin," The New Yorker 75, no. 17 (1999): 50–64.

5. Ronald S. Lauder, co-owner of the Estee Lauder Company, was the largest single investor who founded CEDC. Mr. Lauder, formerly US ambassador to Austria, pulled out of the project Das Business Center, legally known as Checkpoint Charlie KG, in summer 1997.

6. In fact, Stimmann's tenure was interrupted 1996–99 by Christian Democrats who sought a more uncritical reconstruction of Berlin. Hans Stimmann and Martin Kieren, Die Architektur des neuen Berlin (Berlin: Nicolai, 2005), 60–63.

7. Hans Stimmann, "Kritische Rekonstruktion und steinerne Architektur für die Friedrichstadt," in Neue Berlinische Architektur: Eine Debatte, ed. A. Burg (Basel: Birkhauser Verlag, 1994), 119.

A New Way Through: Manifesto for Coexistence. *Source: Lucas di Gioia.*
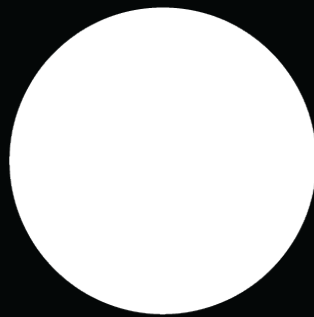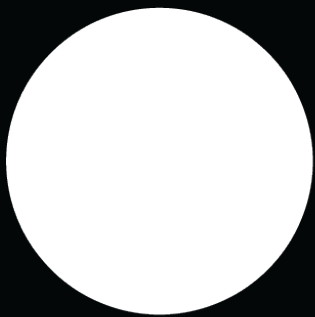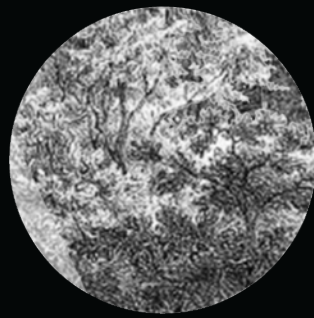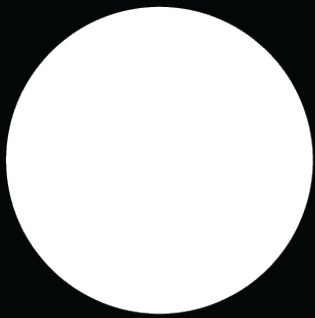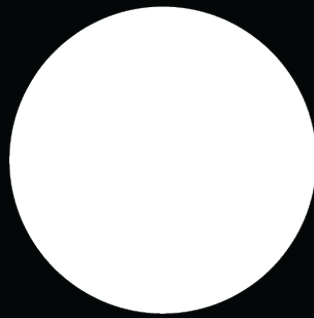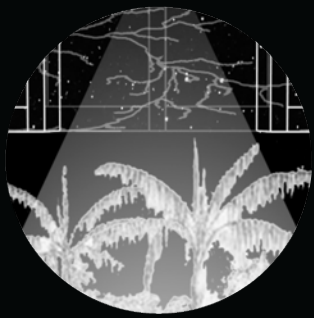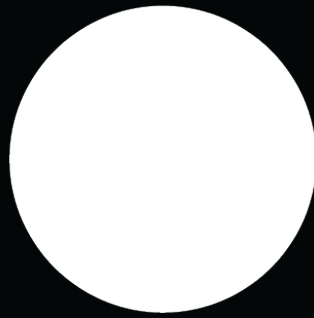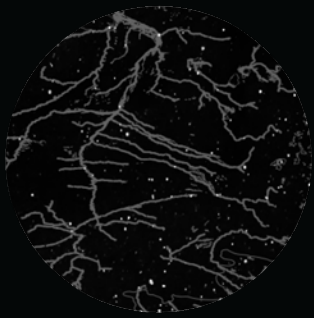
Territories of Mediation

Shared Existences in the Brazilian Amazon
Lucas di Gioia

The Amazon Basin is one of the largest river drainage systems in the world, with numerous tributaries that form a complex network of waterways flowing towards the Atlantic Ocean. River ecologies depend on free-flowing water so that hydrological cycles can continue to thrive. Riverine communities and ecologies are intrinsically dependent on free river flow to regulate their activities.

The Xingu River sits within the Amazon Biome, flowing into the Amazon River. Its basin is part of the eastern deforestation belt of the Amazon, where encroaching activities threaten the rainforest. The Xingu Basin holds a multitude of riverine endemic species and is home to around 26 Indigenous Amerindian nations across 21 Indigenous territories and 9 nature conservation units. The complexity of its spatial arrangement is only surpassed by the extent of its history and ecological complexity.

In the Xingu River basin, all life has developed around water in the physical and metaphysical realms. The importance of the river pulse and its free flow, which in turn depends on continental and planetary water flow cycles, has been suddenly altered and blocked by the Belo Monte Dam project. Such conditions are stark reminders of the detrimental effect that infrastructure projects of this magnitude can have when environmental and ecological cycles are not fully taken into consideration.

This article summarises the thesis defended in 2021 developed within the Transitional Territories Studio of the Department of Urbanism part of the Faculty of Architecture of TU Delft.

CONTEXTUALIZATION

Facing ecological collapse from resource-based developmentalism, life on Earth is increasingly at risk. Urbanization now extends beyond traditional hinterlands, as planetary urbanization theory (Brenner & Schmid, 2012) explains. This
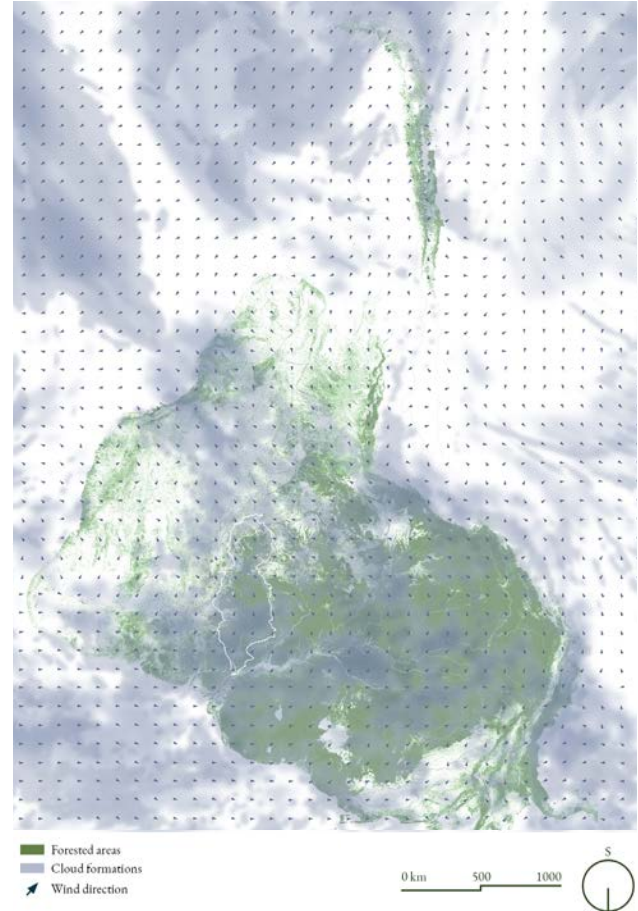
Fig. 1: The Amazon rainforest as a continental biotic water pump. Source: Lucas di Gioia.

tinction (Pezzuti et al., 2018). Roads built for dam construction have further degraded biodiversity (Guerrero et al., 2012; ELETRONORTE, 2009)

The Juruna (Yudjá) people, riverine inhabitants of the lower Xingu River, have faced disruption from the Belo Monte Dam, impacting their fishing-based livelihoods and traditional ways of life, pushing many to urban peripheries (Guerrero et al., 2012). This has mobilized them and other Indigenous groups to resist such projects. Indigenous populations recognize the importance of ecological stability for sustainable living (Durán Calisto, 2019; Tavares, 2016), viewing all living beings as humans, not commodities (Krenak, 2019; Castro, 2002; 1996).

Modern consumption demands have desynchronized natural, social, and economic systems, defining the Anthropocene and threatening biodiversity (Recubenis Sanchis, 2020; Steffen et al., 2015). The Juruna exemplify Indigenous experiences of this desynchronization, living through an altered world and resisting

modernity (Krenak, 2019; De Castro, 2002). The climate crisis threatens humanity's survival, not all existence (Krenak, 2019).

PROBLEM

In contrast to the hegemonic planetary worldview, Indigenous cosmologies view the Amazon not as a resource for exploitation but as an interconnected system where humans are integral to the biome (Krenak, 2019). The land, rain, and other elements hold diverse meanings that may not easily translate across worldviews. Cosmopolitics, as conceptualized by Isabelle Stengers (2010), challenges the notion of a singular world, emphasizing a pluriverse where different entities coexist. This differs from Western perspectives, which often perceive cultural differences as variations on a single reality (Latour, 2004).

After the construction of the Belo Monte Dam in the Lower Xingu River basin, local biodiversity has been endangered by the loss of natural flooding and drought cycles, which regulate the reproductive cycles of fish species that migrate from the river source. Additionally, restrictions on water flow downstream, compounded by limitations on river navigation due to the dam's operations, have altered the traditional patterns of human movement and interaction along the river.

The resulting conflicts over the allocation of water resources highlight the complex interplay between ecological sustainability, cultural preservation, and economic development. However, the significance of these issues extends beyond local disputes. The rising deforestation of the Amazon rainforest exacerbates the situation, as it directly impacts the region's hydrological cycle. The reduction of forest cover diminishes the biotic pump effect, leading to decreased water discharge upstream and, consequently, reduced flow downstream. This exacerbates existing conflicts over water allocation and places further strain on local ecosystems already on the brink of collapse.

This interconnected web of environmental and social challenges underscores the need for holistic and collaborative approaches to conservation and development in the region. Addressing the root causes of conflict requires recognizing the interconnectedness of ecological processes, cultural practices, and economic ac-

tivities. Only through inclusive and sustainable management strategies can the Xingu Basin and its inhabitants navigate the complex challenges they face and ensure a resilient future for both people and the environment, without compromising their culture and cosmovisions.

SYNCHRONIZATION FRAMEWORK

The Belo Monte Dam's impact on the Xingu Basin illustrates the challenges of cosmopolitics, highlighting the interconnectedness of human and non-human actors in shaping political, social, and ecological processes. This case study underscores the clash of perspectives among Indigenous communities, environmental activists, government agencies, and energy corporations, making it difficult to address the diverse desires and values of different worldviews.

The river itself acts as a significant actor, with its natural dynamics influencing human decisions. Fish species, vegetation, and symbolic
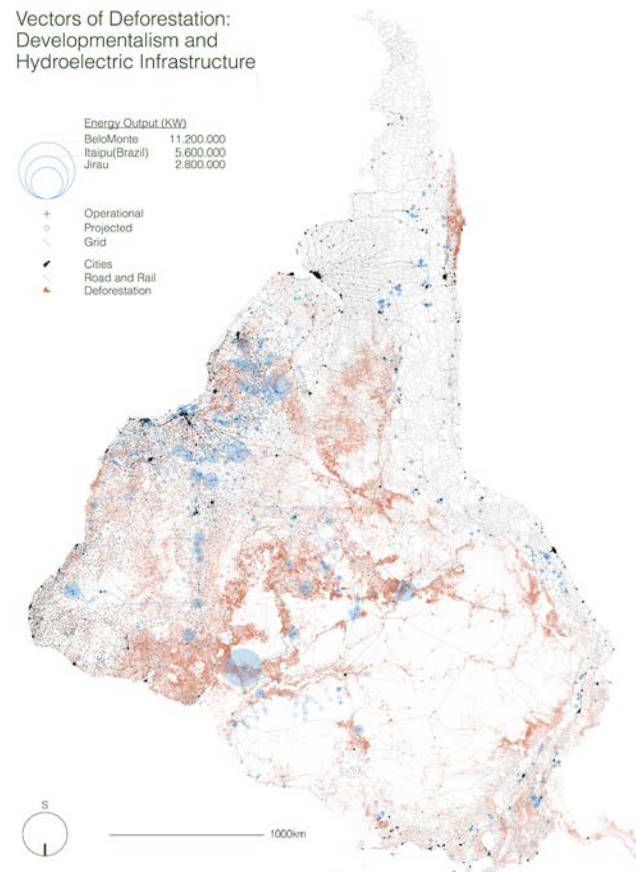

Fig. 2: Vectors of deforestation: developmentalism and hydroelectric infrastructure. Source: Lucas di Gioia.
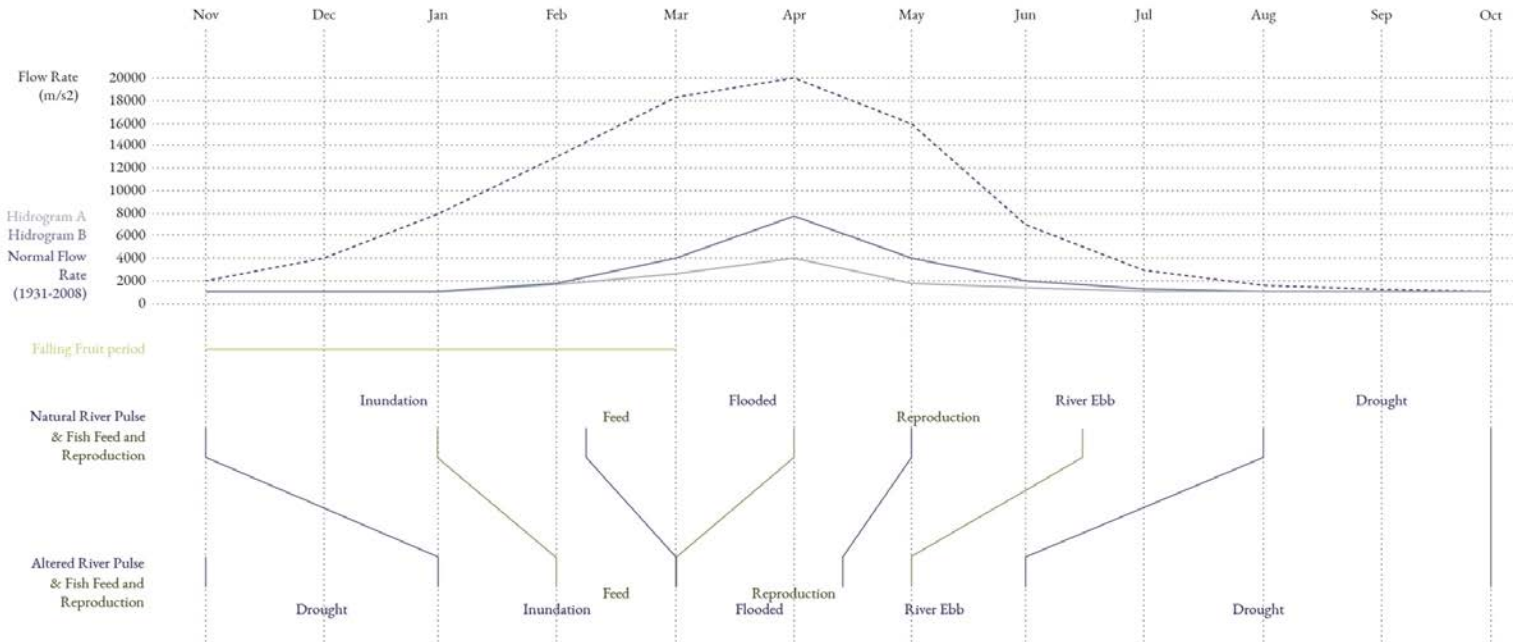
Fig. 3: Consensus hydrogram and river flow diagram. Source: Lucas di Gioia, 2020. Data: De Olho no Xingu, 2019.

rock formations also play crucial roles in the socio-ecological network affected by the dam.

A cosmopolitical approach is necessary for envisioning a shared occupation of the Volta Grande do Xingu, allowing the coexistence of diverse cosmovisions with national aspirations. This vision must balance utopian desires with the dam's operational realities. Utopian proposals, which can be imagined by anyone (Koning & Van Dijk, 2021), offer transformative power beyond current possibilities.

Indigenous mediation practices (Brandao Barrios, 2020) can help synchronize landscape transformations with social system changes, reconciling different worlds and aligning cosmovisions. To mediate effectively, it is essential to identify the values of each worldview, categorized as Modern, Local/Indigenous, and Natural. Understanding these perspectives can reveal potential conflicts and alliances, enabling mediative designs.

This investigation revolves around values, human presences and territories which are out of sync with each other as well as with themselves, from their own doing, or by force of others. The question of synchronisation is fitting when we comprehend the physical scales and timeframe of systems at play, from the individual to community, river basin to territory and nation to region. It is through a cosmopolitical proposition (Stengers, 2018) that we must untangle the web of crossed values present within the systems governing the Xingu Basin territory.

Four Mediation Principles, informed by Ecological and Landscape Urbanism, guide the alignment of ecology, landscape, and society with Urban Design, as well as conflict management for coexistence and reconciliation:

1. Regeneration: Guides ecological and social systems toward recovery, renewing their capacities and synergies.

1. Stabilization: Achieves balance in deregulated but not destroyed systems.

1. Rehabilitation: Addresses partially damaged systems for partial remediation.

1. Re-signification: Aids symbolic or metaphysical repair for systems beyond physical repair.

The Synchronization Framework maps the alignment of cosmovisions in the Volta Grande do Xingu, organizing strategies by their synchronization potential in themes like Water Flow, Ecological Sustainability, Basin Connectivity, and Territorial (re)Settlement. Systemic Mappings spatially indicate where design and governance strategies can re-synchronize systems and

Fish nesting sites | Human Settlements | Human Settlements
Dam | Roça Agriculture | Human WaterConnections
Vegetation Cover | Cattle Ranching | Water

0 km   5   10
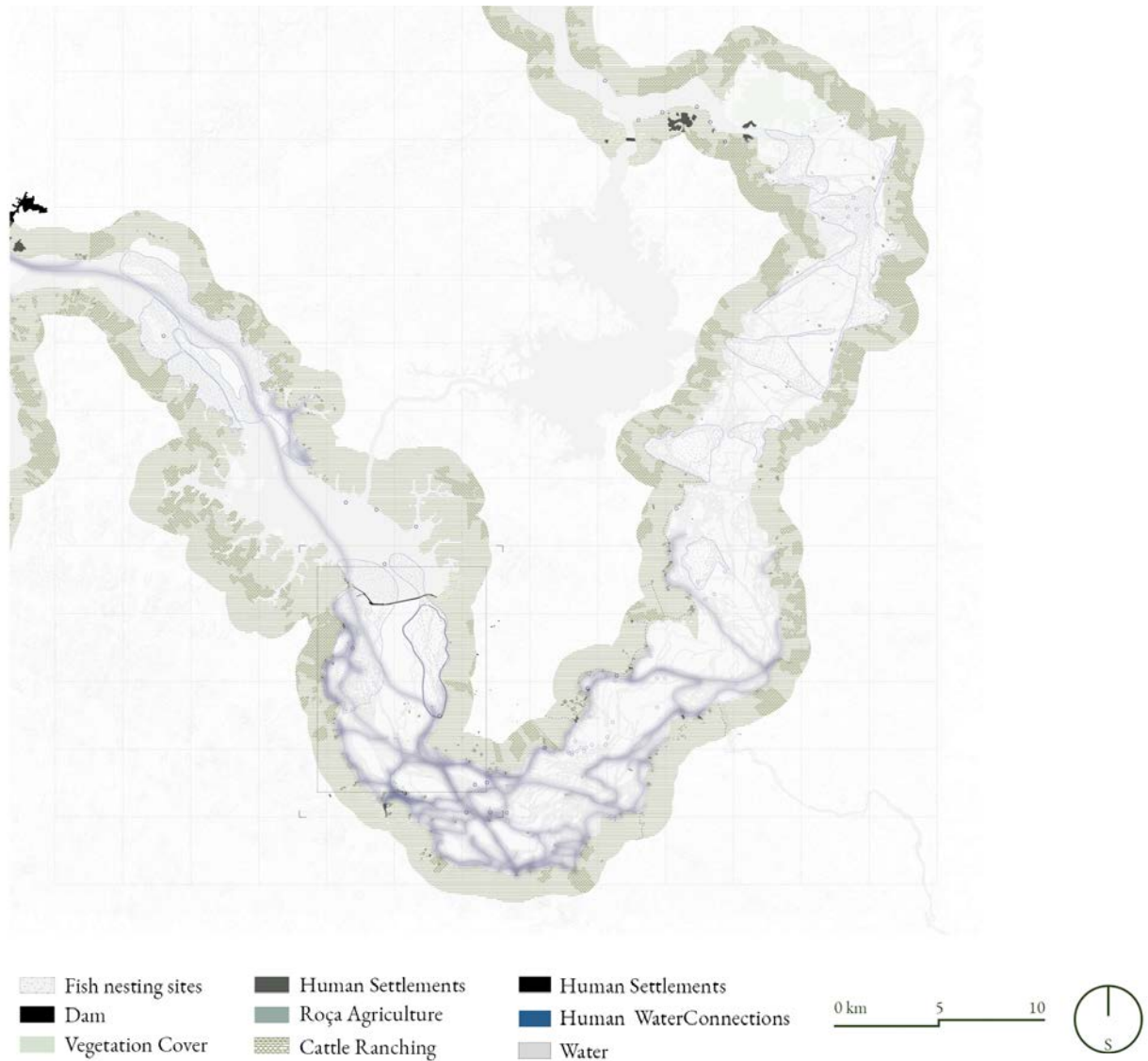
Fig. 5: Systemic mappings for water flow systems in the Volta Grande do Xingu. Source: Lucas di Gioia, 2021.

achieve mediation, with specific strategies and design actions tailored to each system and site.

By plotting the Systemic Mappings, we indicate spatially where specific design and governance strategies can re-synchronize systems and achieve mediation. Mediation Principles indicate which strategy must be utilised in the given system, site and involved aspects and Design Actions, indicate the intent of spatial solutions.

DESIGN OUTCOMES

Through the Systemic Mappings methods, the Alignment Strategy is built up utilising the identified Systemic and Situational mapped elements and their consequent alignments with

procedural aspects such as Laws, involved stakeholders and identified objects from the Synchronisation Field table. With these elements we have identified the specific elements needed or part of the system in question. Mediation Principles indicate which strategy must be utilised to achieve mediation in the given system, site and involved aspects. By utilising the Design Actions, spatial propositions can be placed to achieve and set a designed mediation strategy.

From the Water Flow Systemic mappings, Mediation Principles are selected which can answer to the needs of synchronisation of these systems. The location just after the Pimental Dam in the Volta Grande do Xingu River bend has the most potential to receive Design Inter-
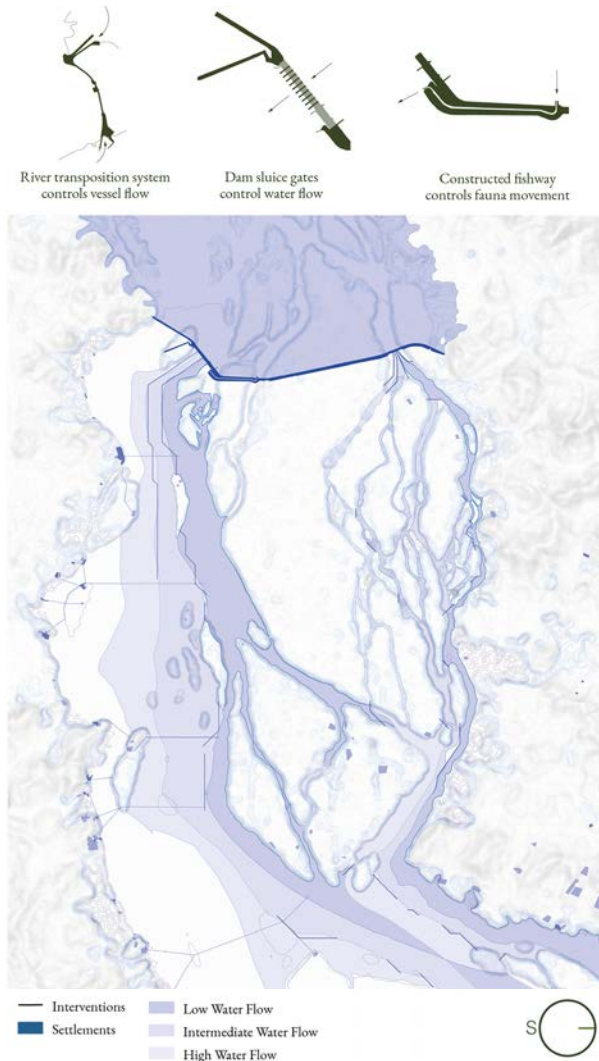
Fig. 6: Designed dam interfaces for mediation master plan. Source: Lucas di Gioia, 2021.

faces for meditation which can bring the most impact on the water flow.

The re-naturalization of this branch of the river, will allow for fish to return to their natural nesting and feeding cycles in the area, re-connecting species throughout the river basin. Allowing for the natural river pulse to occur and natural river movements to flood forested land areas will facilitate the entry of fish species which are dependent on falling fruit to sustain their diets and so guarantee their cycles of nesting. This is possible with a constant open flow of water through the dam, with a design that considers the reservoir's need for water storage as well as the river pulse water level changes which guarantee the cues for fish given by the river's movement. The partial opening on Pimental Dam is designed to permit water flow levels in accordance with the permitted hydrograph projections from IBAMA(2019) and

ELETRONORTE (2009), whilst maintaining the natural pulse dynamic of the river.

Dikes are strategically placed downstream directing and concentrating constant flowing water to sustain river ecologies and social activities. The dikes are designed to capture sediment through time, and eventually be covered with vegetation, re-naturalizing the landscape.

Given the redirection of water, some parts of the river will become permanently dry and of difficult accessibility given the rocky riverbed nature. Pathways would be constructed to connect communities with the water and river islands, helping to maintain their way of life connected to the river.

CONCLUSIONS + RAMIFICATIONS

Hydropower infrastructure, as a state tool, aims to integrate territories and populations into Brazil's nation-state framework, often at the expense of existing ways of life. Recently, hydropower has been promoted in international forums to combat climate change, despite evidence of its environmental damage and impact on those who protect nature. While Brazil needs energy for growth, a better, decentralized, and regionally adapted energy grid is crucial.

Fig. 7: Dam interfaces: strategic openings and re-naturalization dams. Source: Lucas di Gioia, 2021.

Reduced Water Shore Intervention
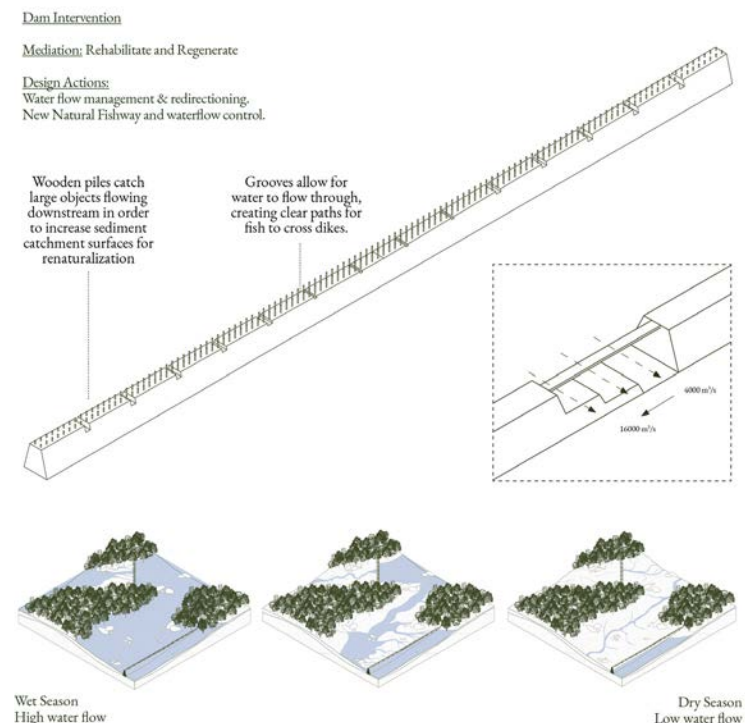
Mediation: Resignify

Design Actions:
Re-connection of isolated shore populations.

Wide pathway
to drag canoes
along

Floating
platforms
which adjust to
water level.

Access stairs to
reach riverbed
along route.

Wet Season
High water flow

Dry Season
Low water flow
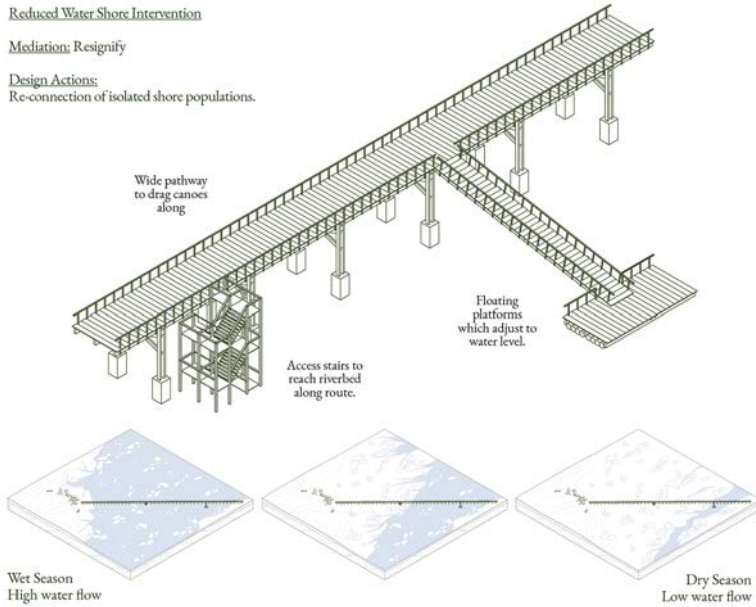
Fig. 8: Pathways for reduced water flow re-connectivity. Source: Lucas di Gioia, 2021.
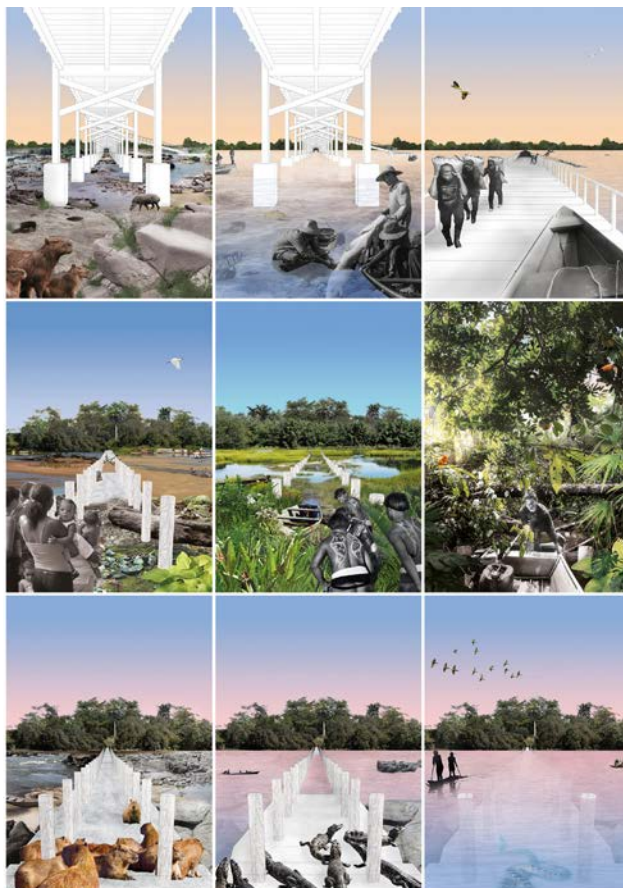
Fig. 9: Visualizing interfaces. Source: Lucas di Gioia, 2021.

Recognizing the territory as a pluriverse is essential for Brazil's sustainable future. Embracing multiplicity, as some nations have, can address social and ecological challenges, especially in the exploited and impoverished South American region. Institutions focused on strengthening natural and Indigenous relations should lead legislation and procedures for ecological preservation.

The government and society must recognize the Amazon's importance for energy, agriculture, and water supply. Deforestation risks catastrophic economic and social collapse. A paradigm shift towards national security policies supporting a forested Amazon is essential. Infrastructure projects should serve regional sustenance rather than solely Brazil's territorial ambitions. Planning and governance must originate from within the region.

Revising municipal boundaries and preservation territories should favour local lifestyles and enable sustainable landscape management. Governance arrangements rooted in local landscapes and millennia-old self-governance can sustain systemic equilibrium. Involving local populations in management organizations will enhance preservation and ecological processes, bolstering the region's position and autonomy.

This research questions urbanism's ability to propose designs for such territories, emphasizing the need to address worldview asymmetries and conflicts. Urbanism must develop designs for these frontier territories. A synchronization framework can help understand these conditions and facilitate non-definitive, solution-oriented actions. Moving beyond the modernist urbanism paradigm requires integrating cosmopolitics theory. Would *Cosmourbanism* be possible?

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Fig. 10: A New Way Through: Manifesto for Coexistence.
Source: Lucas di Gioia.

Infinite Permeability

Richard Joseph Findley (MArch '78)

Interior of Japanese Great House (oil on canvas, 36" x 36")
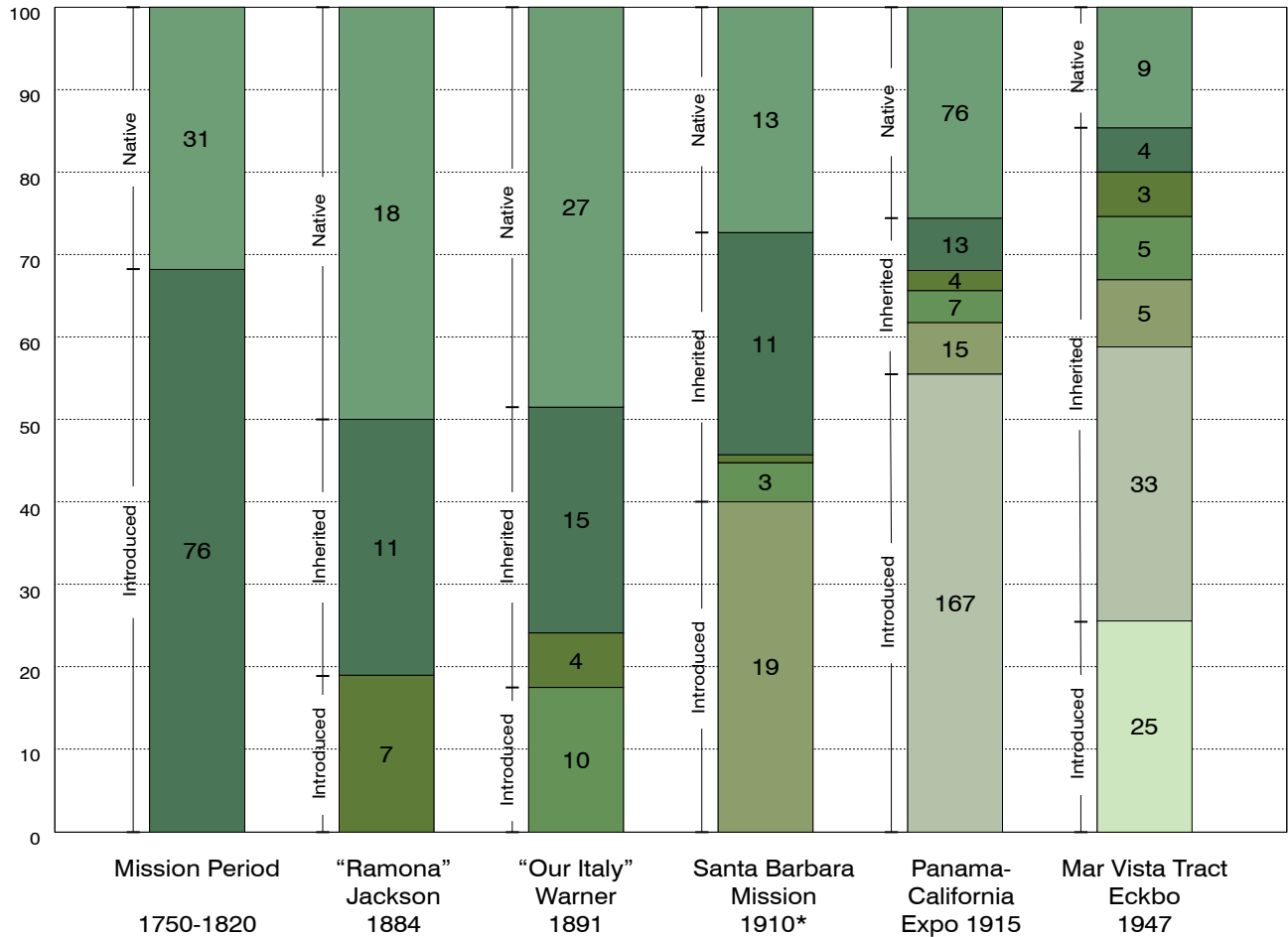
Fig. 1: Analysis of historical plant palette models. Source for all figs: Jeff Stevens.

HOA Plant Palettes

The Curation Of
Californian Aesthetics
Jeff Stevens (MArch II '22)

Within the monotony of Southern California's suburban communities, layers of ecological and cultural history permeate into the present. With a climate so temperate, and a landscape so malleable, Southern California can readily transform into any image projected upon it. Philosopher Jean Baudrillard writes, "On the aromatic hillsides of Santa Barbara, the villas are all like funeral homes. Between the gardenias and the eucalyptus trees, among the profusion of plant genuses and the monotony of the human species, lies the tragedy of a utopian dream made reality."[1] This utopia is constantly being reimagined and realized in the landscape. The re-

sulting landscape is self-referential, dominated by introduced species, and closely tied to mythologies of place. The research here interprets the "profusion of plant genera" in two suburban communities as an aspirational retelling of the region's history, offering insights into which utopian visions have permeated, been filtered out, subsumed by others, or created anew.

The research begins with an overview of the region's horticultural history, analyzing six key historical accounts of landscapes and gardens (fig. 1). The goal is not to provide an exhaustive list of native or introduced plant species (California has over 8,000 endemic plant species), but to mark the existence of plants in knowable historical records. By comparing the plants mentioned in each account, we can see the extent each model was mimetic or created anew.[2] We start with the Mission Period when California was under the Spanish Empire, where written accounts of the landscape were compiled into a list

of species with over 100 unique genera.[3,4] Later, when California belonged to the new nation of Mexico, ranch houses with courtyard gardens dotted the landscape while millions of cattle and sheep devoured native meadows, leaving behind cacti and scrub.[5] The most vivid account of the landscapes from this period comes from Helen Hunt Jackson's bestselling romance novel *Ramona*. The story follows a young half-Native American and half-Mexican heroine, faced with racism from both Californio high society and the new Anglo immigrants, searching for a place to call home.[6] A decade after *Ramona*, Charles Dudley Warner's book, *Our Italy*, offered a different vision, boasting of the region's farming opportunities and horticultural diversity.[7] While *Ramona* was winning the hearts of Americans and Warner was tempting entrepreneurs to move West, Father Romo tended to his garden in the former workyard at Mission Santa Barbara. Romo's recently constructed, Italian cloister-inspired garden was accepted by many as a model dating back to the mission era, inspiring imitators across the region.[8,9] In 1915, Old California and new farming opportunities collided in San Diego's Balboa Park at the Panama-California Exposition. Bertrand Goodhue's architecture confirmed the Spanish origins while hundreds of new species were brought from Australia and South Africa, as the landscape was reinvented as a "Semitropical" paradise.[10,11] After World War II, the mania for Spanish Romance had waned, but the temperate climate attracted GIs looking for new homes with lush gardens and simple maintenance. The Mar Vista Tract, designed as a collaboration between Gregory Ain and Garrett Eckbo in 1947, is one of the earliest examples of

a community-specific plant palette, one dominated by introduced species inherited from the past.[12] The new introductions become inherited species in the following graphs, tracing how new plant introductions permeate through history.

Just like the Eckbo-designed Mar Vista Tract, the landscapes of Southern California's planned communities today are largely dominated by introduced species. This is not by accident or personal taste. In new communities, the developer creates a Homeowners Association (HOA) that provides residents with Covenants, Conditions, and Restrictions (CC&Rs), a legally binding document that dictates the community's aesthetic guidelines. One aesthetic guideline is the HOA-approved plant palette, which states the specific plant species allowed in the community. This simple list of botanical names is a valuable tool in mythologizing the state's ecological and cultural histories, as homeowners can face heavy fines if their landscaping fails to comply with community standards.

Two new communities were selected for this study: Irvine's Orchard Hills and Rancho Mission Viejo. Both are still selling new homes and located just twenty miles apart in Southern California's Orange County. The CC&Rs for Orchard Hills introduce the community planting palette as a "Traditional California" landscape.[13] A cursory glance of the palette reveals typical suburban plants with notably few natives. In their conception of California tradition, the regional landscape is mostly introduced species (fig. 2). Meanwhile, Rancho Mission Viejo describes its plant list as a "celebration of California's Ranch heritage" (fig. 3).[14] Their CC&Rs separate subdivisions into themes that follow specific

Fig. 2: Historical composition of Orchard Hills' "Traditional California" palette.

Fig. 3: Historical composition of Rancho Mission Viejo's "Farmhouse Interpretive" palette.
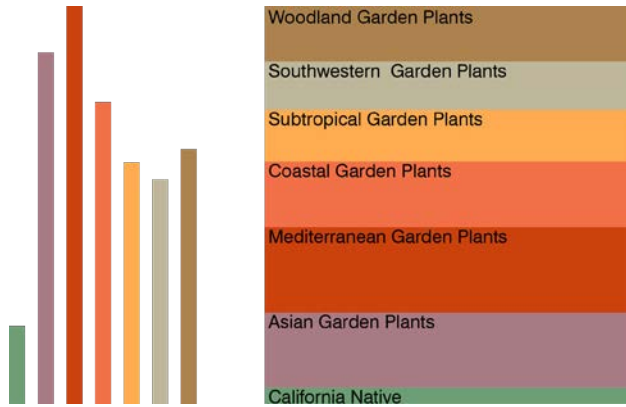
Fig. 4: Thematic palettes compared to Orchard Hills'
"Traditional California" palette.

Fig. 5: Thematic palettes compared to Rancho Mission Viejo's
"Farmhouse Interpretive" palette.

plant palettes, including "California Bungalow" and "Farmhouse Interpretive." While it can be tempting to dismiss these nostalgic community narratives as something of a pioneer town or "theme park," understanding them in this context is where they gain their cultural traction.[15,16] Just as the pioneer town chooses a specific moment in history, real or fictional, to represent in perpetuity, the planting palette does the same. The approved plant palette acts as a historical filter selecting specific moments and ideas about California to realize in the landscape. By comparing each historical palette to the community-approved palettes, we see how much of each narrative is reproducible in the present. The community plant palettes are more than 50 percent similar but where they differ can be mapped to historical representation.

One limitation of comparing plant palette data is that all plants are treated as equal, ignoring the cultural significance of specific plants. For example, the Fan Palm is possibly the most iconic plant in California, but Rancho Mission Viejo's "Farmhouse Interpretive" palette forbids the common Mexican Fan Palm and the native Californian Fan Palm.[17] But by comparing over 2,000 species from 400 unique genera, the data shows Rancho Mission Viejo suppressing the "Semitropical" conception of California from Balboa Park and preferring pre-19th century historical models. Because the fan palm permeated through layers of history to more contemporary conceptions of California, it was intentionally excluded. Meanwhile, the fan palm is allowed in Orchard Hills, which borrows mostly from 20th-century landscape models.[18]
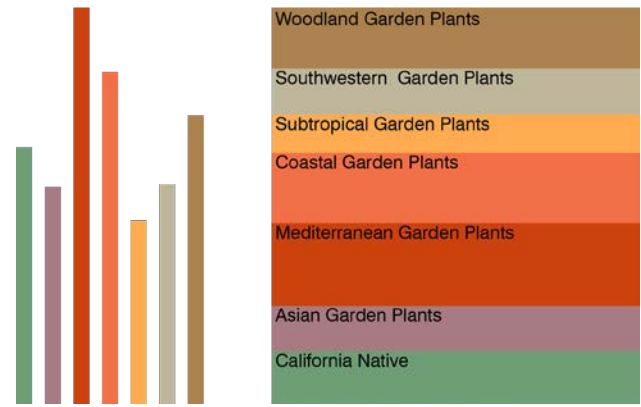
It is impossible to know the intent behind each specific plant choice as the reasons are complex, and CC&Rs often speak to signifiers rather than significance. We can see how the general outcomes reflect the lack of neutrality and the simultaneous historical weight of aesthetic decisions. Historian Phoebe Young observes that it may have been "Spanish Romance" that inspired many Anglo immigrants to revive the Mission Style, it also brought a social order where new Anglo-American immigrants inherited the roles of Spanish colonizers, displacing and subjugating the local population.[19] So, while in Rancho Mission Viejo, the revival of plants from Ramona might have been motivated by the culturally dominant farmhouse aesthetic, characters from the story permeate to the present. Which character remains a question: will they sympathize with the novel's young mixed-race protagonist, or do they more easily identify with the lavish lifestyle of the landowning Californio society?

HOA-approved plant palettes can also be projective as they forge a new idiomatic expression for the region. Throughout California's history, land prospectors, boosters, and developers, through HOAs, have reinvented the region to fit current trends and market demands. Comparing the approved plants to thematic plant palettes in Bob Perry's Landscape Plants for California Gardens, a book frequently used in planting design classes in Southern California, we see the extent to which contemporary trends are expressed in the landscape. While the Mediterranean remains an integral part of California's identity, we also note how the "Coastal Garden" palette of imported plants with high salt tolerance, necessary in beach communities, has permeated

both communities as an aspirational style despite being miles from the ocean (fig. 04, 05).[20,21] Where the communities differ is Rancho Mission Viejo uses far more California natives, and Orchard Hills heavily favors plants belonging to Bob Perry's "Asian Garden." Before accusing either community of pandering to new trends or markets, we should recognize that, historically, reimagining the region with a new aesthetic is possibly the most "Traditional California" thing to do.

In the early 20th century, we saw how "Spanishness" was reinvented with plants from every continent while retaining little from the actual Mission Period. Today, Orchard Hills and Rancho Mission Viejo ground themselves in different periods of the region's history. However, their memories of that history are highly curated with not only historical plants but also introduced species. Through the HOA-approved plant palette, the suburban lot becomes a contested site for remembering the past and imagining the future of California's landscape.

Notes + References

1. Jean Baudrillard and Chris Turner. *America*. (London; New York: Verso, 1989), 37.

2. Due to the use of common names in many descriptions, many plant species could only be determined down to the genus. For this reason, it was decided to use only genera for all historical plant data and not discriminate against more detailed descriptions.

3. Allan A. Schoenherr, *A Natural History of California*, 1. paperback printing, [Nachdr.], California Natural History Guides 56 (Berkeley, Calif.: Univ. of California Press, 2002).

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7. Charles Dudley Warner, *Our Italy* (Harper & brothers, 1891).

8. Elizabeth Kryder-Reid, *California Mission Landscapes: Race, Memory, and the Politics of Heritage* (University of Minnesota Press, 2016).

9. Romo began gardening the patio garden in 1872. A botanical survey was completed in 1910, the same year Mission San Juan constructed their version of a Mission Garden.

10. Paul Thiene, "The Exposition Flora," in *Official Guide Book of the Panama-California Exhibition*, n.d., 55–79.

11. "Semi-Tropical California" was also the title of Major Ben C. Thurman's much earlier 1874 book. It is characterized by a love of climate and agriculture and a seething disdain for the unimproved landscapes, which Thurman calls a "forbidding waste." The Panama-California Exhibition, through complete transformation, realized the potentials outlined in this early guidebook.

12. "Mar Vista Tract -a Community Website," accessed May 18, 2024, https://www.marvistatract.org/plant_list.html.

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15. Michael Sorkin, ed., *Variations on a Theme Park: The New American City and the End of Public Space*, 1. ed., 8. print (New York: Hill and Wang, 1997).

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17. The Mexican fan palm is locally well-known as an introduced species and was heavily planted in the 1930s in preparation for the 1932 Olympics.

18. In a strange coincidence that needs more investigation, homes in Orchard Hills cost approximately 50% more per square foot than those in Rancho Mission Viejo, and the designer Mar Vista tract also cost approximately 50% more than comparable homes in the area.

19. Phoebe Schroeder Kropp, *California Vieja: Culture and Memory in a Modern American Place* (Berkeley, Calif.: University of California Press, 2008).

20. Bob Perry, *Landscape Plants for California Gardens: An Illustrated Reference of Plants for California Landscapes* (Land Design Pub., 2010).

21. The term "Mediterranean" was frequently used in Dudley Warner's *Our Italy* and the topic of Thomas Church's 1927 Harvard thesis, *A Study of Mediterranean Gardens and their Adaptability to California Conditions*.

Fig. 1: Fragmentation: Design and Counter-design in Palestine, exhibited at the GSD. Source: Fragmentation Collective, 2023.

Fragmentation

Design and counter-design in Palestine

Issam Azzam (MLA I/MUP '25), Hana Cohn (MLA I '24), Matthew Kennedy (PhD History and Theory of Architecture), Melanie Louterbach (MLA I '24), Dominique Mashini (DDes '24), and Cory Page (MLA I/MUP '25)

The Fragmentation Collective was founded by a group of Harvard Graduate School of Design (GSD) students to examine the role of design in the *Nakba* in Palestine. The *Nakba* (Arabic for "catastrophe") is a structure of fragmentation by design, constructed and reconstructed, to impose instruments of domination over Palestinian lives. It is from this foundational premise that the collective's work emerges, with a core understanding that design is never incidental. The very etymology of the term "design" suggests not only the act of marking a surface but also a purpose: to contrive, to plot, to intend. The work of imagining and producing the built environment is not, and must never be, exempted from discourses and struggles surrounding systemic and persistent racism, inequity, economic exploita-

tion, domination, and violence. Recognizing that design is only one of many instruments, we must strive to transform our pedagogies, reshape our practices, and apply our skills in a way that resists complicity and complacency. The work of designers, in imagining, illustrating, and constructing the built environment becomes ever more urgent in the wake of the genocidal war imposed on Palestinian people.

We must urgently recognize that the everyday lives of Palestinians have been indelibly marked by designed interventions, both material and immaterial, permeable and impermeable. These include architectural, infrastructural, and other environmental elements. Most visibly and viscerally, the walls and fences, illegal settlements, surveillance apparatuses, and armed checkpoints dictate the movements of people, goods, and ideas. We must also include the legal frameworks of fragmentation that deem some people, places, and things to be invisible and/ or illegal. For example, the instrumentalization of "natural protection" laws enacts a functional prohibition on the harvesting of culturally significant native edible plants like *za'atar* and *'akkoub.* This was the central theme of Jumana Manna's 2022 film *Foragers,* which the Fragmentation Collective screened alongside our exhibi-
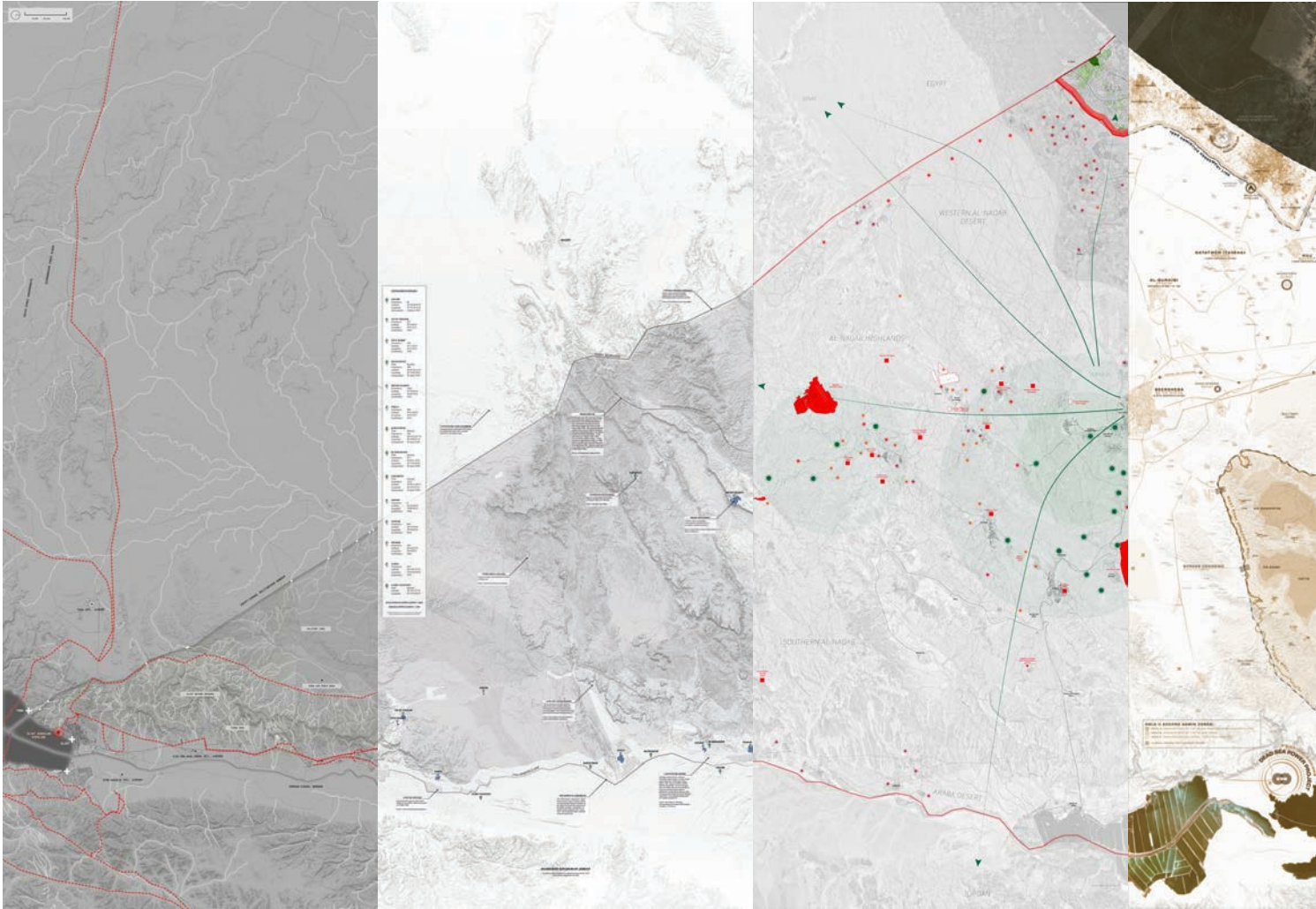
Fig. 2: Composite map. Source: Fragmentation Collective, 2023.

tion-roundtable discussion on April 15, 2024. In addition, in positioning design, we also offer the position of counter-design to identify practices that may fall out of the traditional range of design, yet that extend to a population living under conditions of socio-spatial oppression a limited range of agency. It is through such acts of subversion that oppression might be transformed into opportunities for resistance, resilience, and resurgence. As designers, we have much to learn from these practices.

DESIGN SKILLS

We begin by reiterating our understanding of the *Nakba* as a structure of fragmentation by design. To initiate this conversation, it is necessary to make visible the social, political, and environmental fragmentation that Palestinians face at all scales. It is in this making visible, that

designers position one of their many important contributions to the field of Palestinian studies. Here, designers employ their technical representational skills to illustrate the fragmentation and violence of the *Nakba*. To imagine trajectories of liberation, we must name and make visible systemic injustices at multiple scales. In design school, we become educated to represent, to question the presumption of an objective representation and instead ask the questions: *Who* made the drawing? *What* did they want to show or hide? With the privilege of our design education, how can we subvert these powerful tools to portray people, environments, and systems made invisible by the map? How can drawing function as one tool to render the struggle against oppressive systems more visible? Drawing is the tool by which we communicate critical narratives through the means of a representational typology—the plan, the diagram, the model. For

Map-makers: Issam Azzam, Hana Cohn, Melanie Louterbach, Cory Page, Felix Rosen, Dafne Saint-Hilaire, Makio Yamamoto.

the first effort of the Fragmentation Collective, we began with: the map.

THE MAP: A PROCESS

Fragmentation Collective brought together twenty GSD students from the landscape architecture and urban planning programs to collaborate on a critical cartographic exercise. As stated earlier, the territorial fragmentation of Palestinians is highly complex and multi-faceted. As such, this mapping attempt does not attempt to be a comprehensive or complete analysis of the *Nakba's* total extent of fragmentation. Yet in the face of Israel's accelerated destruction of Palestinian territories, and the accompanying silence of academic design institutions, it was clear we had to start somewhere. An important part of our work was collecting archival maps, open-source GIS layers and satellite visualizations to illumi-

nate infrastructures, ecologies, displaced populations, natural resources, and political histories that continue to shape the lives of Palestinians. Using these, we were able to trace, cut, fill, map, and create new representations of mapped data. In our preliminary workshops, we were inspired by the mapping work of Léopold Lambert: "The Architecture of Settler Colonialism in Palestine." [1] Lambert himself visited the GSD on March 1, 2024, to lecture on Palestine, Algeria, and the French Banlieues for the GSD student organization MEdiNA, which focuses on design issues in the Middle East and North Africa.

Following Lambert's projection, we rotated the map to establish a wider horizontal breath. From here, we divided the map into seven transects (36"x 87") for each student to map. Each student was tasked with focusing upon one thematic scope of fragmentation to map their transect. The topics of the resultant transects in-

Fig. 3: Fragmentation roundtable event on April 15, 2023. Source: Fragmentation Collective, 2023.

cluded mapping oil pipelines, deserted Bedouin villages, energy enclaves, water accessibility, and much more. From the Red Sea to the Lebanese border, these maps trace an axis that reveals gaps, lines, and overlaps that reflect a larger political agenda to splinter, displace, and isolate indigenous populations in the occupied territories of Palestine. Taken together, the work collates disparate datasets and perspectives forging an "exquisite corpse" of occupying forces at work. Despite the multiple viewpoints and entryways into the project, common threads come to the fore, highlighting the layered nature of settler colonialism and the labor required to maintain oppressive regimes. The composite map (252" x 87") was displayed as the center-piece of the Fragmentation Collective's first exhibition in the Quotes Gallery at the GSD, which ran from April 15 to May 26, 2024. The opening of the exhibition was paired with a roundtable event in Piper Auditorium; speakers included Nora Akawi, Rabea Eghbariah, Ali Hishem Musleh, and Sophia Stamatopulou-Robbins. The "Fragmentation: Design and counter-design in Palestine" map was awarded the 2024 Fisher Prize for excellence in GIS by Harvard University Center for Geographic Analysis. The exhibition and rountable event were supported by the GSD Racial Equity and Anti-Racism Fund.

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The Blue Heart Delta

A perspective for an evolutionary habitat permeability
Fábio A. Alzate Martinez

The Blue Heart delta, a severely altered estuarine landscape located in the Netherlands, is an example of the intricate interdependencies between human intervention and ecological transformation. Once characterized by its dynamic habitats, this deltaic system has undergone significant anthropogenic alterations, primarily due to extensive flood control measures and intensive land use. While these interventions have ensured protection for the thriving Dutch urban centers and intensive agricultural lands, they have also resulted in the fragmentation of the natural landscape and the degradation of critical habitats. This article explores the ecological consequences of these interventions, demonstrating the relationship between hydrogeomorphology, land use, and the delta's evolving ecosystems. It also advocates for a paradigm shift in water management strategies toward ecosystem-based adaptation frameworks that can allow human-nature habitat permeability in the context of increasing climate uncertainty.

ESTUARINE DELTA LANDSCAPE

The Blue Heart is an altered estuarine delta which connects the Alps and the North Sea through the Rhine basin. Despite being currently a highly controlled water system, composed of the IJssel, the lakes IJsselmeer and Markermeer, and the Wadden Sea, this region was once defined by its fluid water-land transitions and landscape permeability (fig. 1).[1] Following a period of peat expansion around 1500 BC, the deltaic landscape began to emerge when a series of tidal variations and storm surges created Lake Almere by uniting diverse water bodies. In 1287 AD, the St. Lucia Flood opened an outlet to the sea, morphing the freshwater peatland lake into the brackish water estuary of Zuiderzee.

Estuaries are critical habitats, acting as "nurseries of the sea" due to the diverse ecosystems that flourish in the brackish water's gradi-
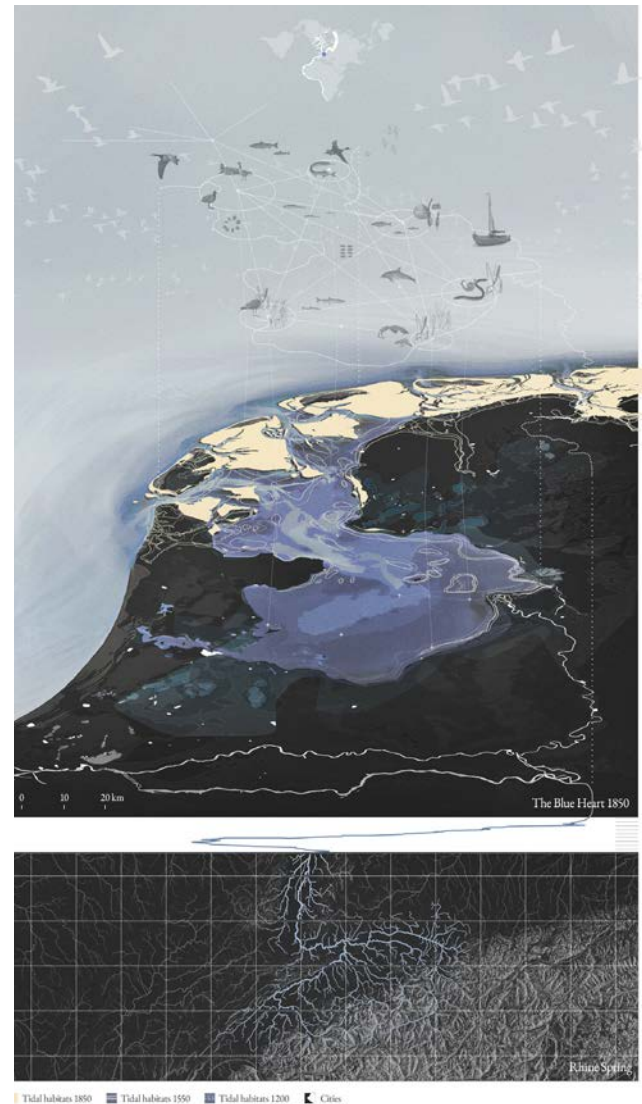

Fig. 1: The dynamic natural state and origin of the Blue Heart estuary. Source: Fábio Alzate-Martinez, 2023.

ents and tidal habitats. In the Blue Heart, since the Zuiderzee period, fish migration routes intersect with the East Atlantic Flyway, providing feeding grounds and shelter for the migrating birds during the winter periods. This migratory route of coastal waterbirds extends from the Arctic breeding grounds in Northeast Canada and central Siberia to the wintering grounds in Western Europe and West Africa (Roomen et al., 2022). The Blue Heart can therefore be considered a global node of life.

Among the avian and marine species that were common and abundant in the Zuiderzee, it is worth highlighting the Coot (*Fulica atra*), Pintail (*Anas acuta*), Zuiderzee herring (*Clupea harengus*), anchovy (*Engraulis encrasicholus*), Smelt

(*Osmerus eperlanus*), eel (*Anguilla anguilla*), and the macrophytes *Zostera* sp. and *Ruppia* sp. which dominated lower salinity ranges.[2] Marine mammals such as the bottlenose dolphins (*Delphinus truncatus*) were present along with other species from cetaceans.[3,4]

Nevertheless, the persistent risk of storm surges demanded the implementation of solutions to safeguard the flourishing cities in islands and along the estuary's edge, such as Amsterdam. Following a period of evacuations and disasters, a number of engineering projects were proposed, with Cornelis Lely's plan being selected and carried forward after the Zuiderzee flood in January 14, 1916, resulting in dozens of deaths when the dikes broke, affecting especially the island of Marken.[5] Lely's project involved the enclosure of the Zuiderzee from the North Sea with the construction of the dam Afsluitdijk and the creation of polders in the shallow marine clay-rich areas surrounding the Zuiderzee coast. In other words, the project contemplated a terraforming process that capitalized on the highly fertile soil formed from river sediments while providing protection against floods.[6]

IMPERMEABLE CONDITION

"Let there be no mistake: the Afsluitdijk is a project of which the Netherlands can be duly proud. But from an ecological perspective I often refer to it as the greatest disaster we have ever experienced."[7]
- *Wouter van der Heij, marine ecologist and deputy director of the Wadden Association*

The construction of the Afsluitdijk and the remaining elements of the Zuiderzee Works interrupted the geomorphological unity of the delta, disrupting the landscape permeability that allowed ecosystemic interactions.[8,9] The last natural, uncontrolled fragment of the Blue Heart is the Wadden Sea, a World Heritage site designated by UNESCO. The Wadden Sea, a tidal habitat system, serves as a seasonal habitat for approximately 10 to 12 million migrating birds, including gulls, waders, geese, and ducks which depend on this area as their wintering site, to shed feathers, reproduce, raise their young, and to rest and replenish their energy during their journey along the East Atlantic Flyway.[10, 11, 12]

The water body of the estuary that remained within the Afsluitdijk was transformed into two compartmentalized freshwater lakes: the IJsselmeer and the Markermeer. The lakes became important freshwater reserves for the intense urbanization and industrial agricultural activities carried out in the Netherlands. However, the change from brackish water to freshwater in a period of 15 years caused a sharp decline in the thriving delta ecosystem, evidenced by the drastic loss of local biodiversity and drop in the number of birds that annually visited the former sea.[13, 14, 15]

By essence, the compartmentalization of the water bodies is what ensures climate safety in the region. Dikes and dams work by reducing the probability of flooding with the replacement of the natural soft land-water edges with hard edges arranged in lines and rings. This creates
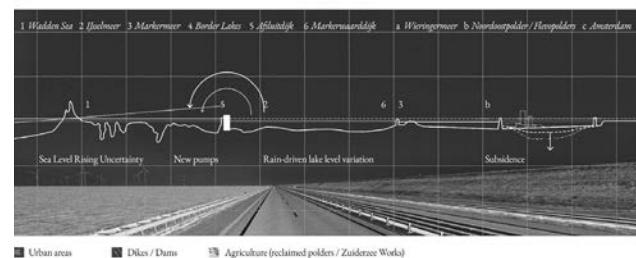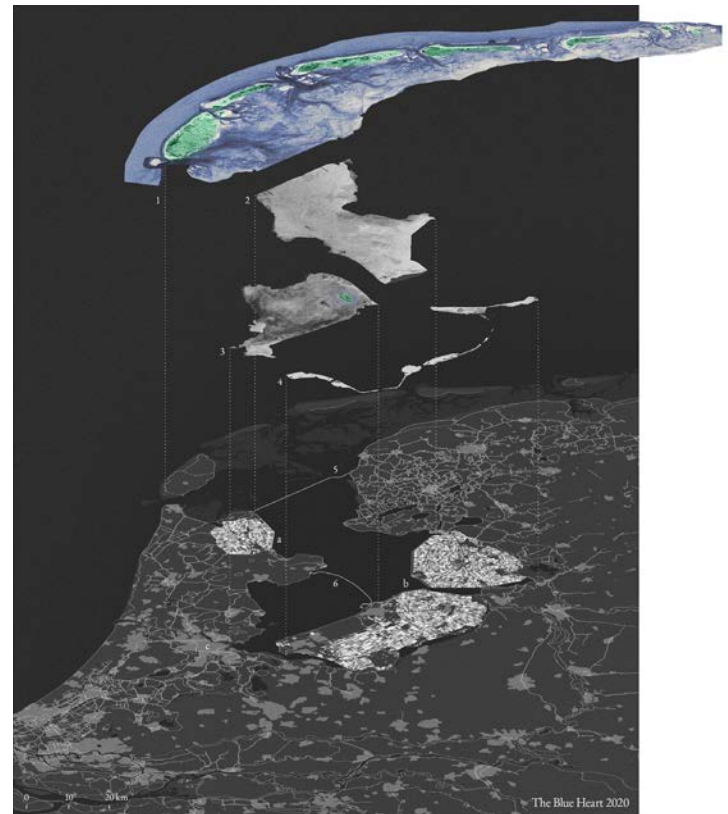

Fig. 2: Compartmentalization in the Blue Heart. Source: Fábio Alzate-Martinez, 2023.

a condition of static impermeabilization, which is controlled by a sophisticated network of dynamic water infrastructure based on canals, pumps, and sluices that guarantee safe arable and urbanized soil in the reclaimed polders and nearby areas.

The implementation of this extensive water defense infrastructure resulted in the division of the Blue Heart into distinct patches of land use (fig. 2). Apart from the water bodies that were transformed into freshwater reserves, the marine clay-rich sea floor became reclaimed polders, destined to become intensive agriculture land and areas to alleviate urbanization demands.[16] For instance, the province of Flevoland, located in the Flevopolders, became one of the most productive arable lands in the world, and it is often regarded as the largest man-made island.

Nevertheless, while the flood defense strategy has proven effective thus far, the water quality of the lakes has been significantly compromised due to the complex environmental management issues on these bodies of water, which are part of the Natura 2000 network. On one hand, the Markermeer presents a thick layer of silt that has accumulated on the lake floor, resulting in elevated water turbidity levels as the wind agitates the surface water in circular patterns. Furthermore, the Markerwaarddijk acts as a barrier, imprisoning the sludge in the Markermeer. On the other hand, the IJsselmeer faces challenges such as a low fish biomass, which demands a constant revision of fishing regulations and the creation of fish passages connecting it to the Wadden Sea.[17]

TOWARDS A FUTURE OF FLUID COEXISTENCES

From an ecological perspective, the Blue Heart was fragmented due to a conflictive relationship between land use and its hydrogeomorphology. The increase of climate risk led to the proposal of a robust solution, which compromised the natural habitat dynamics that depended on transitional land-water transitions. In the aftermath, the thriving brackish water estuary was converted into lakes, which are a critical resource for intensive agriculture and the growing urban centers after the reclamation process.

Despite the success of the project in terms of climate safety and the creation of freshwater reserves, there are significant challenges associated with this territorial compartmentalization. It can be reasonably concluded that any operation aimed at restoring the ecological qualities of the lakes will constantly depend upon the maintenance of an altered freshwater habitat, which can only exist due to human intervention. A failure of the Afsluitdijk in its current form would result in a second ecological disaster if the sea water were to return abruptly to the estuary, damaging the controlled natural habitats and also the capital-intensive land use.[18]

It is evident that there is a significant pressure on this type of linear flooding defense infrastructure, which narrows the event of flooding to a human error, with likely catastrophic social and environmental effects. The necessity to release this pressure becomes more evident as climate uncertainty increases the risk of failure for this system. The Rijkswaterstaat made a mistake in the Afsluitdijk reinforcement,[19] which will cost €400 million more and require an additional three years of construction to build one of the largest pump infrastructure in Europe. Depending on the linear flooding prevention infrastructure can become a risk due to the complexity of maintenance, considering the uncertainty surrounding the rate of sea level rise and the potential effects of the melting of the Alps in the water discharge in the Rhine.[20] This creates a double-edged uncertainty for the maintenance of the dam that may require it to operate in a different and more flexible way in the future to ensure freshwater availability and flooding protection.[21]

To mitigate the potential for a dangerous path dependence lock-in in the linear flooding defense, which may arise in the event of a rapid rise in sea levels, this article advocates for a paradigm shift that allows the rebuild of the estuarine landscape permeability. Rather than focusing on reducing the probability of flooding, by compartmentalizing habitats, the emphasis should be on learning how to live with the dynamic land-water habitat, by reducing the consequences of flooding and sustainably adapting to the brackish water estuary resources.[22] This perspective allows the reconnection with the Blue Heart transitions, reestablishing permeable human-nature relationships in an ecosys-

Fig. 3: Evolutionary design integrated with ecosystem-based adaptation in the Blue Heart. Source: Fábio Alzate-Martinez, 2023.

tem-based adaptation framework, that couples climate adaptation with biodiversity restoration. And in the intertwining of these conditions lies the foundations for a long-term evolutionary adaptation (fig. 3) based on buffered NbS, that mitigates the ecological trade-offs of hard infrastructure. Furthermore, to effectively achieve this form of ecosystem-based adaptation, it is necessary to envision a gradual coordinated long-term land-use change. In one hand to repurpose the intensive agriculture land into a regional agroecological system that synergizes with the vibrant agrobiodiversity of the delta, reducing the need for freshwater and dry arable land.[23] And on the other hand to promote urban environments adapted to water-level fluctuations and storm events with innovative projects in architecture, landscape, and urbanism, that ensure safe and restorative urban functions based on a deltaic landscape infrastructure.[24,25]

Author

Fábio A. Alzate Martinez is an interdisciplinary designer and researcher with a MSc in Urbanism from TU Delft (Cum Laude), and B.Arch in Architecture and Urbanism from FAAP (Academic distinction), currently running his own practice, Nawi Studio. He received several national and international awards and excellence scholarships in his trajectory, and gained knowledge in the scales of the object, building, city, and territory from his professional experiences in Brazil (SIAA, Estudio Tupi, and e-DAU), and in The Netherlands (FABRICations, Mei Architects and Planners, and Flux Landscape Architecture). His work has been published in the conference Acadia, and in the magazine Atlantis, and also exhibited at the Museum of Brazilian Art MAB-FAAP and TU Delft. With the goal to become an agent of positive change, his work aims to integrate multi-domain knowledge to envision sustainable futures towards a better living environment for all.

Acknowledgements

Notes

1. *With the meaning of the quality of a landscape to provide ecological connectivity, where animals on land or in water have free passage and movement.*

2. *Van Vierssen and Breukelaar, 1994*

3. *Hoekendijk et al., 2021*

4. *Van Der Sleen, 1923*

5. *After years of debate, the Zuidezee Works started in 1918, when the Dutch parliament decided to start the reclamation project with the Zuiderzee Act while Conelius Lely was Minister of Water Management.*

6. *Driving the Blue Hearth to be part of the 50% of the world's estuaries that have suffered severe anthropogenic alterations (Ravilious, 2024).*

7. *www.rijkswaterstaat.nl/en/news/archive/2024/04/swimming-through-the-afsluitdijk*

8. *Completed in 1932.*

9. *Starting with the publication of Lely's plan in 1891, and ending with the construction of the Enkhuizen - Lelystad dike, also known as Markerwaarddijk and Houtribdijk, in 1975.*

10. *Wolf et al., 2010; Koffijberg et al., 2015*

11. *Kleefstra et al., 2022; Kabat et al., 2012; Koffijberg et al., 2015.*

12. *Wolff et al., 2010; Koffijberg et al., 2015*

13. *De Beaufort (1954) indicated that the fauna transformation was completed in 15 years (as cited in Van Vierssen & Breukelaar, 1994).*

14. *Noticed by the rapid change in plankton and bottom fauna, and the disappearance of the former principal fishes such as herring and anchovy, and the shrunk in the stock of flounder (Redeke, 1939).*

15. *More than 80% of the number of the birds originally present disappeared from the Zuiderzee ecosystem after the closure, according to Van Vierssen and Breukelaar (1994).*

16. *Wieringermeer (1930), Noordoostpolder (1942), Oostelijke Flevopolder (1957), Zuidelijke Flevopolder (1968).The polder Markerwaard was never reclaimed, resulting in the enclosure of the Markermeer.*

17. *Which is currently being addressed with the construction of an artificial "fish river" passage that goes through the Afsluitdijk.*

18. *Which may not come soon, however comparing the longevity of natural processes and man-made infrastructure, we can observe that there are very few structures that can survive the milenia of Earth dynamics.*

19. *A disconcerting reality, according to Rob Nijsse, professor of structural engineering at TU Delft. Source: www.nl-times.nl/2022/05/20/afsluitdijk-renovations-cost-eu400-mil-due-errors-govt-knew-report*

20. *Climate change is anticipated to significantly alter the contributions of snow and glacier melt to european rivers discharge. These shifts could be crucial during dry periods, as snow and glacier melt are primary water sources at such*

times, specially in the first half of the century (Freudiger el al., 2020). Some effects of this variation are already felt in Dutch rivers (Hindrichs & Simon, 2023) and in Germany (CHR, 2018). However, more scientific studies are needed to assess the direct impacts of the Alps melting with the water quality and protection in the IJsselmeer-Markermeer system.

21. Currently there are projects of implementing flexible water levels in the lakes IJsselmeer and Markermeer, making the system more dynamic and adaptable to rain-driven level variations.

22. Following the trend In flood risk management to shift the paradigm of reducing flooding probability to reducing the consequences, as feasible and acceptable as a means of mitigating risk (Hooimeijer et al., 2022).

23. Which can be catalyzed as solutions for the current salinization and subsidence problems in the reclaimed polders, and the need for ecological restoration projects in the area.

24. Possibly tested in cities with pioneering vocations such as Almere.

25. Potentially working along with the processes of sedimentation deposition and accretion, tidal influence, and vegetation growth, to propose new types of dikes based on the existing infrastructure.

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Moving Through Fragments of Time

Time Permeability of Space

Sanam Mirzaye Ahmadi

I walk through a garden with old and new trees. A large wooden door, with an inscription above it that says "take off your shoes," stands before me. Passing through the door, I step into the courtyard, feeling the stones under my bare feet. I walk past an old pistachio tree, its branches reaching out in front of the porch. Under the arch of the majestic porch, a small reflective fragment shines on the wall beside the wooden door. Local stories whisper that it's the truth-telling mirror. I look through the mirror, and everything shatters into fragments. It feels like a fragment of time…

While I was writing my master's thesis, "Recognition and Analysis of People's Narratives of Urban Spaces for Collaborative Planning, (Case Study: Historical and Central Urban Spaces in Torbat-e Jām, Khorasan, Iran)," on urban planning, a penetrating concept emerged from data collection and analysis of narratives in Torbat-e Jām. Using grounded theory, I termed this concept "the extension of space," defined as the stretching of space. It includes physical aspects like transparency and visibility, as well as sounds and smells that extend beyond a place. It also signifies the connection of a space with people and cultures beyond boundaries, and the stretching of space over time. In short, the extension of space determines how it permeates its surroundings and beyond.

The Sheikh Ahmad-e Jām mausoleum complex, known as Mazar, in Torbat-e Jām, Khorasan, features structures from the 13th-19th centuries, including Sheikh-e Jām's tomb, domes, mosques, water storage, and a Persian Garden. Mazar is on the tentative list of UNESCO World Heritage sites. The characteristics of Mazar, as noted by its users, played a crucial role in the emergence of the extension of space concept. Its open spaces create transparency, with the tall Iwan visible from afar. The call to prayer echoes across the city, and the scent of garden flowers permeates the surroundings. Mazar extends itself through different senses

Fig. 1: The Wooden Door.
Source for all figs.: Sanam Mirzaye Ahmadi.

and holds a special place in the city and region due to its strong historical, social, and cultural links. Mazar reflects Iranian Islamic architecture and the broader historical and cultural context of Greater Khorasan, embodying both Iranian and Islamic history. These qualities make Mazar permeable in various dimensions, extending beyond boundaries and borders.

The concept of the extension of space inspired me to explore how a space is both permeable and permeated—how it allows penetration and how it penetrates its surroundings physically, spatially, culturally, and historically. I will explore this concept from the perspective of time permeability—the experience and feeling of time flux. Permeabilities determine and measure movements in space. Time permeability shows how time flows and penetrates space, and how space moves and penetrates time. Time permeability exists on both macro and micro scales, influencing how spaces and times interact at different levels.

Mazar is both a monumental site and an everyday urban space. People visit to see the architectural monuments, attend prayers, walk, be alone, socialize, and play. Its garden is al-

ways open as an urban green space, reflecting the passing of seasons. This complex is a public open space without an entry fee, accessible any day of the year and at any time. Its spiritual character and the presence of people provide a sense of safety. The space is always present, demonstrating time permeability on a micro scale. It offers opportunities, possibilities, and availability to people at different times, making them feel safe, comfortable, and pleasant. With micro-scale time permeability, time flows freely through space, and space moves actively through time.

Mazar is a historical monument site with architectural works from different periods. Mazar comprises remnants of the past, where history feels alive and has brought itself into the present. On the other hand, when you are in Mazar, you can feel and re-experience both collective history and individual memories. It feels as if this space travels through time, taking you with it. As Marcel Proust says in *In Search of Lost Time*, "The past is hidden somewhere outside the realm, beyond the reach of intellect, in some material object (in which sensation with that material object will give us) of which we have no inkling."[1] But Mazar is not an abandoned site; its

original and new functions keep it alive. People of all ages are welcome, making the present time actively present. This is not the end of time travel; the future is also tangibly present. Efforts to preserve Mazar and plan for future changes ensure its continued relevance and adaptability. This is time permeability on a macro scale, determining how space can be flexible, practical, and compatible with the past, present, and future. It provides time continuity, integrity, and interconnectivity, inviting people to experience movement in time and share different aspects of the built environment. With macro-scale time permeability, the past, present, and future reveal themselves and flow fluidly through space, allowing space to travel through time. As Billy Pilgrim in Kurt Vonnegut's *Slaughterhouse-Five*, who was unstuck in time, says: "All moments, past, present, and future, always have existed, always will exist."[2]

Time permeability is not exclusive to Mazar or other historical sites. I've experienced time permeability in other urban spaces and cities. Walking across the city, streets, squares, and urban parks with historical, social, or cultural significance also demonstrate time permeability. Spaces linked with our individual mem-

Fig. 2: The Pistachio Tree.

ories and experiences can transport us to different times, whether centuries ago or just last week. Some streets are alive at all hours, and there are urban green spaces we strive to preserve for future generations.

Spaces vary in time permeability; not all streets are busy and lively at all times. Some preserved historical sites are not active today, while new places are designed for future needs. However, some spaces, like Mazar, exhibit vibrant time permeability. It is crucial for cities and urban spaces to have time permeability in different states to function and remain vibrant.

What does time permeability bring to a space, and how does it help cities? Time permeability on both macro and micro scales creates opportunities for people to experience and re-experience spaces. It brings diversity, a sense of security, and inclusiveness, making spaces multifunctional and integral for collective and individual events. It strengthens historical, social, and cultural connections, fostering a sense of belonging to urban spaces and the idea of a shared city. It increases collective and individual awareness of different dimensions of the built environment, its surroundings, and other people. It fosters flexibility, resilience, and sustainability, helping to create better urban spaces and cities.

How and when does time permeability occur? For example, the lack of proper lighting in Mazar deters people from visiting at night. Despite city planning documents highlighting Mazar's potential, officials often neglect this urban space. Nevertheless, Mazar has vibrant time permeability due to the strong relationship between the people and the space. Viewing urban planning and design through the lens of time permeability reveals its significant role. Urban planning and design involve preserving historical areas, revitalizing forgotten parts, using history to design new spaces, creating safe and pleasant urban areas, and preparing cities for social, economic, and environmental changes—all of which involve time permeability. Urban planning and design use various approaches and tools, from infrastructure and land use planning to revitalization, place-making, and sustainable development. Viewing cities and urban spaces through the lens of time permeability also makes ideas permeable, without time limits. This perspective helps us see different aspects and scales of urban spaces, opening the door to new ideas.

Fig. 3: The Courtyard.

Fig. 4: The Garden.

Fig. 5: The Truth-Telling Mirror.

In general, urban planning and design aim to understand the past city, improve the present city, and prepare for the future city. They should move in time, observe all dimensions, and let time flow in the planning process, considering all people. Not just the present people, but also past and future generations. Urban planning and design need to embody time permeability themselves.

…I look through the mirror, and everything breaks into pieces—a fragment of time! Space fractures, allowing time to permeate. The trees, stones, bricks, colorful tiles, and people become fragments of time. As I catch these fragments in every part of Mazar, I feel timeless. I am not just in the present; I exist in the past and the future as well. Time permeability illustrates how space and time interpenetrate in a city, with space being permeable to time and vice versa.

I conclude with words from Sheikh Ahmad-e Jām, an Iranian Sufi:

> The light of the mirror shines from there. Whatever is in the land, he/she sees and is shown to him/her.[3]

> But know that "the time" is precious and not for anyone. "The time" is when you are delighted and make your heart so that…it takes you from yourself and does not give it back to anything. Then, this is "'the time.'"[4]

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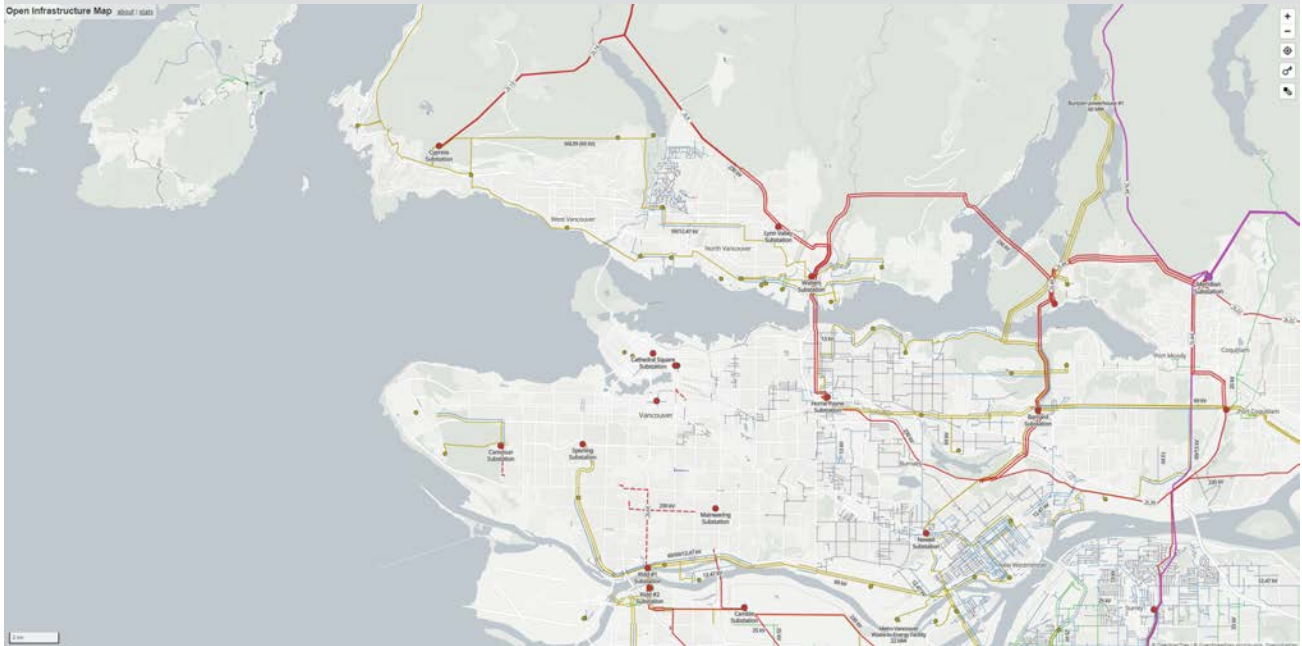
Fig. 6: The Main Path.

Fig. 1: Main power lines in Vancouver's metropolitan area. Source: Open Info Map, 2023.

Access Before Infrastructure: Vancouver Power Line Rights-of-Way

Juan Fernández González (MArch I '25) and Sidney Hambleton Sponer

From its boreal forests to its coastal fjords, British Columbia's diverse landscapes are divided by an overpowering network of power lines. BC Hydro, the Canadian province's main producer and supplier of electricity and energy, administers approximately 80,000 km of transmission and distribution lines (BC Hydro 2022). With their current practices, forests must be cleared along linear paths before installing power lines. The resulting deforestation damages the environment, aggravated by the resulting subdivision of the landscape's flora and fauna. Furthermore, power lines run through the unceded land of the sovereign First Nations in British Columbia. As a provincial Crown Corporation, BC Hydro is subject to federal law and the 1982 Constitutional Act, which recognized and affirmed Aboriginal and treaty rights (Government of Canada 2018), but power lines still run through their land. The damage done by this infrastructure represents a physical manifestation of extractivism and the decentralized production of energy throughout the province's territory and beyond. Power plants throughout the province are connected via power lines to urban areas such as Vancouver (fig. 1). Although the steel transmission towers and their seemingly light cables appear to have a minimal footprint on the landscape, the legal structures that protect them extend their physical barriers to deny access to people.

LAW OF ROWS AND TRAILS

Through expropriation, or eminent domain, BC Hydro seizes land to develop power lines spanning thousands of kilometers across public and private property (BC Hydro 2024d and BC Laws 2024a). Power line rights-of-way (ROWs) prohibit people from entering the paths of power lines. This is justified by the 1996 Hydro and Power Authority Act, which states that "BC Hydro has the authority to generate and distribute electricity to consumers, businesses, and the other utilities in B.C." (BC Laws 2024b). BC Hydro writes that "Any individual travelling along power line rights-of-way without the property owner's consent is subject to the same laws of trespass

as if they were trespassing on any other private property" (BC Hydro 2024d). In recent years, BC Hydro has faced significant legal hurdles in justifying their expropriation powers, such as with the massive hydroelectric project at Site C in Peace River, which allegedly violated First Nations groups' Treaty 8 rights (Grant 2022). Amid ongoing protests surrounding that major project, BC Hydro settled out of court with the West Moberly First Nations in 2022, paying them an undisclosed one-time payment, ongoing payments for seventy years, and 2,000 hectares of "Crown land" (Hoekstra 2022). The effects of powerlines reach far beyond their cleared forest paths and deep into regions such as Peace River as a consequence of the decentralized production of energy in the province and beyond.

Contrary to the vast network of BC Hydro ROWs, another network of pathways exists and is open to the public: trails. According to the British Columbia Government (2013), the province is home to more than 30,000 km of formally recognized and managed trails. These are primarily designed for recreational purposes and access to nature, and they include power line trails accessible to both pedestrians and bikers. BC Hydro takes a careful approach to the development of land access and public use near its powerlines. Paths, roads, and parks built under powerlines are subject to a case-by-case review by BC Hydro and remain subject to BC Hydro's terms and conditions (BC Hydro 2024b). BC Hydro reserves the right to destroy the path in the future if it chooses and requires landowners who are interested in developing a public use to release BC Hydro from any liability that may arise (BC Hydro 2024c). Finally, BC Hydro reviews requests from landowners, First Nations groups, cities, and municipalities to move electric transmission lines altogether, if the "customer" pays the fee for the relocation (BC Hydro 2024e).

The spatial and legal mechanisms behind BC Hydro's ROWs suggest that the importance of energy infrastructure surpasses that of people and nature. Where power lines meet people's needs or desires for public use, BC Hydro reserves the right to review, control, and even destroy public access projects, while not taking on any of the future liability or costs. Despite BC Hydro's purported enthusiasm and interest in facilitating public access projects, their systematic approach to pushing the costs onto private landowners and communities makes their vision of "A cleaner, more sustainable future for all British Columbians" ring hollow (BC Hydro 2024a).

ENVIRONMENTAL HARM

Power lines cause great harm to the environment. Their most visible effect is deforestation since long corridors are cleared through forests to install and maintain ROWs. These corridors facilitate the circulation of heavy-duty forestry vehicles, accelerating deforestation. Moreover, forest fires often result from trees burning by being in contact with power lines, which has devastating impacts on the environment and on people's lives. This was the cause of the Parker Lake fire near Fort Nelson, when a tree fell on a conductor during high winds (Faguy & Yousif 2024). In the province of Alberta, which borders British Columbia to the East, eighty-five wildfires were caused by power lines in 2023 alone (Government of Alberta 2023). These incidents, which can lead to catastrophes, result in clearings for power line corridors being increasingly wider as preventive measures. In addition to the changes in the composition of plant and animal communities that follow the altered conditions around ROWs and the creation of an "edge" condition (Willyard et al. 2004), they cause a "temporary disturbance to wildlife from the presence of construction workers and machinery" (Berger 2010). Thus, ROWs harm the natural environment through their construction, operation,

Fig. 2: Powerline trail in North Vancouver. Source: Authors.

and maintenance. As a response to the environmental damages of ROWs, biodiversity projects such as pollinator corridors can mitigate harm. Massimo Martini writes that "Despite the negative effects of landscape conversion on biodiversity, green spaces within anthropogenic systems may be managed to serve as refuge habitats for insect pollinators" (Martini 2022). Managing this vegetation in a more "natural" way has "the potential to benefit both wildlife and people" (Garfinkel et al. 2023). Although companies such as BC Hydro promote these initiatives to align themselves with an image of green, clean energy, these initiatives are nonetheless much smaller in scale compared to the deforestation that BC Hydro is responsible for, likely negating any environmental claims.

Despite more sustainable alternatives of energy distribution, power lines seem to be far from being removed. Political support for clean energy goals oscillates and can prevent sustainable projects for the environment from becoming a reality (Pevzner et al. 2021). Instead of constructing new power lines to meet increasing energy demands, it is possible to "replace existing power lines with cables made from state-of-the-art materials," which "could roughly double the capacity of the electric grid… making room for much more wind and solar power" (Plumer 2024). Localized power generation (involving solar panels, wind turbines, and other renewable energy infrastructure near cities) limits the need for long ROWs connecting power plants to urban areas. BC appears determined to support hydroelectric energy projects long-term. In the face of an expected 15 percent increase in electricity demand from 2023-2030, BC Hydro announced its first call for power in fifteen years. In April 2024, the company started reviewing project proposals that will acquire energy from clean or renewable resources (British Columbia Government 2023 and BC Hydro 2024). Notably, these project proposals require at least 25 percent Indigenous equity by the First Nations whose traditional territory includes the location of the project (Adkins et al. 2024). The project may also be subject to an Indigenous consent requirement as part of their Environmental Assessment, a requirement that was not in force during the last call to power in 2008 (Adkins et al. 2024).

METRO VANCOUVER

Metro Vancouver, the province's largest and most populous metropolitan area, is permeated by numerous power line ROWs and provides a series of case studies which can inform our notion of expanding access to ROWs. Each permeable encounter between the infrastructure and the city is unique because of the specific site conditions and context. In North Vancouver, a residential neighborhood surrounds Princess Park, which is traversed by a ROW. Numerous points of access indicate an entry point to the "Powerline Trail" (figs. 2 and 3). Its multi-use nature for hiking and mountain biking is highlighted in the trailforks.com website, which regroups trails across the province with user input. Signs indicate the dangers that people are exposed to while hiking, such as "DANGER Overhead

Figs. 3a and 3b: Signs at Powerline Trail in North Vancouver. Source: Authors.

Fig. 4: Power Line in front of the Stawamus Chief Provincial Park. Source: Authors.

Wires," "Keep Off! Hazardous Voltage Above," and "YOU CAN BE ELECTROCUTED OR FALL OFF." Although access is permitted by the presence of the trail, certain areas are kept off limits with these signs, accompanied by ones indicating "PRIVATE PROPERTY NO TRESPASSING" in neighboring backyards. Another example of a power line trail is in Deep Cove, a luxurious residential neighborhood which attracts recreational tourism to its waterfront. The entrance to the nearby Baden Power Trail, which leads to the ROWs, lies discreetly between two homes. Access is permitted but not advertised. Barnard Substation in Burnaby is surrounded by highways with highly controlled access to the ROWs. Surrey, Coquitlam, and other points of interest with booming construction present different urban and suburban responses to power lines which question the idea of the city's boundary. These have varying degrees of access, inclusivity, and difficulty. The permeability of the city at these points is defined, in part, by its spatial response to ROWs.

Scholar Mimi Sheller describes the notion of "carbon form" as "the coalescence of our energy culture" (Sheller 2019). This can be used as a framework to understand the imperialist and colonial motivations behind resource extraction and energy distribution, which have a direct impact on the spatial configuration of ROWs and the deforestation that accompanies them. We can wonder what carbon form would look like if governments and corporations would consider the mobility of people and access to nature in their energy projects starting with the earliest decisions, not as an afterthought. In addition to the spatial mechanisms of urban planning and landscape architecture, a change in legal mechanisms could greatly improve the carbon form of future energy projects.

CLOSED UNTIL FURTHER NOTICE

Power line planning and easements can work better for the landscape and for the people on it. By looking at Vancouver and BC as a case study, it becomes clear that there are both significant obstacles and potential for public use projects near powerlines. BC Hydro is only beginning to work substantively with groups such as First Nations

communities whose land they affect. In future years, BC Hydro, with its continued reliance on extensive utility easements, owes it to the public and private landowners to design powerlines in a way that benefits the land and people.

For today, public use and access appear secondary to infrastructure, capital, and tourism concerns. In April 2024, the Sea-to-Sky gondola, operating in nearby Stawamus Chief Provincial Park (fig. 4), announced its plans to develop a power line project in collaboration with BC Hydro to service its restaurant and bar, retail, and weddings and special events space at the top of Mount Habrich. Solar and wind projects were considered and ultimately deemed not as reliable as BC Hydro. Public access paths in the area will be closed until it is safe to reopen (Sea to Sky Gondola 2024).

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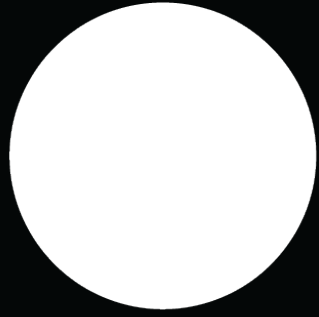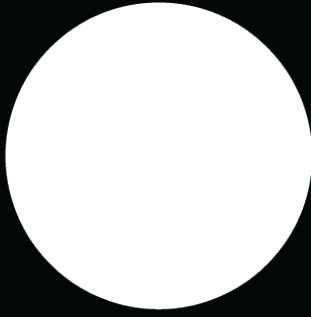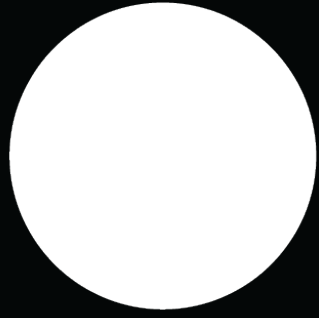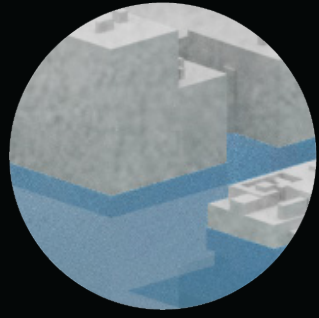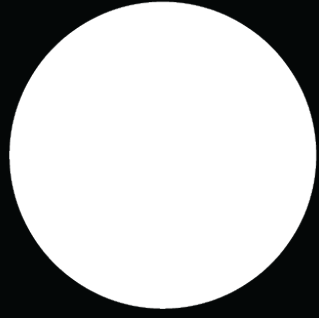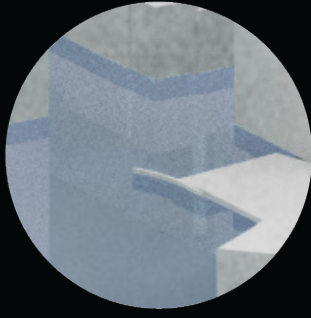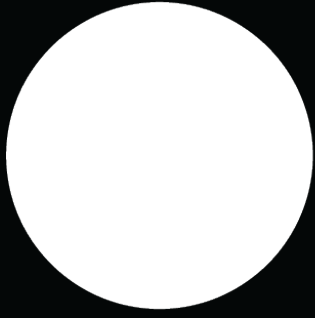
Fig. 6b.

SeaPort Station

Redefining Resilient Infrastructure
Inmo Kang (MArch I '25) and Hannah Wong (MArch I '25)

How can transit infrastructure provide a new sense of togetherness in the face of physical separation due to sea level rise?

Boston's harbor has always been an integral part of the city's interaction with both the public and the marine ecosystem. Through regulatory interventions across two centuries, such as Chapter 91 of 1866 and the Clean Water Act of 1972, Boston has dedicated urban waterfronts as public spaces, connecting a growing network of Bostonians to various marine industries and water-related civic programs. However, as the climate crisis escalates, Boston Harbor's civic disposition is facing rapid deterioration. With the inevitable rise of sea level and increased frequency of storm surges, the city of Boston must address various coastal urban conditions. In 2016, the city launched its Climate Ready Boston initiative to prepare for the current and increasing flooding along the coastline. In dialogue with the current plan's "climate resilient infrastructure" guidelines, our intervention, entitled SeaPort Station, first interrogates the characteristics of resilient infrastructure—re-imagining how urban infrastructure, commonly perceived as perfect and indestructible, can be planned more flexibly in tandem with social and environmental changes. Planning for resilient and transient infrastructure occurs on three scales of connection on our site: the macroscale of urban networks (fig. 1), the mesoscale of program and building systems (fig. 2), and the microscale of the human experience (fig. 3). By fostering different scales of connection, the station allows for continued and evolving forms of civic engagement and fascination.

Situated at an old dry dock at the current Boston Seaport site, SeaPort Station is an underwater multi-modal transit hub seeking to amplify symbiosis among Boston's residents, infrastructure, and harbor (fig. 4). It also aims to generate a new sense of togetherness as a new, and perhaps the only sustaining, public space on the Boston waterfront (fig. 5). Isolated from the mainland due to sea level rise and storm surges, in the year 2074, the SeaPort Station is rendered as an oxymoronic island: a physically disconnected transit hub whose sole purpose is connection, not only of people to each other by transit, but of humans and non-humans, civic and industrial spaces, and marine and terrestrial systems (fig. 6). As an underwater public ground, the open courtyard fosters a new sense of togetherness by providing various means of interacting with the water collected through the site (fig. 7). The arms hugging the courtyard are dedicated to rail transit services on the lower level by re-imagined Silver-Line metro and Amtrak services (fig. 8); the upper levels are occupied by civic and industrial programs, such as a capsule traveler hotel and aquaculture fish market (fig. 9).

The project was born out of the Harvard Graduate School of Design's spring semester architecture option studio Urban Glitch (STU-1323), led by professor Elizabeth Christoforetti. It hopes not to develop an ever-enduring, utopic system, but instead to create resiliency in the face of fallacy, to adapt and adjust to the inevitable occurrences of an ever-changing world.

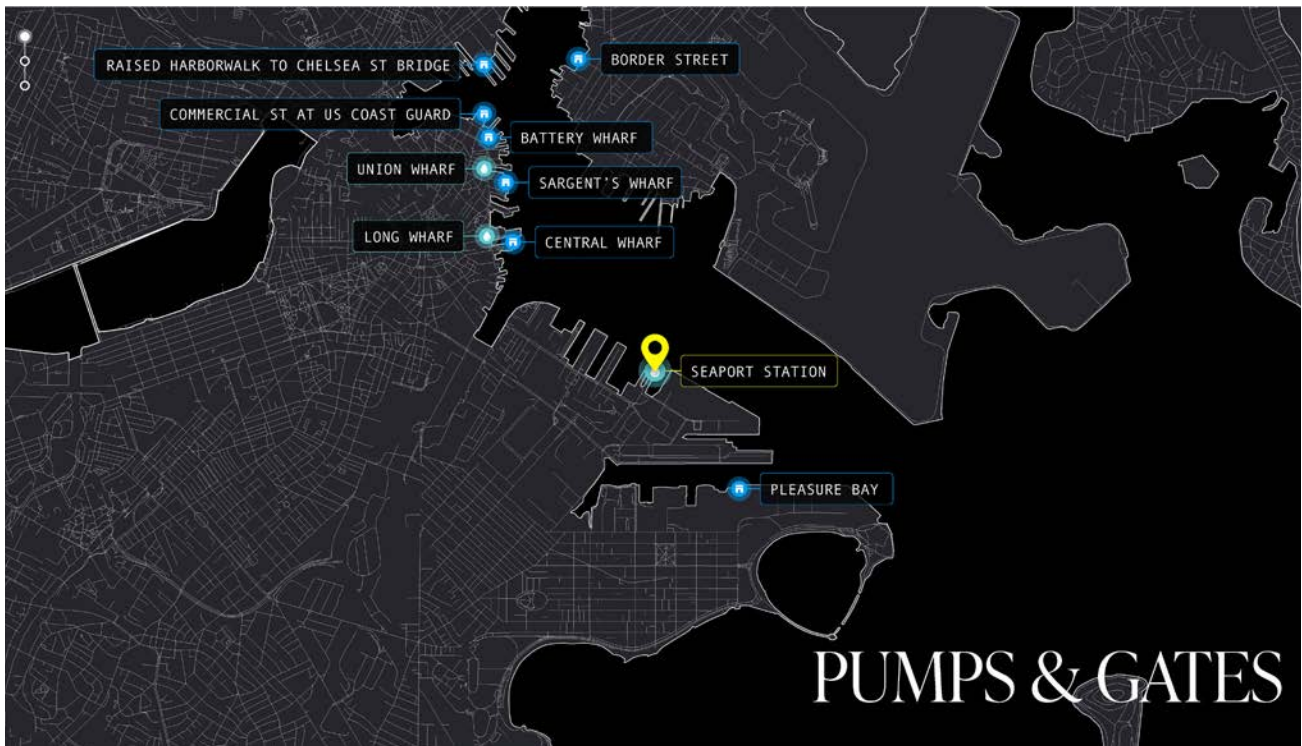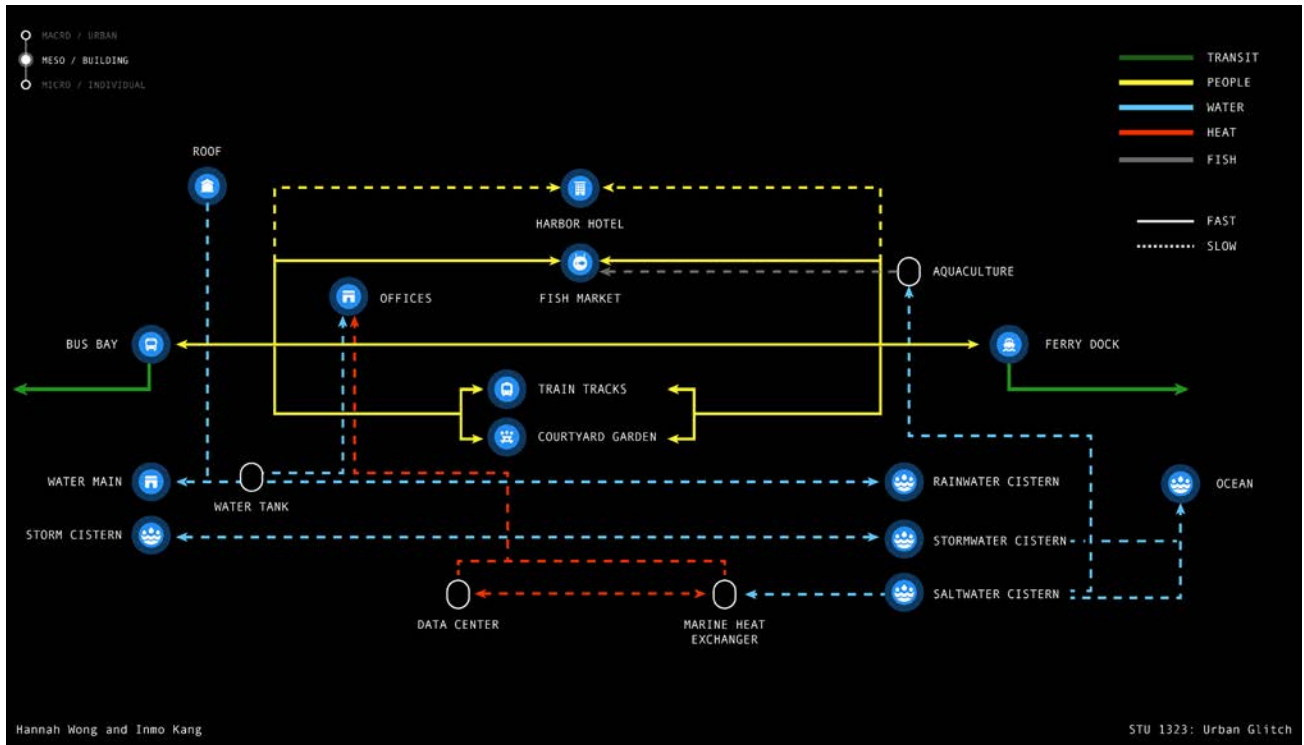*Fig. 1a. Source for all figs.: Inmo Kang and Hannah Wong.*
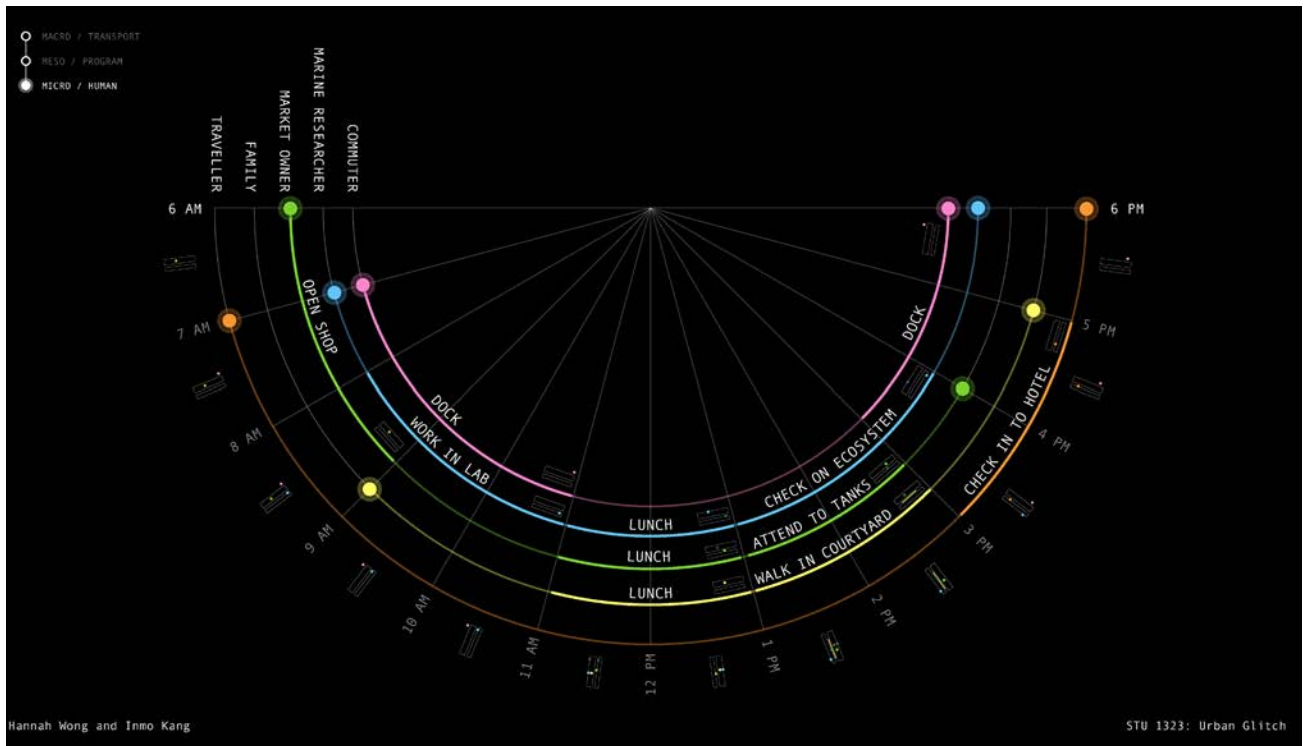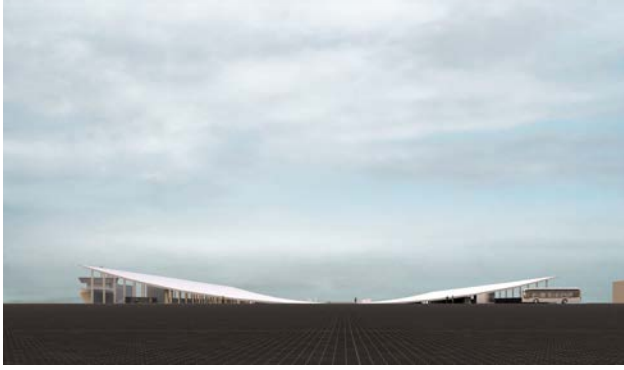

Fig. 1b.

Fig. 2.

Fig. 3.

Fig. 4a.
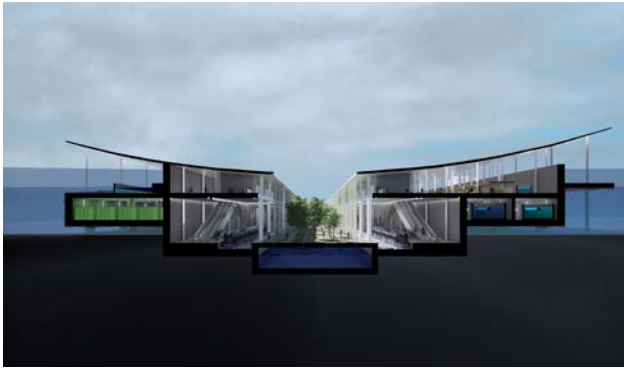

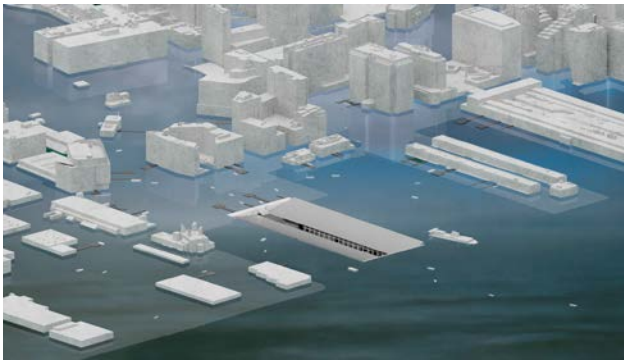*Fig. 4b.*

Fig. 5.

Fig. 6a.

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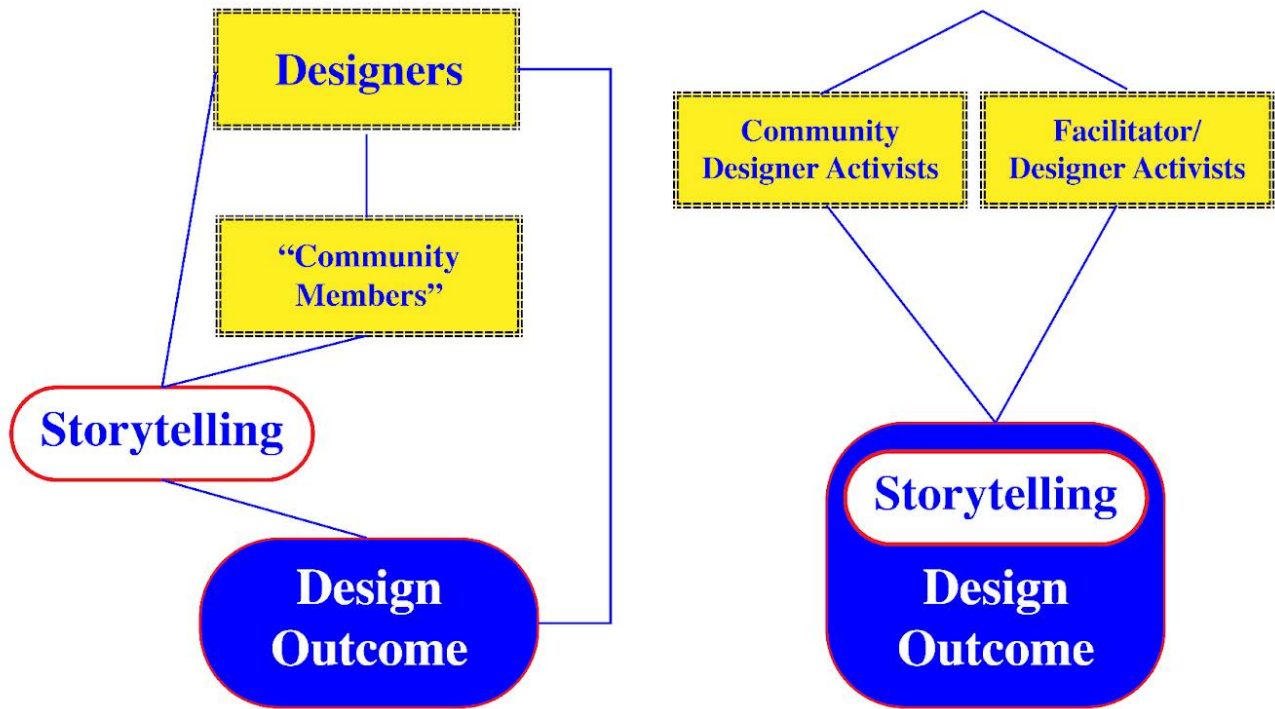

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 1: Comparison of traditional design roles and community activist design roles. Source: Klara Kaufman.

Porousness of Carceral Space

Storytelling as a Counter-Mapping Design Methodology
Klara Kaufman (MDes Publics '25)

CALLS FROM HOME

If you were to tune to radio station WMMT 88.7 on a Monday evening between 9:00 and 10:00 PM, you might hear a man's voice saying, "Hey man, I'm just overwhelmed right now–I really miss you. Keep your head up." You might also hear a little girl singing her ABCs, showing off her new skills for her dad.[1] Or you might hear a mother letting her son know he's just become an uncle. But these people wouldn't be speaking to you, at least not directly. These are real instances of people sending in messages and shout-outs to their incarcerated loved ones to be played on the radio show "Hot 88.7: Hip Hop from the Hill Top," or Calls from Home.

The show, which is run by Appalshop, a community media and arts nonprofit based in Whitesburg, Kentucky, is described by its DJs as "restorative radio." One of only two hip hop radio shows in Kentucky, it broadcasts songs requested by incarcerated people and their family members. On its website, Appalshop writes that Calls from Home "was created in response to aggressive state and federal initiatives to build prisons in the face of the declining coal industry."[2] The show's radio signal reaches seven prisons in central Appalachia, allowing incarcerated people and their families to connect, even when facing exorbitant telephone fees, long distances, and restrictive visitation policies.

The people who contribute to, listen to, and facilitate Calls from Home are co-mapping new affective relationships that challenge carceral politics of remoteness, isolation, and erasure. As a design medium, audio creates a porousness in built enclosures, contesting the myth of containment by creating a third space that is neither incarcerated nor free.

STORYTELLING AS A COUNTER-MAPPING DESIGN METHOD

I first heard about Calls from Home while watching a screening of a documentary of the same name, directed by Sylvia Ryerson, in the fall of 2023. I wanted to approach the radio show from a design perspective, and to explore the ways in which the program's community storytelling methodologies might be understood as design techniques.

In their 2021 article "The Phenomenology of Change: How Conflict Drives Urban Transformation," Nanke Verloo and Diane Davis emphasize the importance of a phenomenological approach to design, one that considers the way reality is lived, experienced, and felt subjectively by individual people. They note that "because a phenomenological approach recognizes a diversity of views among citizens and authorities, and notes how they may differentially attribute meaning to objects in their local environments, it requires methodologies that can include an array of narratives and languages."[3] Phenomenology legitimizes the power of everyday experiences as a form of what feminist scholar Donna Haraway's calls situated knowledge–in the context of this essay, the spatial and lived experience of incarceration.[4]

As a design medium, audio creates a porousness in built enclosures.

Storytelling as a phenomenological design method can reveal power structures and conflict in the built environment, seen from up close. Instead of being a static account that contextualizes a design choice ("people told us they wanted places to gather, so we built a park"), a story becomes a tool that shifts–designs–involved parties' relationships to space. Each phrase or song played over Calls from Home's airwaves emerges in real time, mapping against the hard boundaries of carceral infrastructures and policies. Unlike a traditional map, story-designed

programs draw "new lines of solidarity, which, in turn, contributes to the production of new conditions for struggling both in a place, and between one place and another."[5] These stories are thus a form of anti-carceral counter-mapping.

In her 2023 article "The Problem of Cartography: From Singular to Plural Mapping," Annelys de Vet defines counter-mapping as "a field that stimulates increased attunement to situated and plural approaches to humanize cartography."[6] De Vet describes how states have historically used maps to draw borders, shape boundaries, and justify colonial violence. Counter-mapping is a political response to this history, a methodology that can reclaim power and "legitimize land and resource claims by Indigenous communities."[7] In the case of Calls from Home, storytelling serves as an activist design process that counter-maps carceral boundaries and catalyzes new spatial relations.

THE POLITICS OF REMOTENESS

The prison industrial complex depends on the deliberate concealment of a vast system of punishment and control from much of the American population. Rural prison expansion is prefigured on a politics of remoteness, in which people are disappeared from the public view and excluded from the very idea of the Public. This manufacturing of distance thus occurs not only in the walls of a prison, but in the minds of the Public as well. The separation of families is a purposeful technique to weaken connections.

One hundred and thirteen million American adults—roughly half of the adults in the country—have an immediate family member who has been impacted by the carceral system. Roland V. Anglin describes the importance of proximity in organizing, both spatially, and through shared experiences: "Proximity reduces the cost of collective action…Moreover, segregation forces significant numbers of people to live and work together in a defined space, which increases the production of social capital. This social capital can be used in birthing and maintaining a social movement."[8] Incarcerated people, through violent separation from their communities, are denied access to the production of the social capital that proximity offers.

Calls from Home brings participants and

listeners back into proximity. The intimacy of hearing someone's voice, as they speak sweetly, candidly, jokingly, plaintively, directly to someone they love, defies the carceral system of remoteness. The show's storytelling practice also has the potential to build social capital between incarcerated people. Hearing other people's favorite songs and the sound of their loved ones' voices strengthens submitters' webs of relations and experiences outside of prison, blurring the physical and emotional boundaries of incarceration. The messages map a new Public through the airwaves, connecting DJs, incarcerated people, loved ones, and casual listeners and insisting that they are all part of the same Public. This re-mapping of a Public in a carceral system defies the politics of remoteness and creates possibilities for imagining a world without incarceration.

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AFFECTIVE IMPLICATIONS OF COUNTER-MAPPING

By connecting incarcerated people to listeners inside and outside of the carceral system, Calls from Home engages in a form of embodied counter-mapping–what critical geographer J.T. Roane might call "worldmaking" through tactics of survival.[9] Roane writes: "Black vernacular architectures, infrastructures, and landscapes are often marked by impermanency, sometimes active only in and through the appropriation and commandeering of stolen space—and with it, the corollary of stolen time."[10] We might think of the "space" of the radio program in this way: by definition, finite and impermanent, but lasting as a rewriting of Public space. The messages, subverting what Haraway calls the "God Trick" of a top-down view "from above, from nowhere," facilitate relations across space and power, refuting the disconnection implied by criminalization.[11] The mapping creates a conceptual fold, just as you might create a fold in a quilt by pinching two squares your fingers and bringing them together. The distance between the squares still exists, but the fold offers an affective closeness.

It is important to situate Calls from Home as an activist design strategy. Here, I return to the roles of the participants. Appalshop has been a staple of the community for decades, and its staff and organization have built genuine connections with incarcerated people, their loved ones, and prison abolition activists. The show, which is largely facilitated by white Appalachian DJs, creates an opening for incarcerated people, who are largely Black and people of color, and their loved ones who live far from prisons. While the main flow of dialogue, mediated by the radio DJs, occurs between the incarcerated people and their loved ones, the sounds and stories radiate outward.

Building empathy in white listeners outside the carceral system is not the primary purpose of Calls from Home. The show fills a real need to connect people with their loved ones, provide joy, and help people avoid prohibitive phone call feesall tactics of survivance (not merely survival).[12] But the deeper understanding developed by other listeners is a positive externality of the project, one that undermines the logics of the prison industrial system that erases the humanity of incarcerated people. The song requests, the messages, and the mediation between the two, all facilitated by the Appalshop DJs, constitute an activist co-design practice.

BUILDING COMMUNITY NOT PRISONS

The work of Calls from Home is intimately connected to a broader movement to abolish prisons, especially the work of Building Community Not Prisons (BCNP), a coalition that is working to stop the construction of what would be the most expensive federal prison in the U.S.: U.S. State Penitentiary Letcher in Kentucky. Activists have mounted several successful campaigns against the prison: between 2015 and 2019, incarcerated people and Letcher County

residents sued to stop the prison's construction under the National Environmental Protection Act, and won. In the related #our444million campaign, organizers demanded that the $444 million allocated to build the prison be redirected toward meeting their actual needs and desires, including protection against flooding. However, funding for the project is still allocated by the Bureau of Prisons, and there have been recent pushes to resuscitate the project; the BCNP is running a new counter-campaign. The proposed location for the $505 million prison is the site of a former strip coal mine in Roxana, Kentucky, and represents an investment in incarceration rather than the economic needs of the region.

The proposal to build on a remote mountain-top site that has no existing infrastructure (like electricity, sewerage, and water) stands in contrast with the lack of general infrastructural support after the devastating flooding in the area in 2022. Describing their reasons for activism, the No New Letcher Prison website states, "there are no public transportation, bus, or train routes to the proposed site in the small community of Roxana, KY. The closest airport is several hours away. This remote location would make it extremely expensive and nearly impossible for family members without personal transportation to visit their loved ones incarcerated at this prison."[13]

As of March 2024, The Federal Bureau of Prisons stated in their Environmental Impact Statement that the Roxana site is still their "preferred location" for a new medium security prison, greenwashing prison expansionism.[14] The politics of remoteness is specifically deployed in places that are at higher risk of the changing climate and economic terrain–they are more vulnerable and thus more violable. By proposing Letcher as a remote prison, the Federal Bureau of Prisons hopes to further estrange the Publics of incarcerated people and rural Appalachians.

In this context, Calls from Home is a crucial methodology to respond to remoteness and bring these issues closer to home, emotionally and politically. It is a tool of emotional activism that runs in tandem with BCNP's approach of legal, policy and grassroots organizing.
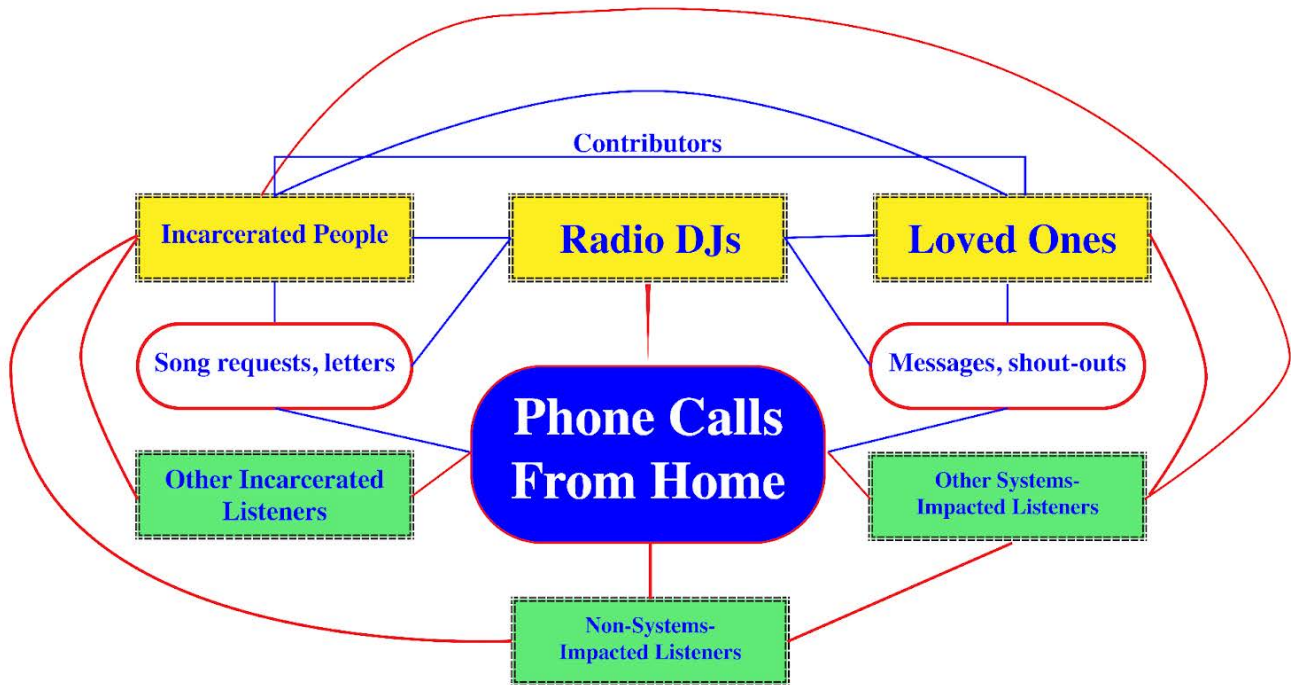

Fig. 2: Mapping a New Public: diagram of Calls from Home's relational pathways of storytelling. Source: Klara Kaufman.

CONCLUSION

Verloo and Davis conclude in their work on conflict that "conflicts that showed the greatest potential to advance change occurred when citizens did not limit themselves to a single action repertoire but simultaneously involve a variety of action repertoires, and when these actions and negotiations unfolded at various scales and spaces simultaneously."[15] Calls from Home is one such negotiation and creates one such space: it is an important tool, but it is only one tool. It is the pairing of this strategy with political activism, community pressure, and litigation that stopped the first iteration of the Letcher prison.

This essay hopes to shift emphasis from designers' "big moves" to Roane's notion of Black vernacular moves: small-scale edits to place that can help incubate futures outside of the racial capitalist state.[16] These activist storytelling methodologies are a form of design, creating new spaces that have ripple effects. The legitimization of emancipatory knowledge, such as messages and music facilitated through Calls from Home, creates a porous space, bringing together communities that have been historically held apart.

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I Know What Is Possible

Mary Geschwindt (MUP '22)

I know what is possible in a
world with pink clouds.

Defy your expectations: the problem is gravity
and the solution is gravity.[1]

Binaries break down by themselves
when their containers are full.

Why would I contain multitudes
when I could contain—me?

Don't you remember your limits, drawing
suns in the corner of the page?

The teacher saying other suns
are possible, elsewhere.

Stop trying so hard to look
perfectly: defy your expectations.

Sometimes suns don't make it
to the picture,

but they're still a kind of sun.
Pink clouds are possible

because I contain gravity—
and worlds in many forms follow.

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1. *Dionne Brand, Love Enough, 157.*

Fig. 1: The wheat grain taking hold. Source: Layal Merhi.

AAMHA // قمحة

Uncovering Beirut's Phantom Ecologies
Layal Merhi (MDes Ecologies '23)

PHANTOM LIMBS

The National Institutes of Health defines a phantom limb as the perception of pain or discomfort in a limb that is no longer there.[1] Cities, like individuals, can manifest pain and discomfort from past events. Every encounter is felt throughout the life of a city, each with its own magnitude.

This project uses Beirut as a case study to explore the concept of phantom limbs in urban environments, examining what has been forgotten, gone unseen, or been left uncontained. The project leverages Beirut's complex history to examine the city's past memories and their impact on the future. Urban environments are constantly active, with each movement influencing the city's fabric. Even mundane events can lead to significant shifts revealing hidden yet present Ghost Ecologies.

Beirut is no stranger to staggering occurrences, its 5000 years of life have undoubtedly collected experiences that time does not erase. From the destruction of Phoenician Beirut in 140 BC and the earthquake of 551 AD to the French Mandate and the civil war of 1975, the city has perpetually found itself at a crossroads, often transforming in a radically different manner after drastic power shifts. In its more recent history, Lebanon has found itself in turmoil for over half a decade. A singular event is not what caused the upheaval. Besides the political vulnerability that Lebanon has–unfortunately–adapted to, an unprecedented economic crisis has disrupted daily life and has pushed the people to the brink of hopelessness. Shedding their desensitized

second nature, an uprising was the people's answer and is exactly what followed. Protests, riots, strikes, and various other forms of activism have by then become the status quo. In solidarity, hope began anew, until hope and outrage collided with the August 4 port explosion. Human and non-human interventions have played a role in shaping and reshaping the urban landscape causing one to question reality. The fact in fiction and the fiction in fact define Beirut's perpetual state of war. Tools of warfare—taking on different shapes and forms, including and perhaps most importantly human behaviors—have become invisible, thriving in a national blind spot. Today, one might argue, every transformative shift in the city's history lives through its everyday struggles, and–more meaningfully–through the collective memory of its people. In the words of Italo Calvino, the city doesn't tell its past, but it contains it.[2] Beirut is certainly no exception, and there is no shortage of past to contain. If anything, the spaces, places, and objects of containment struggle to accommodate the massive layering of memory.

AUGUST 4

On August 4, 2020, Beirut was shaken by a devastating explosion, considered one of the most powerful non-nuclear explosions in human history. The blast claimed hundreds of lives, destroyed thousands of homes, and caused widespread destruction across the city, well into the suburbs and mountains. The grain silos at the epicenter of the explosion were severely damaged but did not fully collapse.

"I like to compare them to three ranks of soldiers," says Emmanuel Durand. "Those in the first line are all dead, those in the second line have been injured, and those in the third have held on."[3] The silos represent a prosperous period in the city's history, built to provide a strategic reserve ensuring food security during global challenges. In fact, the silos had a significant role in maintaining the affordability of bread as the country had been amid a colossal economic collapse, making the damage they sustained all the more hurtful. The role of the silos, however, is not without irony. They played the role of storage alone, while the country always relied on importing its grain as it does most resources.

In the aftermath of the August 4 explosion, wheat from the silos spread across the city, sprouting in neighborhoods and creating unexpected pockets of nature that peppered areas of industry and urbanity. The wheat grew where destruction had gone. Some may see this as a sign of hope, while others may view it as a romanticized idea of "resilience": a second skin that most locals may feel ready to shed. Despite the poeticism, the dispersion of the wheat also signaled the collapse of affordable food access for citizens, a pain that would only deepen over time.

PLANTING AAMHA

Using the Beirut blast as a starting point, where destruction permeated life, this project examines the story of absence in Beirut through three layers: the wheat scattered by the blast, the green line that demarcated the Lebanese civil war, and the political assassinations that shook the country in 2005. Those included the car bomb that killed Gebran Tueini, Editor-in-Chief of Annahar, one of the only free-thinking newspapers in the region. Annahar's blank edition from October 2018 serves as a unique resource. The newspaper published a full edition that merely consisted of blank pages,[4] both rallying the public for support at a time when print periodicals were quickly disappearing and inviting

Fig. 2: Aamha's inaugural issue in print. Source: Layal Merhi.

them to take part in political discourse.

Aamha (which is Arabic for "a grain") learns both from Annahar's relentless effort to speak truth to power over generations, and its resonating message in printing a blank edition. By pulling on the thread of this blank edition and the corresponding reaction, Aamha comes into being as a crowdsourced, open-source periodical that hopes to develop a life of its own. Beirut aches for a platform to make voices heard, one that bypasses existing structures and mends division. The city has a long and convoluted history of journalism. Nearly all news outlets are politicized, a reality not too distant from the days of the civil war when newspapers and magazines were printed by the battling factions and dropped strategically to influence public thought and force conformity.

Taking on these challenges, Aamha will collect knowledge from a variety of sources for its first edition, focusing on the single grain of wheat as a symbol of hope on one end and corruption on the other. Beckoning unfiltered truth in content, it currently investigates the impact of the wheat silos on social, economic, and cultural levels and explores its geographic, socio-political, and metaphorical aspects. As the first edition drops

on August 4 of this year—the third anniversary of the Beirut Blast—crowd-sourced features will delve into the thoughts, feelings, and reactions of the population as they process their experiences through the abstraction of a single grain of wheat. More importantly, Aamha will incite a conversation about the grain of wheat within and from the silos, consequently bringing on a moment of reflection on the August 4 explosion. The newspaper will assemble the public around an aching phantom limb in their city, slowly expanding the assembly around increasingly visible memories the city lives with.

GROWING AAMHA

Once the first edition drops, quite literally, in Beirut, the infrastructure for reproducing Aamha will be open-sourced, and a platform for crowd-sourcing public opinion will be established, paving the way for the decentralized continuity of the "newspaper." Aamha will live on its website and online archive acting as a resource, outlet and DIY publishing house. The reader is now a reader-publisher. Detailed templates and print instructions will be hosted online, and the first print edition will direct the public to them. These will merely act as guidelines that allow
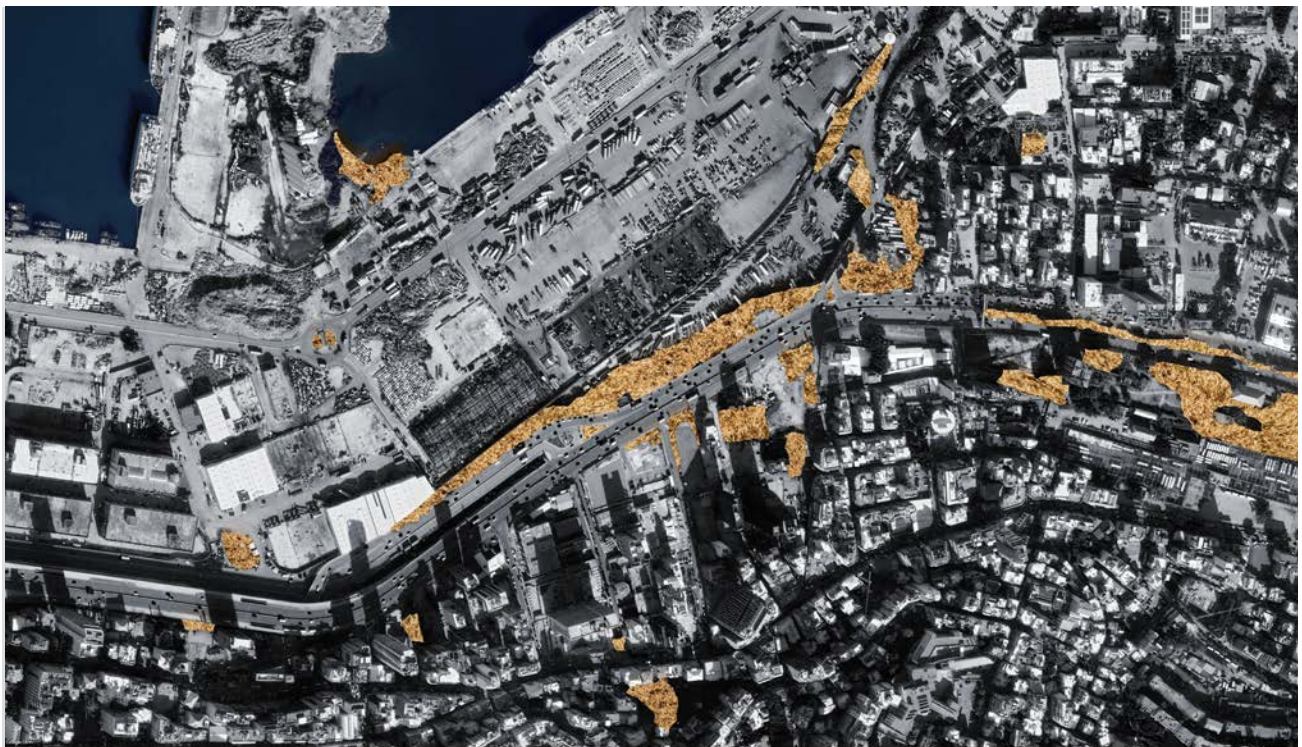

Fig. 3: Wheat occupies the city's fabric. Source: Layal Merhi.

Fig. 4: Aamha proliferates through its open source template. Source: Layal Merhi.

any reader to print a second, third, or three thousandth edition consisting of self-driven and crowd-sourced articles all of which will be stored on the website itself keeping the archive alive. In parallel, this digital platform will collect commentary and other contributions by individuals, building the Aamha archive over time and giving every reader-publisher the opportunity to draw from the accumulating archive of knowledge and thought. The archive is perpetual, the template is endlessly reusable, and the first edition is just the beginning of a conversation on something that aches us all but that we cannot find.

Aamha hopes to shed light on the unseen and forgotten aspects of Beirut and explore the complexity of the city's history and its narrative–still being written. How much can a single grain of wheat contain?

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Fig. 1: Exterior view of Vanato Cabin. Source: Kasawoo, 2024.

Vanato Cabin

Building Lightly

*Kyriaki Kasabalis (MAUD '16) and
Darius Woo*

Vanato Cabin is a home on wheels situated on the island of Zakynthos in Greece, a highly sought-after holiday spot on the Ionian Sea. This tiny cabin is a case study that proposes an alternative way of engaging with the local land—one that is culturally sensitive, touches the earth lightly, and reduces its carbon footprint.

For the last few decades, the island of Zakynthos has experienced the mounting pressure of mass tourism, which has led to rapid and hasty development in an attempt to keep up with the ever-increasing demand for short-term holiday rentals. In Vanato and other villages across the island, more and more farmland is snatched up by developers so they can build new luxury housing to meet the growing demand of seasonal tourism each year. According to local news sources, the island issued 80 percent more building permits in 2023 than in 2022. This model of impatient, capital-fueled development has not only permeated the built environment, but the collective consciousness of local residents as well, who now dream of someday owning luxury villas to rent out to tourists. The speed and scale of development, however, is putting enormous strain on the finite resources of the island. This raises a critical question: Can the island be both a tourist destination and a sustainable place to live?

APPROACH

There is both great resistance to hyper-development as well as a sense of urgency to find alternative, more sustainable modes of development to mitigate the unfettered growth straining the island's resources. While tourism injects much-welcomed revenue into the local economy, it also perpetuates a system of development that favors short-term profits over long-term environmental considerations. As a design practice, we asked ourselves: can we do more with less? Vanato Cabin rejects the conventional ideas of permanent, luxury development in favor of a small, prefabricated home on wheels. The Vanato Cabin is built off-site using timber for both its structure and cladding to reduce its carbon footprint.

Prefabrication is a more commonplace construction method in many other parts of the world, but it is met with greater skepticism on Zakynthos, where the intrinsic longevity and permanence of concrete is a significant part of their building tradition. Vanato Cabin plays an important role in challenging this norm and demonstrating that impermanence and mobility are not inherently oppositional to the same goals and objectives achieved by traditional methods.

Can the island be both a tourist destination and a sustainable place to live?

Uniquely small, compact, and mobile, Vanato Cabin carefully considers its relationship to local context. Two large barn doors on either side of the cabin mark the threshold between interior and exterior, providing crucial cross-ventilation during summers under the relentless Ionian sun. Two triangular wooden platforms fabricated on-site extend the interior outdoors, conducive to minimal living and maximal connection to nature. Lastly, the exterior cladding is painted a deep red, paying homage to the colour of traditional houses found across the island, signaling the importance of cultural sensitivity in new construction methods that respect their surroundings—both man-made and natural.

Fig. 2: The house is prefabricated off-site before being transported to its destination. Source: Kasawoo, 2024.
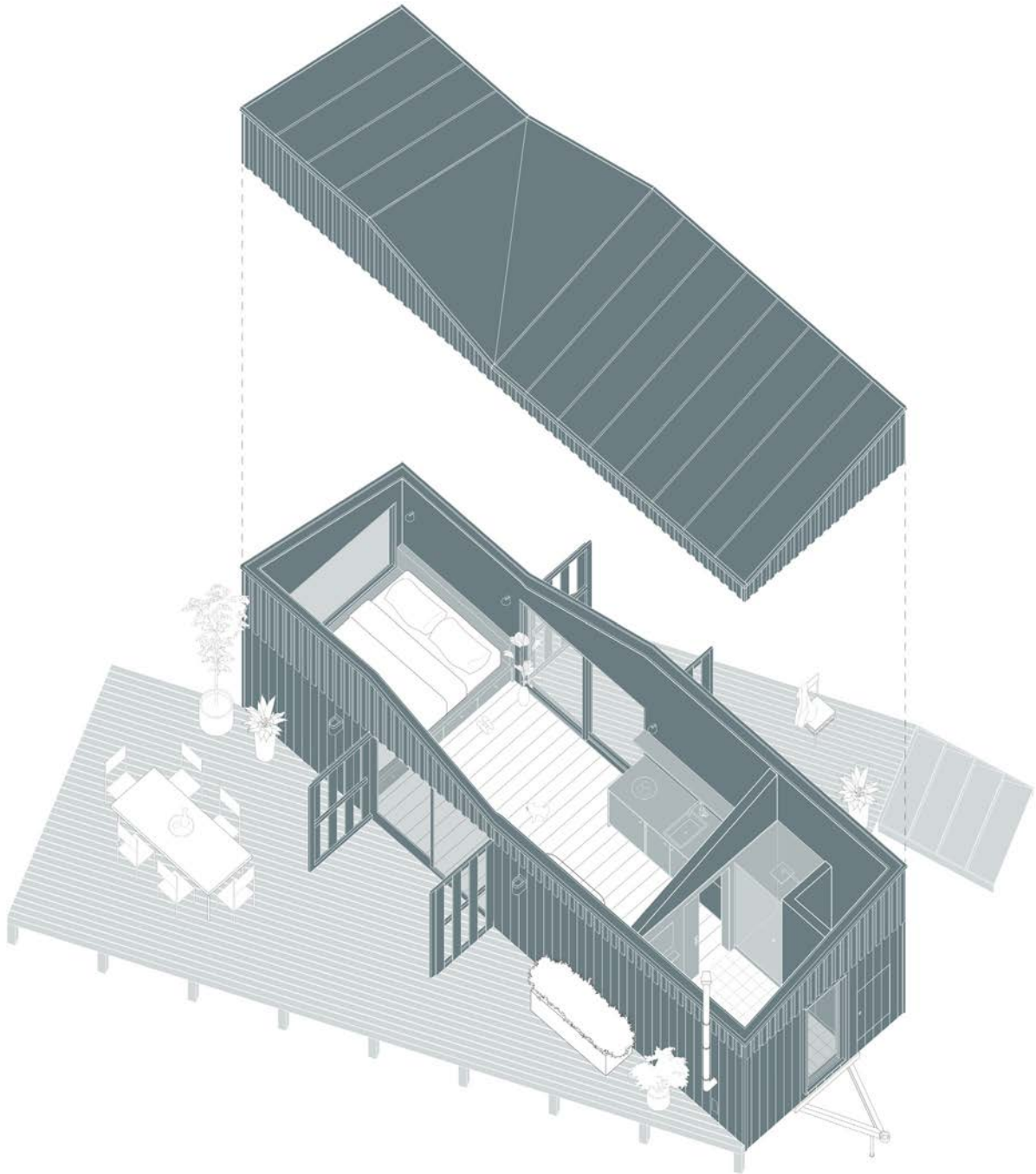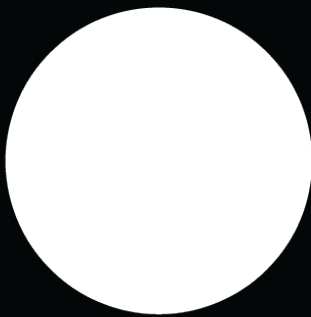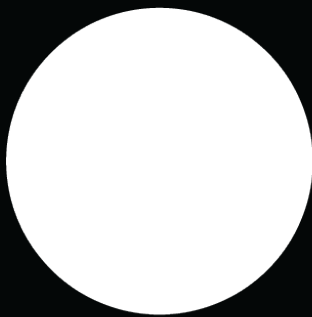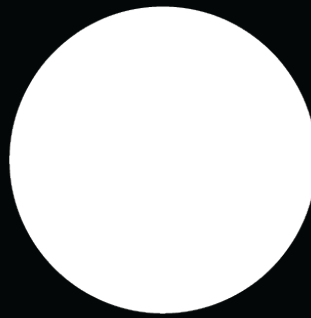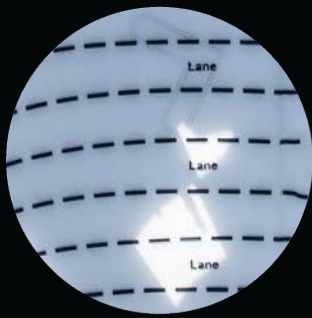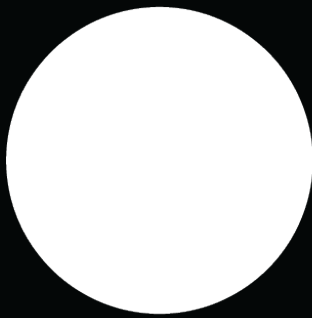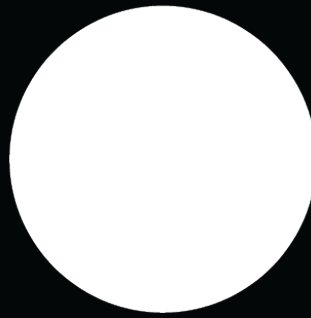
Fig. 3: Axonometric drawing demonstrating the relationship between interior and exterior. Source: Kasawoo, 2024.

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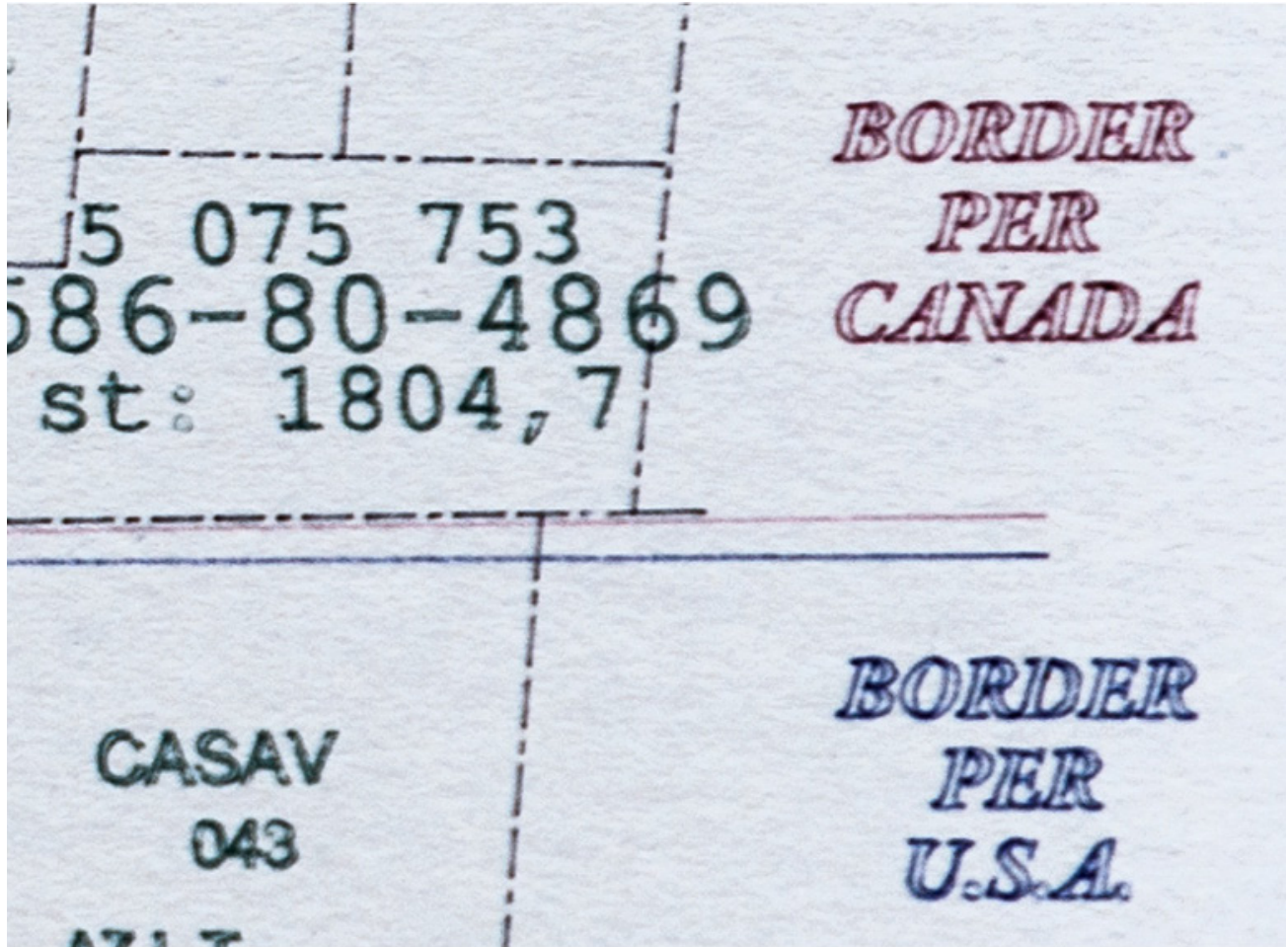
Fig. 1: Stanstead, Quebec, and Derby Line, Vermont, operate as one town across a national border. Source: Alexandru Vilcu, 2019.

Out of Bounds

Alexandru Vilcu (MArch I '19)

Architecture has always undergone phase changes, passing through various media before it finds itself built on the *geography-of-the-land.* For the Renaissance architect Sebastiano Serlio, the printed ink figures in his *Fourth Book* represented a phase change from the stone elements he observed in ancient architecture to ink representations in which these disparate fragments became canonized into the *Five Orders*: Tuscan, Doric, Ionic, Corinthian, and Composite. Arrested within the *improbable-geography-of-the-printed-page,* this inventory of architectural illustrations simultaneously promised a convention for drawing while prompting an analog tooling process of *cut-and-paste*.[1] Today, Serlio's *Five Orders* are a few page-turns away from the United States National CAD Standards
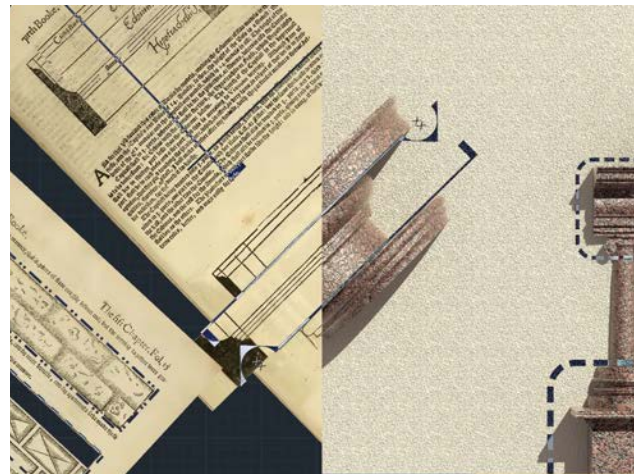

Fig. 2: A phase change from geography-of-the-viewport to geography-of-the-land. Source: The Center for Land Use Interpretation, 2015.
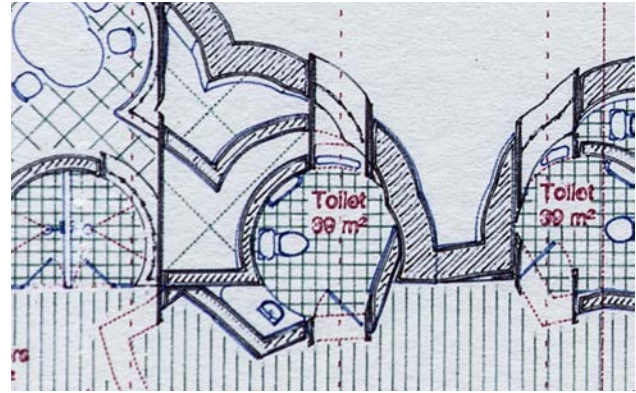
Fig. 3: A window leads to Canada, a door to the United States. Source: Alexandru Vilcu, 2019.

(USNCADS) in the AIA Architectural Graphic Standards 11th Edition. Like Serlio, the USN-CADS represents a phase change—in this case from ink to digital "polylines" in which disparate one-dimensional lines are canonized into "linetypes" by architectural software based on their role in design. Arrested within the *improbable-geography-of-the-viewport*, this inventory of virtual boundaries not only sets a convention for drawing but creates a new set of tooling processes within the limits of the viewport. Architecture is a negotiation between boundaries, which can be conceived through the mutable linetype. To find new value in antiquated drawing conventions, this Harvard Graduate School of Design thesis proposed merging the gulf between the solid and dashed lines of a drawing set, thus creating a caricatured plan that distorts notions of physical and virtual boundaries.

One such boundary is the "border line" that separates two nations, both in drawings and on land. Occasionally, a building straddles this line, becoming a "line house" that interrupts the border and provides a common ground for disparate citizens.[2] The *Haskell Free Library and Opera House* in Derby Line, Vermont, and Stanstead, Quebec, serve as a cross-border cul-
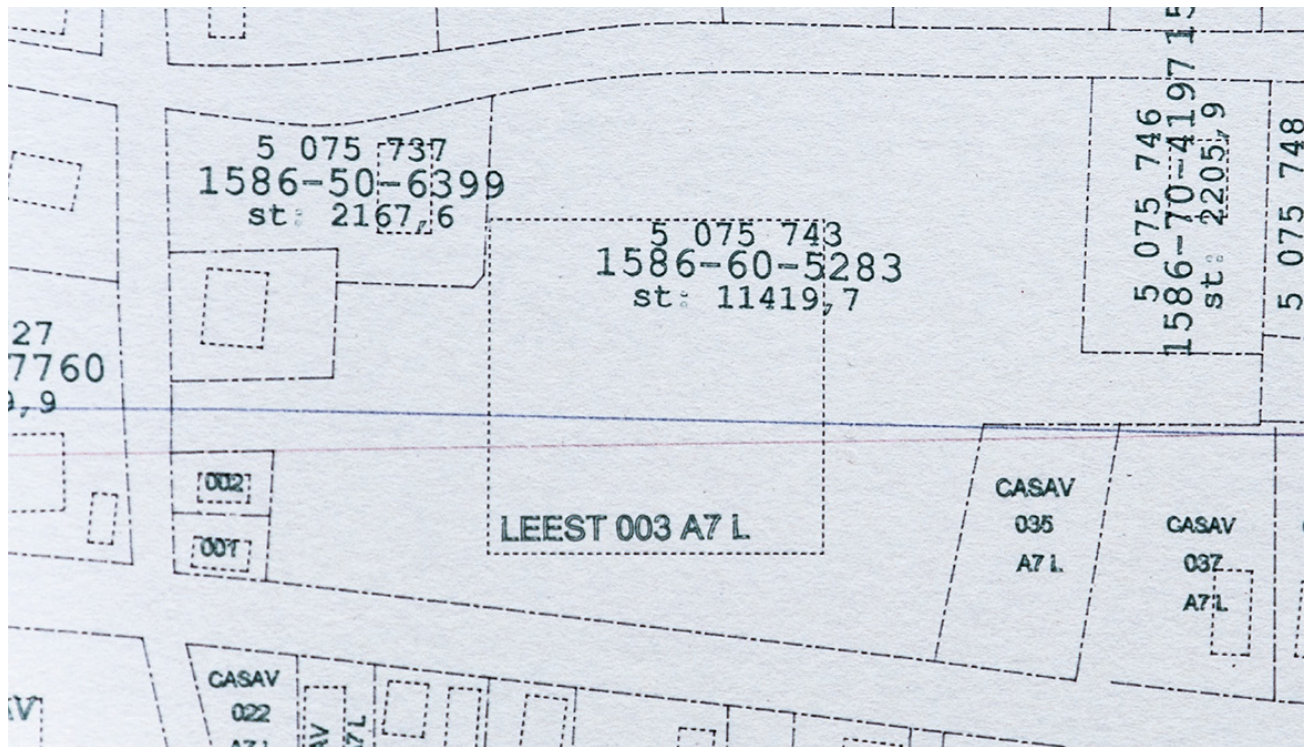

Fig. 4: A "line house" crosses the border of the United States (red) and Canada (blue). Source: Alexandru Vilcu, 2019.

tural hub shared by Americans and Canadians.

In recent years, it has become controversial as a liminal space for family reunions bypassing travel bans. Regardless of a visit's purpose, the painted black borderline in the reading room and across the theater turned a political and bureaucratic marker into a spectacle.

In a similar vein, and a few doors down, the thesis's multi-purpose gymnasium adds a sporting element to the cross-border community. The design stems from cartographic conflicts in the property data maps of each town that expose a fissure of "no-man's-land" between each nation's boundary line.

In a series of "inverse kinematic" operations, these two lines are pulled apart, widening the fissure into a gorge. This collapsed animation of distorted lines created the "setting-out drawing" that organized space, sometimes yielding walls and other times floor joints, but always radicalizing the artifice of the borderline.

Though officially a gymnasium, the building's reality as a line house has materialized at the territorial, building, and detailed scales, creating a funhouse of cross-border spectacle where the representational boundary confronts its physical counterpart.
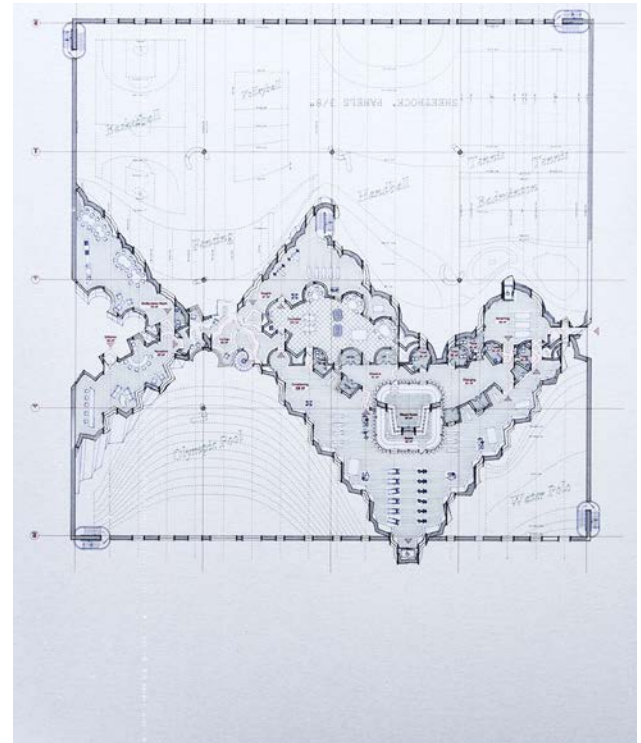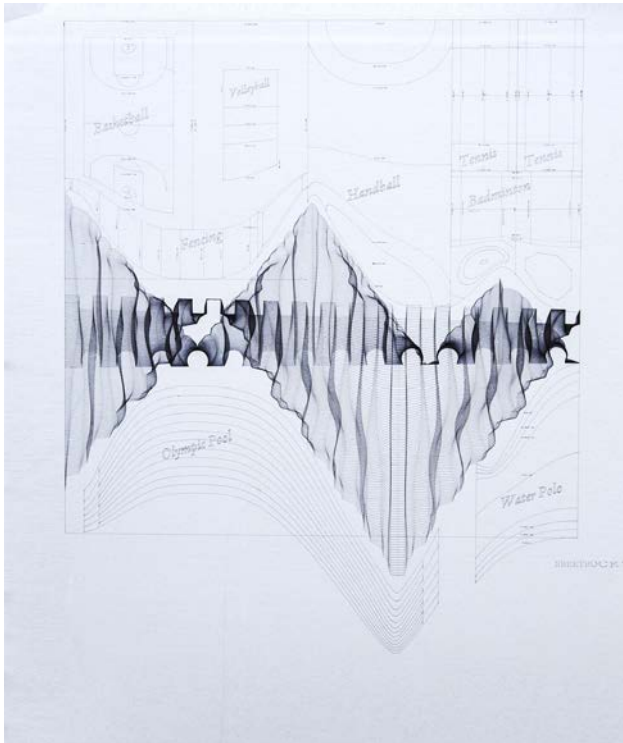
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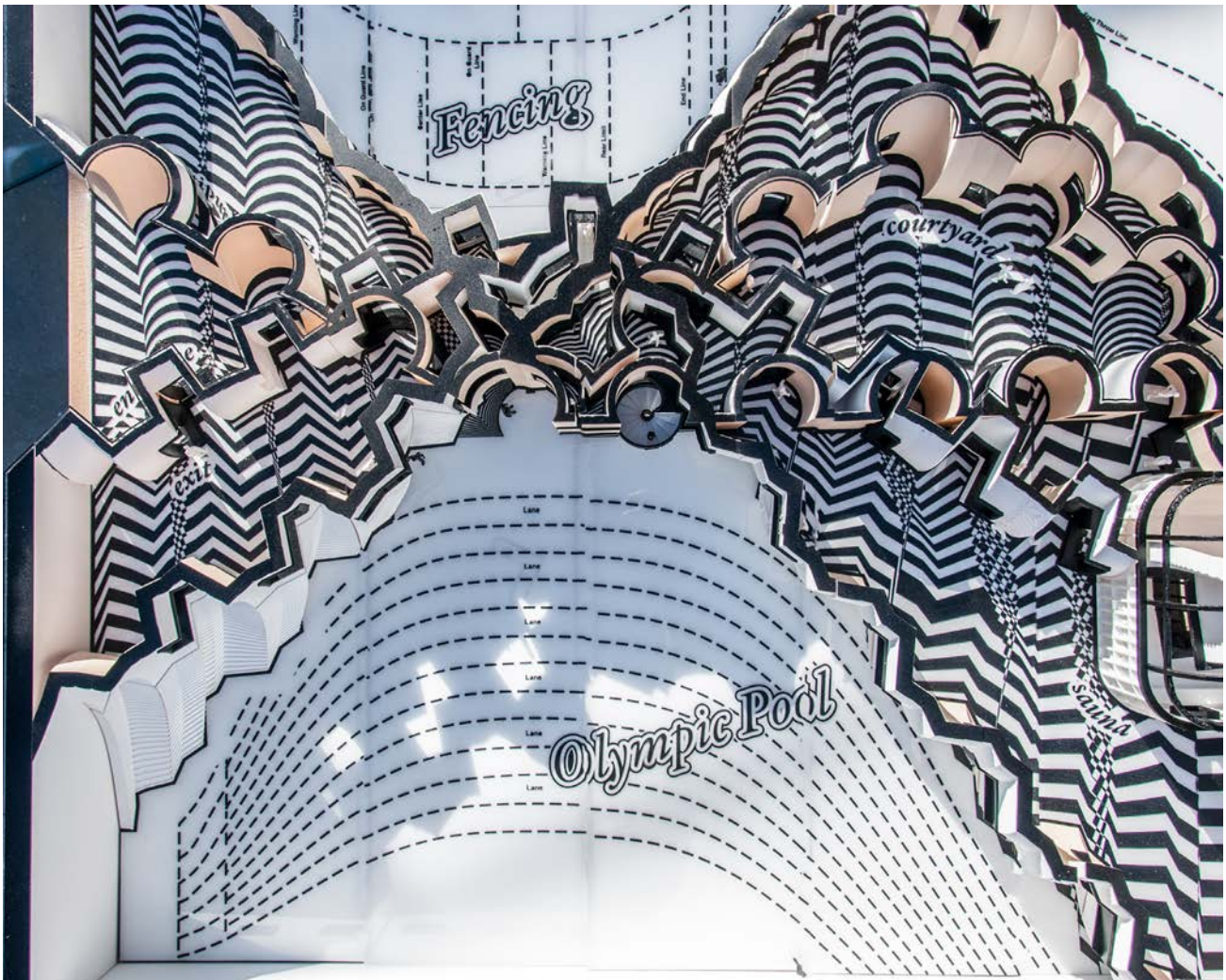
Fig. 6: Model showing animation frames collapsed into one composition. Source: Alexandru Vilcu, 2019.

All Under Heaven Are Equal

Trent Bullion (MDes Critical Conservation '22)

Tianxia (天下), or "under heaven," is the collective of all living things in a place. With this idea in mind, Trent Bullion has assembled the following photographs as a conversation with the denizens of Columbus Park in New York City. The historic Olmsted and Vaux park sits at the intersection of the Courts District and Chinatown. Both landscapes are evolving: The Courts District physically, with the construction of a 40 story jail set for completion in 2027, and Chinatown demographically, as young folks like Bullion himself immigrate into the neighborhood.

The park has a history of photographic inquiry: in the late 1800s, photojournalist Jacob Riis photographed the site, then an overcrowded and impoverished neighborhood; his work prompted the city to demolish the neighborhood and transform it into a park.[1] While Riis saw the inhabitants of this space as other, Bullion seeks to find commonality and connection.

The work reads as a microcosm of Robert Frank's *The Americans*. Much like Frank, Diane Arbus, and Gordon Parks before him, Bullion documents things no one would witness had someone not photographed them.[2] He says that he sees the park as "an emotional site, full of both joy and pain" and is interested in the contrast of park visitors recreating and "NYPD officers regularly waltz[ing] through, shackled incarcerated people in tow."[3]
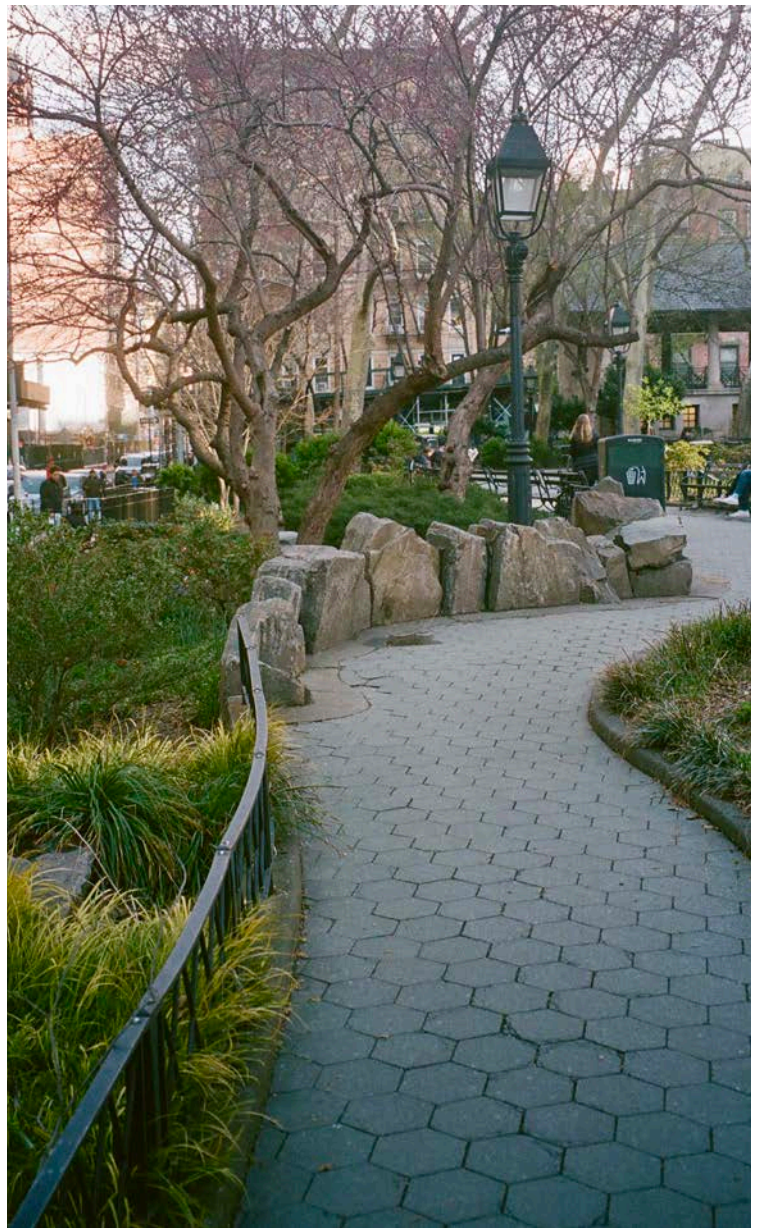
Text by Kieran Silva (MLA '26).

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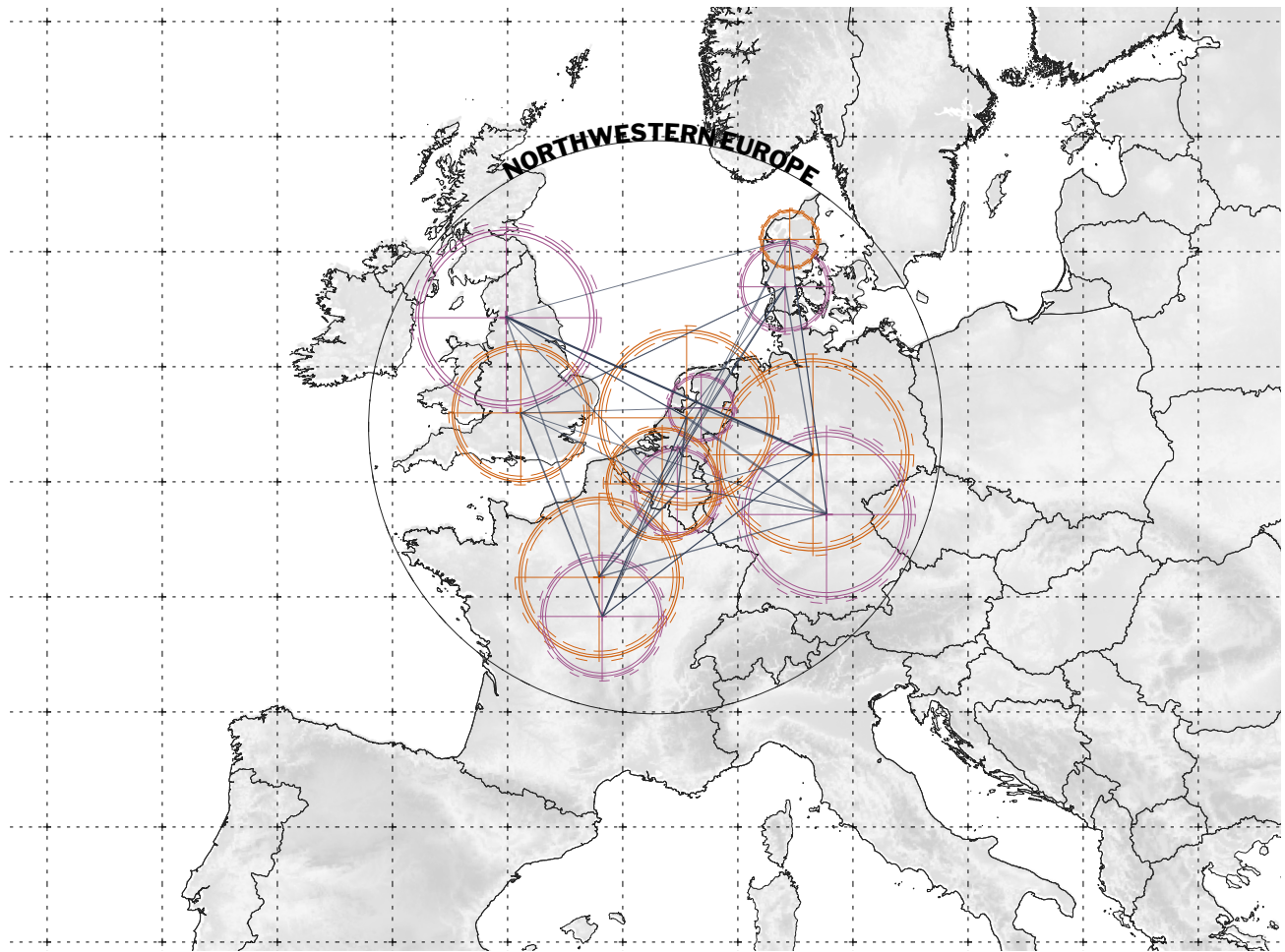3. *Trent Bullion in discussion with Kieran Silva, May 2024.*
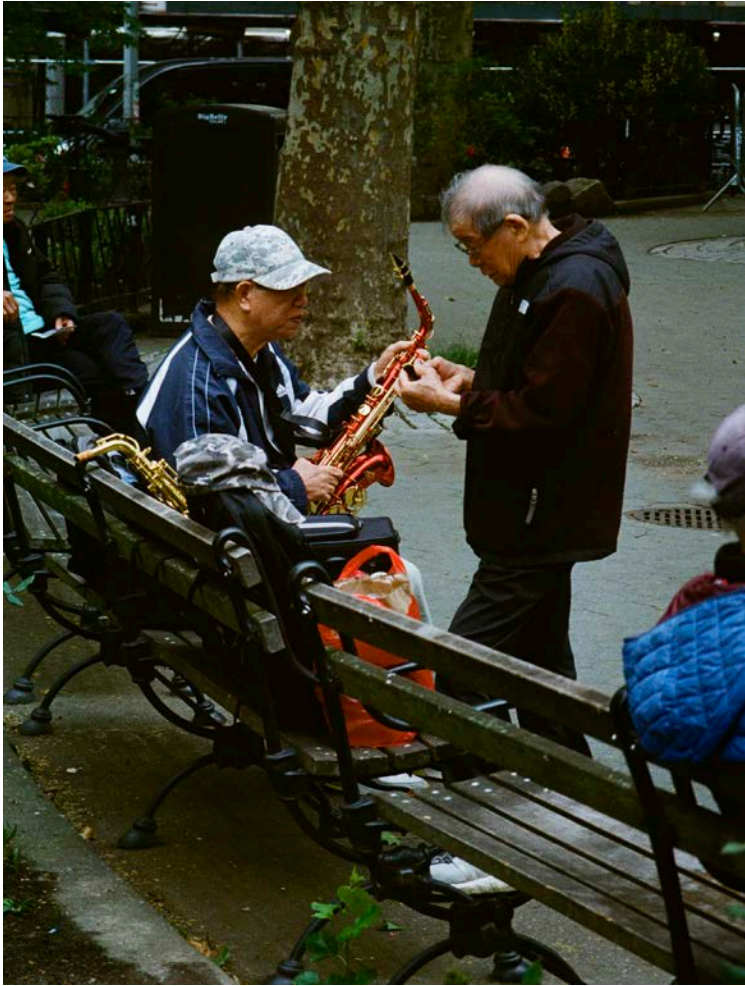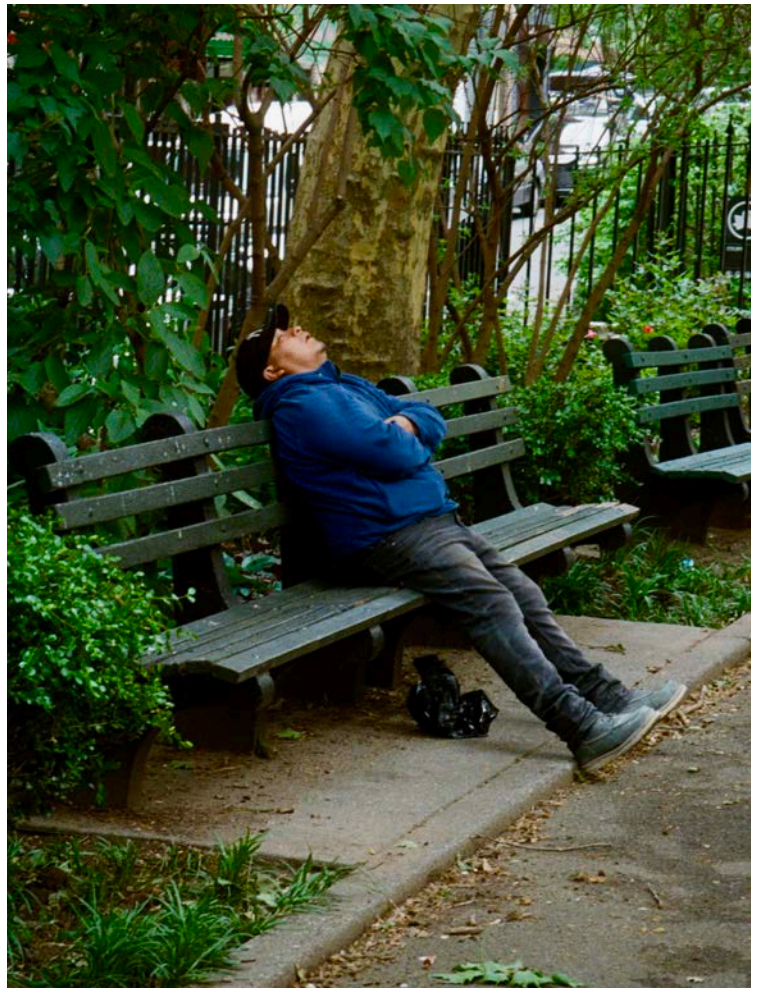
Fig. 1: Exports and imports in northwestern Europe. Source: Lorenzo Novajra.

From Depletion to Regeneration

Soil Permeabilities and ICLS Systems

Divya Agarwal

AGRICULTURE AND THE NETHERLANDS

Cheese

The Netherlands produces 947 million kg of cheese annually, contributing 6.3 percent of agricultural greenhouse gas emissions in northwestern Europe.[1] FrieslandCampina, the country's largest dairy processor, handled 11.8 billion kg of milk in 2018, ranking sixth globally.[2] Dutch cheese exports totaled $4.12 billion in 2020, with Germany as the main market (fig. 1).[3] An average Dutch person consumes 35g of cheese every day of the week;[4] it plays an important role in the daily diet and as a favoured ingredient for the heart.

Pasture

Fifty-three percent of the Netherlands is covered by agricultural land, half of which is pasture.[5] The sector emits nearly 6 percent of the country's greenhouse gases, primarily methane from 3.8 million cows across 16,000 farms.[6] Despite the fact that the number of farms is decreasing, productivity has risen, highlighting environmental concerns related to monoculture and spatial occupation. Permeability is observed through the health of the soil in the following essay.
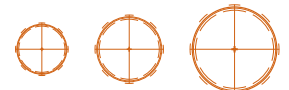
Soil

The Netherlands's fertile delta regions historically faced flooding, fostering fertile soil including peat.[7] Peat, with anisotropic permeability, supports agriculture but has drawbacks like subsidence and compaction, which can impact water management and farming.[8]

Crops

The Netherlands has shifted to fewer, larger farms with horticultural clusters and crop roughage for livestock.[9] South Holland and Friesland focus on pasturelands while Zeeland, Brabant and Flevoland specialise in human-consumed crops.[10]

Salinity

Coastal regions in the Netherlands face increasing surface and groundwater salinity due to rising sea levels and reduced river flow.[11] Managing salination remains crucial for sustainable agriculture and water management.

PERMEABILITY

The future of farming revolves around prioritising healthy soil, which is crucial for addressing issues like soil health, crop suitability and salinity challenges—all interconnected through soil permeability.[12] Circular systems are proposed to maintain self-regulating soil health across short-term, mid-term and long-term cycles. The USDA Soil Texture Triangle[13] (fig. 5) and Dutch soil texture maps[14] guide crop positioning based on silt, clay and sand proportions (fig. 6). Soil permeability, influenced by water needs, fertilisers and pH levels determine optimal crop placement and soil recovery.[15] Integrated Crop-Livestock Systems[16] (ICLS) (fig. 7) are advocated to enhance soil health, reduce greenhouse gas emissions and optimise land use. This shift requires a mindset change and holds significant implications for dairy industry sustainability and broader societal benefits. The strategy aims to guide policymakers and stakeholders toward regenerative farming practices that foster environmental, social and economic sustainability.
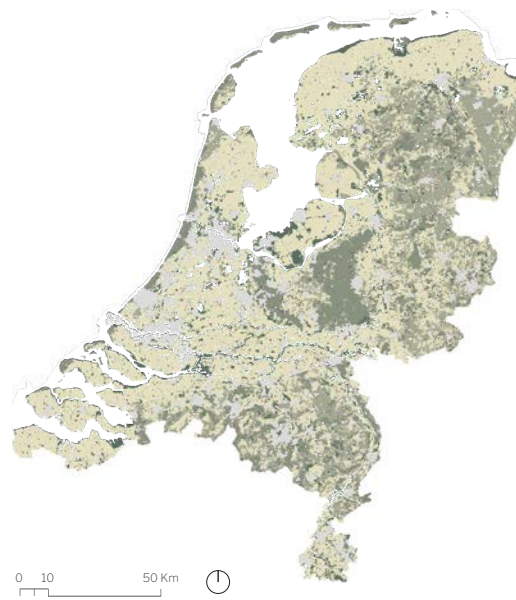

Fig. 2: Soil Fertility. Source: Lorenzo Novajra.

Fig. 3: Crops Production. Source: Lorenzo Novajra.

Fig. 4: Surface Water Salination. Source: Lorenzo Novajra.

SOIL TEXTURE DIVERSITY

Agricultural specialisation or monoculture farming does provide benefits of scale, including lower production costs and ease and efficiency of management; however, it has resulted in widespread environmental issues in the Netherlands.[17] A switch from monoculture farming methods to polyculture farming methods in clustered farms is required. While monoculture is a type of farming where a single crop is cultivated or livestock are grazed on a single piece of farmland, polyculture includes a mixed farming method where land is parcelled to allow for different activities.[18] Multiple products and crops are produced in one location based on internal and external factors. External factors include climate, weather, soil conditions, political stability and market prices.[19] Internal factors include land areas, land ownership, ingenuity between farmers, farms' economic structure and equipment availability.[20] For this article, we delve deeper into the environmental aspects of this system.

This article is an exploration of these rotational agricultural systems: vegetable crops and fruit crops, livestock grazing, poultry, cereals and oilseeds. As a starting point, it focuses on major crops that are cultivated or consumed crops in the Netherlands, such as wheat, tomatoes, onions, carrots, potatoes, sugar beets, grapes, apples, peaches, strawberries, rapeseeds, sunflowers, soy, and olives.[21] Using the USDA Soil Texture Triangle and combining it with the soil texture map of the Netherlands, the crops are analyzed based on the soil in which they would grow best.[22] Water requirements, fertilisers, and pH levels are other important determinants for regulating crop growth.[23] In fig. 5, soils are divided based on these properties and proportions of silt, clay, and sand. For example, if a soil texture type is 80 percent silt, 40 percent sand, and 40 percent clay, it belongs to the loam soil but can be suitable in sandy loam to silt loam. (A limitation of this graph is the exclusion of chalk soils and peat soils.) The crops are categorized on this triangle, with animal farming left for later. This helps us understand that most of the crops would flourish in loamy soils.[24] Compatible soils range from silty clay to silty clay loam to sandy clay to sandy loam.

Water irrigation or rainfall is necessary for these plants to utilise the sun's energy to make their food through photosynthesis.[25] Water is calculated based on crop requirements that is absorbed by these soils. For the triangle, this
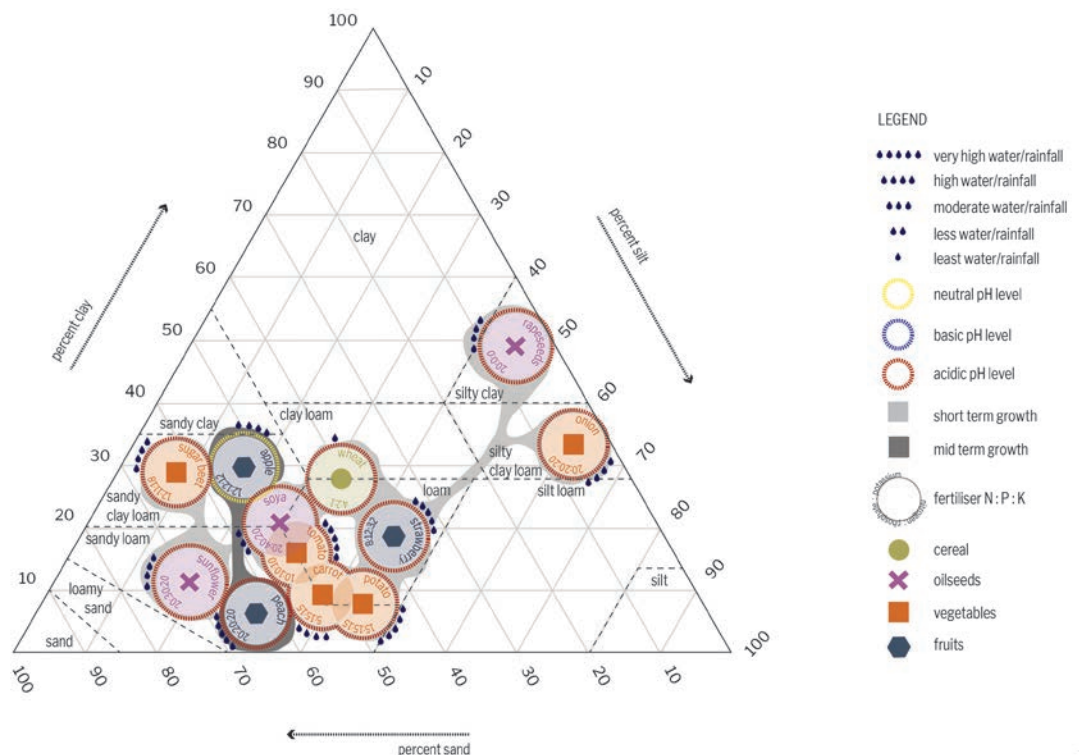

Fig. 5: Evaluation Graph for Major Crop Productions in the Netherlands. Source: Divya Agarwal.

requirement ranges from very high water needs to low water needs.

Currently, fertilisers speed up the process of crop growth.[26] The fertilisers are measured in the ratio nitrogen (N) to phosphate (P) to :potassium (K).[27] Every crop has a special fertilizer requirement. These requirements also help us understand manure requirements, which will result in a circular system. Not only do these fertilisers recover the soil's nutrients, but they also help bring soil to a recommended pH level. Sulphate is added to soils to make them acidic and limestone is added to make them basic. Some soils are neutral, whereas others require these additional nutrients.[28] The growth period of the plants is distributed into short-term (less than five years) and mid-term (greater than five years).[29] Rotational crop patterns and cycles can be pre-planned depending on these growth periods and requirements.[30]

The following conclusions are drawn:

1. Most crops thrive in loamy textured soil.

2. The crops situated closely on the soil texture triangle have similar soil requirements and thus can be in the same larger rotation cycles.

3. Different families of crops can be grown in the same rotation cycles.

Peat soil is an extremely fertile soil.[31] Due to the difficulties with water and irrigation, it is a high-maintenance soil for crop growth. Although it is not included in this graph, its high availability in the Netherlands is deemed essential to include it in the next table (fig. 6) that explores crop patterns at length.[32]

INTEGRATED CROP LIVESTOCK SYSTEMS

The Catalog for ICLS shows the nuances of crop and livestock systems. Crop growth patterns and requirements are complex, so this catalogue is a bottom-up approach to breaking soil's permeabilities and capacities into comprehensible concepts.

This catalog should be read through the broad frame of two axes: Major Crop Families (horizontal x-axis) and Crop Growth Period, Soil Texture Properties, Soil Depletion Properties and Soil Recovery Properties (vertical Y-axis) (fig. 6).

All crop families are selected depending on their importance in the Netherlands. The crop circles are carried forward from the USDA Soil Texture triangle (fig. 5) and are now expanded to families. The water requirements and pH requirements complement the information about these families. Knowing what family a plant belongs to can be useful in making decisions about rotating plants, and for managing pests and soil fertility in the garden. Plants in a family are genetically related, so they have similar characteristics.[33]

Some families are nightshades, squash, legumes, oilseeds, fruit trees, and creepers.[34] These families are further classified based on their growth periods. Most families are short-term because crops are grown according to seasons. Productive summer months in the Netherlands range from March to September.[35] An exception is fruit trees, which can one to five years to produce, depending on the fruit.[36]

Crops deplete soil's nutrient value, thus affecting its permeability. Healthy soil has its limitations in growing crops, and depleted of nutrients, it needs to be refilled or recovered by fertilisers.[37] This theory is the basis for understanding crop politics, from depletion to regeneration. The crop families are categorised into heavy feeders, medium feeders, light feeders, and soil builders.[38] Of the most-consumed crops in the Netherlands, tomatoes and potatoes are extremely heavy feeders and require immense soil replenishment as compared to onions which are light feeders and can be grown on various soil ecosystems.[39] Legumes, such as soybeans, clover, and vetch, are effective soil builders by adding nitrogen.[40] Their soil-building and feeding properties inform crop rotation cycles, with shorter, one-season cycles requiring less labour than longer ones. These require agricultural expertise and practical trials to perfect over time.

Crop families are then distributed based on the soil textures. Most families grow on a range of closely situated soil textures rather than a specific one. This is where the Catalog adds to the understanding of fig. 6. In the Catalog (fig. 7), peat soils have been included to expand their presence and importance in this geographical context. The onion, cabbage, lettuce, beet, nightshade and carrot families thrive in peat.[41]

MAJOR CROP FAMILIES		CREEPERS	FRUIT TREES	OILSEEDS	LEGUMES FAMILY	CARROT FAMILY	SQUASH FAMILY	NIGHT-SHADE FAMILY	GRASS FAMILY	BEET FAMILY	LETTUCE FAMILY	CABBAGE FAMILY	ONION FAMILY
GROWTH PERIOD	short term	●		● ✕	● ✕	●	●	●	●	●	●	●	●
	mid term		●										
SOIL DEPLETION PROPERTIES	light feeder								●				■
	medium feeder					■							
	heavy feeder	⬡	⬡	✕			⬡	■		■	■	■	
	soil builder				■								
SOIL TEXTURES FOR CROP GROWTH	sandy loam		●	✕	■	■	●	■	●		■	■	
	sandy clay loam		●				●					■	
	loam	●			■	■	●	■	●	■	■		
	clay loam								●	■			
	silty clay loam												■
	silty clay			✕									
	peat soils					■		■		■	■	■	■
SOIL RECOVERY PROPERTIES	cover crops/fallow	⬡		✕		■	⬡	■		■	■	■	
	crop residue-grass	⬡	⬡						●				
	animal grazing	⬡	⬡						●		■		
	livestock manure									■		■	

Fig. 6: Catalogue of Crops Typological Characteristics. Source: Divya Agarwal.

Soil builders help recover soils; however, soil recovery properties depend on cover crops, fallow seasons, animal grazing, and livestock manure.[42]

Fast-growing cover crops like buckwheat, sorghum-sudangrass, and Japanese millet can suppress weeds.[43] Cover crops and crop residues can also be grazed on by animals like cows and pigs to ensure soil activity with their hooves and automatic manure planting.[44] Soil-feeding crops should never be planted on the same soil in the same rotational cycle.[45] The soil builders and recovery take on from there to fix the soil nutrient levels to grow crops in other seasons. Cover crops are left for a season; grass can be left for a season for animals to further graze on its residue; in some instances, it is recommended that the soil be left fallow for underground earthworm activity.[46] Extreme tillage by machinery might also destroy soils, hence these measures also help in rebuilding an existing drain field or farm of soil.[47]

Along with crop politics exist farm animal politics. Pigs are monogastric animals that feed on diverse plant species, while ruminants such as cows that break down grass (pasture) into dairy products.[48] Finding the right balance is important since multiple animal species can forage together efficiently since they consume different things. On the same field, cows consume grass whereas chickens consume insects.[49] Sometimes they prefer different plants or different parts of the same plant. This is symbiosis (fig. 7).

The following are the benefits of the ICLS system as put down by the Rodale Institute, which researches organic farming: reduced animal feed costs, utilised marginal lands, reduced labour but efficiently distributed labour, reduced machinery inputs, improved soil health, reduced tillage, increased farm biodiversity, an additional weed management strategies, additional source for plant fertility and reduced pest problems.[50]

In order to achieve these benefits, we must:
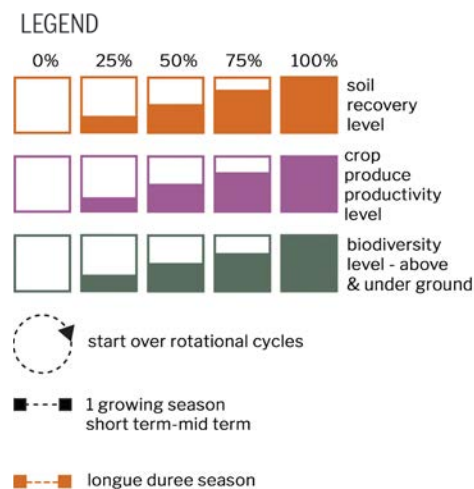1. Identify land-use practices based on the suitability of the land.

2. Plan crop-livestock rotation based on flock/herd size, crop species, and seasons.

3. Be conscious of the stocking rate, including multiple animal species and the number of animals per pound per unit area.

4. Select pasture type for optimal grazing to reduce the amount of additional feed needed.

5. Use soft fencing where required.

6. Move livestock frequently instead of standardizing on specific farm locations.

7. Encourage plant regrowth from grazed pastures.

8. Provide fresh water access.

9. Be aware of weather.

10. Maintain economic and social viability of farmers.[51]

Multifunctional landscapes are those providing multiple ecosystem services (ES) simultaneously.[52] By balancing the delivery of provisioning, regulating, and supporting ES, the promotion of landscape multifunctionality ensures the sustainability of "working lands"[53] and human well-being.[54]

These strategies for implementation are a step towards mature ecosystems and future multipurpose foodscapes. Fig. 7 shows various crop rotation cycles to be adopted as the initial phase of ICLS in the Netherlands.

The recovery of an existing drained farm is used as a starting point for existing farmlands. Exhausted farmlands that can not be recovered, adopt the rewilding future, long duree (long-term) strategy. Farmlands are exhausted due to high salination levels as well, desalination and bio-remedial technical processes should be adopted. This article limits itself to ICLS for soil recovery.

The ICLS system opens up opportunities for seasonal farmers and initiates the formation of temporary farming communities based on growing seasons. The bottom-up ICLS suggests looking at the soil's permeability and capacity as the starting point.
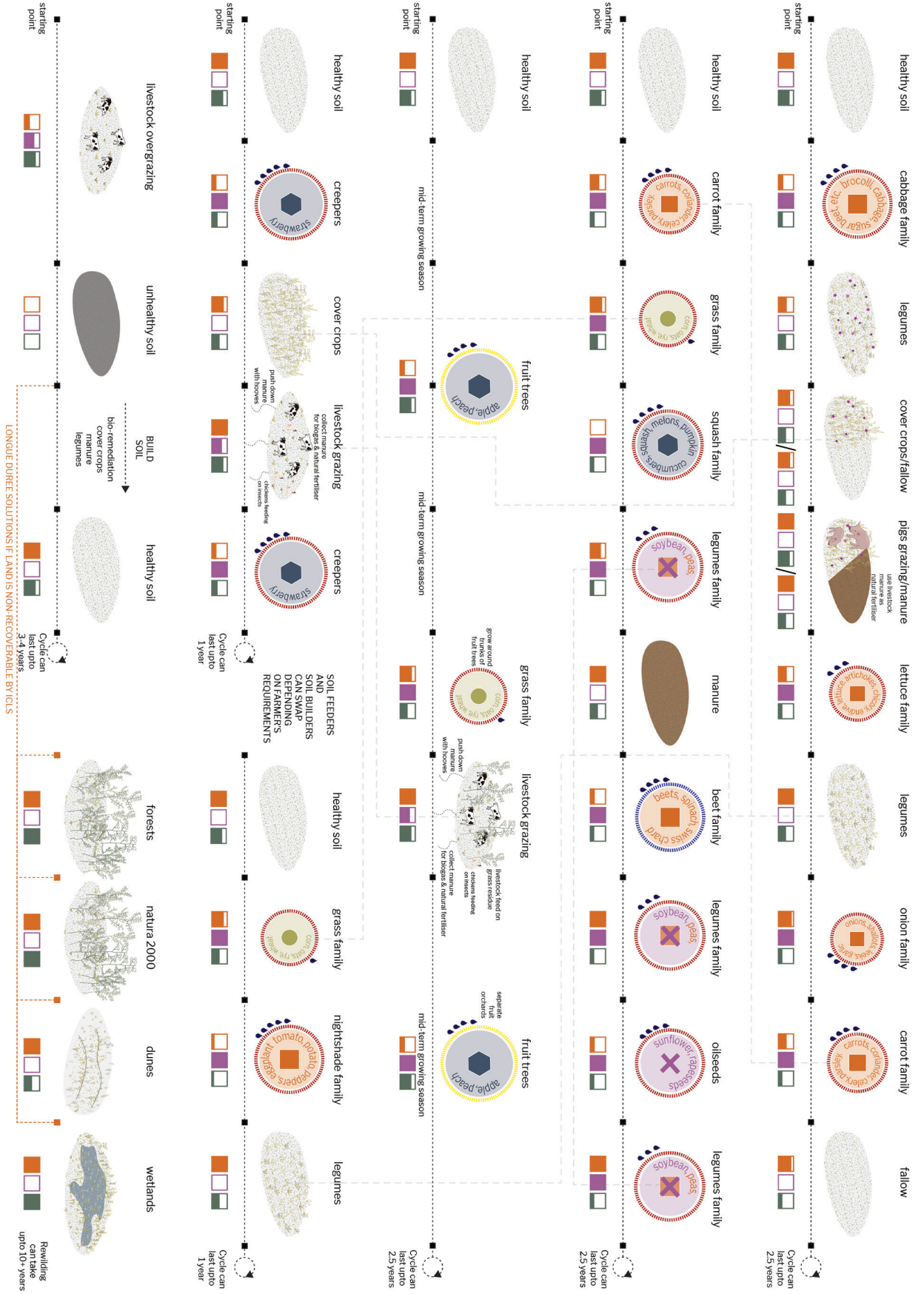
LEGEND

0% 25% 50% 75% 100%

soil recovery level

crop produce productivity level

biodiversity level - above & under ground

start over rotational cycles

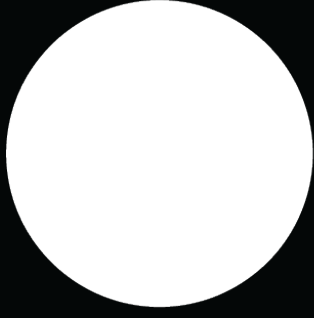1 growing season short term-mid term

longue duree season

Fig. 7: ICLS Cycles Typologies. Source: Divya Argawal.

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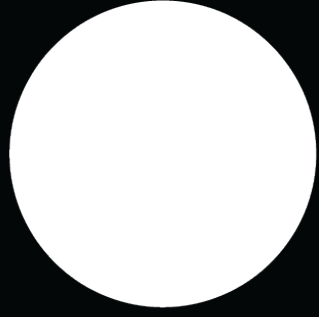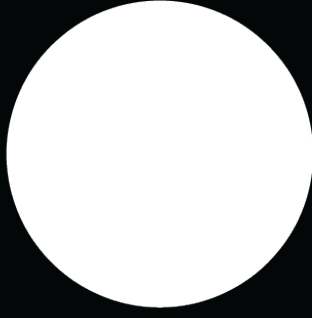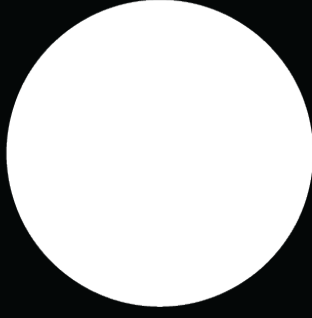
Fig. 1: An aerial perspective of the proposed waterfront design intervention. Source for all figs: Authors.

De Bord En Bord

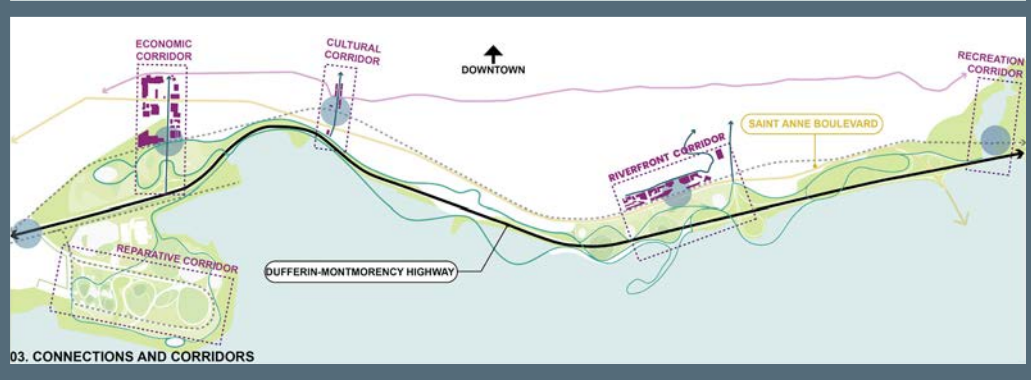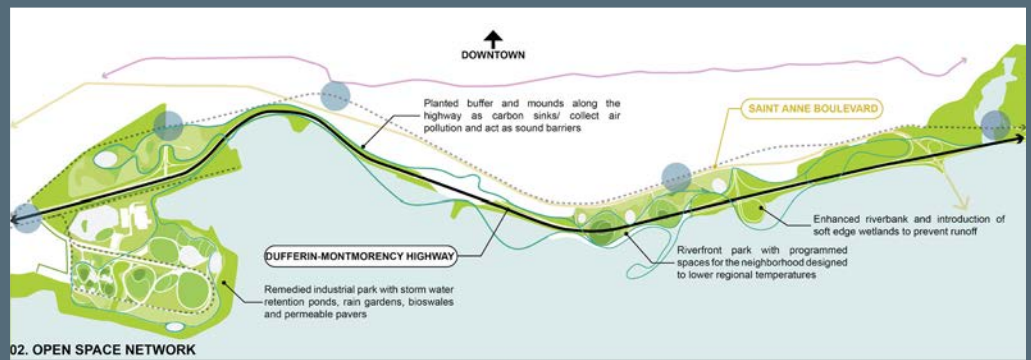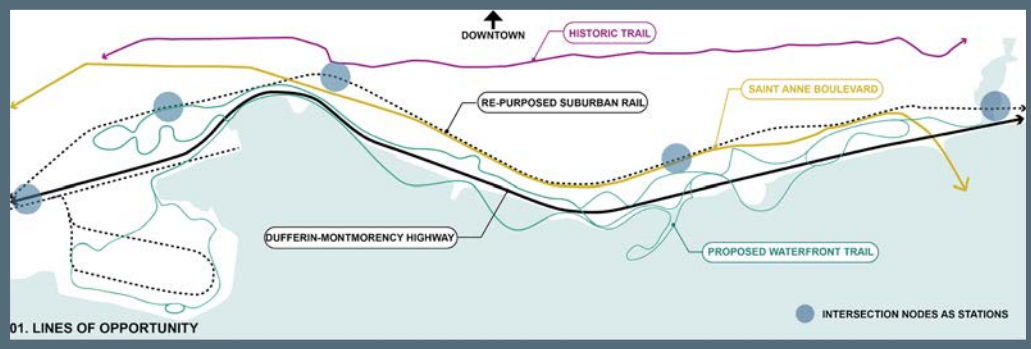## Transcending Urban Borders Along St. Lawrence River Shoreline

Celina Abba (MLA I '23), Tanushri Dalmiya (MAUD '22), Oliver Shi (MLA II '22), and Mengyu Zhao (MArch II '23)

The project De Bord En Bord, meaning "from edge to edge" in French, unfolds along the shoreline of the St. Lawrence River in the northeastern reaches of Quebec City. De Bord En Bord is an investigation of urban design approaches aimed at transcending artificial borders—the imposing Autoroute Dufferin-Montmorency and Boulevard Sainte-Anne, two major motorways—along the river's meandering shoreline. It showcases a process of identifying the primary borders of a specific site and enhancing the area's permeability by then engaging with these borders and reimagining the spaces they delineate.

Within this project, the concept of "permeability" refers to the extent to which these borders can be accessed, passed through, and thickened into public space. By increasing their permeability, a border can transform and weave together two disparate sides.

01. LINES OF OPPORTUNITY

DOWNTOWN
HISTORIC TRAIL
RE-PURPOSED SUBURBAN RAIL
SAINT ANNE BOULEVARD
DUFFERIN-MONTMORENCY HIGHWAY
PROPOSED WATERFRONT TRAIL
INTERSECTION NODES AS STATIONS

02. OPEN SPACE NETWORK

DOWNTOWN
Planted buffer and mounds along the highway as carbon sinks/ collect air pollution and act as sound barriers
SAINT ANNE BOULEVARD
DUFFERIN-MONTMORENCY HIGHWAY
Enhanced riverbank and introduction of soft edge wetlands to prevent runoff
Riverfront park with programmed spaces for the neighborhood designed to lower regional temperatures
Remedied industrial park with storm water retention ponds, rain gardens, bioswales and permeable pavers

03. CONNECTIONS AND CORRIDORS

ECONOMIC CORRIDOR
CULTURAL CORRIDOR
DOWNTOWN
RECREATION CORRIDOR
SAINT ANNE BOULEVARD
RIVERFRONT CORRIDOR
REPARATIVE CORRIDOR
DUFFERIN-MONTMORENCY HIGHWAY

_L_ CORRIDOR
- cilities
- ls to Activity Track
- mulator Gardens
- Sink + Ventilation
- Ponds
- Amphitheater

ECONOMIC CORRIDOR
1. Planting
2. Potential Commercial Area
3. Urban Pedestrian Access

CULTURAL CORRIDOR
1. Arts & Culture Investments
2. Urban Pedestrian Access

RIVERFRONT CORRIDOR
1. Landbridge
2. Mixed-use Affordable Housing
3. Quay Center
4. Athletic Facilities
5. Cool Island Sink + Ventilation

THE GREEN LINK
1. Commuter Rail
2. Enhanced + Restored Wetland
3. Soft Edges
4. Rentention Ponds

RECREATION CORRIDOR
1. Montmorency Falls Park
2. End Of The Commuter Train
3. End Of The Route

1500M   500M   100M

MACRO-SCALE

De Bord En Bord embarks on an exhaustive analysis of "borders" that could be softened and transformed. Identified are Autoroute Dufferin-Montmorency and Boulevard Sainte-Anne, which make the river embankment extremely difficult to access.

At the macro-scale, the project aims to transform the linear artificial borders into "lines of opportunity," with re- purposed infrastructures. Spanning 11 km from Port Beauport to Montmorency Falls, the project creates an ecological corridor characterized by expansive landscapes and green highway buffers. The existing abandoned railway infrastructure is envisioned as a suburban commuter rail, connecting downtown to the newly developed waterfront edge. Route 138 is reactivated with reduced vehicle carriageways interspersed with pedestrian boulevards and bike paths. The once hard-to-access shoreline of the St. Lawrence River is transformed into a meandering riverfront ecological area, offering visitors a pedestrian trek and multiple attraction points.

De Bord En Bord aims to reconnect the urban fabric of the city to its waterfront by reframing the borders and the urban spaces around them—transforming its divisive Dufferin Montmorency freeway and boulevard into an ecological corridor and an urban common, allowing citizens to reclaim their right to the river.

De Bord En Bord aims to transform the divisive Dufferin Montmorency freeway into an ecological corridor and urban common.
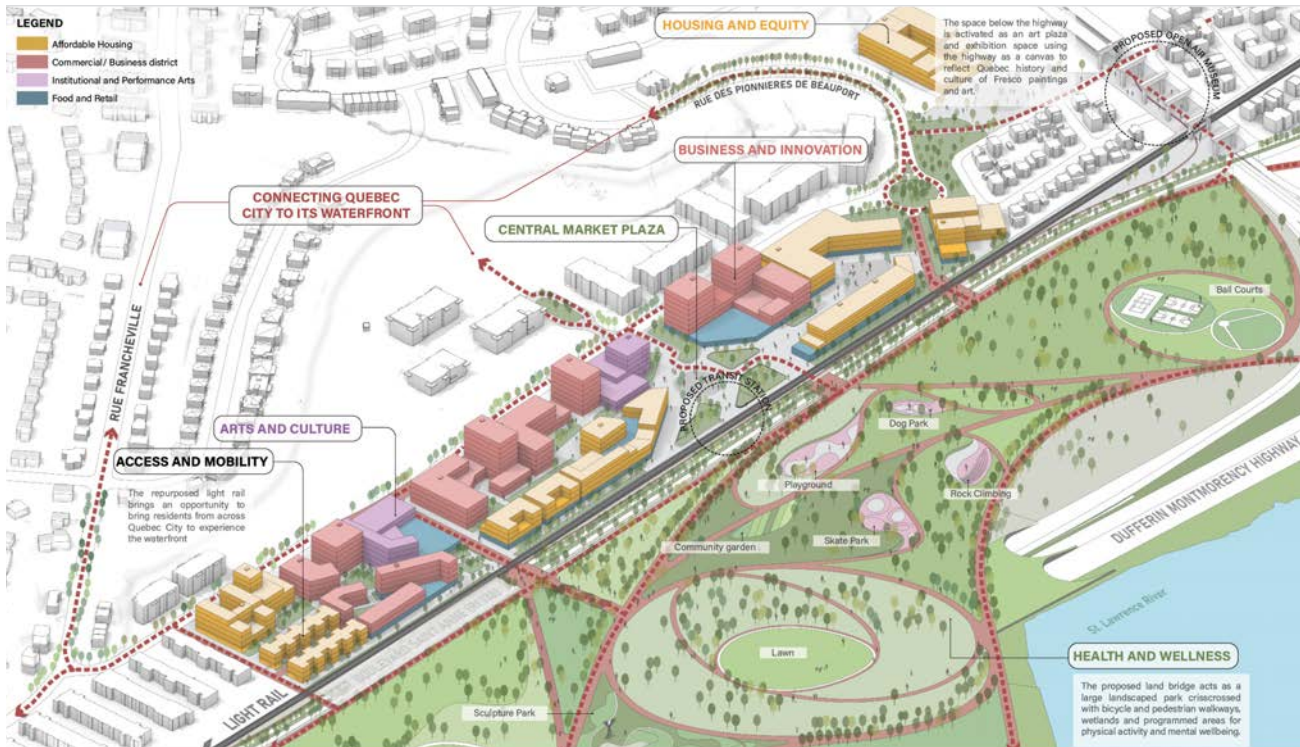
Fig. 2: An axonometric view proposing a catalytic corridor alongside the capped highway.

MESO-SCALE

At the meso-scale, the project primarily investigates two areas: the proposed residential corridor and the Beauport area.

The proposed riverfront corridor repurposes vacant industrial land into mixed-use spaces characterized by affordable housing, business development, and cultural expression. These spaces are anchored by a public spine of market and retail spaces that not only catalyze business, but are an extension of community life, connecting the existing historical trail to the water's edge.

The vision of permeability extends to Beauport, the historic port of Quebec City. This neglected industrial site was reimagined as a porous green lung for the city.

Over time, as industry grew, wetlands along the river were diminished. This loss of wetland in turn decreased permeability and increased storm water runoff. By enhancing and reintroducing a planted edge, the project softens and thickens the boundary between river and land. The design incorporates stormwater retention ponds, rain gardens, bioswales, and permeable pavers, weaving history with ecology to create a new reparative corridor.

This interplay between past and present is reflected in the preservation and retrofitting of industrial relics, with tanks and machinery re-imagined as historical monuments, evoking memories and nostalgia of Quebec City's past identity.
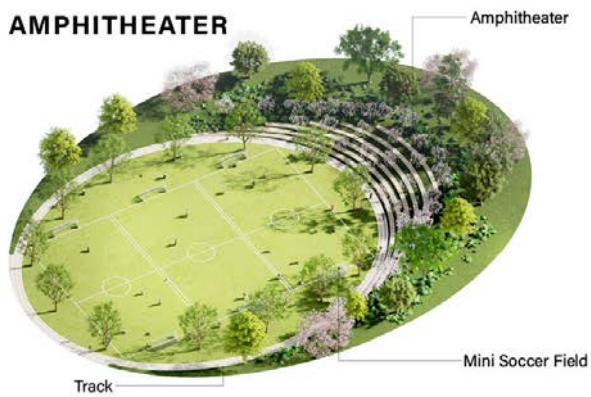
Reintroducing a planted edge softens and expands the boundary between river and land.

Fig. 3a and Fig. 3b: The project re-purposes and integrates iconic industrial forms into the landscape to tell the stories of their past.

EVENT LAWN

Trellis

Picnic Area

Outdoor Concert

AMPHITHEATER

Amphitheater

Mini Soccer Field

Track

SPORTS LAWN
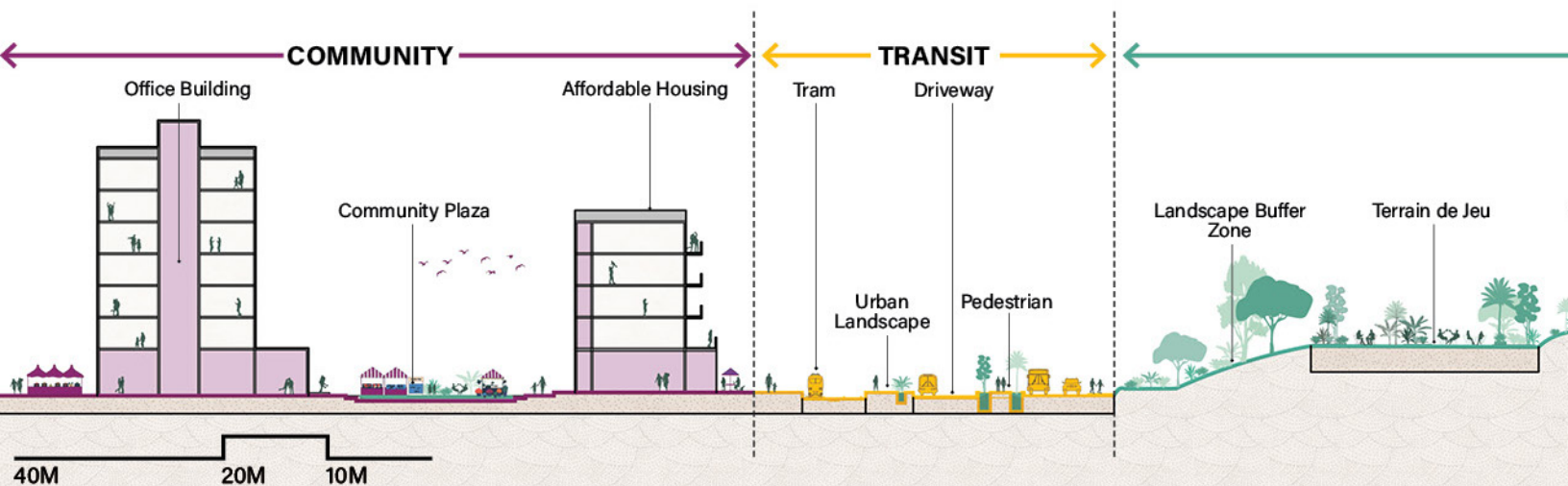
Baseball Field

Tennis Court

Basketball Court

MICRO-SCALE

Finally, the project explores urban design approaches that enhance the permeability of the artificial border—the "Dufferin Montmorency" Highway—at specific junctures. One such exemplary micro-scale juncture is where Dufferin Montmorency passes through residential neighborhoods.

At this juncture, the highway is capped as a land bridge park, offering a wide variety of amenities from amphitheaters to community gardens that moderate the micro-climate and invite moments of play, rest, and community gathering. The land bridge is integrated with soft-edge wetlands that help transform Quebec City into a resilient and absorbent sponge; a city that embraces water and minimizes runoff from impervious roadway infrastructure.

The increased permeability of urban and riverine edges results from softening the hard infrastructural boundaries of Quebec City's urban fabric. These rigid borders have devastated Beauport's wetlands and hindered the physical and socio-economic mobility of residents accessing the city's historic and natural resources. By transforming these impermeable barriers into more permeable and ecological interfaces, we can restore the sites' natural habitats.
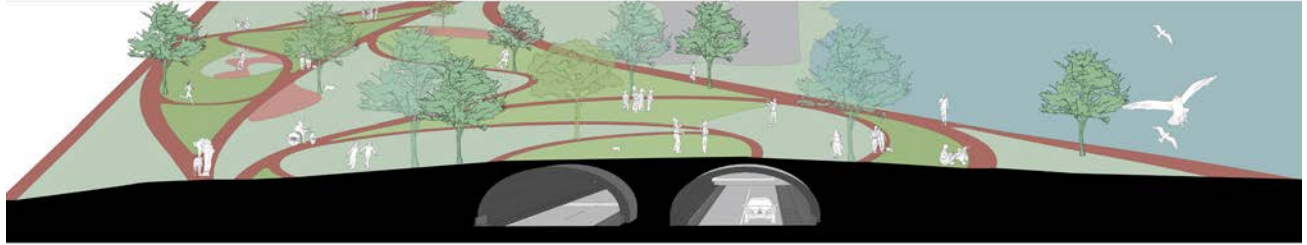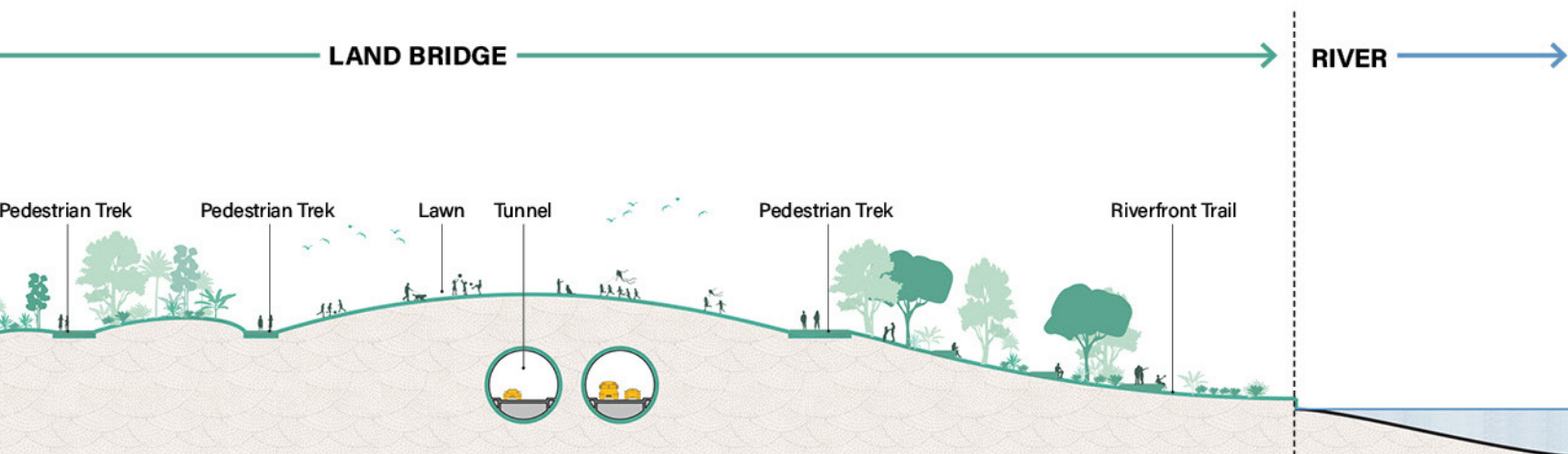

COMMUNITY

Office Building

Affordable Housing

Community Plaza

TRANSIT

Tram

Driveway

Urban Landscape

Pedestrian

Landscape Buffer Zone

Terrain de Jeu

40M   20M   10M

Fig. 4: Parks and green space would cap the existing highways, softening the edge of the river once more.

LAND BRIDGE → RIVER →

Pedestrian Trek   Pedestrian Trek   Lawn   Tunnel   Pedestrian Trek   Riverfront Trail

CONCLUSION

Permeability is an important tool for both urban and landscape design. Ensuring the ease of movement for people, flora, fauna, and water across sites enhances ecological resilience and community well-being. Permeability connects spaces within cities. Creating a network of outdoor corridors and open spaces that foster biodiversity and recreation. It is the critical thread that integrates climate adaptation, social inclusivity, and urban resilience by linking natural and built environments.

Fig. 5: Proposed landmark architecture along the waterfront.

Fig. 1: Intensive U.S. bombing campaigns have turned the area around the The Ben Hai into what locals refer to as "white land," to convey its complete devastation. Source: Vinh Moc Tunnels Museum.

From War Zone to Climate Adaptation

The Permeation of Vinh Moc Underground Village
Minh Nguyen

The current climate crisis, marked by extreme weather events and rapid urbanization, surpasses the pace of natural evolution. With monumental risks and limited space rendering above-ground living increasingly difficult, cities may need to consider sustainably transferring social, economic, and political activities below ground. My interest in permeabilities lies in how the blurring of above- and below-ground relates to the urban environments. This paper explores whether cities worldwide could and should permeate urban dwellings and functions underground on an unprecedented scale, rethinking spatial order and territorial compositions beneath the surface.

Numerous examples of ancient subsurface habitation exist worldwide, such as the underground cities of Cappadocia in Turkey and Noushabad Underground City in Iran. Contemporary urban underground living, once a speculative concept in science fiction and nuclear

arms race discussions of the 1960s and 1970s, is now recognized as a potentially practical and resilient solution. Successful implementation, defined as actions that ensure safe and vibrant lives for both human and subsurface nonhuman populations, requires meticulous planning, extensive research, and interdisciplinary collaboration. Careless excavation or repurposing of underutilized belowground structures, without ecological mindfulness, can introduce new risks and exacerbate existing underground hazards. This poses threats to both above and below-ground ecosystems.

To explore this issue, I examine how humans have historically responded to surface vulnerabilities, particularly in the context of war. While humans are both instigators and victims of war, history reveals communities that developed novel approaches emphasizing interdependence with the local ecosystem to facilitate
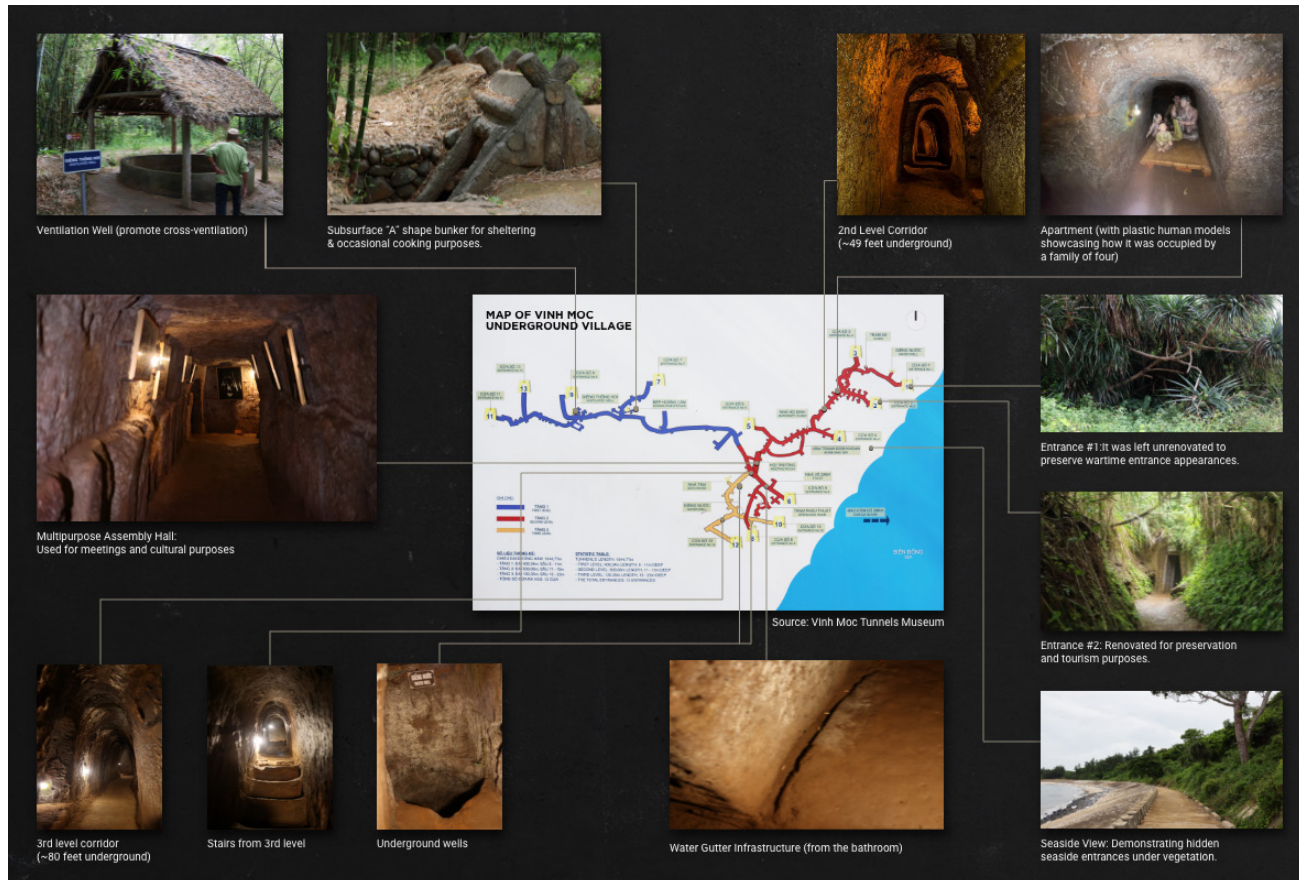
Fig. 2: Map and basic components of the Vinh Moc underground village. Source: Minh Nguyen, 2023.

multispecies survival during conflicts. These approaches included solutions like the creation of subterranean megastructures, such as underground bunkers and tunnel networks.

This study investigates the hand-carved subterranean habitation system in Vinh Moc Village, Vinh Linh District, Quang Tri province, Central Vietnam, created during the Second Indochina War. Guided by Diane Davis's Risk and Resilience principles, which bridge war and climate change theories, this project examines the wartime socio-spatial and territorial practices of Vinh Moc villagers to explore urban underground relocation as a sustainable climate adaptation solution. Field studies and in-depth oral history interviews were conducted with surviving original designers, residents, and veterans.

The tunnel system, often considered an underground village, reflects the people's creativity, determination, and interdependence with nature during armed conflict, transitioning from above-ground to subterranean living. Despite being overlooked globally and nationally as a war relic, this research uniquely analyzes the

site through both design and historical lenses. By conceptualizing this network as a city-like structure and examining its relations to politics, society, and ecology, the study underscores the tunnel complex's significance as an innovative, nature-integrated dwelling system. It provides insights into the universal human experience and innovations amidst hostilities, offering lessons that can address today's urgent crises.

This essay will discuss how the Vietnam War forced civilians to adopt a concept like "permeability" for survival, how the design approach of the subterranean village is based on ground permeability, and how the term permeability can be used to understand resilience.

1. WAR AND PERMEABILITY

Located adjacent to the demilitarized zone during the Vietnam War (1955-1975), Vinh Moc villagers faced dual challenges: combatting the American military and its allied forces amidst armed conflict and dealing with the region's harsh climate. The village and surrounding areas

were subjected to relentless airstrikes and naval assaults, unleashing hundreds of thousands of tons of bombs, including B-52s, resulting in over half a million tons of bomb impacts. Residents faced the weight of approximately seven tons each, leaving the region resembling a desolate "land of fire" or "white land." While many fled north for safety, approximately 60 households, along with Northern Vietnamese troops, chose to remain.[1]

Understanding they must completely change their way of life to survive, they adapted by relocating their lives below ground.

MULTI-SPECIES CO-SHARE SPACE
The plan involves excavating residential 'apartments' with interspaced design, akin to a 'running bond' architectural pattern. This layout includes voids between blocks, accommodating natural functions like aquifer recharge and supporting underground nonhuman communities.

Gutter System:
Water Drainage

☐ Human Space
■ Nonhuman Space
▦ Earth
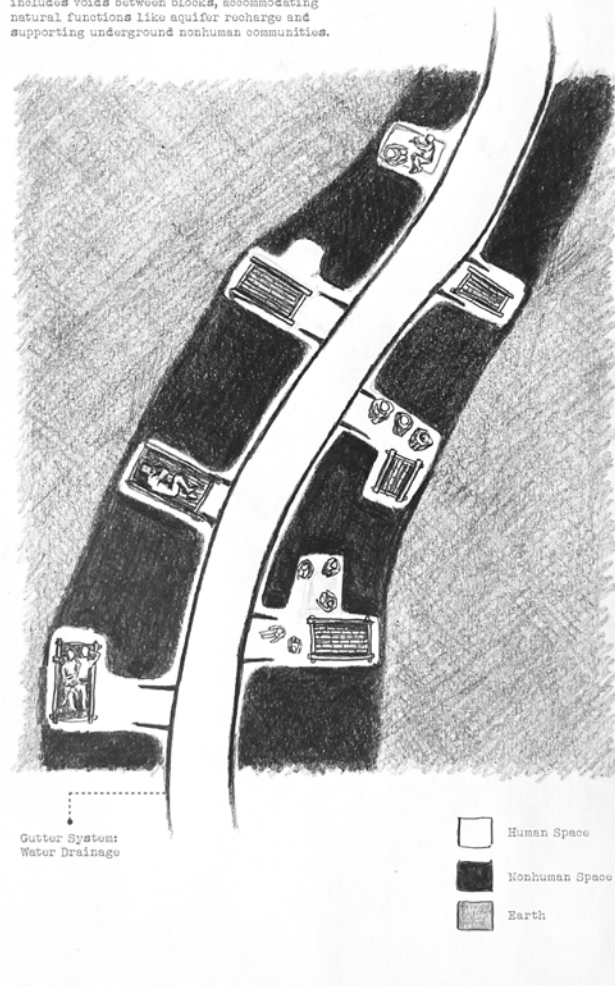
Fig. 3: Diagram of use of space by multiple species, with human areas in white and nonhuman areas in black. Source: Minh Nguyen, 2023.

The tunnels housed structured living spaces where all facets of life—combat activities, services, production, culture, education, and healthcare—continued uninterrupted.

It was representative of the concept of "villages within tunnels." Presently, access to most underground villages is restricted. Stretching over 2000 meters (6,561.7 feet) in total length and reaching depths of 10 to 25 meters (32.8—82 feet) below the surface, the tunnels pioneered Vietnam's underground urban living, accommodating over 400 people with a capacity for 1100 inhabitants. The villagers lived in the tunnels for six years from 1966 to 1972, during which seventeen babies were born.[2] After the war and the reunification of Vietnam in 1975, the town was rebuilt directly adjacent to the tunnels. Today, about one-third of the site has been preserved as a tourist destination.

2. DESIGN APPROACH OF THE VILLAGE

2.1 Local Ecological Knowledge of Permeability

The design of the village's tunnel system relies on the locals' ecological knowledge of the ground. Positioned atop a coastal hill 25 meters (82 feet) above sea level and directly adjoining the beach, the village experiences a notable elevation change from the hill's layered structure to

the sandy shore.[3] Beneath the village lie distinct subsoil layers: a red basalt upper layer, a rocky middle layer, and a deep clay layer. These layers, with their varying porosity and permeability, significantly impact water retention and movement. The malleable yet firm clay layer transfers compression forces from above and absorbs the impact of bombings and artillery shells, preserving the tunnel structure. An aquifer beneath these soil layers served as a freshwater source, recharged due to the permeability of the different soil layers.[4]

The surrounding vegetation showcases a mixture of tropical inland and coastal plants that serve as vital resources for the community, such as jackfruit, bamboo, and mangroves.[5] Generations of villagers understood that the subsurface root systems of these plants played a crucial role in preventing erosion and landslides, allowing rainwater to permeate the soil and replenish freshwater.[6] These systems remained resilient amidst surface devastation during bombings, securing soil integrity and shielding the underground village.

2.2 Intersecting Eco-Centric and Human-Centric Planning

The villagers designed and engineered the underground village based on local knowledge, harmonizing eco-centric and human-centric approaches to coexist with the local ecology while ensuring the tunnels' structural integrity and functionality. The alternating running-bond pattern (Figure 2) with voided spaces preserved nonhuman communities by creating undug spaces along corridors, contributing to groundwater recharge, maintaining water quality, and supporting subsurface ecosystems. These spaces supported root networks and microbe populations, enabling natural water purification for the aquifer. The human-centric design considered Vietnamese proportions, providing adequate dimensions for private and public spaces and pathways, accommodating people's needs, and ensuring the tunnels' durability. The tunnels' land use incorporates zoning, transportation regulations, a designated bomb shelter, and expansion guidelines, emphasizing functional separation, efficient wartime movement, and structural adaptability while protecting nonhuman spaces.

The Vinh Moc villagers' approach, blending eco-centric and human-centric elements, offers a valuable model for cities facing today's ecological uncertainties. It challenges the dominant anthropocentric view in urban planning, acknowledging the interconnectedness of all entities, human and non-human alike. This new perspective broadens urban planning by catering to human needs while creating spaces for non-human functions, such as the water cycle, to be minimally disrupted.

3. PERMEABILITY AND RESILIENCE

As the people's lifestyle became "porous," they exhibited flexibility in redefining spaces for habitation and urban design. The extreme violence of the war pushed villagers to permeate the ground, expanding housing and other activities below the surface. Their concept of permeability in urban design and planning extends beyond facilitating movement through spaces, like a grid street pattern, for efficient traffic flow and pedestrian movement. Instead, permeability encompasses the city's verticality, particularly concerning subterranean habitation, which becomes crucial when surface living is hindered by extreme weather events like increasing heat waves.

This perspective reminds us that cities exist not only above ground but also below, making the underground equally crucial in urban design. To ensure efficiency in city flow and function, planners and designers must consider the environment and underground typologies, accounting for ecological aspects such as soil types and underground water bodies. They should aim to design or improve infrastructures that complement and minimize harm to these ecological elements rather than exploiting them for resources.

Thus, cities can adopt the concept of permeability to explore resilience and inspire innovative approaches that transcend traditional design constraints.

This raises important questions about future design and planning: how can we incorporate permeability into our strategies? What other steps can we take to remain adaptable in the face of crises?
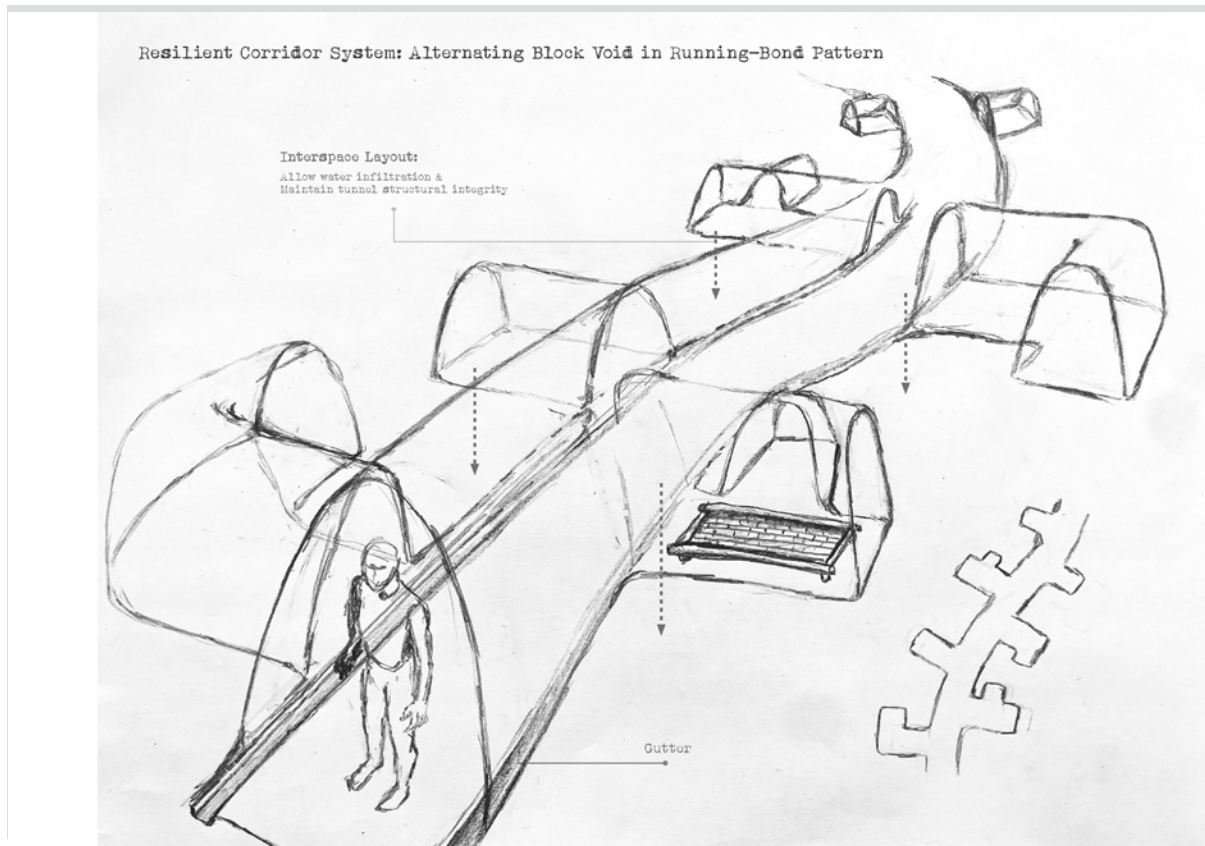
Fig. 4: Sketch of resilient corridor system with alternating blocks and voids in a running bond pattern.Source: Minh Nguyen, 2023.

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1. *Triem Van Ho, interview.*

2. *Vietnam Department of Culture, Scientific Biography of Special National Heritage: Vinh Moc Tunnels and the Vinh Linh Underground Village System.*

3. *Ibid.*

4. *Kenneth R. Olsen, "How Did Vinh Moc Village, Located near Vietnam DMZ, Protect Their Villagers from United States Air Force Bombardment during the Vietnam War," Open Journal of Soil Science 13, no. 01 (2023): 1-27, 10.4236/ojss.2023.131001.*

5. *See Eleanr Jane Sterling, Martha Maud Hurley, Le Duc Minh, and Joyce A. Powzyk, Vietnam: A Natural History (New Haven: Yale University Press, November 27, 2007).*

6. *Luu Thi Nguyen, interview by author, July 27, 2023.*

Civil Twilight

Mary Geschwindt (MUP '22)

I like sunset most when it is over–
when the blue glow has the tint of today
left half in it, refusing to let go.
It's in those moments that I give myself
permission to drive the chariot, to chase
what remains of this vague memory
I am still in the middle of making.
Earth's edges crowned with fading light, holding
tight to our last chances, graciously
illuminated, to make this the right
night for yearning, for learning, for leaving.
For dipping my hand into the cool sky,
for living, like I will never see this
same lucid light loop back to me at dawn.
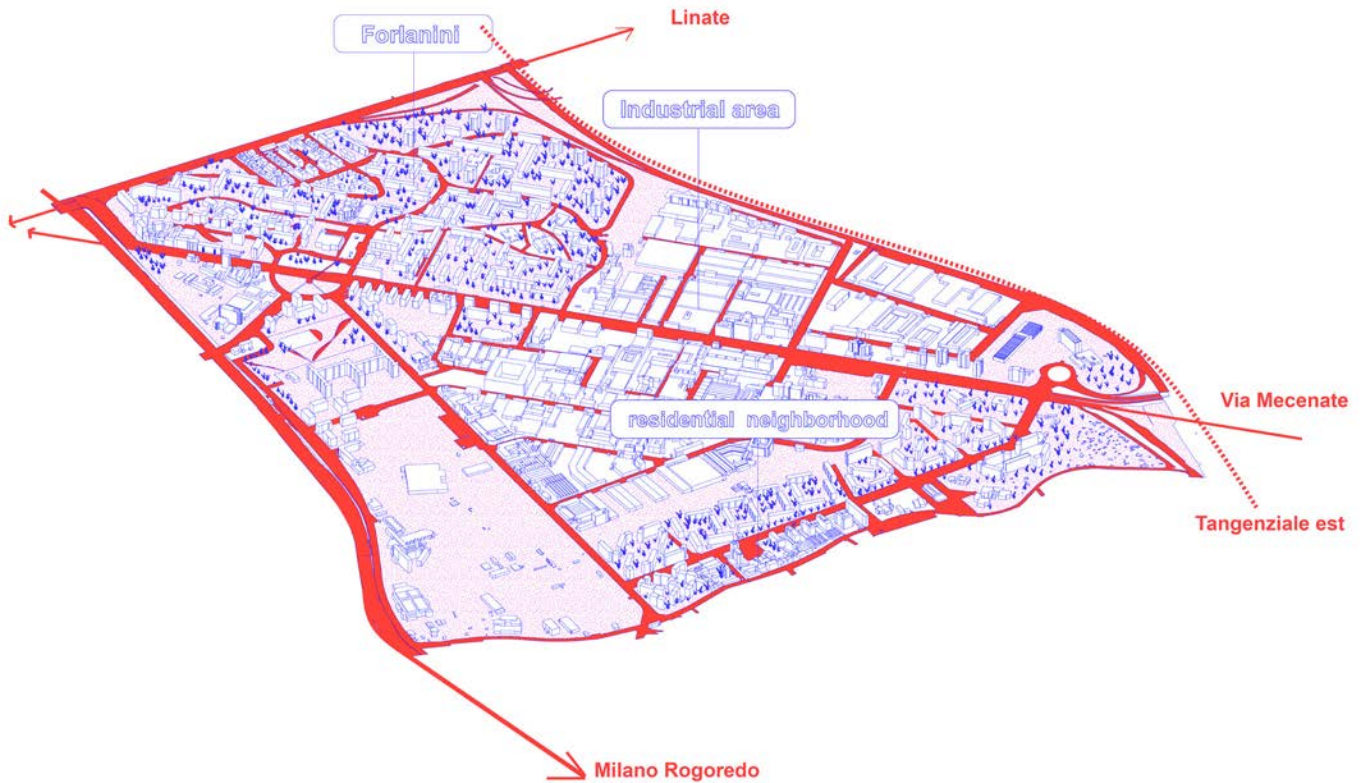
Fig. 1: Overview of the Forlanini-Taliedo neighborhood. Source: Authors.

Porous + Bioclimatic

Envisioning Futures for Milan's Forlanini-Taliedo

Cecilia Cempini, Mariana Pereira Guimaraes (MUP/MPH '19), Pablo Gamboa, and Valentina Dall'Orto

In Italy, the "periferia" refers to the outer city, the suburbs, the urban fringe, and the peri-urban: it sits between what is known as the countryside and the historic and well-defined urban core. (This is not an exclusively Italian phenomenon—most Europeans live in such territories, and several new large-scale urban developments occur in these areas.) However, simply labeling this complex region as "fringes" masks the myriad political, environmental, and social debates they contain and represent (Foot, J. 2010, p. 8). The notions of "fragile" and "anti-fragile" as initially proposed by Taleb (2012) and Aven (2015) and then applied to the planning, design, and policymaking of cities and territories (Chiffi and Curci, 2024), Chiffi and Moroni (2021) and Shearer et al. (2021) help characterize the Italian peripheries, especially in Milan. The term "fragile" underscores the areas' vulnerability, due to their socio-spatial inequalities (Commissione Periferie, 2017). "Anti-fragile," in contrast,

suggests their potential to adapt and thrive in the face of uncertainties, whether economic or environmental, and whether in the short or long term.

Milan's East Fringe is a vast zone with unique characteristics. It stretches from Via Palmanova in the north to Via Rogoredo and San Donato Milanese in the south, and is almost entirely trapped between significant transportation infrastructures. To the west, the railway ring cuts the area off from the city core. To the east, the highway Tangenziale Est (A51), the Lambro River, and Linate Airport separate the fringe from its rural neighbors. Despite its isolation and apparent abandonment, however, this urban strip holds immense potential for transformation (Cozza, 2023). This design research aims to outline a possible future for this post-industrial periphery.

With an abundance of vacant spaces without a defined use, the East Fringe exemplifies var-

ious contemporary issues around delineating, interpreting, intervening in borders, and urban porosity. In this context, "porosity" denotes the extent to which borders permit the movement of people, goods, and ideas. The idea of porosity is not just a theoretical construct but an urgent practical strategy for transforming borders, which are more than merely physical and represent a range of limits and discontinuities. Borders can play dual roles: as zones of contact or conflict, gateways or barriers, facilitators or inhibitors of exchanges (Hauser et al., 2021; Jovchelovitch et al., 2020) We posit that interventions at various scales, from city planning to architecture, can convert these vulnerabilities into opportunities for change.

QUARTIERE FORLANINI-TALIEDO

While a macro view of the East Fringe exposes some important issues (and possibilities), a more detailed examination at the neighborhood scale is crucial. The size and diversity of the area's residential blocks prevent them from forming self-contained neighborhoods with essential services and infrastructure. Roughly four districts can be delineated in the entirety of this fringe. Centrally, between Via Forlanini and Via
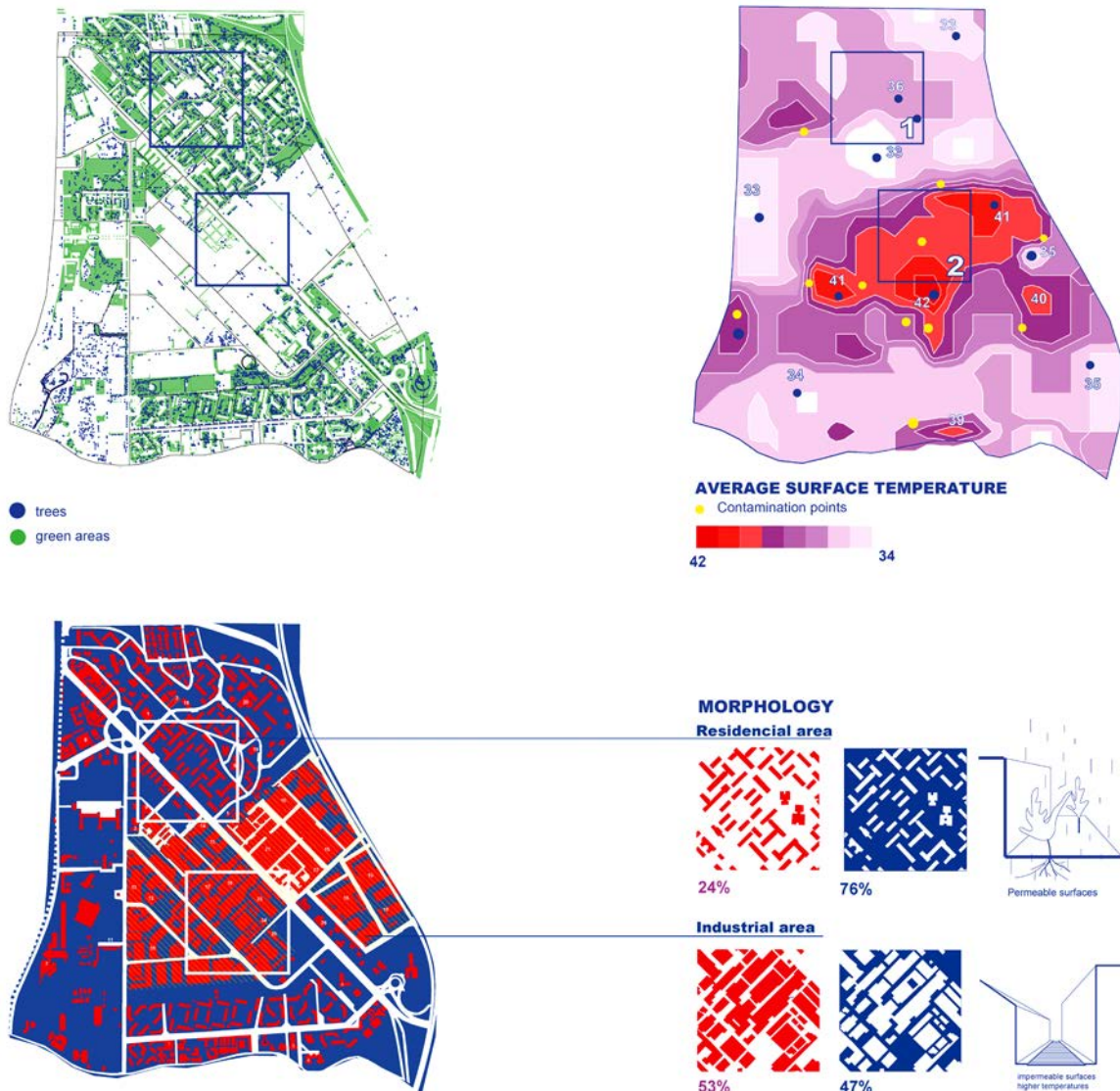
Fig. 2: Environmental and morphological analysis of site. Source: Authors.

Bonfadini, lies Quartieri Forlanini-Taliedo (fig. 1), characterized by disused industrial buildings, 1960s social housing (Ferrante, G. et al. 2005), new developments in the south, and entertainment services like nightclubs in former warehouses. The neighborhood's most significant issue is that the 1910s industrial zone at its core is hotspot, as shown in Milan's Urban Heat Island (UHI) mapping analysis of surface temperatures (Milano Geoportale, 2016). Urban heat mitigation presents an exciting challenge, perhaps providing a regeneration model for similar areas (fig. 2). The proposal includes specific design actions to address these fragilities and opportunities, such as greening the industrial zone and creating new connections between the city core and the countryside.

The Taliedo area has undergone significant transformations since 1910, when the Italian government built an airfield to host the International Air Circuit. The complex was later used as a military airport and aviation school before being decommissioned in 1938 (Apostolo and Pagliano, 1998). The presence of the airport led to the area becoming predominantly industrial, with sparse residential zones. Consequently, the area suffers from internal physical fragilities, such as disconnection due to extensive industrial buildings, degradation of the abandoned warehouses, lack of pedestrian infrastructure, high built-up density, and excessive paving. The remaining buildings have tall brick facades, metal roof coverings that absorb and radiate heat, and narrow alleys that hinder air circulation. The scarcity of trees and other vegetation also exacerbates heat concentration. The neighborhood urgently needs thermally comfortable public spaces to foster social interaction. This proposal aims to honor this rich history while addressing the current challenges and opportunities.

FRAMEWORK: POROSITY

In response to the issues pointed out in figs. 2 and 3, we envision a bioclimatic strategy of adaptive regeneration for this area. To do this, we will put into practice a concept proposed by Richard Sennett in Open City in 2010: "a cell membrane," Sennett writes, "is both porous and resistant at the same time, holding in some valuable elements of the city, letting other valuable elements flow through the membrane" (Sennet 2010, 9). This concept, which derives from a master planning strategy, is put into action in a multiscalar vision that moves from a general analysis of the entire urban fringe to a medium-scale analysis of the Taliedo area to a detailed analysis of specific conditions in buildings and public spaces (fig. 3).

A material with low porosity is compact and rugged, closed and enclosed within itself, much like as the urban fabric of Taliedo's industrial area. A porous material is openly permeable, and
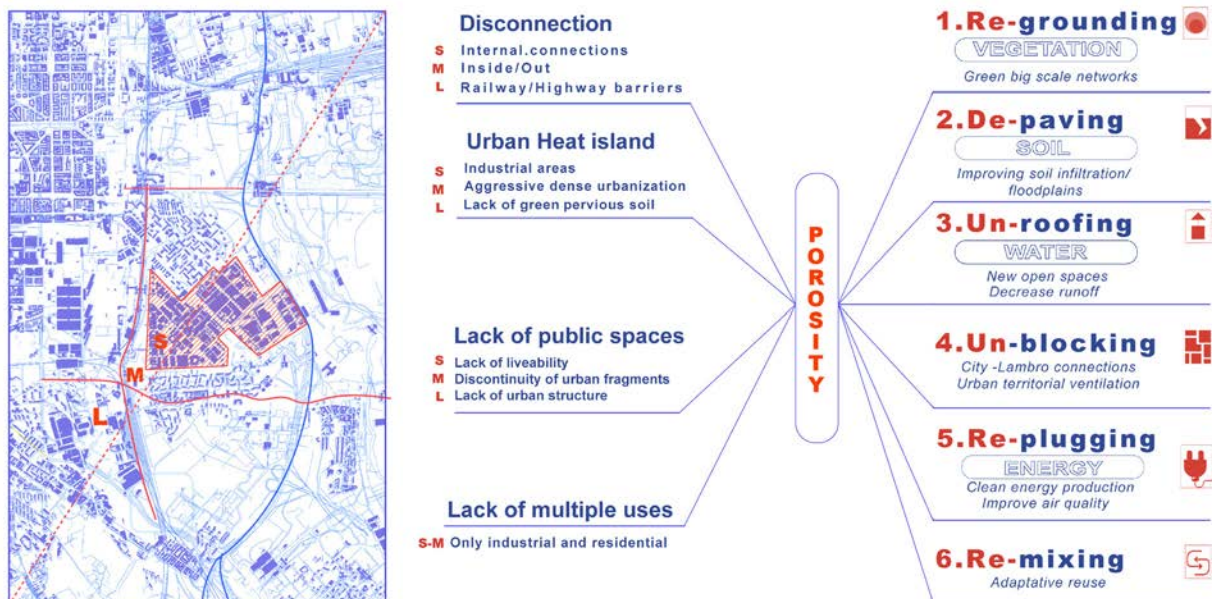

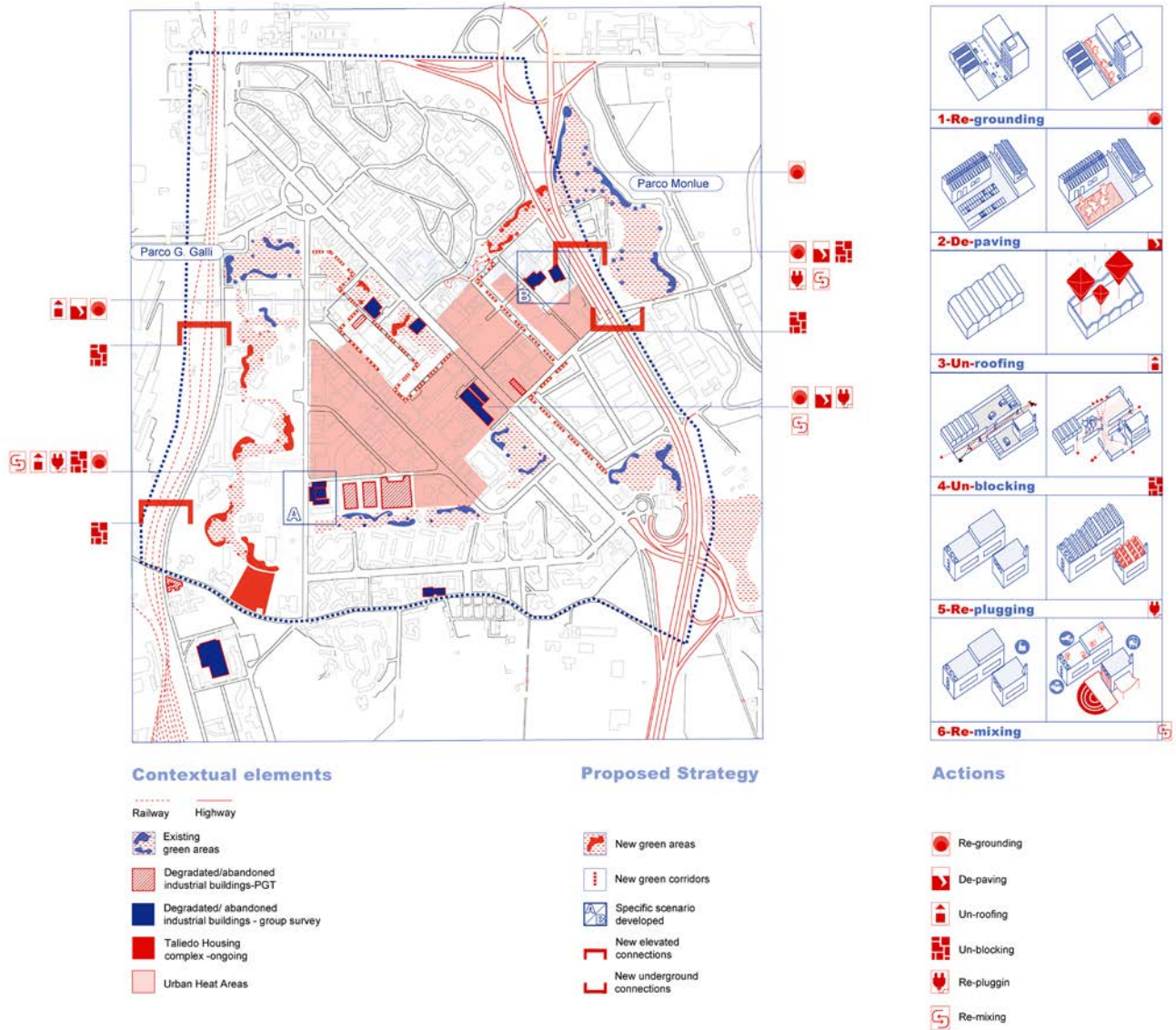*Fig. 3: Porosity framework for understanding existing issues and proposed design actions. Source; Authors.*

Fig. 4: Proposed strategies and design Actions. Source: Authors.

able to relate its interior with its exterior. Porosity as a strategy (Viganò et al. 2016, 223) seeks, in a physical sense, to open space between things, to strengthen connections between interiors and exteriors, to link separate landscapes (Weilacher 2018, 231), and to allow multiple and variable land uses (Dona 2018, 166) that can "bring the city to the factory" (Rappaport, 2019). Hence, architectural and urban interventions use porosity as an overarching strategy to foster varied spatial and social contexts within the urban landscape. It advocates for mixed, autonomous, and sustainable utilization of communal spaces, aiming to shape a vibrant and diversified district.

METHODOLOGY: THE TRI-SCALE APPROACH

A multiscalar approach is crucial to addressing the different issues in Taliedo. At the metropolitan scale, the main opportunities to mitigate isolation include enhancing connections along the railroad, constructing a new train station near Taliedo, establishing the new subway station north of Forlanini, and building underpasses and overpasses for the A51 highway by Linate's airport. At the neighborhood scale, improving walkability through better pedestrian paths is crucial. However, these connections cannot spark transformation without actions to increase soil permeability, lower local temperatures, and create livable public spaces during sweltering

summers (fig. 4). Small-scale adaptive reuse can capitalize on large industrial spaces to introduce new services, stimulating regional regeneration (Baum & Christiaansen, 2012).

The UHI phenomenon is an environmental issue that must be tackled in tandem. Although observable at the city scale, UHI mitigation can only be addressed at the architectural scale through local solutions such as green roofs and green walls, as Sofia Dona poses in the text "Moving from the Macro to the Microscale in the Anthropocene" (2018). These solutions must be multifunctional and address flooding, lack of livability, and disuse. Additionally, they must be integrated into a more significant planning strategy incorporating green corridors, as in Milan's 2030 Piano di Governo del Territorio (CITATION). These plans can guide a more efficient placement of these interventions, creating

openings, or pores, for green public spaces.

In sum, the methodology follows a tri-scale approach and aims to achieve a bioclimatic urban regeneration by increasing porosity. It first identifies the main social and environmental problems of the area at multiple scales, then envisions a design that uses punctual actions to promote an adaptive transformation of the site (fig. 4). The abundance of abandoned industrial structures is a defining characteristic of the area, prompting strategies that prioritize post-industrial revitalization. Key objectives include repurposing these buildings and adjacent public areas at various levels, with former factory spaces offering opportunities for energy generation and water storage. Additionally, ground-level transformations aim to establish connections with the existing urban fabric, which is currently characterized by imperme-
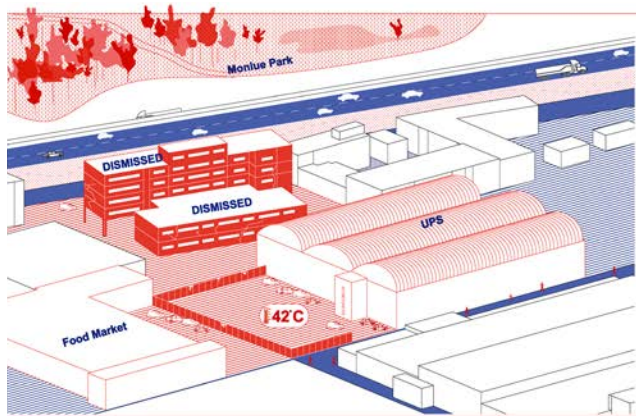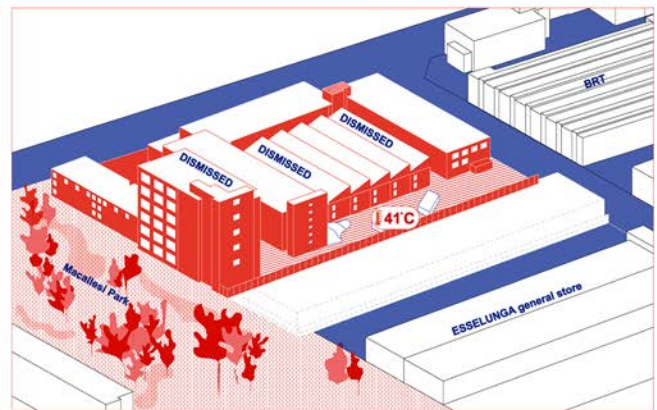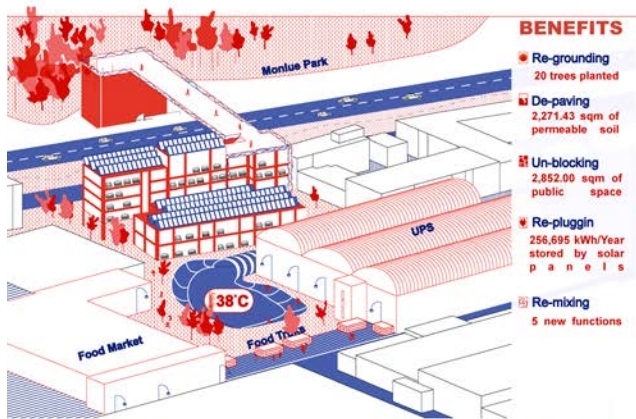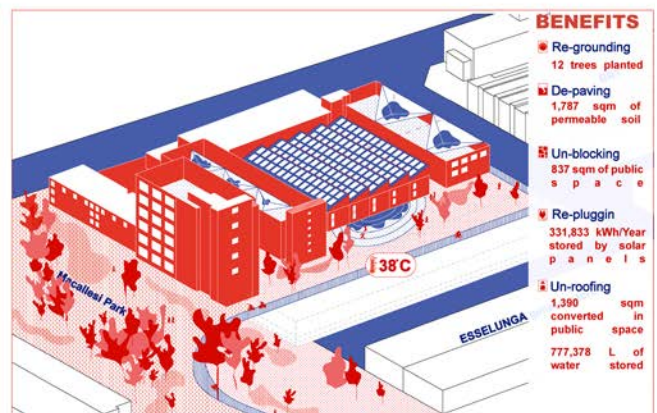
Fig. 5: Scenarios A and B Depicting the Current Situation and Post-Design Interventions. Source: Authors.

able surfaces designed for vehicular traffic. Diversifying functions within the area will foster the development of urban life and a cohesive social fabric, a principle endorsed by notable urban theorists like Jane Jacobs, Jan Gehl, and Philippe Panerai.

DESIGN STRATEGY: SIX DESIGN ACTIONS

The local design strategy is framed as a set of six "design actions": 1) unlocking "locked" industrial areas at different scales to address the problems of disconnection and wind blocking, 2) re-grounding by planting trees to provide shade and alleviate the UHI effect, 3) un-roofing unused industrial buildings to collect and infiltrate stormwater, 4) re-plugging by using solar panels to enable renewable energy in the site, 5) depaving in-between spaces to increase permeability and address lack of public spaces, and 6) remixing to create new multiple uses in an area marked by specific services and industrial uses. These design actions are linked to the Sustainable Development Goals (SDGs 3, 7, 8, 9, 11, 12, 13, and 15). They are distributed at testing sites found in the analysis (A and B) as specific interventions (fig. 5). Initial calculations demonstrate the potential benefits of these interventions.

These micro-scale design actions demonstrate the wealth of possibilities of nodes and networks that can positively transform the whole Taliedo district by making it more porous. The two test sites investigated present a five year transformation plan to shift a "fragile" condition to an "anti-fragile" one. Moreover, tangible results in energy savings, water storage capacity, soil infiltration gains, and the creation of new functions in a short time frame are only the beginning for an area that can then grow more sustainably in the long run.

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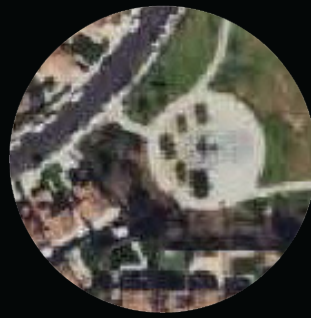
Fig. 1: Ecological systems are interwoven across the border. Source: Risa Sundu.

Birds and Border Walls

Ecological and human flows at the U.S.-Mexico border

Risa Sundu

When an incoming wave approaches the coast at the western edge of the U.S.-Mexico border, it looks like any other wave. A dark, reflective face becomes progressively steeper until its peak begins to spray and foam crashes down. Tumbling whitewater rushes forward to greet the protruding, unyielding metal wall, then continues, unbothered, on either side. Deep below, powerful rip currents meet and swirl around the wall's foundation. The tide pulls back and reaches out, slowly eating away at the steel.

What does a border wall mean to the ocean?

What does it mean to a bird, an insect, or a person? Ecological networks, human communities, and natural systems are interwoven across the U.S.-Mexico border. When we critically examine the relationship of the border wall to these surrounding natural and human cycles, the wall's absurdity becomes glaringly apparent. The urban and environmental contradictions of the border are especially obvious in the San Diego-Tijuana region, where the wall stretches across hundreds of miles of land, and hundreds of feet into the sea. Centuries of oscillating between "de-bordering" and "re-bordering" have led to a border zone that attempts to obstruct crossings of all kinds.[1] The wall stands as an insistence of the myth that national security is strengthened through isolation and containment rather than outreach and integration.

The current border management strategy of both countries is unsustainable due to its impact on fauna, flora, natural resources, and human

lives. These elements should move across a permeable landscape in cyclical, rhythmic flows, just as a wave moves over a shore. An effective intervention along the border would be more porous not just for humans, but also for animals, plants, natural elements, and even policy.

ANIMALS

The border wall is a deadly intrusion into a delicate ecosystem that is home to many unique and endangered animals. Threatened species living in the border region include jaguars, ocelots, Mexican gray wolves, American black bears, American badgers, kit foxes, black-tailed prairie dogs, pronghorn antelopes, bighorn sheep, and North American porcupine.[2] Many of these animals are too large to pass through the border fence; the wall interrupts their migration and cuts them off from much of their habitat.[3] The animals cannot simply move further north or south, as the region around the border wall is a vital geographic area for their livelihood. Twenty five threatened or endangered species have "designated critical habitat on the border."[4] Caught as collateral damage in an imprudent attempt at human social isolation, these species thus find their natural flow of migration artificially dammed, and their chances at survival drastically reduced.

The physical wall is not the only disruption to ecological flows at the border: disparate land use and policy have also led to fractured habitat corridors and dysfunctional urban flows. The municipalities of San Diego and Tijuana, which sit across from each other on either side of the westernmost border, regulate land development quite differently. On the U.S. side, the Tijuana River National Estuarine Research Reserve encompasses 2,800 acres of wetlands in the southwesternmost corner of the country.[5] This land is mostly undeveloped aside from a small, fragmented network of trails through the tidal marshes. In contrast, the Mexican side is developed all the way up to the border with dense residential and commercial infrastructure. This manifests in a jarring asymmetry on the ground: while Playas de Tijuana hosts a vibrant mix of tourists, residents, vendors, and retail, the adjacent land in the U.S. is vacant aside from a few lone pickup trucks emblazoned with the words "Customs and Border Protection." Both human and animal movement are disrupted by this development pattern. A bordser system that is responsive to natural flows would weave urban and conservation uses together, allowing for organic interchange. The border region should be managed as a cohesive urban and ecological fabric, not a mosaic of patchwork uses.

WATER

The two countries' failures to acknowledge the border's permeability, coupled with their disjointed approaches to urban development, have led to acute ecological crises. As with land, the U.S. and Mexico manage water and waste very differently. This issue comes to a head between Tijuana and San Diego due to the unique topography of their shared landscape. High-elevation canyons in Tijuana, densely populated by informal settlements lacking basic services, drain into the Tijuana River. The river then crosses the border wall, heading north and bringing with it all of the wastewater runoff from Mexican communities that the U.S. would prefer to ignore. Sewage contamination in the Tijuana River and corresponding beaches is a well-documented problem, one that is exacerbated by the lack of sewage treatment systems in the low-income neighborhoods of the Tijuana River Valley.[6] In 2017, this routine contamination became a crisis when there was a purportedly "intentional" spillage of 143 million tons of sewage from Mexico into the Tijuana River over a period of two weeks.[7]

Such complex and damaging social and ecological issues result from the countries' uncoordinated techniques for managing shared resources, and their failure to acknowledge porousness of the border. In recent years, the U.S. has managed the Tijuana Estuary as if it began at the border wall. However, this approach has been likened to fixing the issue at the valve rather than at the source.[8] The U.S. and Mexico are part of one ecological and social community, and this should be reflected in their policy: you cannot cleanly divide an ecosystem into two isolated halves. A solution must emerge from strategic, bottom-up collaboration between countries, who must find ways to support sustainable community development so that the sewage never enters the water in the first place.

IMMIGRATION

The government has adopted a similarly isolationist approach to the flow of humans at the border, despite the intrinsically permeable nature of human migration dynamics. Massive amounts of money have been invested in making the border wall more physically impressive and more difficult to climb, and staffing the border with trained militaristic agents. In 2021, the budget for Customs and Border Protection was $17.7 billion and the budget for Immigration and Customs Enforcement was $8.3 billion, with billions more dedicated to building the Trump administration's border wall.[9]

As with the Tijuana River, however, it is fruitless to try to stop the flow of humans at the end of their journey, since "sealing the border with Mexico to avoid their problems is analogous to attacking the symptoms, not the cause" of long-distance human migration.[10] Instead of spending so many billions to fortify the plug at the end of the drain, why not just turn down the faucet? Why not prioritize investment in rural economies to improve opportunities there, so people can create livelihoods in their home countries and do not need to look abroad for financial stability? While the prevention of undocumented human movement across the border is
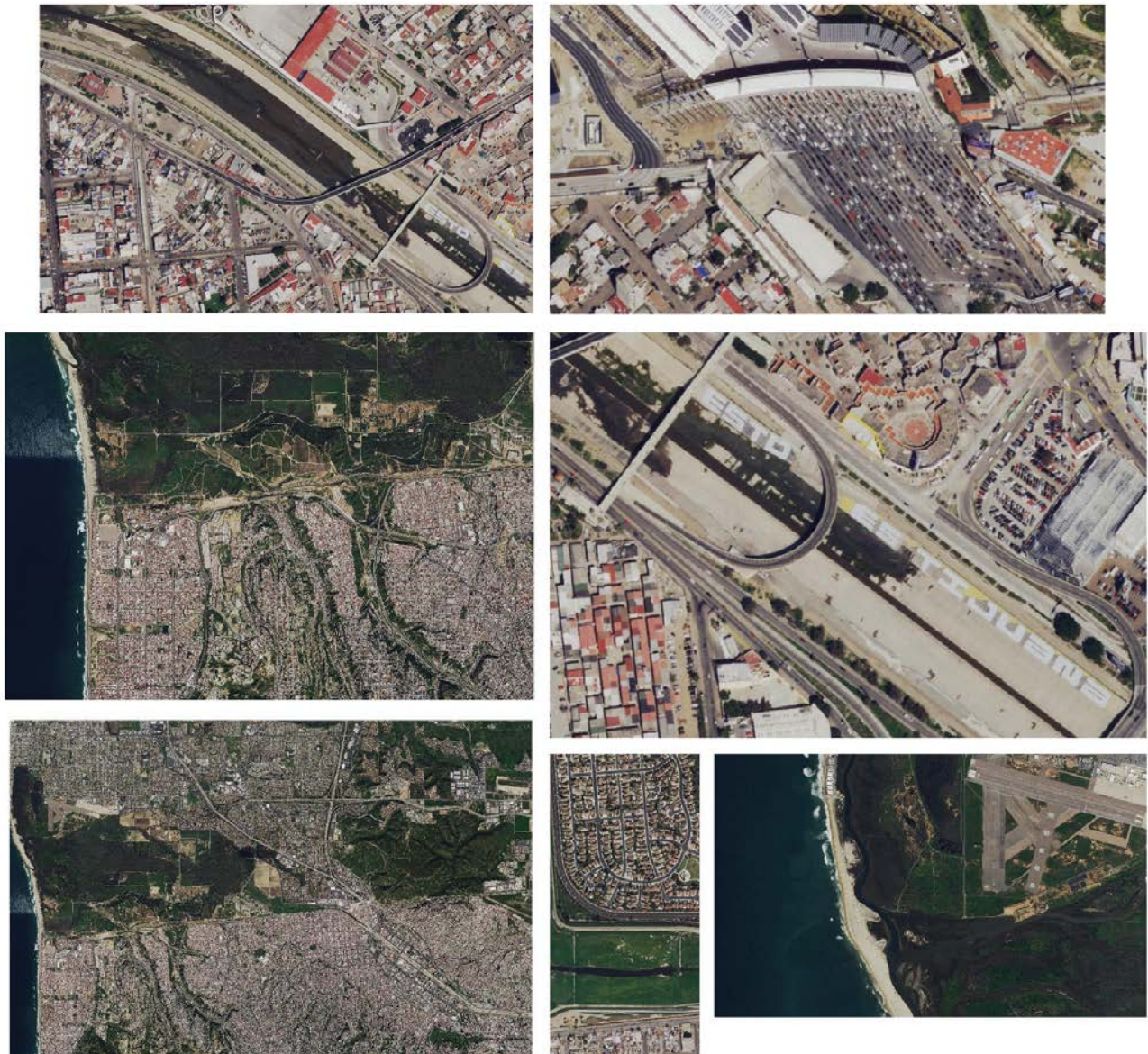

Fig. 2: Images of the U.S.-Mexico border. Source: Risa Sundu.

the primary justification for the destructive wall between the two countries, the barrier blocking this flow is just as unnatural for humans as it is for the prairie dog or the antelope. Like flora, fauna, or water, humans are not meant to be separated by artificial barriers– they move to environments where they can survive and thrive, and they crave connection and community.
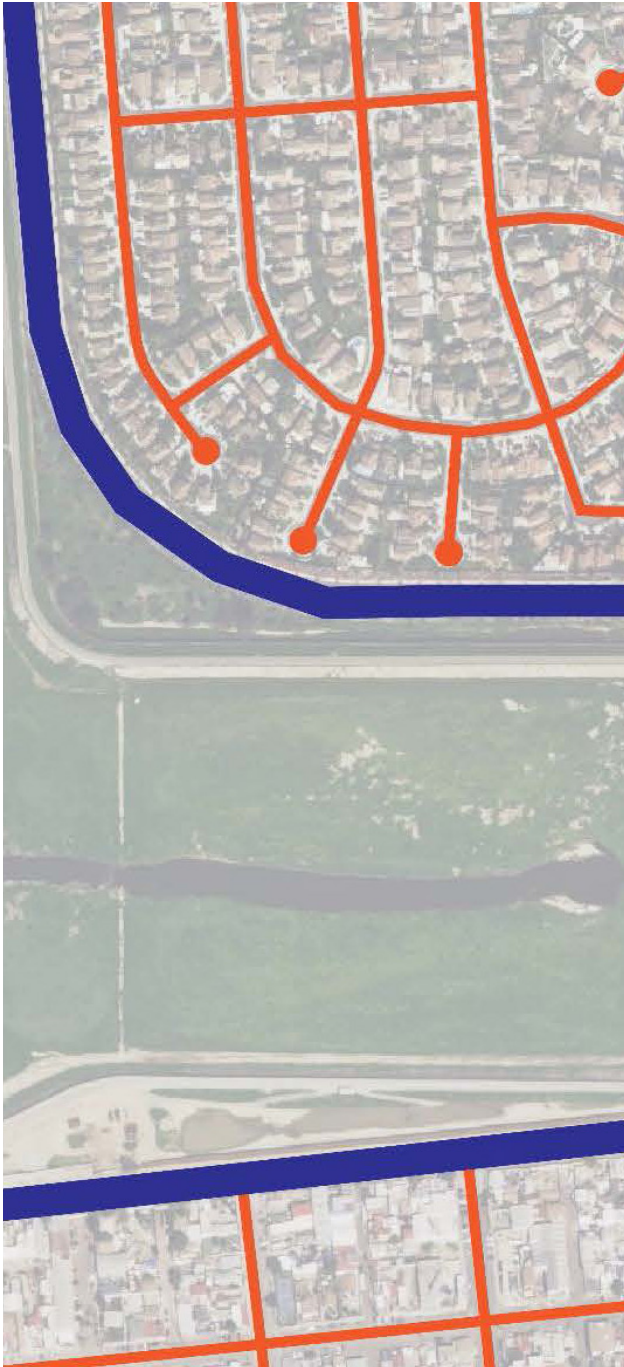

Fig. 3: Stopped flows at the border. Source: Risa Sundu.

SOLUTIONS: ACROSS THE DIVIDE

One attempt to connect across the chasm created by the alien structure of the wall is the Friendship Park (in the U.S.) and Parque de la Amistad (in Mexico). Here, separated families and friends could gather on either side of the wall and talk, pray, hold hands, or even organize yoga classes with participants from both nations.[11] However, the U.S. side of the park closed during the pandemic and has not reopened due to the ongoing construction of a taller, more fortified wall there. In fact, it is impossible to get within sight of Friendship Park in the U.S. since contamination has shut down the surrounding Border Field State Park entirely. In the meantime, the Mexican side of the park is open and lively, a vibrant public space with murals painted along the fence where it still stands. Every Sunday, the Border Church/ La Iglesia Fronteriza holds church service there and serves free meals afterwards, describing how "somehow, mysteriously, the border wall becomes… a table at which all are welcome".[12] Though only one of the two bordering countries is currently extending the hand of friendship through this park, it offers inspiration for the borderlands as public space, a brighter world where the border is seen as a "coming-together" instead of a "splitting-apart."

CONCLUSION

Current strategies for managing the U.S.-Mexico border region are unsustainable. The governments' irresponsible policies treat symptoms instead of causes, and, in the process, harm the residents and the ecosystems of both countries. Plants, animals, natural resources, and humans are all caught in the crossfire of an increasingly militaristic border presence. However, interventions like Friendship Park provide a template for reimagining the borderlands. What if the wall acted not as a dam but as a bridge across which we might remember our shared histories and humanity? How might the border become a permeable barrier that facilitates positive human and ecological flows, as a pier allows waves to pass beneath it?

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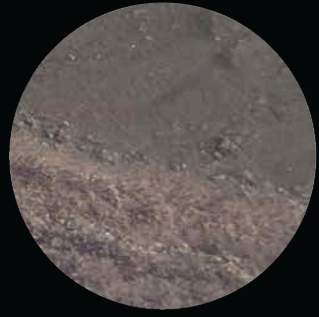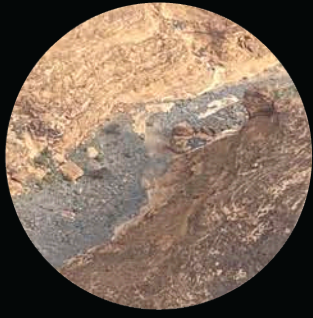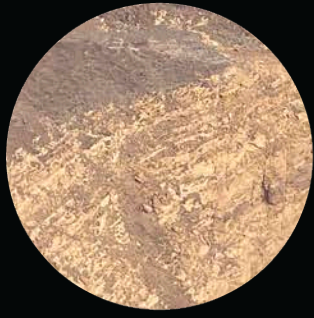
Fig. 3.

Foreign

Hannah Leung

I am stretched thin
forced
into a meager stream twisted up from the
depths of this earth

I am unwilling
dragged from the coast
through a dark canal for miles on end
to a mountainous terrain that is foreign
with traces of the place I used to run
engraved by silt
carved into sandstone

I am exploited and underappreciated
sprayed onto crops I do not recognize
feeding communities I do not know

I am blocked
herded around
I swim through these foreign canals
the land that was once my home
does not welcome me anymore

I am here temporarily
rapidly rushing by empty tombs

I used to easily slip in and out of structures
now my formless friend has paved a new path
diverging from where I used to roam
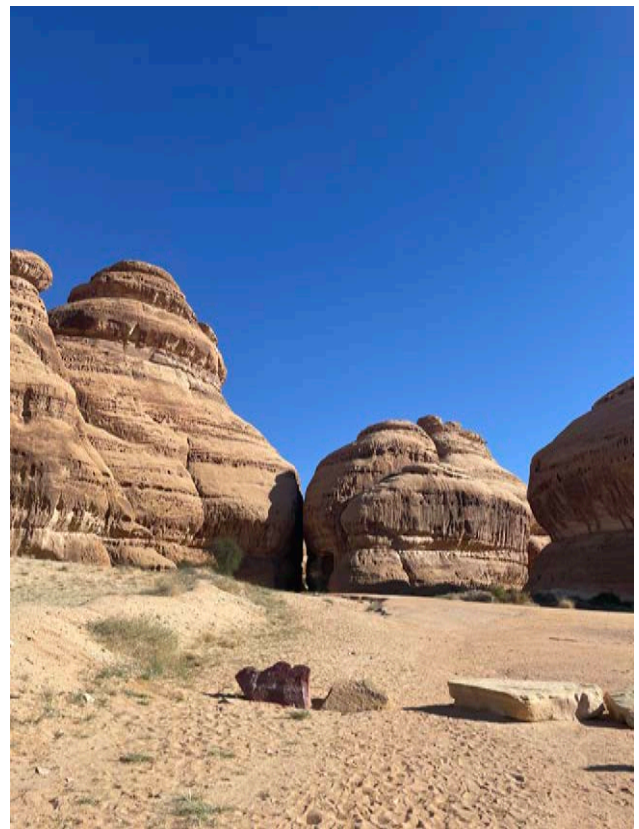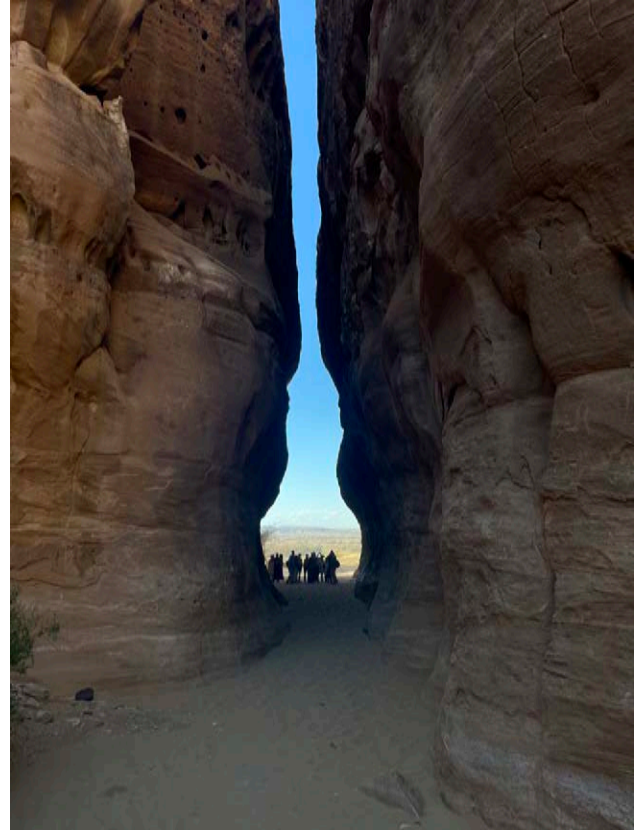
(top) Fig. 1. Source for all figs: Hannah Leung.
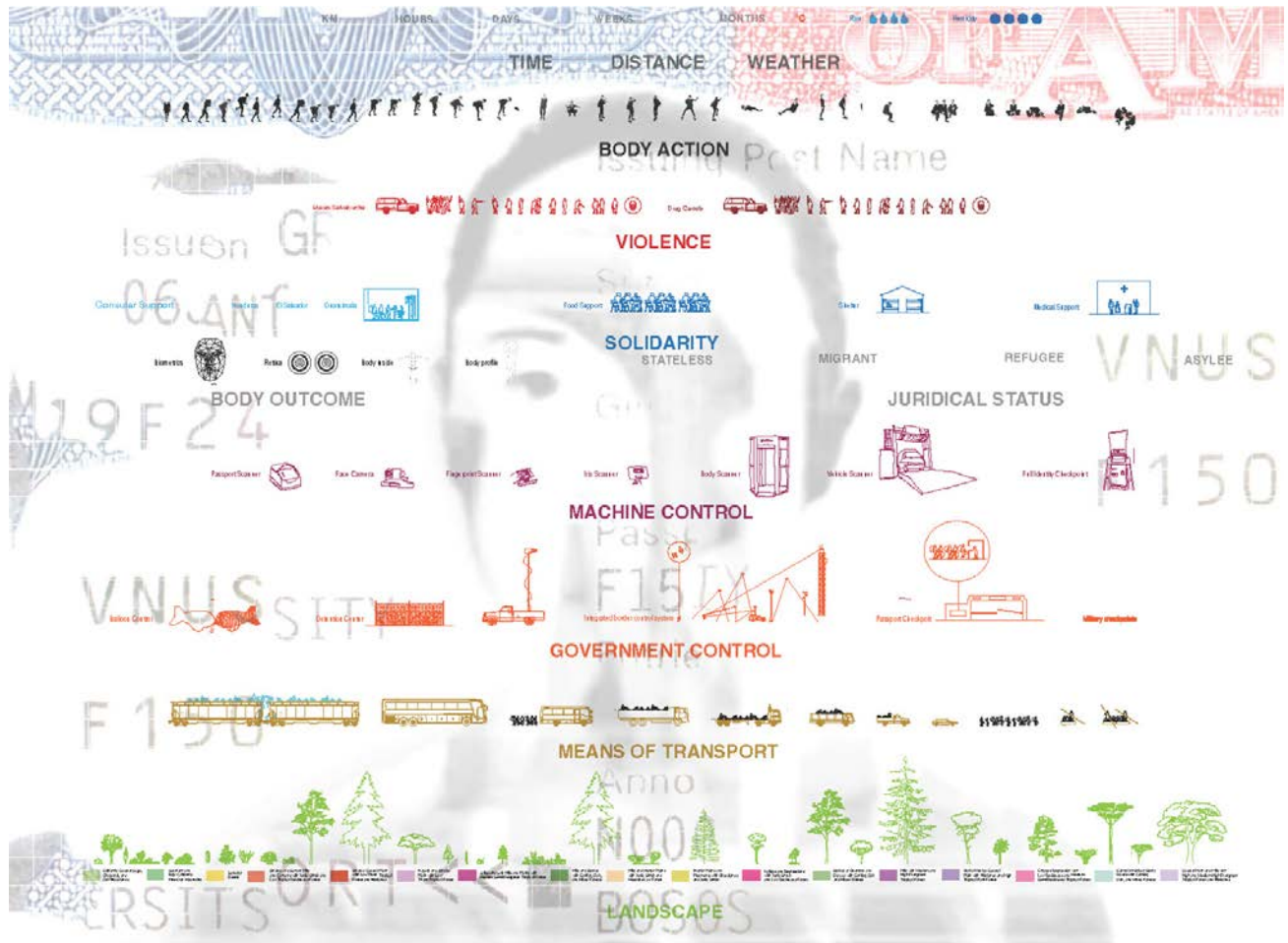*(above) Fig. 2.*
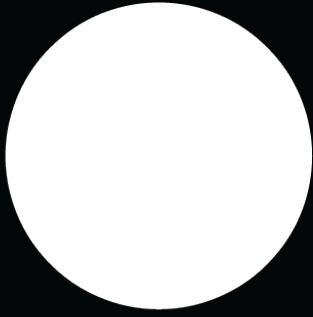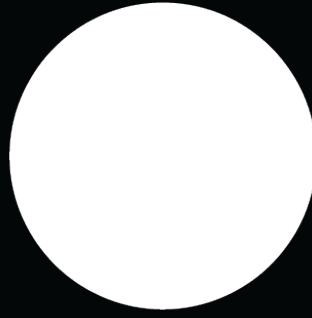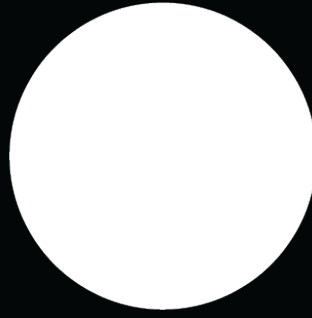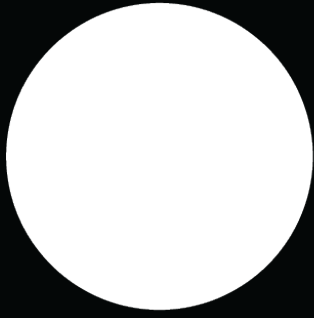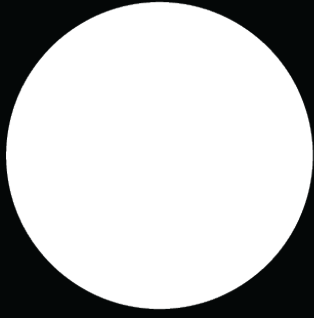
Fig. 1: General methodology diagram. Source for all figs: Authors.

Border Choreographies

Bodies - Identity - Personhood

María Gracia San Martín (MArch II/MDes ADPD '22), Adriana David (MDes ADPD '21), and Eva Lavranou (MDes ADPD '22)

BORDERS AS CHOREOGRAPHIC DEVICES

Borders are places where flows change direction. They are fluid, always in motion; they do not stop flows but redirect them. There are different kinds of borders: some are tangible, and some are intangible. Borders are not impermeable structures but dynamic ones, constantly becoming more complex, affecting and unraveling human identity, body, and personhood. They are places of exchange and interaction that emphasize in-terconnectedness and facilitate the movement of people and resources. However, they can also be tools for exclusion and marginalization that perpetuate social injustice and discrimination.

According to the International Organization of Migration, an international border is a "politically defined boundary separating territory or maritime zones between political entities."[1] This research examines the process of crossing an international border by a human being. Crossing a border requires the physical presence of a body. Our main objective is to delineate how a body is addressed, controlled, and deconstructed when crossing a frontier. Does this deconstruction affect human identity and integrity, and how do borders reinforce the power dynamics of human movement across territories?

Technology has undoubtedly affected border control in formal and informal mobility routes. Today's society is data-driven, and border governance requires that people have adequate iden-
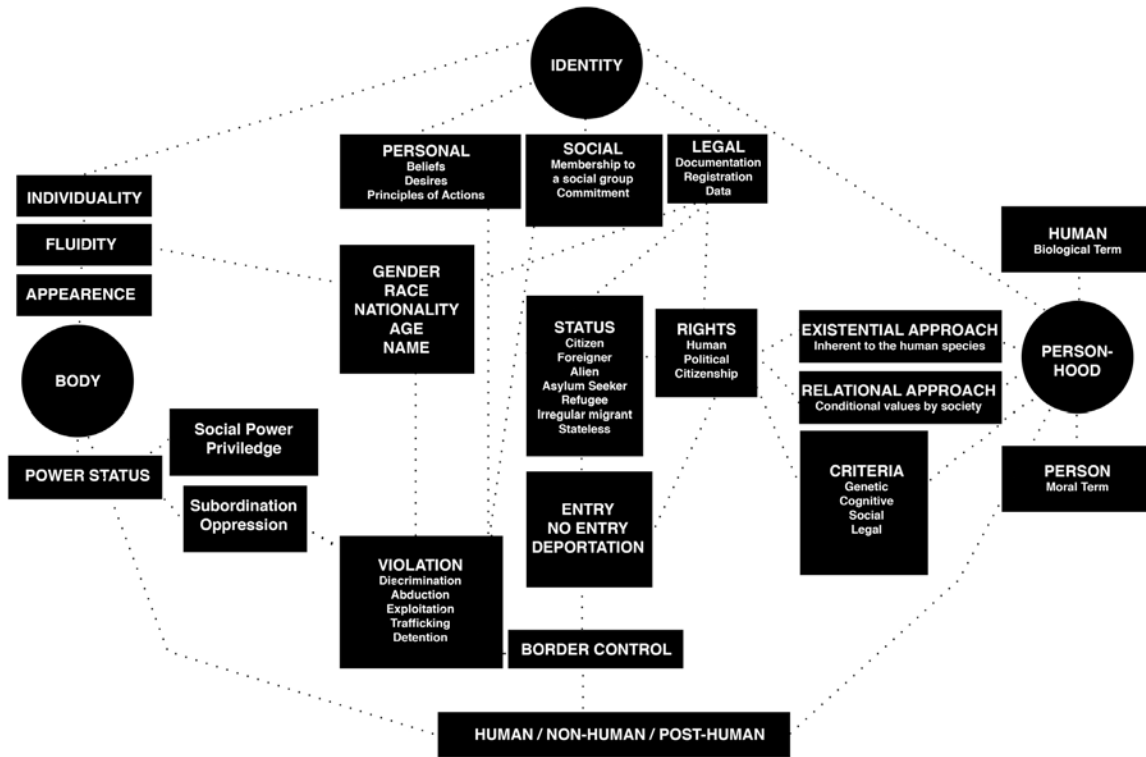
Fig. 2: Theoretical framework.

tification to cross a border. Border identification includes proper documentation, body scanning, biometrics, and physical control. Identification relies on pattern recognition and data comparison within algorithms. Discrimination based on gender, minority status, and even nationality can trigger completely different experiences at the crossing. How can the mechanisms of control at an airport perceive, read, and transform the human body?

In informal land crossing, the body engages in multiple actions such as walking, running, swimming, or climbing, and often faces unpredictable dangers and crime. Moreover, the landscape plays a vital role in shaping movement rituals along the routes. The result is a different sequence of movements in which, unlike in an airport examination, the human is treated as part of a collective, not a unique individual. Nevertheless, this collective experience may be more humane than the robotic airport experience, as it involves a constant struggle for survival and uses the body to its maximum capacity.

For each case below, a specific example of migration in which violence, suffering, and transformation are deeply exacerbated is ex-

amined. For air crossings, the focus is on U.S. airports and the rigid security policies implemented after 9/11. For land migrations, the focus is on the Mexico-U.S. border, examining how Mexican territory acts as a corridor for informal crossings from South to North.

To identify all the procedures that affect a human's body at a border crossing, we have created a general methodology map. For each border category, we identify and examine elements such as control machines, landscape, solidarity networks, areas of violence, means of transport, governmental mechanisms of control, juridical status, time, distance, temperature, body actions, and body outcomes.

Consequently, the borders are examined as choreographic devices, as they arouse certain body movements and rituals that follow specific patterns. The body is completely reconstructed at borders, and both formal and informal crossings provoke violation and transformation. Bodies navigating boundaries challenge traditional notions of division and exclusivity. This analysis presents a sequence of movements, and a choreography, that delineates the traumatic experience of a body subjected to border con-

Fig. 3: Figure from "Airport Control Section."

trol. What are the impacts of such an experience on bodies, identity, and personhood?

ON BODIES

by María Gracia San Martín

Drawn from critical theories on bodies and borders, the project Border Choreographies examines a system of forces created by our hierarchical world that attempts to produce deformations and delegitimating the body. In this system, our bodies are classified in terms of gender, race, ethnicity, class, and ability, developing a series of patterns that define to what extent our bodies are included within this system. After all, in our liberal free market world, everybody is supposed to be "welcomed," although

to different degrees. As we have learned from social and postcolonial studies, the world needs the Other to profit, and the Other needs the world to survive through assimilation. This logic of "including to exclude'" creates categories of desired and undesired bodies, with the latter being legally deprived of universal rights—that is, from their rights to be treated as humans. As Judith Butler argues in *Bodies that Matter*, "the limits of constructivism are exposed at those boundaries of bodily life where abjected or delegitimated bodies fail to count as 'bodies.'"[2]

In Border Choreographies, sectional drawings track how the body becomes delegitimated when a person's juridical status changes, as well as how those bodies are subjected to discrimination, deportation, detention, and other forms of control induced by imperial states.[3] Within legal crossing, the body is understood in its physical dimension using body scanning, biometrics, and identity verification. This results in fragmented images of bodies circulating in the virtual realm as partial images of us, which, in turn, become the property of border control agencies.

The "Airport Control Section" elaborates on a border control methodology that isolates and restricts a body's movement by forbidding any form of resistance. In the route analysis sections of the project, bodies are located in relation to the immediate landscape and juridical status and technologies (figs. 3 and 4). In opposition to the airport's diagrams highlighting rigidity and uniformity, "Land Choreography" is loose,
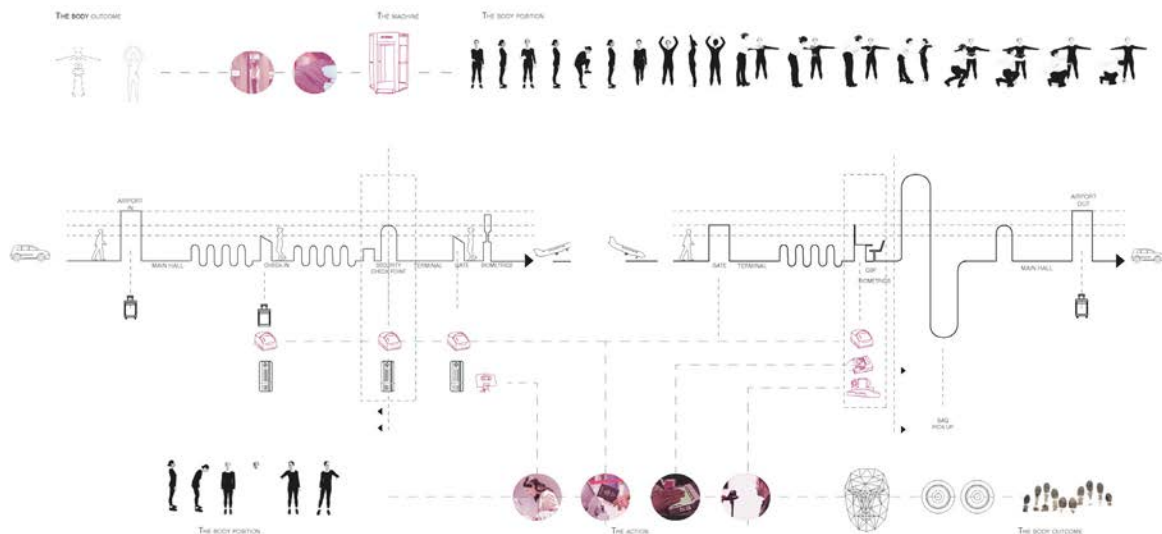

Fig. 4: "Airport Control Section."

Fig. 5: "Land Choreography": body sequence diagram at informal crossing.

mirroring the action of movement affected by topography acting upon a collective body. Here, two main "bodies" in the Mexico-U.S. border—the migrant body or Caravana Migrante, a series of migrant caravans that travel from Central America to the Mexico-U.S. border to demand asylum in the United States; and the "institutional body" or Customs and Border Protection—are represented by the "smart wall" as a metaphor for borders and body restrictions. And yet, as shown here, the Caravana can hack this paradigm, moving together as a collective body that can achieve a temporal inversion of power relations. But that achievement, like all those reached by anti-imperial revolutions, is temporal: the world continues as it is. And in that world, in our world, bodies that cross the border inhabit a new state of otherness, carrying accumulated traumatic experiences and extreme exhaustion. Some bodies cannot make it; they "disappear" in the Sonora desert, a remote and desolated site on the border and one of the hottest places in the world.

But hopes for a just world still exist, as the memory of victims is not forgotten. Indeed, finding their remains means the hopes of more than 70 groups of Mexican mothers who search for their missing with shovels all over the desert. They know that when unburied, they can reclaim their identity and dignity. They won't stop; they won't give up. From the realm of committed design and architecture, the small contribution of Border Choreographies is to represent that fight in the ongoing conflict of borders and bodies.

ON IDENTITY

by Adriana David

Technology development for human identification has thrived during the last century. These techniques have transformed our human body into a hierarchical entity where certain recognizable parts have become more important than others. This authentication development has forced our bodies to become increasingly dismembered with each technological discovery. We face, as Donna Haraway defines it, a militarized regime where male supremacy gains control over the subjugated through the continuous development of enhanced vision instruments.[4] The advancement of these labeling machines has divided our identity into two parts: political and personal.
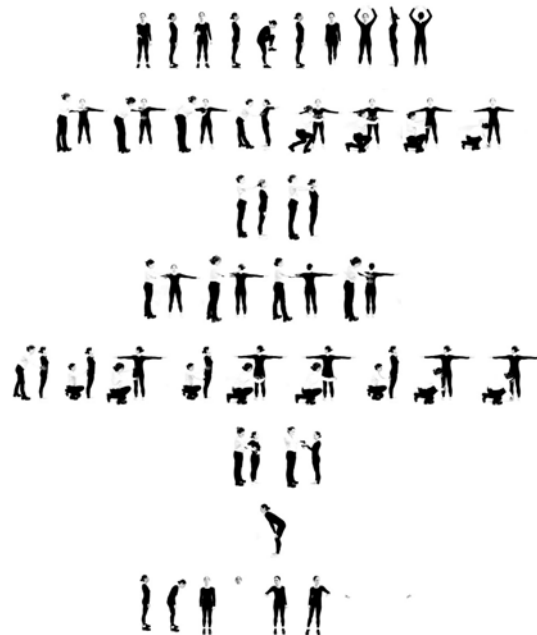

Fig. 6: "Air": body sequence diagram at formal crossing.

As formal borders clearly give priority to political identities, informal crossings, through their actions, time, and territory, make a clear separation between personal and political identity. Informal crossings—specific journeys of refugees, asylum seekers, or undocumented migrants—challenge identity in many ways. Factors include the time of travel, the varied landscape traversed to reach a specific border office, the violence encountered, the means of transport available, and the previous life left behind in the country of origin. The Mexico-U.S. border is a solid example of this long journey described. An average of 30,000 migrants cross the Mexico-U.S. border each month, 70 percent of whom are Honduran, 10 percent Guatemalan, 11 percent Salvadoran, and nine percent Mexican. This journey faces significant challenges in maintaining human rights. Migrants leave their country of origin in search of a safer future, escaping violence and the lack of decent jobs to support their families. They embark on a journey across Guatemala and Mexico that lasts at least one month if they are lucky. When they arrive in foreign countries by land, their lack of proper identification documents prevents them from taking safer, more direct transport to the northern border. This exposes them to violence, abuse, and control by local government entities and crime organizations. Without identification documents, migrants become nobodies, losing their fundamental human rights. Political identity thus becomes the trigger for their invisibility, allowing crime control to dominate the informal migration regime.

Control and abuse of humanity have become the foundation of this totalitarian regime, in which machines of enhanced vision have transformed private and public sectors into militarized data gluttons, capable of enslaving "human persons" and erasing personal, embodied identities.

ON PERSONHOOD

By Eva Lavranou

"Human" is a biological term. "Person" is a moral term, which means that it deserves moral consideration. Personhood is the status of being a person. Is it possible to be a human yet not a person? According to the law, only a natural person or legal personality has rights, protections, privileges, responsibilities, and legal liability. At a border crossing, a person's status changes from citizen in their own country to alien or asylum seeker in transit or destination countries, perhaps eventually evolving to non-resident alien, refugee, or irregular migrant who may be deported.

In formal border crossings, the physical body is transformed into information data through the
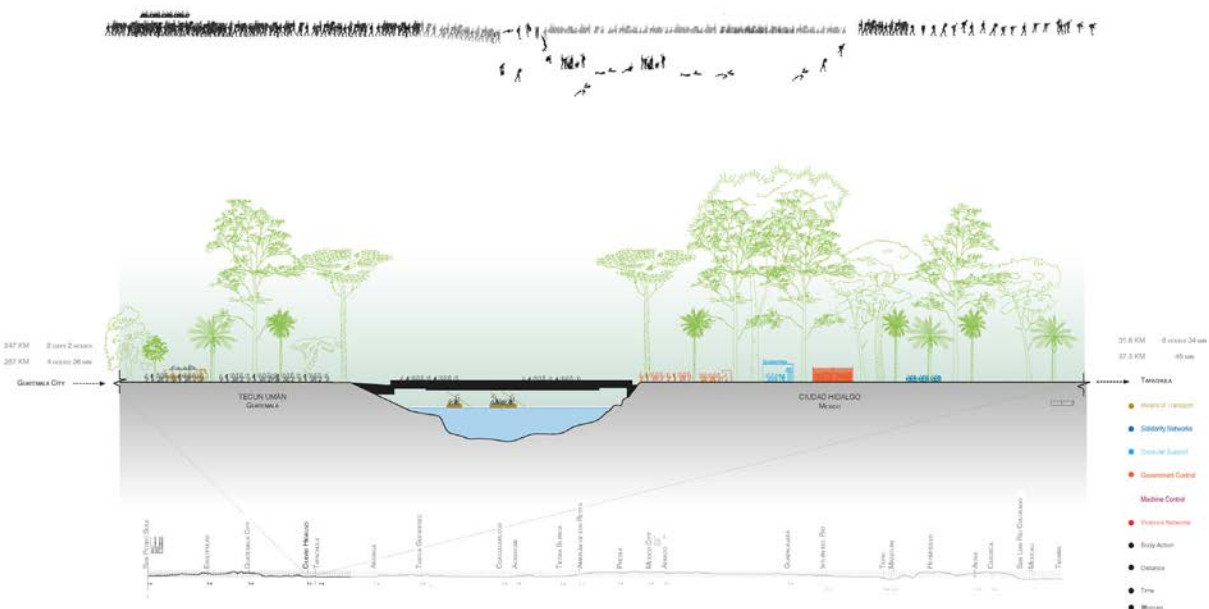

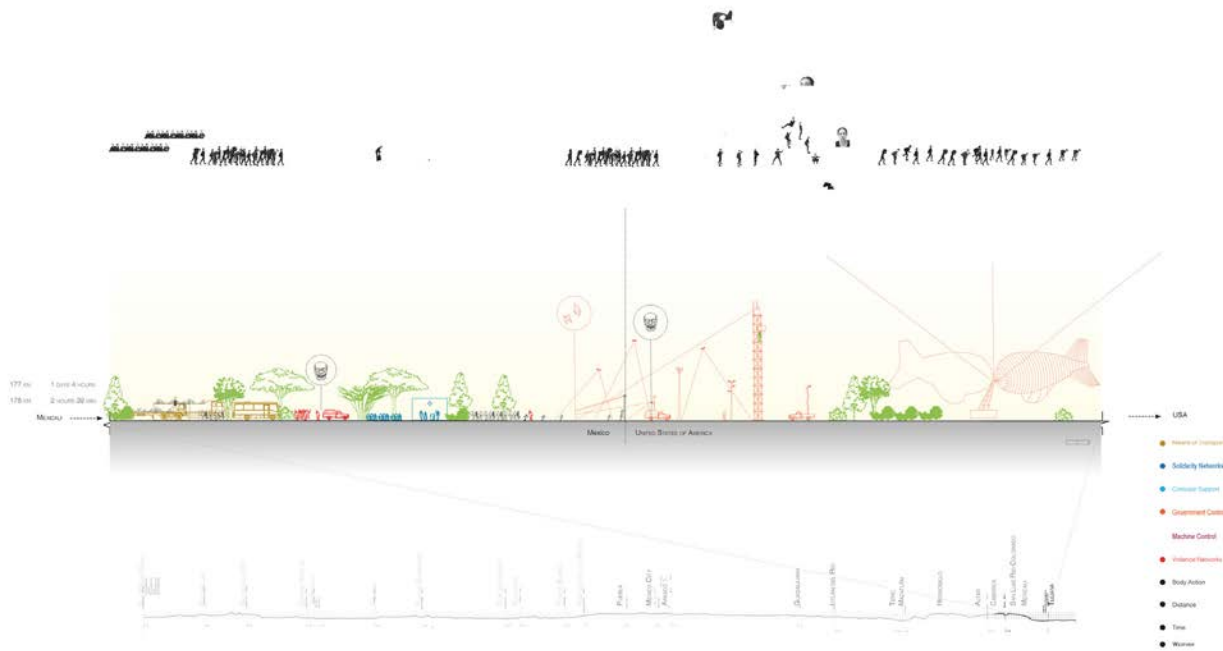*Fig. 7: Route analysis section from Tecun Uman to Ciudad Hidalgo.*

Fig. 8: Route analysis section from Tijuana to San Diego.

assistance of control machines which generate patterns for classification. Securitization at borders can produce inequality by downgrading a person's legal status. Bodies that transgress cultural, social, sexual, and political boundaries are often deprived of their legal entitlements and face discrimination. In informal crossings, physical bodies are often in danger and subject to violation. Many cases of assaults, rapes, kidnaps, trafficking, or even murder have been reported.

Hanna Arendt used the term "stateless" to refer not only to those who have formally lost their nationality but also to those who can no longer benefit from their citizenship rights. In that sense, the stateless are rightless because they were deprived of legal personhood as well as the right to action and speech[5]. She mentions the paradox that when someone appears as nothing but human, but deprived of all social and political attributes, it proves very difficult for that person to claim and exercise the rights they are entitled by virtue of being human.

Territorial borders are entangled with the concept of the nation-state and the mechanism of control through the construction of a common, fixed identity. Giorgio Agamben introduces the category of "bare life" to refer to subjects who are denied both political and legal representation and have been separated from the safety net of the nation-state.[6] The refugee, the political

prisoner, the disappeared, the victim of torture, the dispossessed—all have been excluded, to different degrees, from the social sphere, and have lost their right to be considered human. Today, in the era of globalization, identities are fluid and surpass territorial borders. It is important to establish mechanisms that protect personhood and rights, and eliminate the fear posed by government control. The body should become an apparatus of resistance, regain its liberty, and promote more inclusive interaction among places and communities.

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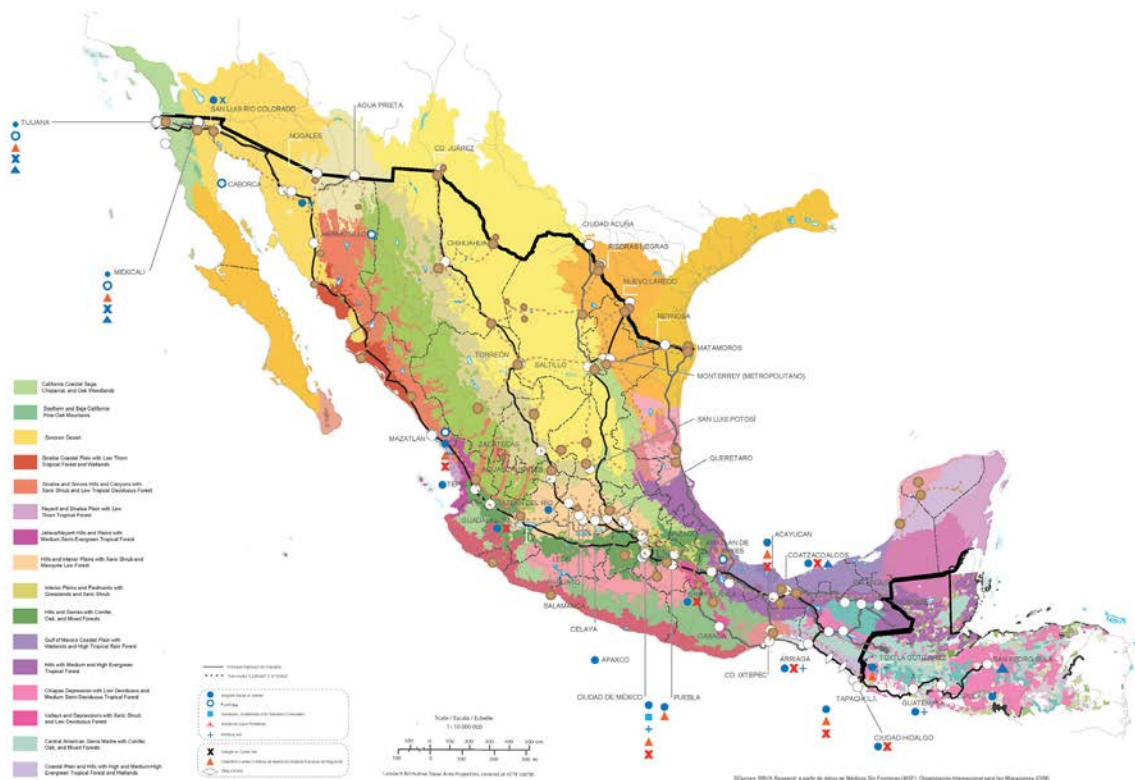
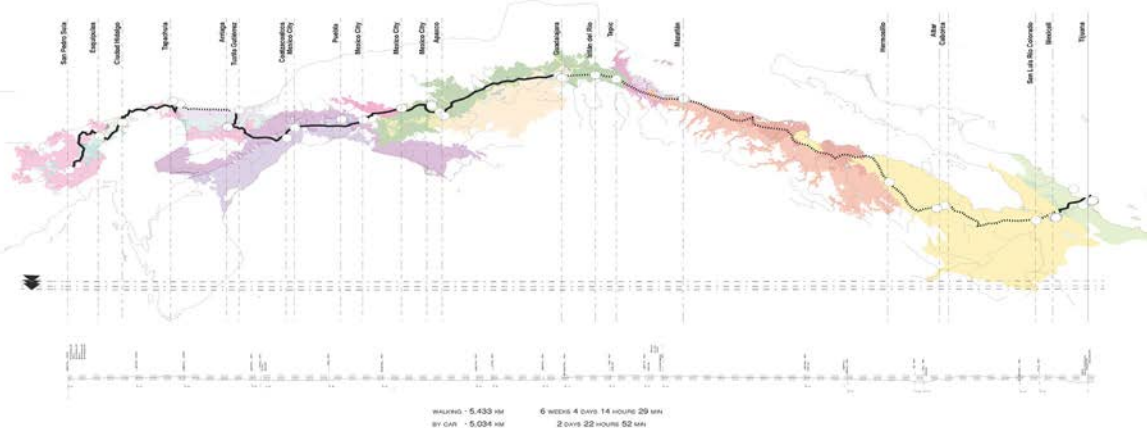Fig. 9: Map showing the Migrant Routes from Honduras to the Mexico-U.S. Border.

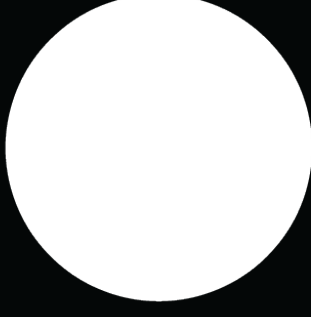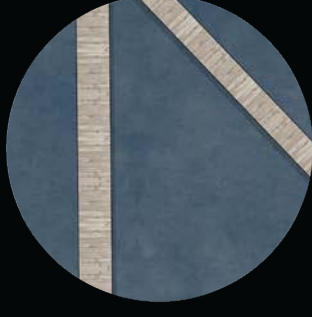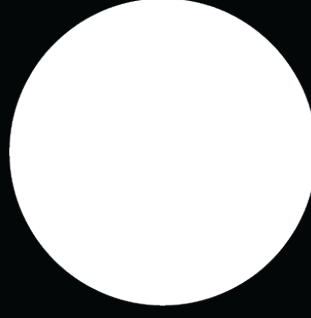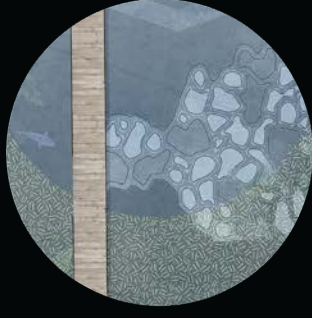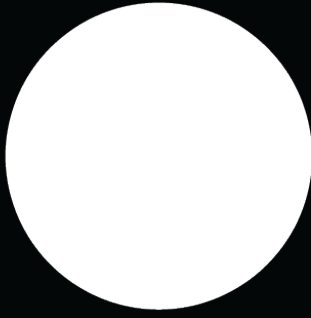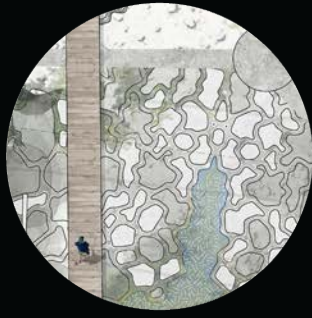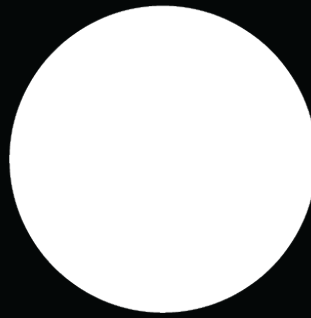Fig. 10: Route elevation from San Pedro Sula to Tijuana.

Fig. 1: Denmark Vejle Ford. Source: Authors.

The Membrane

From an Edge to a Flood Terrain

Luisa Brando, Andrés Hernandez, and Josephine Philipsen

BACKGROUND

In March 2020 Vejle municipality, a city next to one of Denmark's Fjords, announced the idea competition called "Kanten" (The Edge) to get new ideas, perspectives and added values on how to work with storm surge protection, nature based solutions and site specificity. There were two sites to design, each on a different "edge" of the city. This article presents the winning proposal, one that defies the idea of an edge to begin with.

INTRODUCTION

This project presents a strategic design that is opposed to an idea of an "Edge" between land and water, and rather centers on inviting water to come and go in any direction, just as water usually does in an aquatic terrain like Vejle, Denmark. At the same time, we are interested in working with the technical and physical solutions in response to climate change and rising water levels, as well as the cognitive and cultural processes in our relationship with water. The idea of dividing a place either as water or land is a cultural construction that has been maintained for centuries through a static and mechanistic view of the territory. We have drawn aerial maps that state a clear boundary that define a static location for water. However, water has never responded to such boundaries we have created and probably will never respond. Rivers are always changing courses and flooding happens through rain. We have canalized rivers, hidden the pipes in which

water flows, and separated ourselves from water. "Walls have been built, limits have been created, and myths have been created."[1]

Vejle has also been developing through this divided language. The Kante competition is focused on an Edge,as its title presents. But that Edge has been built. It is a terrain that was artificially built on water. Now we are concerned that water is reclaiming her space (it is said that sea level will rise over 3m in the next 50 years in this area of Denmark), and face the problem of water reaching places that have not been designed for her and looking at it as a catastrophe. And it is, but it is a catastrophe that has been created by us, it is by trying to control and place static boundaries, by imposing instead of allowing, by restraining instead of holding, by resisting instead of surrendering. We are choosing to invite life. We are choosing to hold and surrender to an ever changing medium where life manifests.

What would happen if we had to change the imaginary dividing line? Could we change the relationship of water to a reality that does not consist in limiting it, but in allowing and inviting? Instead of designing an edge or a wall, can we not prepare for a flood of terrain as a state of the landscape? Can we afford to design through an adaptive and non-defining structure specific to change over time?

"The problem is not that a city floods, the problem is that we have not known how to live and design in water."

-Dilip da Cunha. *soak[2]*

SITE CONTEXT

1. Waterline. Through the archival research we found that the urban space that the competition called "the edge" is actually not the original. This waterline has been moved and artificially created over time.

2. Water Quality and Life. Vejle harbor environment consists of a lot of hard surfaces such as concrete and asphalt. There is relatively little filtration, and well inside the harbor there is a lack of a dynamic relationship with water. As we all know, many hard surface layers also mean a faster runoff directly to the sea and that the water can lead to more pollution along the way.

PROPOSAL BASED ON FOUR SOLUTIONS

1. *The membrane: from protective edge to inviting terrain.*

A cell is characterized by a boundary (the cell membrane) that separates the "Self" from its environment. Within this boundary there is a network of different structures that allows the system to sustain itself. The cell membrane ensures life in both directions, removing out what is not needed, and bringing in what is needed Looking at the city edge as a membrane, where the in edge is a space, a filter rich in biodiversity that acts as a cell membrane, will enable a more adaptive system. The membrane or flood terrain becomes a meeting place where life can be sustained. It will be a transition zone instead of a single edge that separates.

2. *Time-specific solutions: adaptability through time (Sea level rise).*

The purpose is to treat the phenomenon in time. Water is everything but static, it is ever changing, from ocean to air, from clouds to rain. Therefore the project adapts and functions with waters impermanence. From sea level rise to storms floods, from drought to stability, through topography, vegetation and urban furniture, the master plan and the two sites proposed are designed as time specificity projects. It is a long term thinking and planning with water. Time therefore is read as both a weathering condition (rain, storms, and drought) as well as a linear development.

3. *Places for encounter- Enabling more fecund encounters between humans and other than human beings as a way of check and balance.*

The membrane grows as a rhizomatic expansion creating a series of micro words that promotes encounters between all living species. It is a design based on the co-relation between nature and humans, where we are no longer separate from the natural environment, nor our actions, but we are part of a system. The project cultivates a systematic bewildering, we bring closer and make natural phenomenons evident and become active participants in the success of the project. It is done with the materials and shapes that stimulate the interaction across all living species and not only human to human or human to nature.

4. *Nature-based and filters .Textures and materiality under and over water.*

In order to transition from a hard edge to a flood terrain, the project is based on a restorative design by working with natural elements native to Vejle. Through a series of water plazas a new ecosystem of animals and plants will emerge based on a non linear system of self maintenance. Gradually the membrane will become a platform that foresees the balance between animals and humans. It is an open system based on topographical and vegetation strategies that grow and adapt through time, whose success depends on the livelihood between all agents.

MASTER PLAN

The competition asked to design two specific spaces along the "Water Edge". But we went beyond and created a masterplan for the city's larger space in the area that used to hold water. We called this space The Membrane, and it is a series of ground perforations along the current hard edge, obsolete spaces (such as concrete parking lots, concrete and construction material sites) to grow life. The whole Membrane soon becomes a filter of water in both directions, by using nature based materials, urban furniture and topography, the city's hard edge now becomes a larger breathing terrain that cleans running water while regenerates and oxygenates the ocean.

For water is the space in which life manifests, and water quality is what enables life to happen; animals, vegetation and humans alike. As a longer transformation strategy, the master plan proposes to give water back her place; her streams and wetlands introduce new land and water areas that promote biodiversity based on local species and vegetation. Through punctual perforations along the "membrane" the water will become visible as a main character and will begin to change the perception of the water as a thing or a specific area that we need to differentiate from, but rather cherish and invite.

Currently Vejle´s port area is not attractive for walking nor for public space encounters, yet it could be a highly valuable area because of its
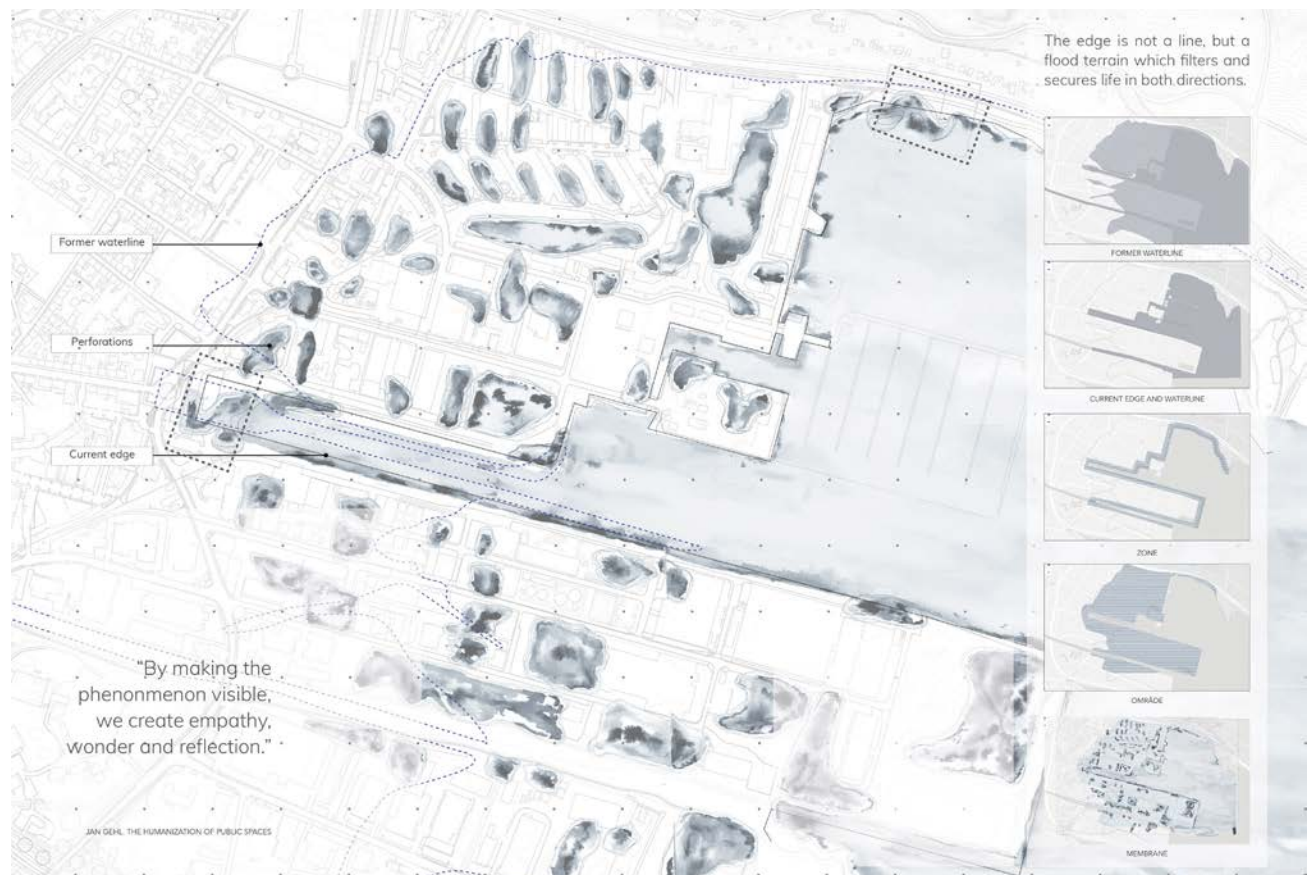

Fig. 2: From an edge to a flood terrain. Source: Authors.

proximity to the sea. There is an opportunity to transform this urban space that can benefit both humans and nature alike.. Through punctual interventions on the obsolete spaces found around the area we call "membrane", the city will slowly transform its relationship to water, from separation to harnessing. The idea is for the design not to be pre-determined. For it to be opened to an active participation of the community as it gradually opens spaces for holding water and for multi species encounters.
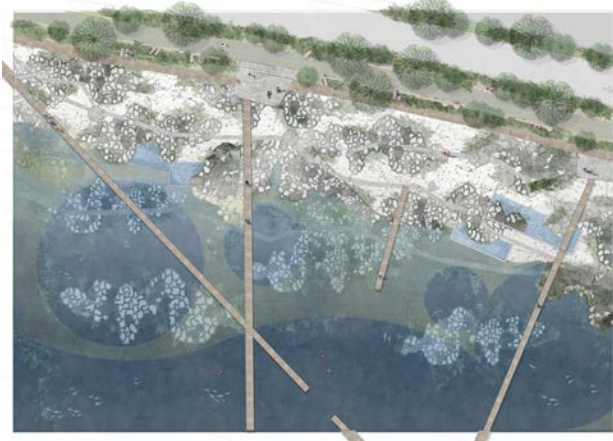

Fig. 3: Plan view of Site 1. Source: Authors.

SITE 1. THE HARBOUR

The terrain is designed as multiple platforms that permeate in and out of the harbour´s current edge, playing a significant role as a space for living being encountered inside and outside water. In order for life to grow along the different platforms, a gradient of a rocky landscape made of rough surfaces, platforms and bridges, is designed that transitions from hardscape to a softscape with inclinations that are not too steep in order to increase infiltration and biodiversity. The success of the project is based on the different encounter points that support cross-border integration between living species.

Flood adaptability is central to the project, therefore the design works with two design elements. First with a terrain strategy composed of multiple stone platforms and second with detachable public benches located at the upper level that function as a protective barrier reaching up to 3m. The movable benches are scattered along the upper level of the plaza, designed with different shapes, lights and materials, becoming a playful barrier as well as a

bench during the storm surge. These two strategies allow for a subtle protection barrier in the case of a flood, but also creates platforms and public space that multiply encounters between humans, plants and animals around water.
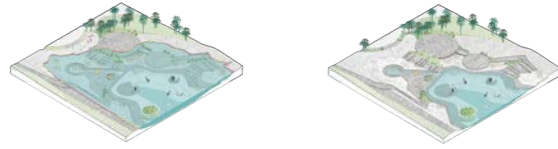

Fig. 4: Axons of Site 2. Source; Authors.

SITE 2. VEJLE BEACH ROAD. SOFTSCAPE

The rural zone composed of platforms that vary from rocks, sand dunes, water pools, bike paths enhance encounters across living beings. The reed forest with openings provides a balance between filtering of malnutrition and provides the nest for animals. Under water, the sand is taken from the deeper sea zones in Vejle where there are significant levels of sedimentation, creating dunes for sea level rise protection. The sand that is excavated allows for stones to reappear which help the bottom to have a harder structure,lifting the edge between 25-50 cm and has a slope of 3 to 4 percent to prevent erosion. Over the terrain, the sand is mixed with stones from the local quarry, and here amphibious concrete ladders are also cast, whose pattern helps algae and other species that live in the water in the future. Slopes and material choices favor of the seabed, which provides a win-win situation, as it has a cleansing effect on eutrophication in the water and acts as a nursery for animals, and for humans it contributes to a recreational experience together with the wooden bridges that brings us into water In addition to designing with the terrain, which reaches up to 2.5 m, there are removable benches along the bike and footpath, just like in the harbor.

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Fig. 1: Web-3 Café was inspired by video game graphics. Source: Benoit Florençon.

From Bricks to Bytes

The Convergence of Physical and Digital Architecture
Grace Chee (MArch I '21)

While designers of the built environment primarily focus on that which is physically built, there is another parallel world that deserves our attention: the virtual environment, as experienced through platforms like metaverses, games, spatial computing, and extended reality. With recent developments in these mediums, the boundary between the two built environments is becoming increasingly permeable, creating new considerations for designers.

Traditionally, digital architecture and spatial planning in the virtual world have operated by a completely different set of aesthetic rules than their physical counterparts, due in part to the different constraints that govern them. In the physical world, building costs, materials,

physics, and zoning codes dictate aesthetics; in the metaverse, aesthetics depend on computer processing power and rendering speed.

This can be seen in the graphics of early virtual worlds like Second Life, which was launched in 2003. Its abstract and low-resolution 3-D graphics clearly differentiated it from the real world. Similarly, early virtual environmental games like Minecraft and Sandbox used a pixelated bitmap style, while Roblox and Decentraland had low-polygon style environmental and avatar designs. No one would confuse these virtual worlds with the real one.

In recent years, however, advances in web graphics such as Unreal Engine's Pixel Streaming have enabled the display of highly realistic visuals

in browsers, removing or drastically reducing the computing limitations that had previously dictated the aesthetics of digital architecture.[1] In addition, the integration of artificial intelligence and other developing technologies have taken virtual worlds a step beyond photorealism, to physics-based, real-time simulation. Digital twins in the industrial or enterprise metaverse provide exact, real-time replicas of buildings and systems like stores, warehouses, manufacturing locations, supply chains, and more, allowing companies to run precise digital simulations.

Even as the 3-D visualization industry has moved towards the emulation of real life, some designers have embraced a reverse trend: the incorporation of digital elements into the physical space. A literal example of this can be found in retail store designs that are inspired by the online experience, such as Crosby Studios' 2022 Web-3 Café, designed in collaboration with jewelry brand Repossi.[2] The cafe, which was released with a video game, featured furniture and decorations with pixelated design and bright, metallic finishes, reminiscent of early computer game graphics. The design foregrounds the digital components of the brand experience in the visitor's mind, thus bridging the barriers a user faces when moving between the physical and virtual worlds.

Some designers have embraced a reverse trend: the incorporation of digital elements into the physical space.

In the next evolution of the relation between virtual and physical environments, we will see even more convergence between the two worlds. The recent release of Apple's Vision Pro and Meta's Quest 3 headsets mark major developments in extended reality technology, which could further dissolve the aforementioned barriers between physical and virtual experiences. In addition, a rise in mixed reality and spatial computing portends a future in which digital architecture and physical architecture blend: users will be able to view, and adjust, augmented facades that have been layered over real facades, thus extending the built environment. Increasingly accurate computer vision can also

Fig. 2: Early world-building games like Minecraft were clearly distinct from the physical built environment. Source: Minecraft.

Fig. 3: Google's new game Space Invaders: World Defense.
Source: Google.

map virtual layers precisely onto terrain and real buildings.

While designers of the built environment primarily focus on that which is physically built, there is another parallel world that deserves our attention: the virtual environment, as experienced through platforms like metaverses, games, spatial computing, and extended reality. With recent developments in these mediums, the boundary between the two built environments is becoming increasingly permeable, creating new considerations for designers.

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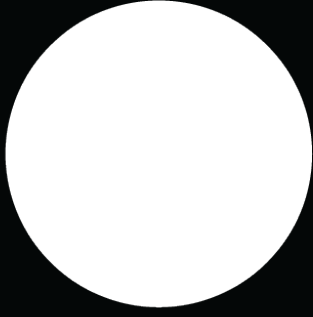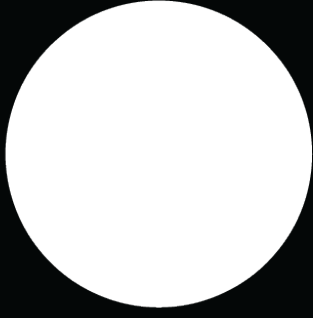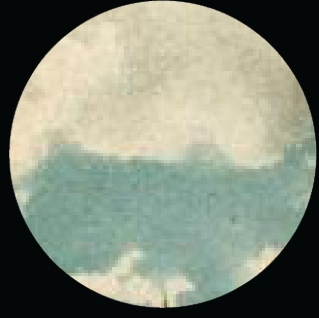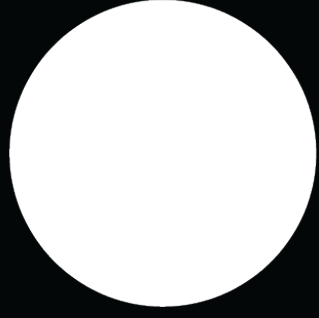
Fig. 1: Antique Map of Malabar by Philip Baldaeus (1744). Source: Dutch National Library.

Tracing Permeable Histories:

Emergent Landscapes along the Malabar Coast
Shreyes Yohan Jos

PERMEATIONS UNTIL WESTERN COLONIALISM

Kerala is a state on the southwest coast of India. Its linear land mass runs 560 km from North to South with an average wid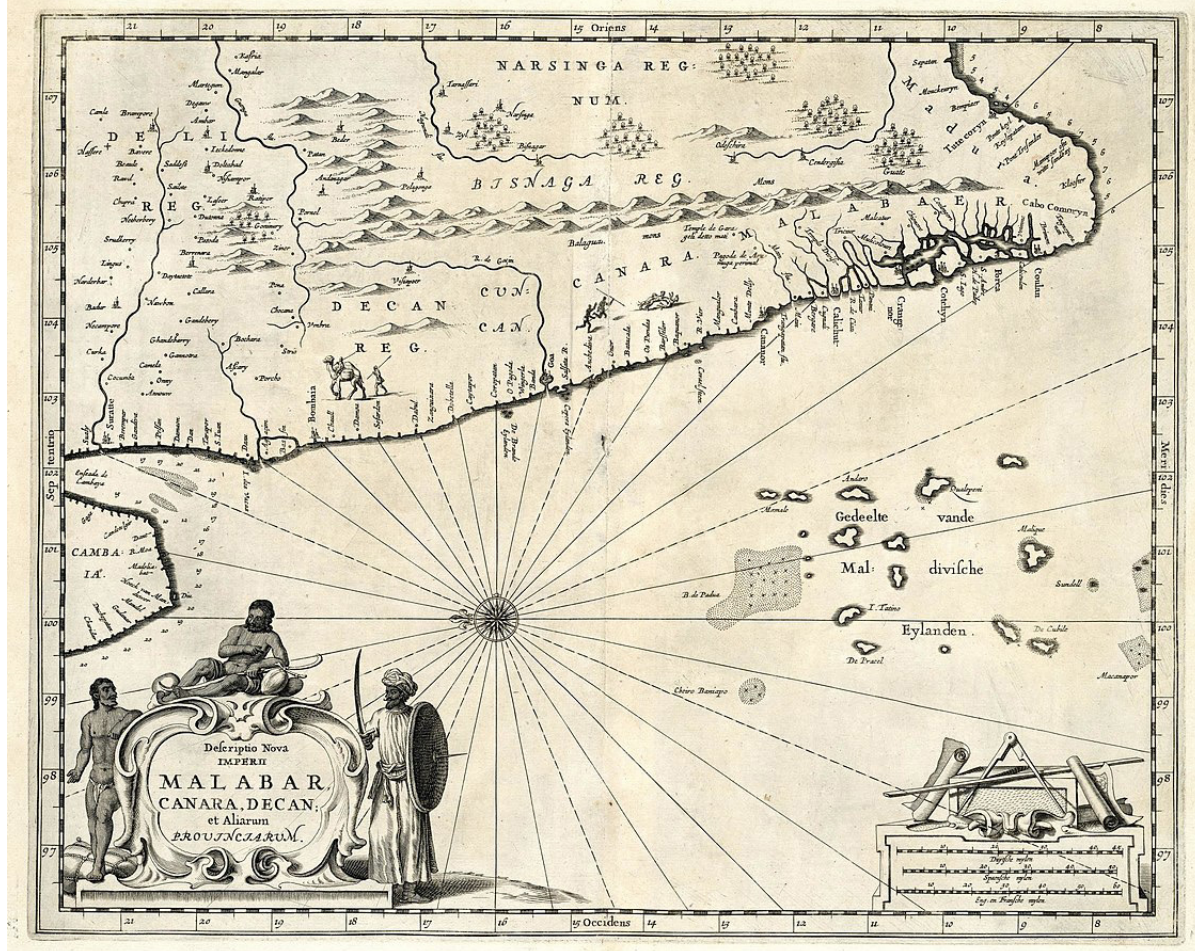th from East to West of 70 km, and a maximum of 140 km. Prior to taking on its current linguisical boundary, this defined space consisted of separate regions of Malabar, South Canara, Cochin, and Travancore. Kerala has always confronted settlers and colonizers through its "permeable" coastline. In the ancient world, the state held a key position in global maritime trade, offering a plethora of spices, textiles, and precious metals. Its "permeable" nature drew Jewish settlers to the Kingdom of Cochin, marked by the arrival of King Solomon's merchant ships in the 10th century BCE,[1,2] followed by Christianity in the 1st century CE when Thomas the Apostle arrived at the seaport of Muziris, and Christianized the indigenous populous through the rite of baptism.[3,4]

Shortly after the conquest of Mecca by Muhammad in the 7th century, Islamic merchants from the Middle East came to dominate the Arabian Sea and Persian Gulf, which subsequently led them towards the Malabar Coast when Calicut (or the Kingdom of Kozhikode) was its principal northern trading center. The Islamic population in Kerala then were categorized as either Pardesis ("foreign" in Sanskrit), referring to non-indigenous, wealthy, Arab Muslims who had dominated

the Indian Ocean trade, or Mappilas (Dravidian term of unknown origin), who were essentially converted indigenous lower caste Hindus. Like lower caste Hindus who had previously converted to Judaism and Christianity, Mappilas had converted to Islam to escape the region's oppressive and "impermeable" caste system that established stratifications between aristocratic upper caste Hindus, (such as the Nambutiri Brahmins and Nayars), and the lower castes, who were percieved as "polluted." This status required the latter to maintain a predetermined distance from the former, to prevent any instances of "pollution" from proliferating through physical contact or touch. By the 18th century, the presence of Islam had expanded from the dominant trade node of Calicut into the predominantly Hindu hinterlands, whereby a key settlement was recorded at a village near the coast known as Tirurangudi. Muslims in these hinterlands were mostly tenant farmers and agricultural laborers, but some were also merchants.[5]

Kerala's dominant agricultural economy meant that merchants continued to visit it through the centuries. Pepper was the most prevalent produce, highly valued in Europe, the Middle East, and other parts of Asia. It was known as "black gold" due to its scarcity and luxury, trade and economic value, preservative qualities, and culinary importance. Spices such as cardamom, turmeric, and ginger were also grown and exported extensively. Rice was also a common crop, due to Kerala's abundant rainfall and network of rivers that provided water for irrigating paddy fields.

Many ancient trading settlements in Kerala remained key trading centers linking Arab and Islamic merchants. Calicut (close to Tyndis), Cochin (close to Muziris), Cannanore (Naura), and Quilon (close to Berkarai and Nelcynda) were seats of local chieftains to Rajas – like the Zamorin or Samudri, the Hindu Raja who controlled the region of Calicut. Although specific locations of spice and grain cultivations have not been found, it can be reasonably argued that these commodities were cultivated near these centers for ease of transportation and coordination. From a synoptic view, it's been assumed that the midlands and highlands were used to cultivate spices like black pepper and cardamom, while rice was cultivated in the lowlands.

PERMEATION OF THE PORTUGUESE

Still, many towns in Kerala remained relative backwaters until political and social shifts were brought about by the "permeation" of the Portuguese with Vasco da Gama's arrival in 1498. The Portuguese gradually gained dominance and began to divert trade from Calicut to Cochin and Goa. Factories were built at Cochin, Quilon, and Cannonore along with fortresses at Thankasseri, Cranganore, and Beypore with Cochin, Quilon, Cranganore, and Cannanore becoming the dominant trading centers. Portuguese colonization was driven by the spice trade, focused predominantly on "black gold" pepper Although they attempted to Christianize the populace, the Portuguese allowed the locals to coexist within their own socio-cultural frameworks. A typical example is Cochim De Cima (the modern Mattanchery district in Kochi) where the indigenous population was permitted to live and practice their socio-cultural activities around the port, royal palace, and temples. The Portuguese, conversely, inhabited the area around their fort (present day Fort Kochi) where they built churches and streets with Portuguese-style buildings.[6]

The Portuguese began their trade in Kerala at Quilon with a factory established in 1504. As a commercial center, Quilon offered commodities like betel nut, colored cotton, coral, butter, and jasmine flowers. According to Chinese travelers, pearls were even brought in from Rameswaram before being exported to countries abroad. The

Fig, 2: A chegada de Vasco da Gama a Calicute em 1498 (Arrival of Vasco Da Gama at Calicut in 1498) by Alfredo Roque Gameiro. Source: Biblioteca Nacional de Portugal.

development of Quilon opened new employment opportunities, which encouraged an influx from other settlements. Professionals settled in the port city and increased demand for housing and amenities. A similar influx drove demand for infrastructure in Cochin. Houses were built of white stone and brick, roofed with lime clay or tiles. Monasteries and warehouses were constructed along with schools and hospitals which serviced the Portuguese and catered to the native population.[7] The Portuguese expanded agriculture by introducing products such as Tobacco, Pineapple, Pappaya, Cashewnut, Plantation, and Coconut.[8]

PERMEATION OF THE DUTCH

By the end of the 16th century Portuguese hegemony was being challenged by the Dutch East India Company (VOC). The Dutch strategically tapped into the contentious relationship between the Portuguese and the Zamorins who ruled Calicut. In 1604 and 1608, the VOC

Fig. 3: Wouter Schouten, A battle on the Malabar Coast between the Dutch East India Company and the Portuguese, with Hindu Nairs in December 1661. Source: Wouter Schouten/Wikimedia Commons.

allied with the Zamorins through treaties that outlined policies to weaken and ultimately expel the Portuguese from Kerala in return for Dutch trade concessions. In a final 1643 treaty the Dutch agreed to protect the ruler from the Portuguese in return for the supply of pepper and other articles. Throughout these contacts, the Dutch posed as a liberator from Portuguese tyranny and were hailed by the local people and the rulers. In 1662, the VOC laid siege to Cochin, established a naval blockade, and constructed a fort on an island across the channel. They also dug entrenchments to cut off the Portuguese by land, and by 1663, the Portuguese surrendered, and Fort Cochin passed into Dutch hands.[9]

The spatial production of lucrative commerce along the Kerala coast continued through the 17th century under Dutch leadership. The VOC possessed only unfortified factories at Kayamkulam and Cannanore in 1650, but by 1663, Fort Cochin had become a major landmark and military outposts and warehouses had emerged at Alleppey, Cheramangalam, Pappinivattam, Ponanni, Pallipuram, Cranganore, Chettuva, Cannanore, Cochin, and Quilon. Dutch rule in Kerala lasted from 1661 to 1795, which paved the way for developments in the state, including the introduction of a land tax in 1762 in Kochi. Prior to this amendment, the state was the divided into a complicated system of feudal tax administration.

PERMEATION OF THE BRITISH

The British arrived on the Malabar Coast in 1615 at Calicut.[10] However, unlike other regions of India, the entirety of modern-day Kerala was never under direct British administration. While the northern districts of Malabar and South Canara were eventually organized into the Madras Presidency headed by the British administration, the southern princely states of Cochin and Travancore were given local autonomy in return for a fixed annual payment. Within the districts of Malabar and South Canara, the municipalities of Calicut, Palghat, Fort Cochin, Cannanore, and Tellicherry were established in 1866, making them the first modern municipalities in Kerala.[11]

The British East India Company catalyzed an exponential production of new towns and villages. Once they established control of all Dutch

Fig. 4: View of the fort of Cochin, from across the backwater, with the Union flag flying from the warehouse, formerly the Portuguese cathedral of Santa Cruz', anon., ca. 1800. Source: Columbia/Wikimedia Commons.

factories, villages began to grow and mutate into towns due to their designation as administrative centers from which district officers of the Company and eventually the British government would tour and supervise the adjacent countryside. Towns also grew to support cantonments. Agricultural cultivation expanded as the British focused on staple crops like paddy, tapioca, and coconut, with tenant farmers engaged in the cultivation of pepper, coffee, tea, rubber, and cardamom. Investment from British capital and Christian missionaries accelerated commercialized agriculture. Increased yields, the need to connect towns and villages for commerce, and a rising population required better transportation infrastructure. Road and canal networks were established to transport agricultural produce from the hinterlands to various coastal settlements, with railway lines laid mainly in northern Kerala to facilitate the movement of troops from the coast into the hinterlands. The subsidiary alliance between the princes of Cochin and Travancore also ensured the British primary access to the commercial crops and land in these regions. The British also urged the monarchies of these states to undertake modernizing reforms, which included a comprehensive land tenure reform as well as the expansion of education and health care.[12]

POST COLONIAL PERMEATIONS AND THE ARABIAN GULF

Following India's Independence in 1947, the new Government of India and the princely states of Cochin and Travancore negotiated their potential annexation to the larger subcontinent, which led to the formation of the short-lived state Travancore-Cochin in 1949, which joined with the Indian Union.[13] Present-day Kerala consists of the Travancore-Cochin state, the Districts of Malabar, and South Canara in Madras State. These were all eventually reorganized and constituted together, based on geographic linguistic thresholds to form Kerala according to the "States Reorganization Act, 1956" with Trivandrum as the administrative capital.

In 1957, state elections for the Kerala Legislative Assembly brought a reformist, communist-led government to power, precipitating conflict with landlords over peasant evictions that culminated in President's Rule (or martial

law) being imposed in 1959. However, a new communist government came to power in 1967 and successfully passed a land reform law.

The "Land Reforms Act of 1969" consisted of three schemes. The first scheme sought to transfer land property rights to cultivating tenants who had leased land from landlords, which translated into the abolition of landlordism, tenancy, and intermediary rights. The scheme required the tenants to pay a nominal sum as a purchase price but did not penalize them (through forfeiting rights) if they defaulted on payments. The Act also exempted the tenants from paying any rent to the government or their landlords from the date of enactment. The second scheme allowed homestead tenants (called "Kudikidappukar") to purchase certain areas of land from their landlords. These tenants were expected to pay 25 percent of market value for these purchases, but only half that if the landlord possessed land area above a ceiling prescribed by the act. One half of the payment was subsidized by the government and the other half was payable by the Kudikidappukar. The third scheme imposed a ceiling on land ownership to redistribute surplus area to landless laborers and land-poor peasants holding less than one acre.

Although the reform sought to dismantle the concentration of land among the few and redistribute it equitably, its consequences were not entirely positive. Land reform accelerated pauperization of the rural masses by establishing of three distinct agrarian groups within Kerala. At one end of the spectrum were a minority of rich farmers who wielded an increased level of social and political influence. At the other was a large group of previous homestead tenants and agricultural laborers (Kudikidappukar) who lacked enough land to generate any capital gain through agriculture. These laborers were forced to continue seeking employment as waged laborers, which proved difficult due to the increased demand for work. Between these poles were poor and marginal farmers who were not homestead tenants previously but who gained rights to land-holdings due to past lease-ins through the land reforms law. This group was disadvantaged too by land areas too small to qualify for agricultural activities. Even when the area was sufficient, high labor costs due to unionization made growth difficult. The inability of these two groups to climb financially neutralized the hoped-for economic progress from the reforms, bolstered rich farmers, and contributed to the financial disparity of post-colonial Kerala.

Pulapre Balakrishnan in "Land Reforms and the Question of Food in Kerala" discusses the decline of rice production in the first half of the 1970s after the passing of the Land Reforms Act of 1969. He states the decline does not directly stem from the land reforms but from the state's transnational relationship with the Arabian Gulf.[14] 1973 witnessed price hikes of oil and a consequential financial boom in the Gulf countries that accelerated processes of industrialization there. This increased demand for foreign labor,[15] which combined with high unemployment within rural areas created preconditions for migration. Kerela underwent population flight towards the Arabian Gulf. This migration, as well as gradual conversion of arable land for infrastructure projects, led to the slow decline of grain production.

Labor migration reduced unemployment in the state, increasing purchasing power for the poor households that migrants left behind, who were supported by an inflow of remittances. Remittance enabled a cycle of increased infrastructure development, which in turn generated employment opportunities in sectors such as transport, communications, trade, commerce, education, health services, and banking. Increased wages for migrant workers in the Middle East thus increased in income levels of poor migrant households in Kerala, which consequently precipitated inflation that challenged economically disadvantaged non-migrant households.

Fig. 5: Swearing-in ceremony of Namboodiripad as first Chief Minister of Kerala, April 1957, photographer unknown. Source: Caravan Magazine.

Fig. 6: A real estate residential township in Puzhakkal, Thrissur - rising adjacent to agricultural fields in the foreground. Conditions like these create a disjuncture between formally realized binaries of urban and rural - whereby, in this case the rural, the urban and the agricultural coexist together in the same space and time. Unknown photographer. Source: Wikipedia.

TWENTY FIRST CENTURY KERALA AND FUTURE IMAGINARIES

Kerala's relationship with the Middle East has been ubiquitous since ancient times. Since labor migrated there in the 1970s remittances from the Gulf have caused a boom in Kerela. But it has not always been advantageous, as seen in 1996 and 1997 when nearly 70,000 migrant workers from the UAE and Saudi Arabia returned to the state, causing a recession and illustrating that the economic prosperity of modern Kerala depends on flows of migrants towards the Arabian Gulf and the flow of remittances they send home.

The inflow of Gulf migrants also comes with large investments in infrastructure, as Malayalis who established businesses in the Gulf expand operations towards Kerala. In this instance, trade from the Middle East to the Malabar has not been limited to remittances, but includes the flow of cultural capital, artefacts, images and landscapes.

As Kerala continues to unabatedly urbanize, will alternative urban landscapes emerge within this milieu? Kerela's form is densely populated and sprawls horizontally, with dominant urban nodes beginning to prevail like Cochin, Trivandrum, Thrissur, and Calicut. Will urban policies evolve to accommodate the changing aspirations and requirements of Kerela's inhabitants? Will another land reform be required to redistribute land for the structured urban densification of its emergent nodes? Or is there an alternative theory for this rural-urban formation on India's southwest coast?

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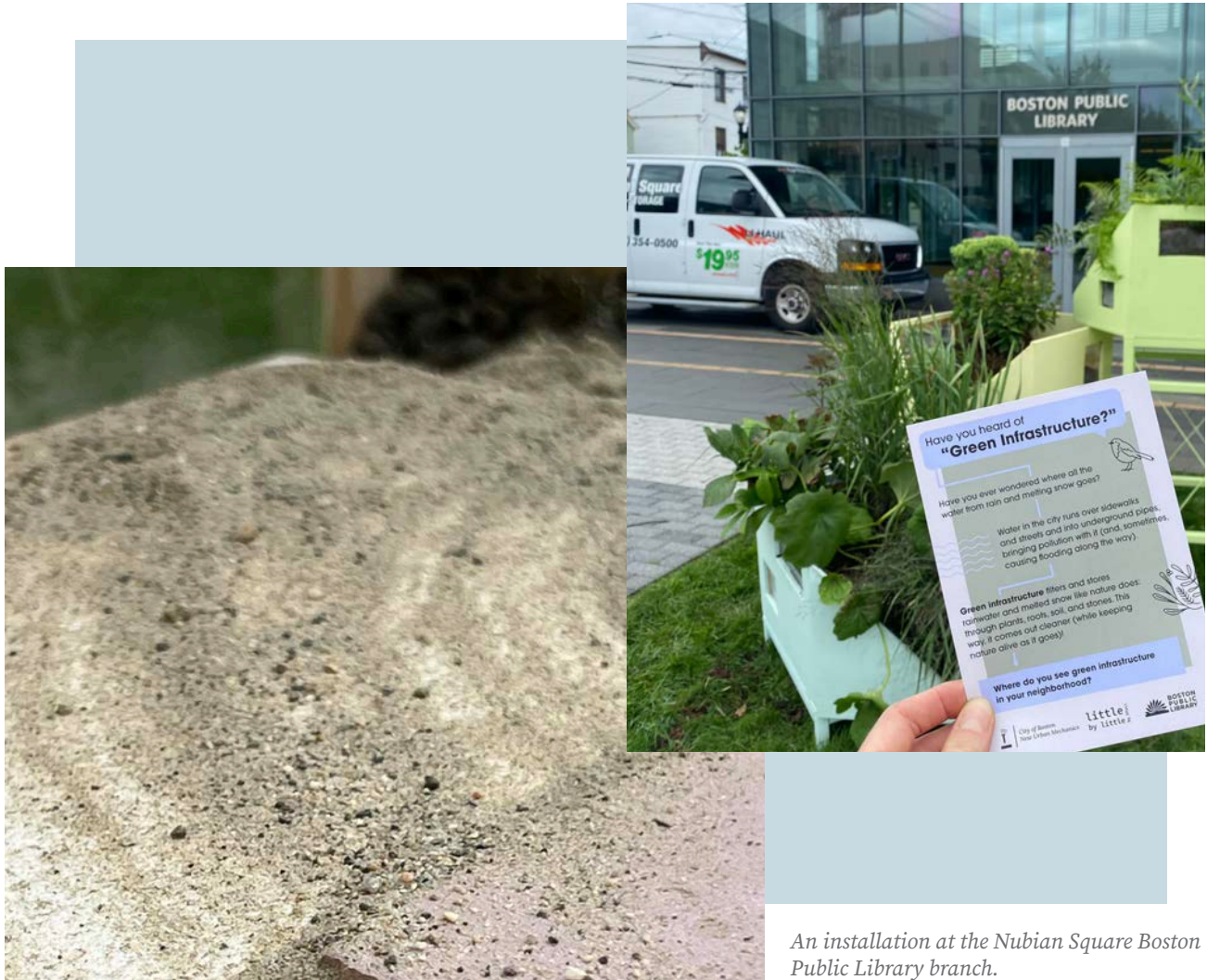
An installation at the Nubian Square Boston Public Library branch.

little by little

by SMaLL

Sonny Meng Qi Xu (M.Arch II/MLA I AP '18), Maitlyn Lang, Madeleine Levin (MUP '23), Liz Cormack (MUP '23), and jiaLei Tang (MUP '23)

little by little is a series of urban installations of deconstructed wetlands. The project won the 2022 Boston Public Space Invitational and was installed at Nubian Square and East Boston branches of the Boston Public Library to raise public awareness of green infrastructure.

It is a three-tiered structure with each segment representing different ecologies—namely Meadow Grasses, Fern & Moss, Glade, and Wetland—which act as important green infrastructure which mitigate flooding, heat, and biodiversity loss.

Three-tier geometric pentagonal house-like planters interact with each other to show the water filtration process of planting, soils, and rocks, visible through plexiglass windows that reveal the permeability of such earth.

This mimics and highlights the ecological processes happening above and below ground in nearby rain gardens at both Nubian Square and East Boston libraries.

The work is part of the Mayor's Office of New Urban Mechanic's 2023 Public Space Invitational and is generously funded by the City of Boston. Today, the installation have been moved to the Community Academy in Jamaica Plain, MA after its debut at the Boston Public Library branches.
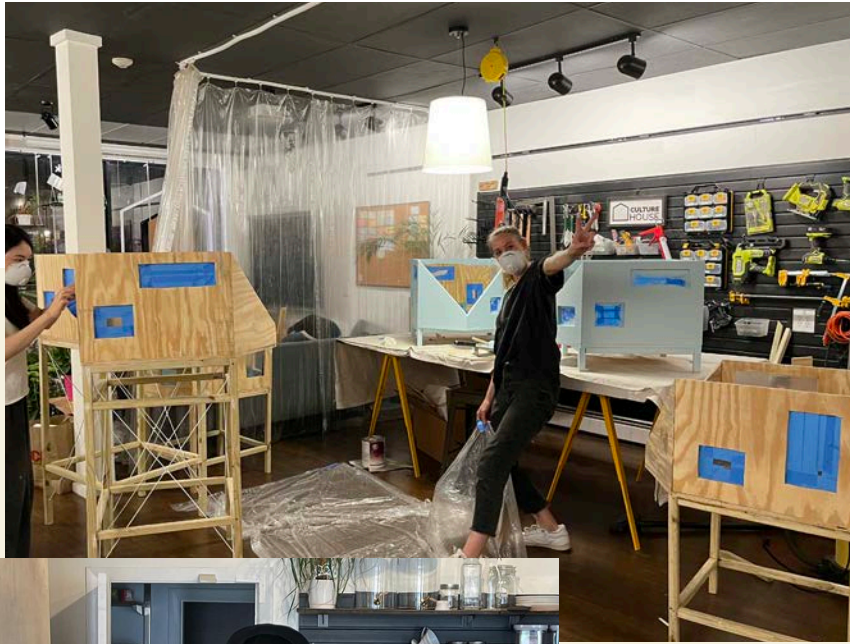
Everything is connected to everything else: that is the first law of ecology.

—Barry Commoner

Making little by little
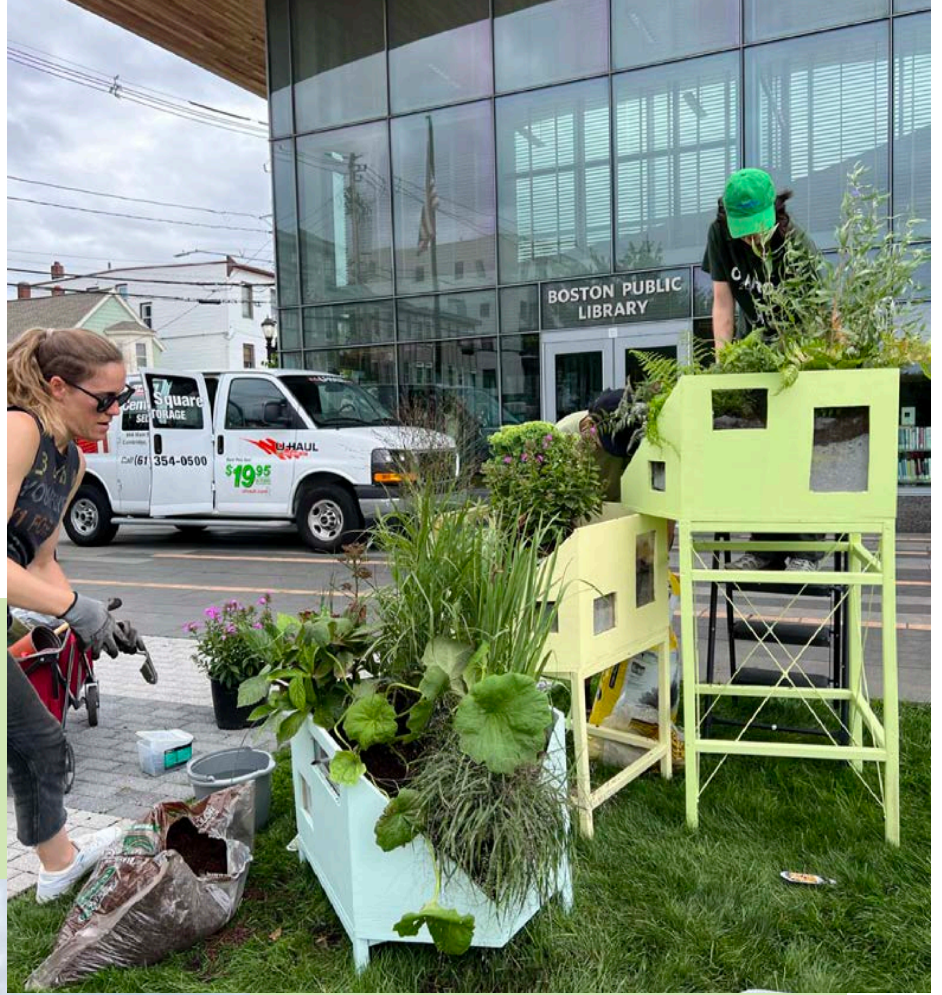
Installing little by little

Team SMaLL with Allen and little by little installation in Boston Public Library Roxbury Branch

Acknowledgments

Notes from the T:

A Diary of Looking

Olivia Fiol

My commute from Porter Square to MIT is only a short bicycle ride. Cycling is an active experience, where one is responsible for the moving from point A to point B. A trip on the T or the bus is an entirely different experience, where one releases control. But it does not have to be an entirely passive one: through transience, I feel more receptive to the world around me.

9AM, May 27, Red Line: At Central station, large fans blast cool air into the train's cars. A breeze passes through the briefly opened doors.

8:41AM, June 3, Red Line: A man in a suit to my right is hunched over a laptop. Another man to my left has a hardcover book open on his lap, readers on. Others close their eyes, resting, before the day. A woman has a bike helmet on, but no bike. Some look up and gaze at those across the aisle.

Public transit is part of the realm of public space. I argue that the intimacy of people's interior lives is most porous in this public space, on the train or bus, where space is confined. Private and public collide when riders may feel alone and individual in their thoughts even as emotion and detail can be read by a stranger.

9AM, May 27, Red Line: Most of us look down, except for two women sitting across from me. They wear matching black T-shirts, black leggings, and carry heavy-looking bags. Their conversation starts and stops, picking up from where they leave off. Sometimes they laugh. One occasionally rests her hand on the other's thigh. The other woman doesn't react to these touches and continues the conversation.

9:21AM, May 27, Red Line: A middle-aged man near me looks at his phone, playing aloud the sounds of people singing. He seems to be reciting or repeating a prayer in response to the video.

10:45AM, May 27, returning from Revere Beach on the Blue Line: Sand sticks to my sandals from the shore. On the ride home, a woman sits at the opposite end of my row of seats. She retrieves a clear water bottle from her bag and gulps down an opaque, white liquid. Is it milk?

10:54AM, May 29, Red Line: A woman (mother as well, I believe) and a young boy sit two seats apart from each other, separated by their dog. She wears a wide-brimmed sun hat, and his small scooter is parked in front of them. They give each other an enthusiastic high-five. Then another. He exclaims with joy, which they follow with a fist bump and a gestural interpretation of an explosion. He wears a baseball hat too. They must be prepared for spending a day in the sun.

2:05PM on May 29, Red Line: This car is warm—no AC. A dog whines at the other end of the car. A young mother smiles at her baby in a stroller; she looks so in love. The baby's head peaks up over the stroller's cover and his mom immediately retrieves him—he wants to move! She allows for a controlled roam, maintaining a firm grip on the back waistband of his tiny pants. He and I make eye contact and he suddenly becomes shy. Hiding, he peeks with one eye through a gap in the side of his seat. He smiles and stares at me, and I smile back.

The blurred boundary between private and public even provides an opportunity for performance. Whether an action operates as a display can be entirely determined by the audience. The specific conditions of transit enable these experiences, where we are all moving and encapsulated within the same space. By pausing to observe, a kind of public theater emerges.

10:45AM, May 27, Blue Line: A few people are chatting on this ride. A man on the phone speaks Spanish through his AirPods. An older couple chat about their time at the beach (much better prepared for the misty weather than I was; in sneakers,

jeans, and rain jackets). At the airport stop, two women laden with suitcases board the train, one sweetly brushes hair back from the other's face. They're talking about people they know, their friends. To make it home, I need to transfer again aboveground. I exit the Blue Line and walk to Downtown Crossing to board the Red Line to Alewife. My path was paralleled by a couple, who moved with more purpose than me. Two of his fingers appear to be broken, wrapped in tiny individual splints. Seated on the Red Line, she leans on him and drapes one of her legs on top of both of his, their hands tightly interwoven. They speak in hushed tones with one another. She closes her eyes.

11AM, May 27, Red Line: More people seem to be riding in groups, in conversation with friends, siblings, parents, and partners. Collectively, we all seem to have woken up; there is more eye contact, more laughter. The train starts and stops, grinding its way up to the next station. This kind of jolting usually makes me nauseous, but many of my fellow passengers seem unbothered. A young woman, arm outstretched, takes a photo with two of her older relatives. A group of men look out the window to investigate what's happening to our train and find no resolution.

Around 6PM, May 28, 66 bus to Nubian: This bus is busy and much louder than my previous one. Sitting down, the bottle of wine I'm carrying slides out of my bag and smacks the ground. There are at least three conversations happening over the phone and pairs chat with one another. On phones, I see: double-checking Google Maps (many are doing this), reading emails, watching an episode of Criminal Minds. A woman leaned her head on the shoulder of one of the Google-mappers. I just double-checked my own directions.

5:46AM on May 30th, 96 bus to Harvard, in my notes app: In the process of moving houses, I accidentally packed my notebook. Two people behind me are chatting

on an otherwise silent *bus*. So far i've heard mention of "after the bombing." Also, "she has to hobble over to the museum" and some throat clearing.
    "Does she have muscular dystrophy?"
    "I think so."

Not infrequently, these spheres crash into one another. Sometimes pleasant, sometimes harmless, sometimes harsh. I have been subject or witness to all three forms. This point of tension, resulting from the crossing of a public-private boundary, requires more attention. How can we imagine transit as a place of cohesion and positive interaction?

10:45AM, May 27, Blue Line: Passengers glance over at their neighbors' phones, momentarily snooping before returning to their own thoughts. Two people move to sit in the same seat, the man beating the woman there. Realizing what happened, he shifts a seat over to allow her some room. She sits next to her daughter.

9:43AM, May 27th, Blue Line: A person sitting directly across from me forcefully taps their feet. I can feel the vibration in my own shoes through the ground. Their jacket holds many patches and my favorite declares that "the mothman believes in me." The taps feel nervous and random. To my left, a man wearing headphones gently taps out a beat with his feet. Later, at the Suffolk Downs stop, the loud tapper asks for my number. I decline, and they let me return to my writing. I exited shortly after and made my way to Revere Beach.

During the day, sometime early spring, Red Line: On a slightly busier trip, I sat alone with my headphones on with two empty seats on either side of me. A man walked down the car, stood close and directly in front of me, propped one foot up on the seat to the left of me, and pushed his hips forward so that his crotch was as close to my face as possible. Quickly glancing up, he smirked down at me. I ignored the positioning so that he would grow bored and move away. However, this resulted in

him walking down the aisle to make other women uncomfortable. Stopping at the other end of the car, the man sat down between two women in conversation, and put his arms around each of their shoulders. They quickly stood up and moved away from him, but not too far to provoke further action.

Transit's invisible stage offers the passenger a peek into the lives of strangers. The fullness of that view depends on the people, time of day, and place. We pass, bump by, or crash into each other as we follow our interior stage cues. In this theater—our seats on the train or the bus—we attend countless performances.

Around 6AM, May 28, 66 bus to Nubian: A woman with over-ear headphones, striped vest, and black skirt rests her Trader Joe's bag on the floor. Bright pink flowers poke up over the top of the brown paper. Her flowers match the outfit of another standing near here – she wears a range of pink shades.

11AM, May 27, Red Line: The train continues to jolt on our path to Kendall. The discomfort's silver lining is the time it gives us to watch sailboats race across the Charles. Many of us turn around in our seats to watch. The train speeds up.
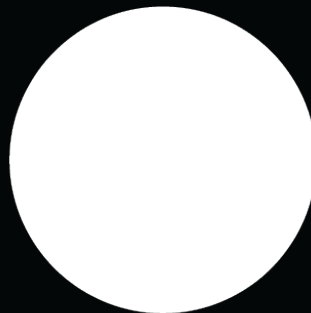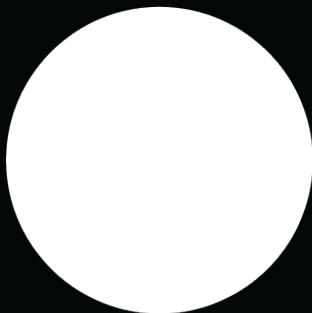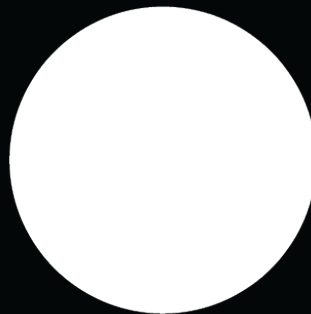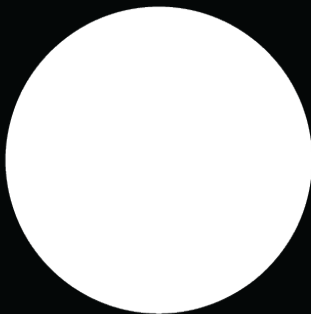
Fig. 1: A railway area in the valley bottoms (Center of Bauru - São Paulo). Source: Authors, 2017.

Lost Landscape

Valley bottoms in the contemporary landscape of a Brazilian city

Ryller Chrystian de Andrade Veríssimo and Luciana Bongiovanni Martins Schenk

The valley bottoms landscape in Bauru (São Paulo state) began to form before the city itself, passing through geological times and historical changes that geographically inscribe human action on the territory.[1]

From the farms of the region's pioneers to urban development today, the landscape has been continuously transformed over more than a century, shaped by the coffee economic cycle and railroads. The railway lines that cross and permeate the city parallel to the watercourses in the valley bottoms have shaped urban design, constructing landscapes disjointed from the rest of the city.

The grid superimposed on the territory disregarded the morphology of the valley bottoms and, accompanied by the movement of sprawling urban expansion, entrenched these open spaces as voids between places,[2] characterized by an intricate framework of socio-urban-environmental challenges.

In this essay, we reflect on the how Bauru's valley bottoms became obsolete, creating an image of a "Lost Landscape".[3] These linear open spaces were isolated, and over time were perceived as obstacles in the city's landscape. We envision desired scenarios for the future and how the valley bottoms could become Productive Landscapes.

THE FORMATION OF THE VALLEY BOTTOMS LANDSCAPE

A brief historical overview

Bauru is part of a network of cities that emerged between the mid-19th and early 20th centuries as a result of religious heritage donations and the arrival of railroads. The railroads actively influenced the relationship between cities and valley bottoms and, in the case of the state of São Paulo, settlement took place on the border of the river basins, promoting distance between settlements and rivers or valley bottoms.[4]

The town began through the donation of a religious heritage by the owner of Fazenda das Flores, Antônio Teixeira do Espírito Santo, who made the first transfer of land to his saint of devotion in 1884.[5, 6] According to Constantino's research,[5] the boundaries of the farms coincided with the valley bottoms. This division guaranteed the farmers access to the highest part- where they started growing coffee, and to water—where cattle grazing took place in the valley bottoms. The first land subdivisions began with the allotment of the farms' plots, in the interest of private enterprise, following the 88 x 88 meter grid laid out in the Code of Ordinances of 1897. This was the beginning of the grid city design that marks the urban layout to this day.

The development of the city of Bauru was based on the coffee-railroad binomial, whose tracks corroborated the establishment of a problem that historically accompanied its development, characterized by the lack of connection in the urban fabric. Bauru's grid is interrupted as it approaches the valley bottoms, the fragmentation of which was reinforced by the railroad tracks, and later the roads. The railway junction began with the arrival of the Sorocabana tracks in 1905, the same year that the construction of the Noroeste track began. This situation contributed to reinforce an original social and cultural segregated character, once favored by the morphological characteristics of the valley bottoms and the river.[7]

Shortly afterwards, the last railroad—the Paulista—arrived in 1910, causing some streets to close, which ended up ratifying the isolation of other areas of the city. The tracks created a barrier that fragmented the city into three large sectors and the regular grid layout that was super-

Fig. 2: Overlap of the Sorocabana, Noroeste do Brasil, and Companhia Paulista railroads on present-day Bauru. Source: Authors, 2023. Based on SEPLAN Bauru Basemap, 2013.

imposed on the territory generated an incompatibility with the morphology of the valley bottoms, which remains in the city today (fig. 2).[5, 6]

Bauru's economy was based on its regional influence through the railroad and later incorporated new modes of transport, becoming an important road-air-water and rail junction. The Paulista and Noroeste railroads encouraged economic development in the regions and cities through which they passed. This relationship and dependence on them, along with cotton farming, maintained economic stability when coffee production decreased in the 1930s. This was followed by the building of a road junction in the city, which until then had been dominated by the railroad.

● City Center
❶ Sorocabana (railroad track)
❷ Noroeste do Brasil (railroad track)
❸ Companhia Paulista (railroad track)

From the mid-20th century onwards, the transition between modes of transport not only intensified, but so too did the economic activities linked to them. As a result of the deindustrialization movement, the railroads lost relevance and were ultimately decommissioned at the end of the 1990s, confirming the obsolescence not only of the entire industrial railway infrastructure, but the valley bottoms as well, where scenes of abandonment characterize a Lost Landscape (fig. 3).

Looking towards the future of these landscapes, the grid imposed on Bauru's urban layout—as if it could indiscriminately disregard valleys and watercourses—creates a challenge for urban development.

BETWEEN CHALLENGES AND POTENTIAL
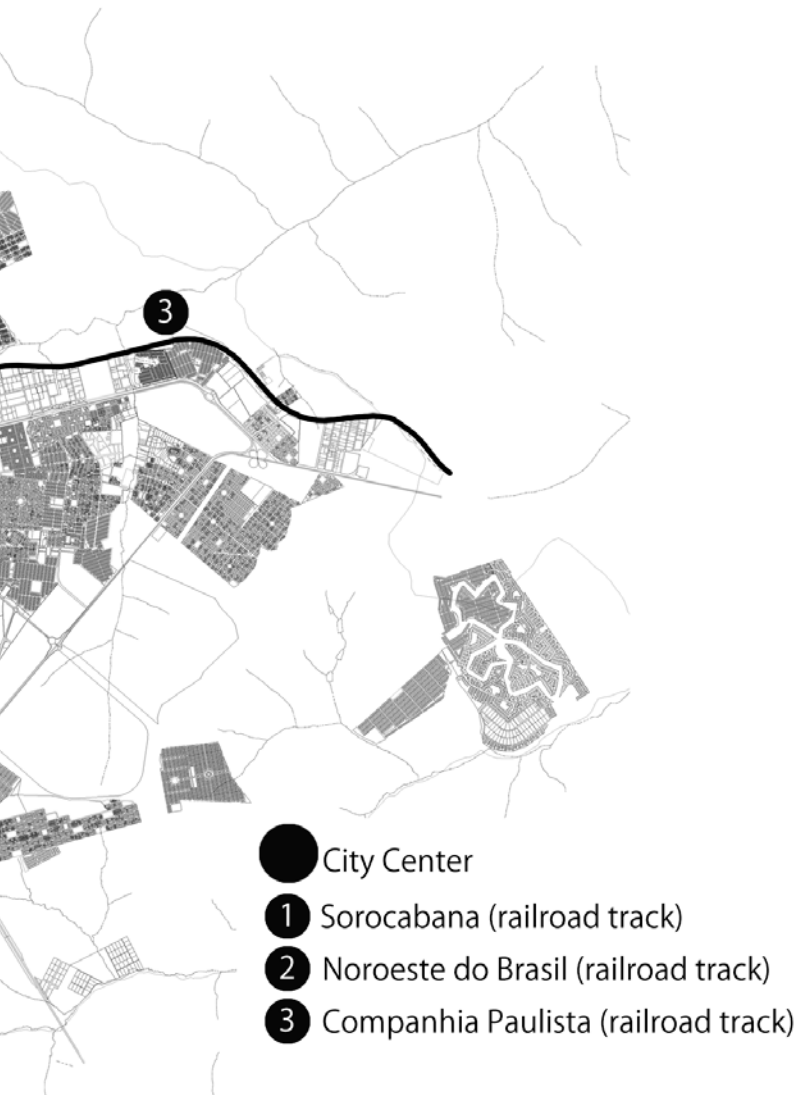
The valley bottoms we want for the future

After the valley bottoms were initially seen as an obstacle to urban expansion, an image built up in the common sensibility that they are problematic and unpleasant. Scenes of illegal dumping, deforestation of native vegetation, lack of security and public infrastructure, and degradation of industrial heritage all testify to this popular understanding (fig. 4). When the river and streams are not channelized or plugged, they are usually silted up and polluted. As a result, the people of Bauru are unable to establish a connection with their watercourses; instead treating them with detachment and lack of affection.

Especially since the 2000s, as urban fabric extended to the peripheries, these urban green open spaces have become invisible and de-functionalized, the neglect reiterated by the abandoned industrial railway heritage. These Lost Landscapes only come back into the news when they are the protagonists of critical hydrological events and environmental or social problems. Every year, the news shows images of destruction, accidents, and deaths caused by floods.

It is time to transform how these Lost Landscapes are perceived. They can be places of opportunity.

The valley bottoms have great potential to promote urban articulation and drainage, mitigating the problems that arise from urban expansion. This requires overcoming the conflicting relationship between the river and the city, recognizing that "water is the city's life blood". An urban redesign must take natural aspects into account when planning the landscape. When faced with images of the current landscape (fig. 5), it is possible to reflect on how the valley bottoms could transform to meet the contemporary city's demands.

Because valley bottoms permeate all of Bauru, they have potential to create a system of open space that connects the urban fabric and "capillarizes" greenery in the city. These revived valley bottoms would activate adjacent degraded and abandoned areas, underused industrial heritage, and edge landscapes. The system would be based on the concept of Continuous Productive Urban Landscapes,[9] which proposes that

Fig. 3: Scenes of abandonment characterize a lost landscape.

urban landscapes ought to be environmentally, socially, and economically productive alike.

The valley bottoms would transform into living spaces, expanding their productivity as they meander through the city, guaranteeing ecosystem services, food access, and places to encounter, culture, rest and learn.

Our challenge now is to build that Productive Landscape through effective public policies, participatory governance, and continuous management that goes beyond land-use planning based on zoning and indexes to include the landscape and its constituent elements.

The landscape is definitely political.

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(above) Fig. 4: Current situation of the valley bottoms (Stream-Córrego da Grama). Source: Authors, 2017.
(below) Fig. 5: Overview of the valley bottoms (Stream-Córrego da Grama). Source: Authors, 2017.