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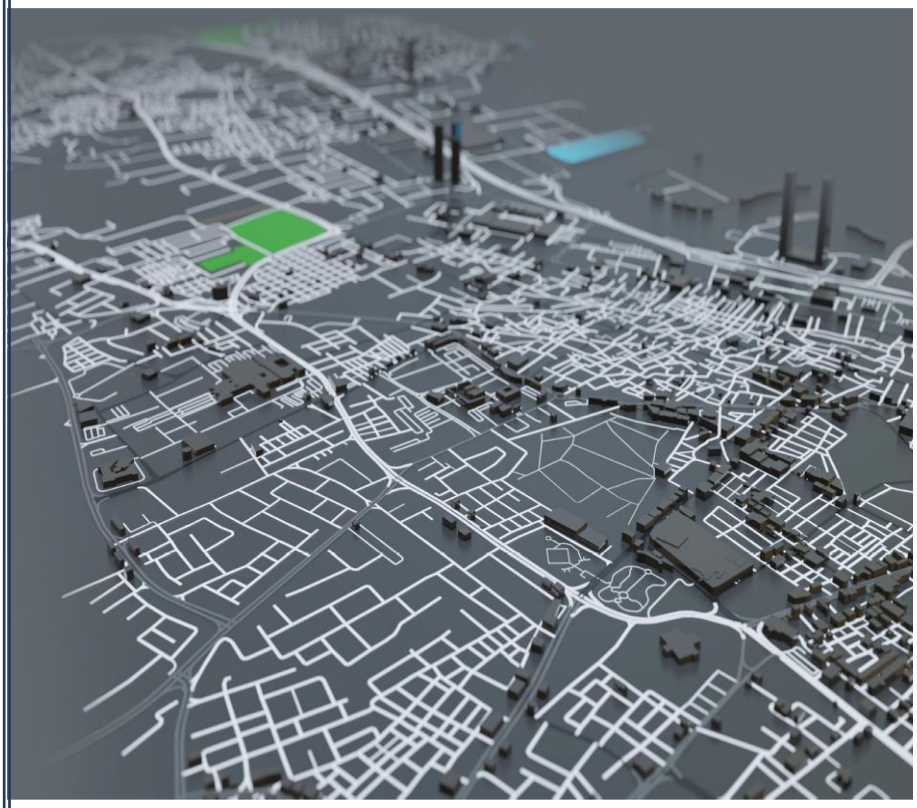

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Gregory T. Papanikos
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Important Dates

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- Submission of Paper: **8 June 2026**

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- **Dr. Giulia Pellegri**, Associate Professor, Architecture-Polytechnic School, University of Genoa, Italy.

Important Dates

- Abstract Submission: **14 April 2026**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **4 May 2026**

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Reclaiming Architectural Imagination through Material Artefacts and Storytelling

*By Stephen Alexander Wischer**

In an age increasingly shaped by algorithmic systems and artificial intelligence, architecture risks being reduced to data-driven efficiency at the expense of imagination and cultural depth. This paper argues that artefactual tools and processes—rooted in material resistance, embodied making, and language—are essential to design as a disclosure of cultural meaning. Drawing upon phenomenology and hermeneutics, it situates artefact-making as a poetic and interpretive practice that mediates between memory, material, and imagination. Case studies from graduate thesis studios and the Speculative Architecture exhibition series at North Dakota State University demonstrate how artefacts cultivate storytelling and embody reflection, enabling students to recover architecture's role as a shared cultural act. By reframing design as a site for poetic inquiry and ethical responsibility, this work contributes to global discourse on architectural education, arguing that artefacts sustain imagination in the face of technological abstraction.

Introduction

Architecture is a discipline of building *and* of storytelling—an imaginative and embodied practice that draws space, time, and memory into situations that speak back to us. As Marco Frascari suggests, practical and theoretical architectural knowledge has historically been passed on not primarily through scaled drawings or models but through storytelling, which helped shape the skillful crafting of buildings and with it our understanding of the world.[1] As contemporary cognitive science and neuroscience demonstrate, the external world profoundly influences the internal world of thoughts and emotions; thus architecture remains a fundamentally human practice for situating ourselves meaningfully in that world.

As Paul Emmons notes, architectural representation is an inherently fictional practice—one that operates through acts of make-believe—which is storytelling. Today, though, with architects increasingly distanced from cultural storytelling *and* the physical act of building, the representations we employ gain renewed significance. Architects' drawings, models, and artefacts are not neutral or passive instruments, mere previews of future buildings; Emmons suggests that drawings and models are poetic constructs that catalyze thought and invite us to envision a world not yet realized.[2] They are active sites of interpretive inquiry where latent meanings are unearthed and

*Associate Professor, North Dakota State University, USA.

1. Marco Frascari's, *Eleven Exercises in the Art of Architectural Drawing: Slow Food for the Architect's Imagination* (London: Routledge, 2011), 6; "An architectural good-life can be built, explained and taught only through storytelling," in *Reading Architecture and Culture: Researching Buildings, Spaces and Documents*, ed. Adam Sharr (London: Routledge, 2012), 228.

2. Paul Emmons, "Adaptations" in *Drawing Imagining Building: Embodiment in Architectural Design Practices*," 205.

imaginative possibilities emerge. In this sense, modern architectural making is always projective, gesturing toward something that does not yet exist.

At its core, architecture requires the imagination to proceed along any line of its own representation, a demand made more remarkable given persistent tension between the so-called "real world" and the imaginatively generative dimensions of design. While speculative drawing practices have increasingly drawn upon interdisciplinary influences to enhance architectural storytelling, conventional representational modes—such as orthographic drawings, models, and perspectival renderings—have, since the Enlightenment, largely functioned as mediators between concept and construction through an isotropic, Cartesian understanding of space.[3] Employed uncritically, these tools become subordinate to logics of utility and production and to representational systems that tend to freeze time and place us away from the object being depicted. In contrast, alternative models—artefacts not intended as finalized representations but as evolving *thought-objects*—open interpretive and imaginative spaces and thus invite a more authentic engagement with the translational process of architecture from the "bottom up" so stories, ideas, and outcomes can emerge from embodied encounters.

Such thinking is not new. Levent Kara explores how the temporally rich, culturally embedded medium of film can provoke architectural ideation beyond static forms of representation, opening new spatial and narrative possibilities.[4] Recent contributions to the *Athens Journal of Architecture* echo the emphasis on interdisciplinary influence and narrative interpretation, exploring place not as a fixed entity but as something that emerges through layered stories, memory, and material engagement.[5]

The alternative approaches to architectural representation this paper explores follow a similar line of inquiry rooted in the critical tradition of theoretical architectural projects initiated by Piranesi, Boullée, and Lequeu—important precedents suggesting that architectural representations are dynamic, narrative structures through which architects think, dream, and reimagine the world.[6] Marco Frascari has called this the "construction of architectural thought" as "cosmopoesis," where representational models are both

3. Martina D'Alessandro's essay *"Oswald Mathias Ungers and Sol LeWitt: Variations"* (*Athens Journal of Architecture* 10, no. 4, 2024) explores a similar permeability between art and architecture where conceptual art becomes a catalyst for architectural ideation. I extend that line of inquiry to examine how artefacts function not as representations of resolved form, but as poetic instruments of thought, where ambiguity and narrative actively shape architectural understanding.

4. Levent Kara, "Representation vs. Ideation in the Architectural Design Process," *Athens Journal of Architecture* 2, no. 1 (2016): 27-44.

5. Giuseppe Resta, "Mapping the Invisible: Problems of Interpretation and Representation of Hormuz Island, Iran," *Athens Journal of Architecture* 11, no. 2 (2025): 201-232.

6. As Louise Pelletier and Alberto Pérez-Gómez have argued, the tradition of theoretical architectural projects emerged most forcefully in the early modern period, particularly during the Enlightenment, as a response to the fragmentation of knowledge and the rise of mechanistic worldviews. In works such as *Architecture and the Crisis of Modern Science*, Pérez-Gómez traces how Piranesi, Boullée, and Lequeu went beyond representation to turn drawing into a poetic and critical medium. They engaged the project as a speculative act—an instrument for restoring meaning in a world increasingly defined by abstraction, quantification, and instrumental reason. Their unbuilt works were not failures of execution, but intentional provocations that used representation to challenge dominant notions of space, time, and the human condition. In this lineage, theoretical projects are acts of *cosmopoiesis*—world-making—through which architecture regains its philosophical and cultural depth.

stories and machines for making stories.[7] This mode of making proposes that architecture exists not only in finalized buildings but also within the act of representation itself.

Three research questions guide the investigation in this paper: How can artefacts function as interpretive and imaginative tools in architectural pedagogy? How does material resistance and storytelling contribute to embodied design processes? How might artefact-making recalibrate architecture's relationship with technology and representation in a digital age? Taken together, these questions ask how artefacts might operate as mediators between memory, material, and imagination, and how such an approach may recalibrate architectural pedagogy in today's architectural education. This investigation does not advocate a retreat from digital practice but a recovery of its embodied and interpretive core. The same poetic imagination that once animated drawing and craft can, when consciously engaged, transform contemporary tools from instruments of abstraction into agents of rediscovery. In this sense, artefactual making bridges past and future modes of representation, inviting technology back into dialogue with the human body and cultural memory.

This paper's contribution is to demonstrate how artefact-making, when framed through phenomenology and hermeneutics, can serve as a pedagogical method for recovering architectural imagination in a digital era.

Theoretical Foundation

To elucidate artefact-making's value as a critical counterpoint to reductive representations and technological production, this article situates physical creative modeling practices within broader philosophical and pedagogical frameworks.[8] It builds on well-known phenomenological and hermeneutic insights, as well as more than a decade of research into Anselm Kiefer's representational strategies—including his poetic integration of material, memory, and spatial imagination at La Ribaute—to investigate pedagogical and representational tools through which architecture continues to act as a vessel for shared storytelling and embodied knowledge.[9]

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7. Marco Frascari, *Eleven Exercises in the Art of Architectural Drawing: Slow Food for the Architect's Imagination* (London: Routledge, 2011), 21-28 and his "An Architectural good-life can be built, explained and taught only through storytelling," in *Reading Architecture and Culture* (London: Routledge, 2012), 226.

8. My approach is especially critical of representational tools found in BIM software that often prioritizes efficiency, standardization, and technical resolution over ambiguity, narrative, and material exploration (ArchiCAD, Revit, Vectorworks, etc.). Such platforms tend to reduce architectural thinking to predefined outcomes, limiting the imaginative and phenomenological depth artefact-making can foster.

9. Kiefer's work, marked by a deep integration of material, myth, memory, and spatial imagination, offers a compelling analogue for alternative architectural modeling practices that resist closure and invite interpretive depth. For reference to the architectural significance of his situated art practice, see Stephen Wischer, *Architectural Lessons from Anselm Kiefer* (PhD diss., McGill University, 2020); and Wischer, "The Architecture of Anselm Kiefer: La Ribaute and the Space of Dramatic Representation," in *Chora: Intervals in the Philosophy of Architecture*, vol. 7, ed. Alberto Pérez-Gómez and Stephen Parcell (Montreal & Kingston: McGill-Queen's University Press, 2016), 303-22.

To approach this expanded field of representational possibilities, I consider architectural artefacts as *tools* through the hermeneutic thought of Paul Ricoeur and Martin Heidegger, phenomenological insights of Maurice Merleau-Ponty, and material theory of Christopher Bardt—who all challenge the dominance of technological rationalism, proposing instead that architecture arises from embodied interpretation, poetic engagement, and material resistance. Drawing from recent student projects created in graduate-level studios at North Dakota State University (NDSU) and displayed in the *Speculative Architecture and Oblique Representation* annual exhibition curated by Anthony Faris, I explore how alternative models open a space of translation between fiction and form, image and meaning. These students, by engaging in a layered and recursive process of making, experience a design methodology that reclaims depth, opacity, and wonder as vital to architectural imagination and storytelling. The artefacts they make preserve the uniqueness of their individual visions, resisting the homogenization that often results from overly rationalized software environments.

The examples I've selected reveal how closely theory and practice—thinking and making—are intertwined, where understanding the architectural proposal arises through embodied interpretation and linguistic imagination. They demonstrate artefact-making as a contemporary hermeneutic act—revealing architecture not as fixed form, but as an unfolding of meaning through situated, interpretive, and synesthetic engagement.

Following Pelletier, Pérez-Gómez, Bardt, and Lisa Landrum, I emphasize that our tools are never *neutral*; rather, the things we do as architects shape how we design and what we come to know through the action of designing, as a verb. In other words, the examples emphasize *making as a form of thinking*, just as *techne*, in its original meaning, was a way of revealing the world and not simply technique or utility. As Heidegger suggests, this revealing is often hidden by the reductive tendencies of modern technology, a concern echoed by Tzonis and Lefaivre in their call to reconnect architecture analogically with deeper cultural and poetic roots.[10]

To what degree, then, might our representational tools allow poetic meanings to emerge in our encounter with materials situated in the spatiality and temporality of embodied experience? While every representational act has imaginative potential, artefactual processes are uniquely dialogical: they slow perception and reawaken the reciprocal exchange between thought and matter. By engaging resistance rather than ease, they sustain a depth of reflection that purely visual or algorithmic modes too readily bypass.

10. In "The Machine in Architectural Thinking," Liane Lefaivre and Alexander Tzonis outline the fundamental shift from premodern analogical thinking—rooted in symbolic, narrative, and cosmological frameworks—to modern productive thinking characterized by mechanistic logic, standardization, and instrumental rationality. They highlight how this transition reoriented architectural representation away from poetic revelation toward technological efficiency.

Artefacts as a Storytelling Tool

In his 1954 essay "The Question Concerning Technology," Heidegger warned that under the dominant mode of technological thinking, the modern world was increasingly perceived as *Bestand*—a "standing-reserve" of resources ready to be optimized, extracted, and controlled. This instrumental worldview, which arose in tandem with the rise of Positivism, introduced a profound bifurcation between the internal, subjective world of human experience and an objectified, external realm. It left the intersubjective realities of shared human meaning (stories held to be of importance in culture) to be vastly misunderstood as lesser forms of knowledge. This split underscores much of modern scientific thought and has deeply influenced architectural representation, particularly through the privileging of visuality and objectivity in design processes.

Pérez-Gómez and Pelletier trace this transformation in the history of architectural thought, arguing that the advent of linear perspective in the Renaissance marked a decisive epistemological shift. Perspective, originally a poetic and philosophical tool used to construct a shared worldview, gradually became a technical device for controlling vision and codifying space. What began as an imaginative act capable of generating meaning and emotional resonance in an intersubjective realm was increasingly reduced to a mechanistic procedure aimed at producing images that simulate objective reality. At its worst, the perspectival space of pictures became misunderstood as homologous to lived experience and perceived as accurately representing reality.[11] This reduction, Pérez-Gómez and Pelletier argue, has had lasting consequences, particularly in its devaluation of other modes of spatial understanding rooted in the realities of bodily interaction and the role of imagination and memory in our encounter with the world.

This legacy persists today in digital design environments. Powerful software tools continue the trajectory of privileging calculability, efficiency, and formal manipulation, often reinforcing a reductive visual paradigm further outlined in Heidegger's "The Age of the World Picture," whereby modern science, technology, and knowledge itself are fundamentally structured by the ability to represent and objectify the world. And so popular architectural approaches today become an exercise in ease of representation and/or algorithmic iteration, driven by performative metrics and parametric variation—putting architectural imagination at risk of being subsumed by systems that favor predictability and optimization over ambiguity, interpretation, and storytelling.[12]

Yet, as Heidegger, Pelletier, Pérez-Gómez, and Frascari remind us, architecture is not merely a technical problem to be solved—it is a cultural act of *world-making*. To reclaim this dimension, we must look beyond the logic that reduces representation to simulation toward modes of making that reassert the interpretive, poetic, and ethical dimensions of design. Architectural artefacts, in this sense, serve not simply as

11. Alberto Pérez-Gómez and Louise Pelletier, *Architectural Representation and the Perspective Hinge* (Cambridge, MA: MIT Press, 1997), 5-18.

12. As Pérez-Gómez suggests, "the continuing loss of conceptual and manual skills is further encouraged today by current technological tools like CAD and Revit, which produce drawings meant to be unambiguously fabricated by robots (or workers functioning as though robots)." This leads to a world perceived as mostly devoid of meaning, with craftsmen turned into menial laborers and an external reality irresponsive to cultural contexts and materiality. See Alberto Pérez-Gómez, "Architecture as a Performing Art: Two Analogical Reflections," in *Timely Meditations, Vol. 2: Architectural Philosophy and Hermeneutics*, ed. Peter Olshavsky (Montreal: RightAngle International, 2016), 92.

representations of an idealized future object to be manufactured somewhere else, but as sites of resistance, as tools for thinking through complex, layered relationships between cultural topics, material meaning, and place-making that is interpretive and intersubjective. Through these practices, architecture might again function as a hinge—not merely between two points in space, but between body and world, past and future, imagination and matter.

Bardt contributes profound insights to this conversation. In his provocative book *Material and Mind*, he explores how materials resist, shape, and provoke thought in ways that build upon Heidegger's ideas of the "ready-to-hand" (*zuhanden*) tool and on Pelletier and Pérez-Gómez's representational critique. He shows that material resistance a partner in the act of cognition, not a hindrance. It is through the tug and pull of plaster, wax, or fabric, in the friction of different textures or pixelated images that architecture emerges rather than being imposed or contrived by the smoothness and ease of production most technological tools emphasize. Bardt proposes that it is precisely due to the physical and material resistance to initial concepts held in the mind that the creator is called to become imaginative in the encounter with a world that is "ready-to-hand." This material dialogue explains the unexpected shifts in material behavior that led to emergent spatial and narrative discoveries in many of the artefacts the NDSU students produce as part of their master's theses.

Speculative Artefacts

My argument rests on the preceding theoretical foundation and on qualitative pedagogical research and the practical act of making. The case studies here from NDSU graduate students were chosen not for polish but for how they foreground recurring themes—material resistance, narrative layering, and phenomenological depth and demonstrate the role of oblique models that function to draw out an overlooked dimensions of architectural ideation through material engagement. Considered as fragments within an ongoing pedagogical experiment, and interpreted through documentation, presentations, and reflective analysis, they serve as situated examples of how philosophical questions translate into design pedagogy and storytelling.

For example, in Daniel Ness's 2021 thesis project, he used texts that preserve fragmented narratives and memories of the Holocaust, metaphorically unearthing these broken stories from a terrain of sand and dust in a performative installation (Figure 1, left). Participants reading translations of the books raised what look like sails, making a spectral projection of Lilith—the she-demon of ruins—appear on the fabric and through cascading sand, which generated shifting apparitions that evoked archaeological memory. These impromptu, emergent figures became central to thinking through the spatial unfolding of Ness's imagined museum at the site of the Babyn Yar ravine in Northern Kyiv, Ukraine.

In the American context, Ashley Kilzer's 2017 thesis was inspired by Suzanne Cataldi's reflections on the "reversible" dimensions of death—whereby "living and

dead can be brought together in the perceptible-perceiving fabric of flesh."[13] Kilzer's project explored how memory opens onto a future that, in turn, folds back into the past in persistent, cyclical rhythms. This emerges from the evocative artefact in Figure 1, right: an analogical landscape composed of paint and seeds poured over Kilzer's own body to form a shroud. She incorporated broken fragments of dried paint from earlier performances—symbolizing the fractured narratives surrounding her subject— which were incorporated into the artefact, weaving together storytelling, spatiality, and temporality into a generative cycle. This poetic process directly informed her architectural response: a spatial procession that led visitors to Alvira, Pennsylvania, underground and through the repurposed World War II-era munitions bunkers there, where projections of historic female figures—whose voices had been suppressed—illuminated the space, offering a layered experience of remembrance and transformation.

Hannah Langr's 2018 project took a distinctly pataphysical turn through the creation of participatory linguistic machines inspired by the writings of Alfred Jarry (Figure 2). Drawing upon the mystical and absurdist possibilities latent in contemporary technology—tracing back to the origins of wonder (*thaumata*)—she designed a makerspace for artists at the base of New York's Long Lines Building. Her work playfully and ironically engaged with programmatic constraints, transforming them into speculative opportunities. Performed by studio participants, faculty, and guest critic Rachel Libeskind, Langr's artefact and architectural model became instruments of poetic logic: devices that enacted fictional interactions and staged alternative realities within the design itself. The project thus aligned with Jarry's pataphysical vision—a "science of imaginary solutions"—by using architectural representation to reframe problems through pataphor, play, and theatrical engagement. The richly layered, performative artefact that resulted revealed how narrative can productively disrupt the conventions of architectural program, inviting both designers and viewers to inhabit a speculative space between idea and form.

Among the most pressing student explorations are those that address ecological crisis without resorting to abstract sustainability metrics. Rather, the students create experientially rich, culturally grounded, and poetically charged architectural responses. To activate storytelling at this level, students are encouraged to draw from broader cultural frameworks—in the case of Andrea Frank's 2025, from Henri Frankfort's discussion of the deep reciprocity between nature and culture in ancient civilizations. Frank's work exemplifies this approach by proposing a transformative pilgrimage from the urban realm into a spiritual encounter with wilderness, her design drawing inspiration from indigenous narratives that reflect an animistic understanding of material and landscape. The artefact she created (Figure 3) emerged from a program involving three interconnected sites along the Elwha River, each resonating with the origin story of the Klallam people and the sacred earth quarried from the surrounding rock.

Informed by Mircea Eliade's reflections on the archetype of Mother Earth and David Abram's *The Spell of the Sensuous*, Frank's work demonstrates how artefactual

13. Suzanne Laba Cataldi, "Embodying Perceptions of Death: Emotional Apprehension and Reversibilities of Flesh," in *Chiasms: Merleau-Ponty's Notion of Flesh*, ed. Fred Evans and Leonard Lawlor (Albany: SUNY Press, 2000), 193.

making can help reawaken a sense of interdependence between language, consciousness, and the more-than-human world—inviting architecture to be a medium for ecological remembrance and renewal, not merely serve as shelter.

Figure 1. Mixed Media Artefacts. Daniel Ness, *The Monumentality of Oblivion*, 2021 (left); Ashley Kilzer, *Traces of the Unborn*, 2017 (right)
Source: Memorial Union Gallery, NDSU; photographs by Stephen Wischer.

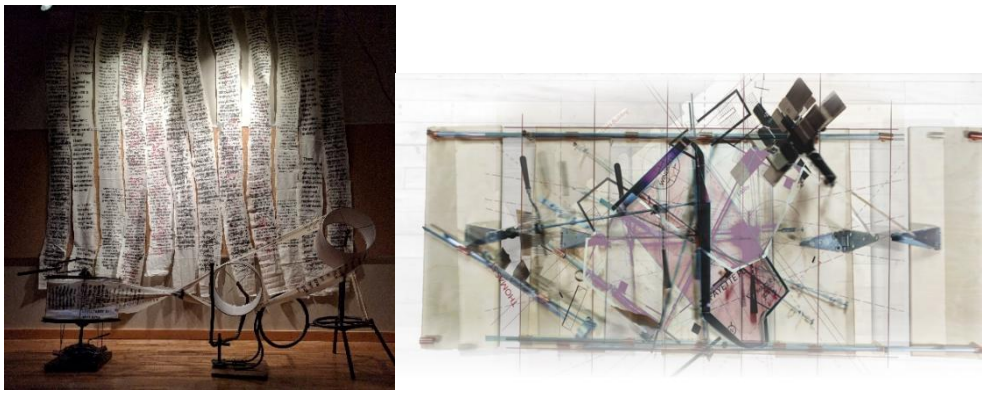

Figure 2. Mixed Media Artefact and Model. Hannah Langr, *Pataphysical Machine* (left) and *Algorithmic Model* (right), 2018
Source: Photographs by Hannah Langr.

Figure 3. Mixed Media Artefact. Andrea Frank, *A Pilgrimage of Wilderness and Spirit*, 2025
Source: Memorial Union Gallery, NDSU; photographs by Anthony Faris.

The NDSU students' artefacts reveal and confirm that materials are, indeed, never neutral, but are imbued with histories, cultural associations, and latent symbolic charge that generate powerful physical and psychological effects that compel viewers and makers alike to engage with the work beyond its functional requirements or visual appeal. Here, imaginative projection is not the simple application of a preconceived concept onto a passive form; rather, it emerges from an embodied, iterative engagement with material as an active participant in the design process.

These are not purely aesthetic or intellectual exercises. Through this encounter, students create artefacts that reimagine meaningful rituals, stories, and situations as material enactments of spatial imagination, deeply rooted in affective experience and cultural storytelling.

In a 2022 essay, Christopher Bardt affirms this approach with his call for a renewed material-based theory of architectural design—one that rejects the longstanding dichotomy between mind and matter. Meaning, he insists, arises through physical interaction and perceptual dialogue. Drawing on insights from neuroscience and embodied cognition, he challenges the reduction of materials to inert substrates for formal manipulation.

Materials do not passively receive meaning; they provoke it. As Bardt argues, "Materials are the repositories of sensory memory, the stimulants of imagination, and the catalysts for new insight."[14] The experience of architecture, then, is never objective or abstracted—it is shaped through tactile, concrete and temporal encounters with the world.

In the most compelling NDSU student works, artefacts metabolize a dynamic feedback loop in which gestures, tools, and materials co-construct form, narrative and atmospheric possibilities for translation into future buildings. These possibilities, though, are not preexisting; they are discovered and continuously reshaped in the work as tensions between intention and material behavior invite interpretation. The resulting artefacts are more than design proposals; they are invitations to think differently about space and experience. They favor the phenomenological dimensions of architecture over the scourge of reductive efficiency and optimization. They transform the studio into a laboratory for reawakening architecture's deepest task: give meaningful shape to our being-in-the-world.

Phenomenology and Depth in Artefactual Models

Maurice Merleau-Ponty's philosophical writings have been a foundational source of inspiration for my teaching because they provide a vital counterpoint to the visual dominance of digital media that tends to reduce space to a homogenous third dimension. His writings on perception address *depth* as a primary, metaphysical dimension where meaning hides and returns.

Even the most routine encounters with architecture reveal how depth is an experiential and synesthetic phenomenon, not merely something visual. Those encounters demonstrate how we stitch meanings together to make sense of the world *as*

14. Christopher Bardt, "Recapturing Meaning: Toward a New Material-Based Design Theory for Architecture," *Frontiers of Architectural Research* 11, no. 2 (2022): 227-238.

we move through it and experience the world in a much more filmic sense than that limited by mere perspective.[15] Merleau-Ponty suggests that for something to be seen fully, it must first recede—his "riddle of depth."[16] Indeed, architectural models operate specifically in this dimensionality, where aspects of an idea are understood through the prism of something else. Our interactions in lived space depend upon this "ecliptic" showing and concealing.

Alternative models such as artefacts can exaggerate this, layering fragments that defer resolution. This partiality *sustains inquiry* and thus invites a restoration of ideas that are reinforced and remade from one work to the next. This process is particularly visible in artefacts from the NDSU students, in which techniques of layering, embedding, and montage mirror Merleau-Ponty's articulation of lived depth. They are invitations to interact with stories in space itself, not conclusive statements about buildings. They are gestures of deferral; they provoke viewers to imagine what lies behind or beneath an action or material as part of the narrative plot of the student's architectural story.

These ideas are embodied in several student artefacts that foreground narrative partiality, material resonance, and spatial storytelling. Inspired by Friedrich Nietzsche's discussion of a critical approach to history, three students developed artefacts that centered on memorials and anti-monuments to underrepresented aspects of war that remain especially relevant in the current global context. Each employed material storytelling as a means of transforming literary sources and personal and cultural stories into architectural expression. Drawing from Marco Frascari's reading of *spolia* in his book *Monsters of Architecture*, their work reconfigured discarded fragments—literal and symbolic—into new narratives, seeking resonance between memory, material, spatial possibilities, and their proposed architectural programs.

Zach Moen's 2017 artefact (Figure 4) emerged from a deep engagement with W.G. Sebald's *The Natural History of Destruction*, drawing upon a global web of literary sources to explore the silences and omissions that haunt the cultural memory of World War II. What could have been a didactic account of historical violence instead materialized the traces of loss and absence through three hollow cylinders, cast in ash and concrete, each molded from a human hand. These phantom limbs—neither fully present nor entirely gone—evoked the spectral presence of bodies erased by war yet inscribed in memory. Suspended in the act of lifting a symbolic weight, the artefact enacted a gesture of unresolved burden, at once intimate and collective. From this representational logic, Moen developed a tripartite museum dispersed across three interconnected sites, each anchored by the artefact's poetics of fragmentation and return. The resulting spatial narrative reframed the traditional museum conceived as a container of resolved history to be a performative field in which historical trauma is held, carried, and continually refigured.

Several years later, Tyler Gefroh's 2020 project (Figure 5, left) added an important stratum to this broader story by focusing on the often-underrepresented tragedy of

15. Maurice Merleau-Ponty, *Phenomenology of Perception*, trans. Colin Smith (London: Routledge Classics, 2002), 235.

16. Maurice Merleau-Ponty, "Eye and Mind," trans. Carleton Dallery, in *The Primacy of Perception and Other Essays on Phenomenological Psychology, the Philosophy of Art, History and Politics*, ed. James M. Edie (Evanston, IL: Northwestern University Press, 1964), 180.

Hiroshima and Nagasaki. Centered around a collection of origami cranes, each folded from paper distressed through charcoal rubbings, his artefact layered a constellation of references: Walter Benjamin's *Angel of History*; the origins of shadow tracing; scorched human silhouettes left behind in the wake of atomic bombings; and the story of Sadako Sasaki, the young girl who endeavored to fold a thousand cranes in the hope of recovering from leukemia caused by radiation exposure. His artefact assembled these threads into a spectral atmosphere of loss and resilience, acting as a charged vessel for future architectural translations in which memory is neither sealed, nor abstracted, but delicately suspended.

Most recently, Cody Williamson, an active-duty member of the U.S. Army, turned inward to examine the silent epidemic of suicide within military institutions. His intent with his 2025 artefact (Figure 5, right) was to "spark remembrance for those whose names have been quickly dismissed, despite their noble sacrifices and contributions to this nation."[17] Made from copper, lead, and steel—materials associated with munitions—it took the form of a folded flag, or a suicide note, or a condolence letter, etched with words from a letter of U.S. Civil War soldier Sullivan Ballou penned in the face of imminent death. Williamson's palimpsestic artefact ties together themes of sacrifice and patriotism and was used to inform the spatial folds of his thesis design, The Memorial Dedicated to Soldier Suicide—proposed to sit adjacent to Maya Lin's Vietnam Veterans Memorial on the National Mall in Washington, D.C. By transmuting instruments of violence into forms of remembrance, his work materialized Frascari's discussion of "trope" through an interplay between material, meaning, and mourning in ways that add a complex, ominous layer to the context of the National Mall.

Each of these artefacts go beyond representation to engage history as something alive, unresolved, and open to reinterpretation. Works of this sort resist closure in favor of empathetic storytelling, challenging conventional museum narratives through an architectural language of depth, deferral, and resonance that, in turn, engage the bodies and minds of those who view them in phenomenological experiences that use history itself as material for storytelling.

17. Cody Williamson. "A Story of Service: Thoughts on Commemorative Architecture and the Anti-Monument," NDSU Thesis, 2025, 57.

Figure 4. *Mixed Media Artefact and Drawing. Zach Moen, Invisible Bleach, 2018 (left); Zach Moen, One of the Three Sites from Trace, Trope, Transcend, 2018 (right)*
Source: Photograph by Stephen Wischer.

Figure 5. *Mixed Media Artefacts. Tyler Gefroh, Memory through Metaphor, 2023 (left); Cody Williamson, Unfolding a Tattered Veil of Memory, 2025 (right)*
Source: Memorial Union Gallery, NDSU; photographs by Anthony Faris.

Projects by Valentina Contreras in 2021 and Amanda Scott in 2022 project extended the exploration of fragments into the realm of the surreal, drawing upon the entangled relationship between dreams and space. Their work was guided by Merleau-Ponty's reflections on perception and James Morley's essay *The Sleeping Subject*, which reframes dreaming as a primary mode of reality, revealing how we perceive: by stitching fragments, impressions, and associations into meaningful wholes. Both projects echoed this process through artefacts that layered images and narratives into dream-like compositions, where fragments became catalysts for architectural imagination.[18]

Scott's artefact (Figure 6, left) took the form of cast resin blocks that encased photographs, textual fragments, and site-based ephemera—interwoven with images and passages from André Breton's *Nadja*. Through an iterative process of recombining these blocks into various constellations, she created an evolving language of spatial montage that guided the development of a series of pavilion structures emerging from the city's disused subterranean networks.

18. James Morley, "The Sleeping Subject: Merleau-Ponty on Dreaming," *Theory & Psychology* 9, no. 1 (1999): 89-101.

Inspired by André Breton's *Surrealist Manifesto*, Contreras's artefact (Figure 6, right) served as a collection of fragments and stories that became the impetus for her renovation of the RKO Keith's Theatre in Queens, New York. Her intent was to engage the viewer in interpreting a dream-like montage of suspended fragments that eventuated in a filmic journey through her architectural project. In each case these projects became an architectural investigation into the porous threshold between waking life and dream, where unconscious associations shape perception and give rise to new spatial possibilities. By invoking the logic of surrealism as both method and material, such work opened-up a space of ambiguity and imagination—one that revealed, rather than resolved layered dimensions of programmatic experience that would become central to their architectural projects in the next semester of their thesis journey. Following their Surrealistic influence, these students seemed to be on a quest to return the imagination to the definition of the "real" in their creation of spatial encounters.

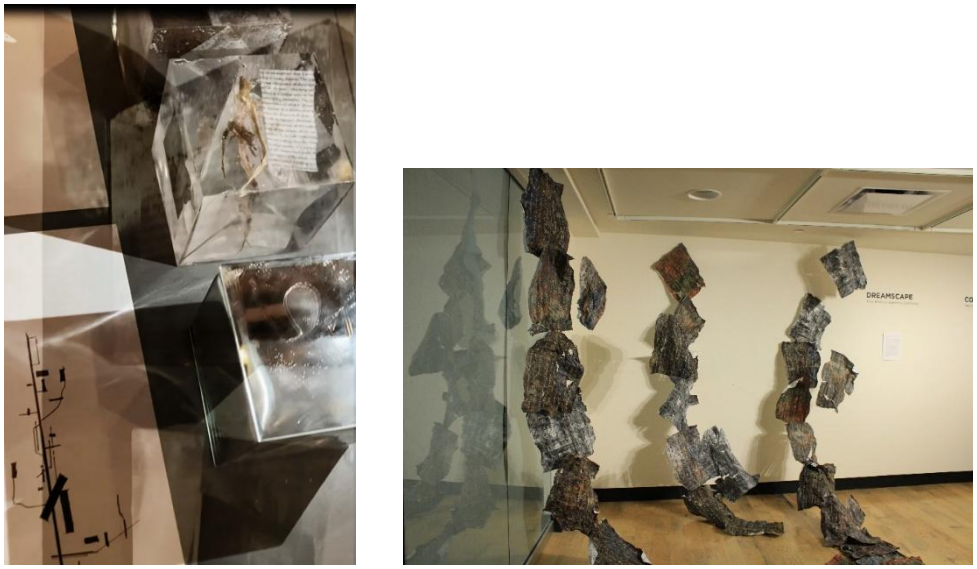

Figure 6. *Mixed Media Artefacts. Amanda Scott, Architecture and the Oneiric, 2021 (left); Valentina Contreras, Dreamscapes: Reframing Consciousness through Architectural Fragments, 2021 (right)*
Source: Memorial Union Gallery, NDSU; photographs by Amanda Scott and Anthony Faris.

Hermeneutics and the Linguistic Imagination

Perhaps the most vital thread running through all such projects is the recognition that language is inseparable from architectural imagination. As Alberto Pérez-Gómez has long argued—and as Lisa Landrum elaborates—the act of designing is never mute; it is fundamentally linguistic.[19] Even when students feel they are working intuitively through non-verbal media, their artefacts are never outside the domain of language. They are shaped by what Paul Ricoeur calls the *hermeneutic imagination*, where understanding arises through the recursive interplay of seeing, speaking, and making.

19. Lisa Landrum, "Varieties of Architectural Imagination," *Warehouse Journal* 25 (2016): 75-77.

His assertion that "all images are spoken before being seen" finds vivid affirmation in student work, where narrative and material practice converge.[20]

Landrum reminds us that for many philosophers, and increasingly for architects, imagination operates primarily through discursive language that serves as a generative ground. Drawing on Ricoeur, Elaine Scarry, and Gaston Bachelard, she illustrates how verbal expression can enhance imagination, enabling metaphor to serve as a bridge between tradition and invention, memory and projection. In this way, the stories embedded in architectural artefacts are not fixed descriptions but dynamic acts of linguistic becoming.

It is crucial to emphasize that this linguistic dimension is not limited to the articulation of proposals in studio reviews or written documents. Both language and material are interwoven into the very act of making. As students fabricate artefacts, they engage in analogical thinking that echoes the architect's "promissory" role described by Pérez-Gómez, each artefact becoming a spatial narrative shaped through metaphor and speculative projection. Moving from *being* (the material creation) to *meaning* (its linguistic and, specifically, architectural significance), the artefact configures a spatial fiction—representing ideas and actively shaping them through the "double gesture" of showing and saying.[21]

The iterative and reflective process of artefact-making thus becomes a form of narrative construction: a provisional plot unfolding through touch, resistance, and transformation. These gestures constitute a kind of non-verbal language—what Pérez-Gómez might call an *atmospheric* or *poetic syntax*—whose logic is found in resonance, mood, and metaphor. This approach aligns with Ricoeur's triadic structure of narrative ("mimesis I–III"), in which the *prefiguration* of experience, the *configuration* of plot, and *refiguration* through interpretation trace a cycle that is deeply operative in both literature and the production (and experience) of an architectural project.[22] Language is not subordinate to form in these projects; they embrace the interplay between the verbal and the material as co-constitutive. Artefacts emerge as narrative condensations—concentrated stories held in suspension, awaiting refiguration. They speak through silence and gesture, echoing Pérez-Gómez's insight that "the voice projects visions" and that architectural imagination, at its best, is a speculative and generative promise— a bringing-near of what is far.

Writing on *photography*, Vilém Flusser warns that the apparatus of modern technology threatens to enclose thought within its own logic. Language-based AI sharpens this concern: by reducing language to predictive pattern, it risks foreclosing the discoveries that arise between fragments—when drawing folds into storytelling or when material resistance sparks metaphor. Heidegger, and later Alexander Tzonis and Liane Lefaivre, remind us that the origins of technology lie in technē-poiesis—a revealing charged with discovery and wonder. In contrast to AI's simulation of speech without reciprocity, artefacts operate as counter-apparatuses in which language, image, and material converge in the reciprocal unfolding of metaphor and narrative.

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20. Paul Ricoeur, *The Rule of Metaphor: The Creation of Meaning in Language*, trans. Robert Czerny with Kathleen McLaughlin and John Costello (London: Routledge, 2003), 217.

21. Bardt, *Material and Mind*, 272.

22. Alberto Pérez-Gómez, *Attunement: Architectural Meaning after the Crisis of Modern Science* (Cambridge, MA: MIT Press, 2016), 189-191.

Dan Porwoll's 2021 project, which demonstrates how fictional narratives and artefacts together can generate a richer field of architectural meaning, stands out as one of the most compelling explorations of linguistic imagination. Inspired by writings of Rachel McCann and Edward Casey that both engage Merleau-Ponty's notion of a shared territory beneath the subject–object divide, Porwoll began with fictional stories, material, and pictorial fragments exploring three politically and emotionally charged "edges": the Korean Demilitarized Zone, the Russia–Ukraine border, and the Carlisle Indian Cemetery in Pennsylvania. These became sites of empathetic speculation through architectural imagination.

Drawing further inspiration from the fragmented narratives and drawings in John Hejduk's *Masques*, Porwoll created a triptych of artefact books (Figure 7) containing six characters each—eighteen in total. As Porwoll describes each of the artefact books as attempting "explore the two sides of each edge" and continues:

> Through the initial reading of the narratives and viewing of the pages, a distinctness is evoked from the varying plotlines within them. But upon further exploration and the compounding of the pages upon one another, a larger, more unified mental image can take form from the specific edge, and familiarities can be drawn from one story or image to the next, drawing meanings across the edges around the world … Through reading these narratives, whether aloud or to oneself, the stories … are released [from the pages] into the space around us or within ourselves, transforming, interacting and creating meaning. By the process of unfolding and revealing this artefact we are more clearly able to understand these edges and through the process of refolding and concealing this artefact we are more clearly able to understand these edges as folds and reflections of one another.[23]

Porwoll created fictional characters and artefactual fragments. The architectural translation of these narrative-charged material books emerged through a series of approximately fifty vignette drawings that captured moments of interaction between characters, such as the Defector and the Dreamer, the Dictator and the Student, the Designer and the Newscaster. Each pairing revealed social, political, and cultural dimensions of border life. One such drawing, *The Battlefield* (Figure 8) references the relentless volley of propaganda across the Korean border—each side seeking to distort the other's humanity, by showing two fortresses separated by a barrage of projectiles. The image also recalls *Seokjeon* (석전), an ancient Korean game of ritualized stone-throwing that evolved into military training and was banned in the early twentieth century during the Japanese occupation. Another drawing, *The Plinth*, depicts an illuminated pedestal accessed from below—a platform for being seen and heard—and symbolizes the performative power of media in North Korea, to praise authority and preserve the past, and in South Korea, to embrace individualism and modernization by letting the past recede.

23. Daniel Porwoll, *The Two Sides of Otherness: A Cross-Cultural Regeneration of Reality*. Master's thesis, North Dakota State University, 2022), 79.

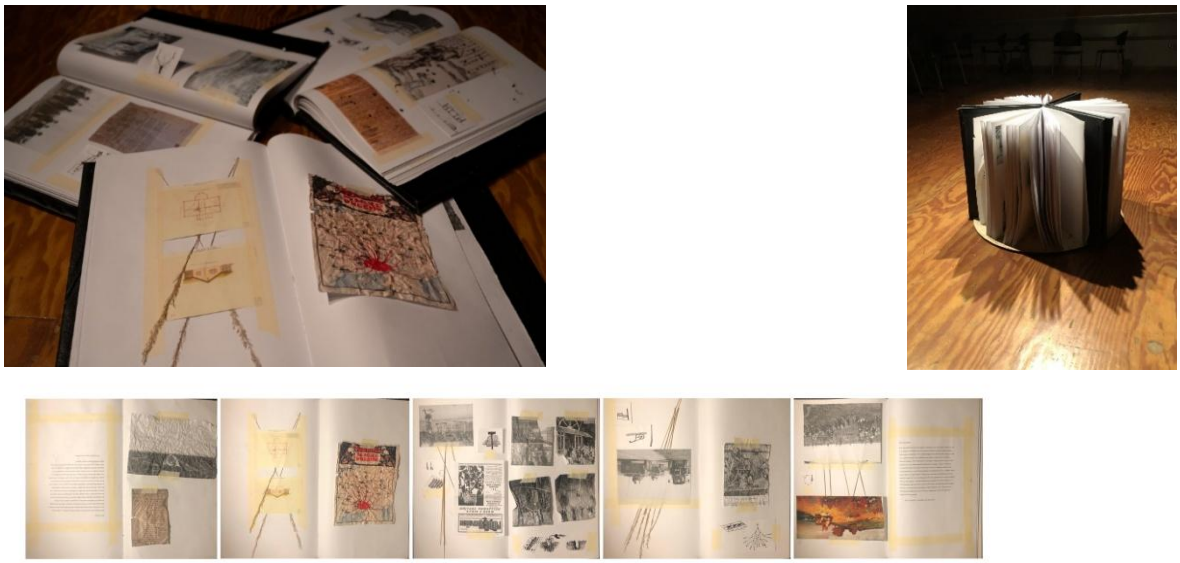

Figure 7. Dan Porwoll, *Three Artefact Books* (top) and *The Farmer and The Separatist Spread* (bottom), 2022
Source: Porwoll, *The Two Sides of Otherness: A Cross-Cultural Regeneration of Reality*, thesis presentation, slide 19, North Dakota State University Institutional Repository.

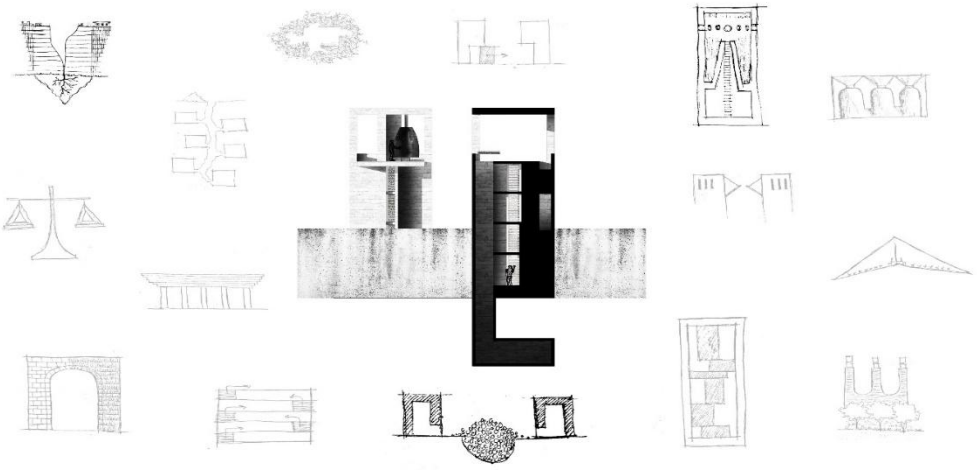

Figure 8. Dan Porwoll, *Design Vignettes and DMZ Border Tower Designs*, 2022
Source: Porwoll, *The Two Sides of Otherness: A Cross-Cultural Regeneration of Reality*, thesis presentation, slide 24, North Dakota State University Institutional Repository.

Porwoll created fictional characters and artefactual fragments. The architectural translation of these narrative-charged material books emerged through a series of approximately fifty vignette drawings that captured moments of interaction between characters, such as the Defector and the Dreamer, the Dictator and the Student, the Designer and the Newscaster. Each pairing revealed social, political, and cultural dimensions of border life. One such drawing, *The Battlefield* (Figure 8) references the relentless volley of propaganda across the Korean border—each side seeking to distort the other's humanity, by showing two fortresses separated by a barrage of projectiles. The image also recalls *Seokjeon* (석전), an ancient Korean game of ritualized stone-

throwing that evolved into military training and was banned in the early twentieth century during the Japanese occupation. Another drawing, *The Plinth*, depicts an illuminated pedestal accessed from below—a platform for being seen and heard—and symbolizes the performative power of media in North Korea, to praise authority and preserve the past, and in South Korea, to embrace individualism and modernization by letting the past recede.

The architectural proposal that emerged centers on a pair of towers, one on each side of the DMZ and linked both visually and conceptually by a shared horizon, envisioned as archives of stories and scrolls. On them, individuals can see across the border, with views that suggest a poetic yearning for empathetic unification. At the summit, a bell and striker—each located in a separate tower—are geographically divided but symbolically united through the imagined sound they produce: a resonant metaphor for the reversibility of edges, and the capacity of architecture to mediate separation through narrative and gesture.

Such translations from story and artefact into architectural form produce precise poetic images—condensations of thought and feeling, rich with implication. These are not vague atmospheres; they embody what Octavio Paz calls an essential poetic act: the creation of images that live within us. The linguistic imagination emerges in Porwoll's images not simply as initial catalyst for design, but as its most enduring promise and expressive foundation.

Language and Silence

The final example is among the most powerful student explorations of the combination of language and material artefacts leading to architectural design. Niloufar Alenjery addressed in her thesis the extinction of languages under globalization, creating artefacts aimed at inhabiting the silence left by lost tongues while rekindling their expressive resonance from within spatial and material encounters. Drawing from her program of a rare book library to be situated in an abandoned dry dock of Brooklyn's Navy Yard, Alenjery first created a cuneiform woodblock and then three lanterns etched with dead languages (Figure 9, left and center). As the lanterns turned, shadows danced across the walls, producing a silent conversation with space and a vociferation of language, woven out of the silence by those who spoke. A third artefact (Figure 9, right) was a massive book containing all the world's lost languages, which became a tactile evocation of memory and forgetting—drawing on the mythic figures of Mnemosyne and Lethe. Created from layers of wax, sand, concrete, and mesh, Niloufar's book could not be read in a linear fashion; rather, it was performed by touch, revealing and concealing language through gesture. The act of leafing through the book became an interpretive ritual later transposed into the architectural logic of her proposal (Figure 10), in which the tactile and temporal qualities of her artefacts found spatial expression, with themes of concealment and revelation recast into a sequence of rotating and ascending movements along vertical passages, echoing the rising and falling of water once present in the now-abandoned Dry Dock 1 at the Brooklyn Navy Yard. In the context of her thesis, the architecture became a vessel for spiritual and cultural

memory—its overall presence recalling a ship departing and returning, carrying the layered narratives of travelers and immigrants who have shaped the city's identity.

Porwoll and Alenjery offer compelling demonstrations of how artefactual exploration can become architectural experience—a process akin to what Ricoeur calls *coherent deformation*, where meaning is recreated in the act of making and encountering work. In this process, language becomes the medium through which thought is formed, just as with the emergence of language itself meaning often comes after speech. In these projects, the metaphors that provoke the *translation* and *adaptation* of architectural meaning into more conventional models and drawings arise through a sustained, responsive engagement that unfolds slowly but can yield sudden sparks of insight when queried through encounters with material, language, and space.[24] Such work reminds us that poetic meaning is not imposed but revealed through a meditative approach to making that requires ethical and empathic imaginative acts aimed at creating meaningful atmospheres for the use and habits of other humans.

Although these artefacts often emerge from deeply personal stories, their ultimate purpose is not private expression but the cultivation of empathy—a means of transforming subjective insight into collective understanding. Within the studio, this translation from inner narrative to shared architectural gesture becomes an ethical rehearsal for public practice, where buildings too can speak through the poetics of lived experience. These examples have different emphases—the resistance of materials, the poetics of depth, or the imaginative force of language—but all converge on a shared ground. Artefact-making emerges as a synthesis of overlapping practices that mediate between the personal and the collective, the intimate and the civic. In this way, artefacts become both tools of learning and vessels of meaning—forms that resist reduction, invite interpretation, and gesture toward architecture's role as a cultural act. There is no single representational mode.

The questions these artefacts raise extend globally, contributing to a broader conversation about how architecture might reclaim its role as a living practice of memory, metaphor, and cultural engagement.

Figure 9. *Mixed Media Artefacts. Niloufar Alenjery, Lanterns and Cuneiform Artefacts, 2016*
Source: Photographs by Niloufar Alenjery and Stephen Wischer.

24. Building on Bachelard's insights, Ricoeur discusses how poetic images are "simultaneously a becoming of expression and a becoming of being." See Paul Ricoeur, *The Rule of Metaphor: Multi-Disciplinary Studies of the Creation of Meaning in Language*, trans. Robert Czerny (Toronto: University of Toronto Press, 1977), 214.

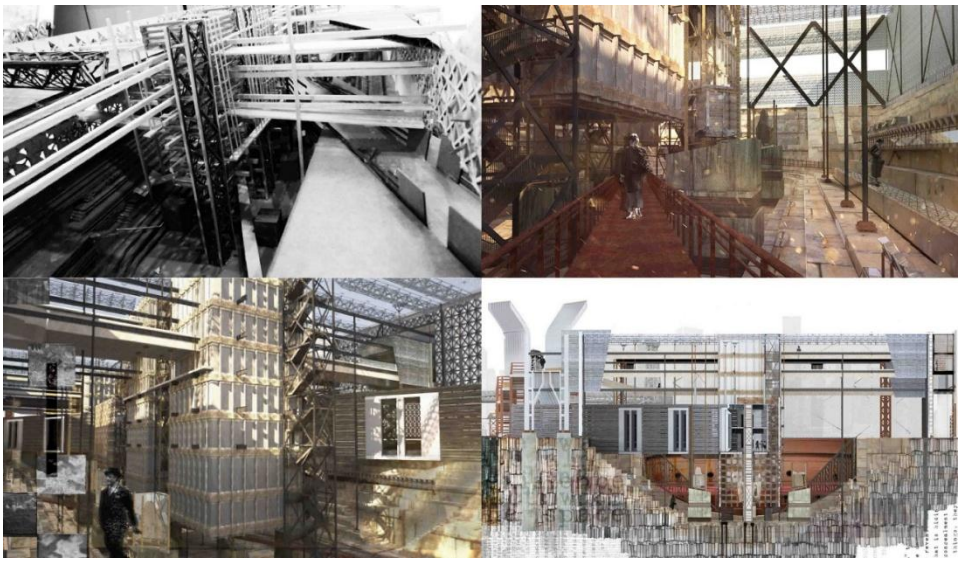

Figure 10. *Mixed Media Artefacts and Design Models. Niloufar Alenjery, Analogue and Digital Models of Rare Books Library, 2016*
Source: Photographs by Niloufar Alenjery.

Conclusion: The Ethics and Poetics of World-Making

This, then, brings us back to this paper's broader argument: that architecture remains one of our most enduring poetic capacities. It is a means of giving form to memory, anchoring imagination in matter, and reweaving threads of language, body, and place. The digital abstraction and technological efficiency that dominates our age risks overshadowing these capacities with reductive modes of representation—which artefact-making resists. This is not about nostalgia. It is about re-poeticizing practice and restoring architecture's interpretive, ethical, and cultural dimensions.

Artefacts work through material resistance, phenomenological depth, and linguistic imagination—as the student projects demonstrate. Artefacts draw the mind and body into dialogue with matter, cultivating tactile forms of thought that counter the disembodiment of purely visual tools. They open spaces of depth where perception is unsettled and reconfigured, revealing architecture not as object but as lived horizon. They extend making into language and story—not as a separate stage, but as a reciprocal act in which creation itself becomes language, generating metaphors and myths that resituate design within a shared intersubjective, cultural world. To make artefacts is also to remember, to bring memory back into the act of creation, stitching together fragments of past, present, and future.

Architecture is not, and should not be, a technical problem to solve. As Ricoeur reminds us in *The Function of Fiction in Shaping Reality*, it is an interpretive act in which metaphor generates new knowledge. Metaphor opens the possibility of seeing-as, of redescribing and projecting new ways of inhabiting the world. At such moments, boundaries between inner and outer worlds dissolve and architecture again becomes a site where stories take shape in space and space itself begins to speak.

This is an invitation to preserve and extend architecture's poetic potential, not only for our students, but for the worlds they will help shape. For in the spark of metaphor and the resistance of matter, architecture continues to unfold as a site of imaginative disclosure, ethical commitment, and shared becoming. In an age of automation and abstraction, artefactual practices reassert the depth of that human making. They remind us that to design is not simply to draw or model, but to listen—to trace the echo of stories not yet formed and model realities not yet built but always within reach.

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From the Eye to the Skin: Architectural Representation Beyond Vision

By Adam Dayem[*] & Arta Yazdanseta[±]

Buildings are assemblies of visible matter that are conceptualized, visualized, and designed through various techniques of architectural representation. Buildings are also assemblies of invisible dynamics that play just as much a role in shaping the physical world as the parts of it that can be seen. These invisible dynamics include environmental phenomena such as conduction, convection, radiation, and evaporation. Through these phenomena, buildings and the materials that make them up, interact with, and become part of, the world around them. These phenomena are primarily sensed though the skin rather than the eyes – through touch rather than vision. There is a critical need to expand the capacities of architectural representation to more effectively deal with how buildings shape, and are shaped by, these invisible dynamics. As well as to deal with how these dynamics are perceived by a building's inhabitants. This essay will discuss invisible dynamics in architectural representation from a historical perspective and then explore how these dynamics can be expanded to more effectively design with invisible aspects of the physical world. The essay will conclude by presenting drawings by the authors that explore how new representational conventions can be developed to visualize and design with invisible dynamics in the physical world.

Introduction

Over the past approximately 500 years, architectural representation has developed as a powerful visual language enabling architects to imagine and describe buildings. The great capacity of architectural representation is its dual role of imagining new worlds, and then describing those worlds. Architects do not typically draw after reality but use drawing to produce new realities. Because they work from the imaginary to the real, the most effective architectural drawings communicate immeasurable and measurable information simultaneously. An architectural drawing communicates qualitative, immeasurable aesthetic information as well as quantitative, measurable information such as length, quantity, orientation, etc. The complex nature of architectural representation is often described with a shorthand, that it is both 'artistic' and 'technical.'

In our era of climate crisis and resource depletion, it is becoming increasingly important for architects to engage invisible environmental phenomena in the design of buildings. For architecture to remain relevant as discipline, it's representational system must evolve beyond an overwhelming bias, inherited from its origins in Gothic and Renaissance building practice, toward conceiving of buildings as static constructions of visible matter perceived through vision. To do this in a way that is not merely directed

[*]Assistant Professor, Rensselaer Polytechnic School of Architecture, USA.
[±]Assistant Professor, Rensselaer Polytechnic School of Architecture, USA.

toward solving relatively straightforward problems such as energy efficiency and thermal comfort, but that also seeks to bring cultural value to the built environment, architectural representation needs to bridge between the imaginary and real, between the qualitative and quantitative, and between the 'artistic' and 'technical' when it comes to conceptualizing, visualizing, and designing the invisible dynamics that shape the physical world. The vast majority of drawings that deal with environmental phenomena such as conduction, convection, radiation, and evaporation are reductive diagrams that remain in the technical realm of building science diagrams. For the most part, these diagrams do not adequately acknowledge the radical shift they could initiate from perceiving architecture exclusively through vision, to perceiving architecture through vision and touch simultaneously.

This essay will discuss new strategies for representing invisible building dynamics that are typically represented in an overly technical or reductive manner. It will present drawings by the authors that describe energetic flows across scales from the atmospheric to the molecular, and in so doing will suggest new ways to visualize the invisible dynamics of environmental phenomena. These drawings, which will be discussed at the end of the essay, are the beginning of a larger project to develop a comprehensive visual language accessible to students, educators, and practitioners that can enrich the discipline with a deeper understanding of the environmental phenomena that are typically relegated to building science specialists. Buildings can be designed as participants in, and shapers of, the invisible dynamics that flow through and around them if architects are given the representational systems to effectively conceptualize and visualize these systems.

Literature Review – Energy and Climate in Architectural Representation

There are many examples of drawings and diagrams dealing with relationships between architecture and energy that can serve as examples and guides for the research presented here. These drawings and diagrams are typically made by architects and/or for architects, and they are concerned with bringing conduction, convection, radiation, and evaporation into a visual relationship with built forms. These diagrams are often sections, sometimes plans, and occasionally three-dimensional projections such as axonometric or perspective projections. They are often based on a simplified, or prototypical building in order to illustrate the concept of a relationship between an invisible dynamic and built form, rather than going deeply into the details and specifics of how the invisible dynamic interacts with a particular building. These diagrams use directional lines with arrowheads, often curved or squiggly, sometimes colored, with varying line weights and line types to show how invisible flows of energy and air move around and through a static built form.

This type of drawing combines disparate things: visible matter and invisible matter, static form and dynamic form, regulated architectural projection and unregulated notation. These combinations imply, but do not necessarily acknowledge, that an architectural drawing can inform both visual and tactile perception. The potentials for architectural drawing to more explicitly deal with the visual and tactile simultaneously will be discussed later in the essay. For now, it is important to note that these drawings seek to describe relationships between architecture and energetic flows. The origin of

the relationship between architecture and energetic flows, as we understand it in contemporary architectural discourse, traces back to Vitruvius's story of architecture as it originates from communal gatherings around the thermal comfort of a fire.[1] For Vitruvius, the space of thermal comfort around a fire precedes humans' ability to conceive of arranging matter into built forms that provide shelter. The perception of space as a tactile environment precedes perception of space as a visual environment. The origins of architecture for Vitruvius are energetic.

In this discussion, it is useful to pick up the relationship between architecture and energy in the 1950s and 60s when architects, and the culture at large, became acutely aware of the limited resources available on the planet. Kenneth Boulding's seminal essay "The Economics of the Coming Spaceship Earth," written in 1966, describes a shift in the perception of the earth as an 'illimitable plane' with a frontier beyond human inhabitation, to a 'closed sphere' that became perceptible through air travel[2] and found its ultimate visual manifestation in the 'Blue Marble' photograph taken by the Apollo 17 astronauts in 1972. The 'Blue Marble' was the first photograph taken of the entire earth floating in the black void of space. This photograph made the reality that the earth is a closed system with limited resources immediately understandable. When he wrote the essay nearly 60 years ago, Boulding observed that much of humanity had failed "to come to grips with the ultimate consequences of the transition from the open to the closed earth."[3] One could argue that this is still the case today. As a whole, the cultural, social, and material systems that participate in the conception and construction of the built environment still have not fully internalized this crucial shift – from considering buildings as closed systems within the earth as an open system, to considering buildings as open systems within the earth as a closed system. The representational systems that still dominate discipline and practice, because they deal primarily with visual aspects of the physical world, are inadequate for expressing the implications of this shift. While the realization that the earth has only limited resources did spur development of a wealth of diagrams describing how buildings interact with their environments in the post-war period, this type of representation is still not widely used instrumentally in architectural design. In contemporary architectural representation, drawings and diagrams that incorporate architecture and energy are more likely to be used in analyzing or justifying design decisions, rather than being used at a more fundamental level to inform design decisions.

Some of the most widely disseminated and influential examples of visual representations of invisible dynamics in buildings are found in Victor and Aladar Olgyay's book *Design With Climate,* which was originally published in 1963 (Figure 1). The Olgyays were concerned with how visualizations of invisible environmental dynamics in and around buildings could fundamentally inform design decisions. They developed a step-by-step method of collecting climatic data, incorporating it into diagrammatic representations, and then using the resulting diagrams to inform

1. Vitruvius, *The Ten Books on Architecture* (Garden City, NY: Dover Publications, 1960), 39.

2. Kenneth E. Boulding, "The Economics of the Coming Spaceship Earth," in *Resources for the Future* (Baltimore, MD: Johns Hopkins University Press), 1.

3. Boulding, 2.

architectural design decisions.[4] The Olgyays believed that the way humans conceive and imagine relationships with the environment is central to culture. The visual representations they produced could thus be seen as being conceived in a way to encourage a new modern lifestyle, and new ways of thinking about familiar social patterns[5] based on a deeper understanding of relationships between human bodies, buildings, and the surrounding environment. These relationships, however, were set out by the Olgyays in a way that today must considered reductive. Operating in the spirit of the modern movement in architecture, the Olgyays' method is geared toward creating an unchanging interior climate that provides consistent comfort for an undisturbed male body. The human is seen as a stable, protected figure within a building that acts as a protective envelope, separating the human body from the surrounding environment.[6] Regardless of the season, location, or culture, the interior climate is conceived by the Olgyays as being unchanging and benign.

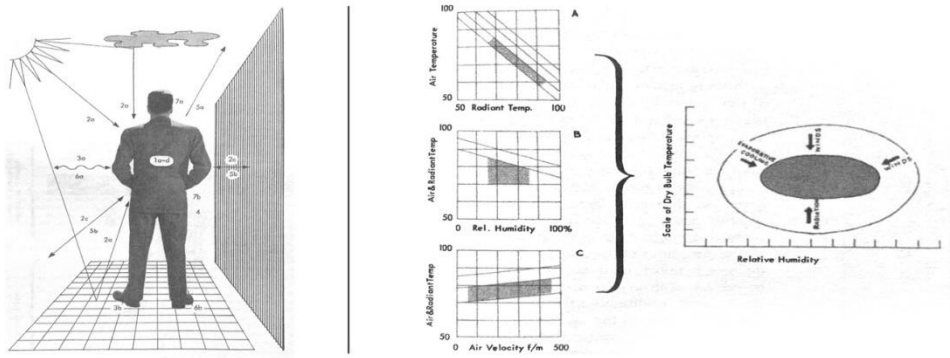

Figure 1. *Heat Exchange between Man and Surroundings (l), Interrelationship between Climate Elements (r)*
Source: Victor Olgyay, Design with Climate: Bioclimatic Approach to Architectural Regionalsim, 16-17.

The Olgyays' diagrams were intended to present an objective reality that would in turn suggest rational design solutions. But any type of representational system, even one that is ostensibly based on rational parsing of data, will convey information and engage audiences differently. As an example, consider Rudolf Geiger's Sankey diagram of radiation from the sun hitting the earth, which has been produced in multiple different variations for different audiences. Geiger's diagram describes percentages of the sun's radiation that penetrate the earth's atmosphere, are reflected back into space, are absorbed by the earth, and are trapped in the atmosphere. Using the convention of Sankey diagrams, percentages of the overall quantity of radiation are shown with the thickness of arrows representing their flows. The diagram was originally presented by Geiger in his book *The Climate Near the Ground*,[7] and then was reproduced line for line by the Olgyays in *Design With Climate* in a context that made it more accessible

4. Daniel A. Barber, "The Nature of the Image: Olgyay and Olgyay's Architectural-Climatic Diagrams in the 1950s," in *Public Culture* 29(1): 147.
5. Barber, 133-136.
6. Barber, 149-150.
7. R. Geiger, *The Climate Near the Ground* (Cambridge, MA: Harvard University Press, 1950).

for architects (Figure 2). It was subsequently reproduced by Russel Ball in *The Passive Solar Energy Book*,[8] and by Greg Arcangeli in *Architectural Science and the Sun*.[9] These subsequent representations reduce the level of detail originally provided by Geiger. Ball's version presents the sun in a whimsical manner suggesting that the diagram is for a popular audience interested in solar design. Arcangeli's version presents radiation flows in a more contemporary abstract manner, presumably to appeal to an audience of contemporary students and practitioners that might find Geiger's graphics outdated and thus assume the information contained in them outdated as well.[10] However, Geiger's diagram could become more useful to architects interested in designing with radiation flows by adding information rather than removing it. Later in the essay, we propose a new version of Geiger's diagram that will do so.

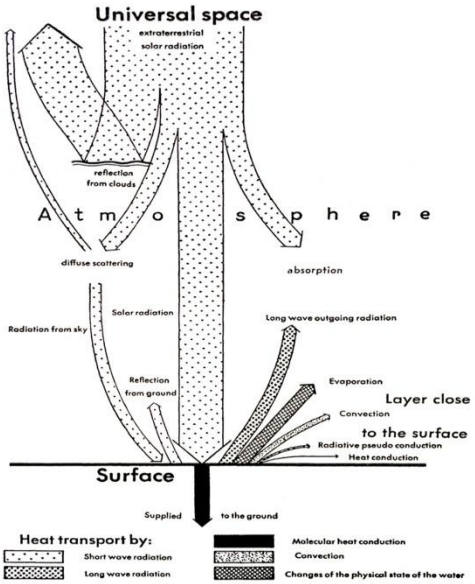

Figure 2. *Sankey Diagram of Radiation Flows toward Earth*
Source: Rudolf Gieger via Victor Olgyay, Design with Climate: Bioclimatic Approach to Architectural Regionalsim, 33.

The Olgyay's approach has many offshoots, some of which are geared more toward building scientists and some that are geared more toward architectural designers. Books such as Baruch Givoni's *Man, Climate and Architecture*[11] reduce the emphasis on graphics as compared to the Olgyays in favor detailed explanations of the physics and mathematics behind environmental phenomena such as conduction, evaporation, and airflow. With expertise gained from the information presented through tables, graphs, and equations, one could potentially optimize architectural design solutions around

8. E. Mazria, *The Passive Solar Energy Book* (Emmaus, PA: Rodale Press, 1979).

9. M. Fajkus, D. Whitsett, *Architectural Science and the Sun: The Poetics and Pragmatics of Solar Design* (New York, NY: Routledge, 2018).

10. Daniel J. Ryan, "Introduction: redirecting the arrows of climatic design," in *Drawing Climate: Visualizing Invisible Elements of Architecture,* eds. Daniel J. Ryan, Jennifer Ferng, and Erik G. L'Heureux (Basel: Birkhauser Verlag, 2022), 10-13.

11. B. Givoni, *Man, Climate and Architecture* (London: Applied Science Publishers, 1969).

environmental phenomena. This way of presenting the functioning of environmental phenomena supports deep comprehension but is inaccessible to architects without specialized knowledge in physics and mathematics. The information Givoni presents through charts and graphs must be interpreted into a visual language before it can be incorporated into architectural representations (Figure 3). And it is only through incorporation into architectural representations that this information can become instrumental in architectural design. Architectural representation is always to some degree mimetic, it has a level of visual similarity with the things it represents. A psychometric chart, a solar graph, or a wind speed graph, on the other hand, is not mimetic. These types of diagrams present information in a different register than architectural representations. A particular point or region in a graph is quantified in relation to other data within the domain of a graph. For this quantitative data, residing in a graph, to interface with the process of designing a building, it has to be applied to a spatial condition. This can be done with a level of expertise in interpreting the data, and an understanding of how the data connects to the space of a theoretical building. However, it is difficult to imagine this type of data as an integrated part of an unfolding design process. Building science data presented in tables and graphs is more effectively used to optimize building forms that have already taken shape.

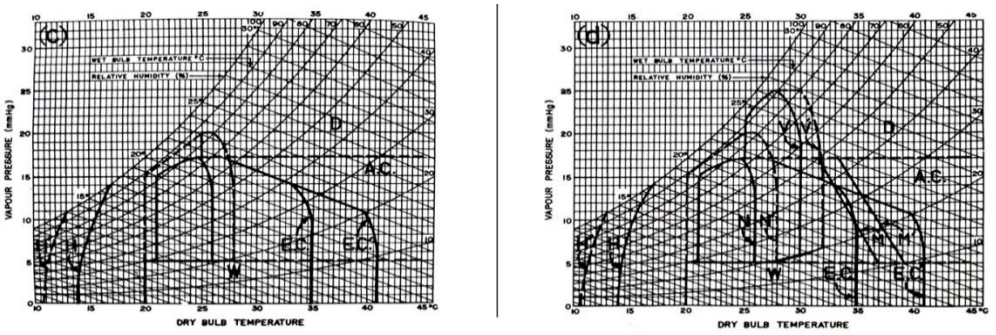

Figure 3. *Building Bioclimatic Charts*
Source: Baruch Givoni, Man, Climate and Architecture, 316.

Books such as *Environmental Control Systems*[12] take a more graphic approach to describing environmental phenomena and their interactions with buildings (Figure 4). A more graphic approach presents relationships between architecture and energy in a manner that is generally accessible to architects and others without specialized knowledge in the building sciences. Moore's diagrams rely heavily on arrows with different graphic styles drawn around plans and sections of simple, conventional buildings that describe flows of air and radiant energy, and how buildings can control these flows.

12. F. Moore, *Environmental Control Systems: heating cooling lighting* (New York, NY: McGraw-Hill, 1993).

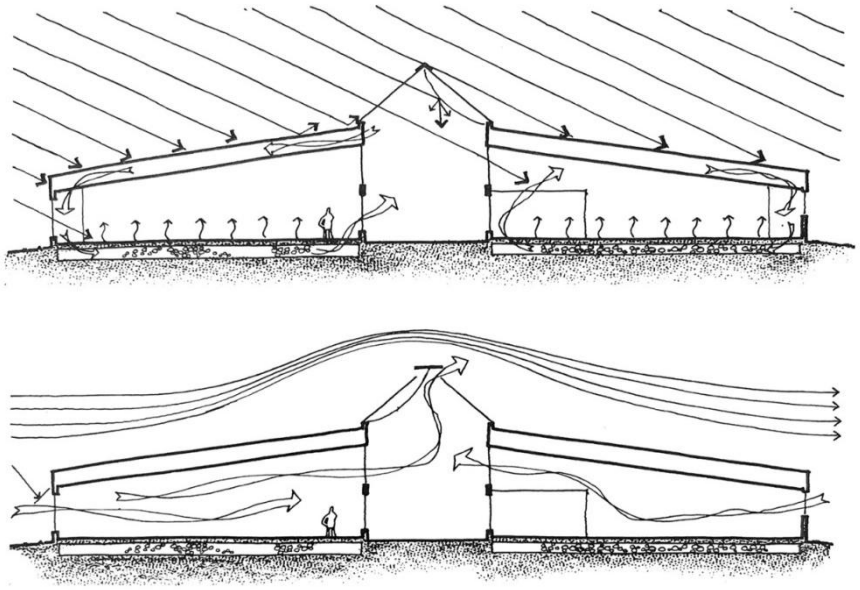

Figure 4. *Passive Solar Heating Section (t), Ventilative Cooling Section (b)*
Source: Fuller Moore, Environmental Control System: heating cooling lighting, 205.

While diagrams such as these do bring invisible environmental dynamics into the realm of graphic representation, we find their shortcoming to be that they remain almost exclusively at the scale of the building. The material principals behind environmental dynamics operate through a wide range of scales, from the micro-scale of the molecular to the macro-scale of the atmospheric, both of which need to be understood, along with a middle scale in which buildings reside, to more fully comprehend the implications of their interactions with built forms. Without a graphic understanding of the fundamentals of how environmental phenomena function at scales outside the visual range, one is left with a similar result to Givoni's building science approach, which is that the building becomes a control system for regulating an environmental phenomenon. The aim of this research is to suggest that architectural representation could evolve in ways that shift environmental dynamics from their secondary status as phenomena that are to be regulated by that which has been designed, the built form, to a primary design consideration. We believe environmental dynamics can have greater impact in shaping built forms and thus the qualitative experience of architecture.

More contemporary examples of representational systems developed to convey a particular aspect of architecture's relationship to its energetic context include *Carbon: A Field Manual for Building Designers*[13] and *Manual of Biogenic House Sections*.[14] While these books deal with a somewhat different relationship between architecture and its environment than that being discussed here, they are useful to consider in terms of how representational systems convey a particular relationship between architecture and its energetic context. *Carbon* uses charts and graphs, which range across large expanses of time and space, to describe relationships between the earth's geology, its forests, and

13. M. Kuittinen, A. Organschi, and A. Ruff, *Carbon: A Field Manual for Building Designers* (Hoboken, NJ: John Wiley & Sons, 2022).

14. P. Lewis, M. Tsurumaki, and D. Lewis, *Manual of Biogenic House Sections* (China: ORO Editions, 2022).

carbon, with the aim of showing where carbon comes from, how anthropogenic processes have moved it from underground into the atmosphere, and how it can be sequestered in forests. These charts and graphs are juxtaposed with drawings of building at different scales showing how carbon can be subsequently sequestered in buildings constructed from trees. *Manual of Biogenic House Sections* takes a similar approach in developing a representational system that explicates relationships between the earth, materials extracted from it, and how these materials are deployed in architectural designs. Readers of the book are able to trace materials from their sources to specific architectural uses in detailed sectional drawings, while also tracking the embodied energy represented by the materials represented in the drawings. Both these books demonstrate how a representational system that expands on conventions already existing in the discipline, can be used to explore and discuss a relationship between architecture and the energy embodied by the materials in its production supply chain. Through a series of visually engaging drawings, these books present a particular way of approaching architecture that is clear and accessible. They both make an argument that if one uses particular materials in particular ways, then the building is successful. The shortcoming of this type of representational system, with respect to the research being presented here, is that the designer is not assumed to engage fundamentally with the invisible dynamics that underlay, and are affected by, the material flows described in the drawings. The implication is that that designer simply needs to understand the larger material and energy context in which they are working in order to produce responsible architecture. While one must acknowledge the critical importance of the message of these books and admire the beautiful and refined systems of architectural representation used within them, they are not suggestive of how architects might engage representation instrumentally in designing environmental phenomena.

The representational approach that perhaps comes closest to treating the invisible dynamics of conduction, convection, radiation, and evaporation as building blocks for architecture, rather than phenomena that need to be mediated, controlled, and/or relegated to the outside of a building or design process, is that of architect Phillippe Rahm. Rahm's work finds philosophical footing in the writing of Bruno Latour who argues against western culture's tendencies to split materiality from design, and humans from their environments,[15] as well as in the writing of Peter Sloterdijk who argues that humans are not observers 'in front' of reality, they are embedded within it. Rahm notes that if we breathe in a toxic substance, the substance becomes part of our bodies, and we are transformed. He describes a plastic bottle not simply as an object we observe in front of us, but as a part of us, as microplastics in our bodies.[16] Rahm effectively throws off much of the modernist baggage that has been carried forward into contemporary architectural representation through the approach of the Olgyays, and other like them, who produce drawings and diagrams that separate the visible forms of architecture from the invisible dynamics that surround it, that treat the visible parts of architecture as the control mechanism for the invisible, and that treat the human body as separate from the

15. Massimiliano Scuderi, "Introduction: Phillipe Rahm and the meteorological architecture," in *Constructed Atmospheres: Architecture as Meteorological Design,* (Las Vegas, NV: Postmedia Books, 2014), 5-6.

16. Scuderi, 69.

buildings that shelter it. What if these prevailing beliefs could be inverted? What sort of representational system would architects need in order to design with the invisible?

The drawings of Rahm's architectural practice documented in *Constructed Atmospheres: Architecture as Meteorological Design*[17] and *Climatic Architecture*[18] begin to suggest how this might be possible. Rahm treats invisible dynamics of the physical world, including conduction, convection, radiation, and evaporation as fundamental building blocks of architecture. As such, two main aspects of Rahm's drawing serve as a jumping off point for the research presented here. First, that the drawing deals with the void framed by architecture as material. Rahm is explicit in describing architecture's reason for being as climatic.[19] At a fundamental level, architecture consists of bubbles of air that have tolerable atmospheric qualities for human habitation. Therefore, the bubbles of air contained in the void must become a part of the architectural drawing. Typical architectural drawings are of course not at all concerned with representing the substance of the voids that are framed by walls, ceilings, and floors, they are simply shown as empty space. Typical energy diagrams, such as those discussed above, deal with the void it terms of how it is controlled and mediated by the visible parts of architecture. Rahm's representational innovation is the introduction of gradient fields that are used to represent different qualities of the void, including temperature, pressure, and humidity. The voids in Rahm's drawings become the habitable spaces where architecture is experienced, rather than the empty space from which one views the architecture. The second aspect of Rahm's drawing that is particularly important to carry forward in this research is the inclusion of the human body as an integrated part of the climatic system. In line with Sloterdijk's mandate to consider the human as 'in' the environment rather than 'in front' of it, Rahm's drawings incorporate the human body as a system that operates within the same invisible dynamics that the building does. Rahm uses the same notational systems to draw the human body as he does to draw architecture, rather than leaving the body as a neutral bystander. This opens the experience of architecture to an array of qualitative sensual experiences that exists beyond vision, in the realm of the tactile.

A Tactile Architecture

The notions that architecture can be experienced by senses other than vision, and that one should be wary of the dominance of vision in the conception and experience of architecture are not new. Juhani Pallasamaa makes this argument in The Eyes of the Skin, where he writes: "The gradually growing hegemony of the eye seems to be parallel with the development of Western ego-consciousness and the gradually increasing separation of the self and the world; vision separates us from the world whereas the other senses unite us with it."[20] It is true architecture is increasingly

17. Phillipe Rahm, *Constructed Atmosphere: Architecture as Meteorological Design.* M Scuderi (ed) (Las Vegas, NV: Postmedia Books, 2014).

18. Phillipe Rahm, *Climatic Architecture* (New York, NY: Actar, 2023).

19. Phillipe Rahm, *Climatic Architecture* (New York, NY: Actar, 2023), 11.

20. Juhani Pallasmaa, *Eyes of the Skin: Architecture and the Senses* (Hoboken, NJ: John Wiley & Sons, 2005), 25.

consumed in fragmentary images that distance the viewer from meaningful engagement with the experience of a building as a whole. However, the position taken here is that Pallasamaa's justification for this criticism, and thus the response to it, folds architectural discourse back into its own intellectual arena concerned with hermeneutics, rather than considering development of a tactile architecture as having much broader implications in the search for buildings that produce meaning by becoming more sophisticated in their relations with their inhabitants and environment. Recent developments in neuroscientific research have found that vision does not actually produce the type of separation between self and the world, or between percept and concept, that Pallasamma suggests.[21] There is no visual world 'out there' that we perceive and then intellectualize. The visual world is within the brain, and thus within the body. Vision is just as embodied as the other senses.

So, the skin is not another set of eyes that somehow 'see' through a process of intellectual interpretation, but rather its enveloping surface is another way the body/brain complex interacts with the physical world. It is an entirely different sensory organ from the eyes with a completely different mode of sensing the environment, which is in fact material rather than interpretive. There are many theories describing how architecture produces cultural meaning, all of which necessarily begin with sensory inputs. The philosopher Mark Johnson notes that one does not need to turn architecture into legible 'texts' to create meaning.[22] Meaning is not entirely linguistic; it is not simply an abstract, disembodied concept. For Johnson, it is a much richer, much more embodied experience that "involves the neural simulation of sensory, motor, and affective processes that we associate with the thing or the event that has meaning for us."[23] These are qualitative experiences: "Our world is a realm of immediately felt qualities that have meaning for us even before language."[24]

If qualitative meaning is produced sensorially and immediately, rather than abstractly and intellectually, then architectural representation must begin to deal with the non-visual material realities that play a part in producing this meaning. The skin is always immersed in a bath of air made of a mixture of molecules including of nitrogen, oxygen, water vapor, carbon dioxide moving and vibrating at different rates, and it is always immersed in, and being penetrated by, a flow of energetic waves. The movement and vibration of air molecules, combined with the flow of energetic waves produces a range of different sensations, some of which are pleasurable or comforting, some of which are not. These sensations are a result of the skin interacting in immediate contact with its environment. Our built environments do not need to neutralize or homogenize these sensations because there is design potential in their variations.[25] Might it be possible to develop architectural representations that deal with these tactile sensory experiences in a way that is distinct, but also learns from, the ways

21. Harry Francis Mallgrave, *The Architect's Brain: Neuroscience, Creativity, and Architecture* (West Sussex: Wiley-Blackwell, 2011), 134-139.

22. Mark L. Johnson, "The Embodied Meaning of Architecture," in *Mind in Architecture: Neuroscience, Embodiment, and the Future of Design,* eds. Sarah Robinson and Juhani Pallasmaa (Cambridge, MA: The MIT Press, 2017), 35.

23. Johnson, 38.

24. Johnson, 38.

25. Lisa Heschong, *Thermal Delight in Architecture* (Cambridge, MA: The MIT Press, 1979), 35-6.

representation already works between visual cognition and visible matter? Might it be possible to develop architectural representations that bring the tactile and visual together more effectively?

Representing Invisible Dynamics

One of the keys in bringing the visual and tactile together in architectural drawings, is an ability to represent aspects of the material world that are not perceptible to vision. Visible aspects of the material world are described through mimetic means, which have evolved to represent largely static organizations of objects. To represent invisible aspects of the material world, architectural representation must expand to include the visual language for describing elements that are very large, very small, dynamic, or otherwise visually imperceptible. There are no established representational conventions for these aspects of the material world precisely because they elude visual perception. There are of course many examples of energy drawings in architecture that make use of arrows, gradients, and other notations to describe dynamics that are imperceptible to vision. These, however, are typically done to illustrate settled decisions, rather than to explore the potentials of designing with invisible dynamics. If design drawings need a level of ambiguity,[26] so that they are subject to multiple interpretations, how does one introduce invisible dynamics to architectural representation with the level of ambiguity that allows them to function as design drawings? To explore how this might be possible, it is useful to consider a relatively recent technique of notational diagramming in architecture.

In the late 20th century, perhaps as a response to the computer's ability to flood the discipline with new visual approaches to design, certain architects became interested in thinking about architecture more in terms of 'what it does', rather than 'what it looks like.' To visualize 'doing something,' in relation to different types of invisible, immaterial information such as the performance of events, the relationships between the various parts and users of a building, and the organization of flows of people in and through a building, these architects used notational diagrams. The invisible aspects of architecture they were concerned with were immaterial, as opposed to the invisible aspects of the material world being discussed here. However, the approach to notational diagramming potentially holds a series of insights in terms of representing invisible aspects of the physical world. These notational diagrams were influenced by the philosophers Gilles Deleuze and Félix Guattari's concept of an abstract machine. For Deleuze and Guattari, an abstract machine is a productive tool that contains a structure or code which holds potentials to produce many different outcomes: "We define the abstract machine as the aspect or moment at which nothing but functions and matter remain."[27] Functions and matter, in Deleuze and Guattari's terms, deal with aspects of the world that *could* exist but have not yet come into being, they are potentials of the

26. The neurologist Semir Zeki offers a neuroscientific explanation of how ambiguity works in art by holding multiple equally valid readings or interpretations at the same time. Semir Zeki, "Art and the Brain," in *Daedalus,* 127(2), 87.

27. Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* Transl. Brian Massumi (Minneapolis, MN: University of Minnesota Press, 1987), 141.

world that have not been actualized. The abstract machine thus produces ambiguity in its reading because it can hold multiple, equally valid, versions of the world.

The architect Stan Allen recognized the potential for a type of architectural drawing, what he defined specifically as a diagram, that is abstract and not mimetic: "Unlike classical theories based on imitation, diagrams do not map or represent already existing objects or systems but anticipate new organizations and specify yet to be realized relationships."[28] Like Deleuze and Guattari, Allen changes the conventional way of thinking about abstraction, rather than considering it to be a simplification of a reality that already exists, an abstraction is a representation that holds the potential to produce multiple realities. The diagram, as an abstract machine, is a productive design instrument. It is "not a thing in itself, but a description of potential relationships among elements; not only as an abstract model of the way things behave in the world, but a map of possible worlds."[29] As they are not mimetic, they are not scaled-down pictures of buildings, the graphic information in diagrams is notational. Similar to music or dance notations, architectural notations can describe a performance, an event, movements, and relationships between parts. Allen writes, "notation…directs attention toward all of the intangible properties of the real that cannot be set down in graphic form. Many aspects of the experience of architecture can never be predicted or simulated by representational drawing."[30]

Although they preceded Allen's writing, one of the clearest examples of notational diagrams that direct "attention toward all of the intangible properties of the real," and function as a "map of possible worlds" are architect Bernard Tschumi's theoretical architectural drawings, The Manhattan Transcripts. These drawings are a visual manifestation of Tschumi's assertion "that there is no space without event, no architecture without program…Our work argues that architecture–its social relevance and formal invention–cannot be disassociated from the events that 'happen' in it."[31] The Manhattan Transcript drawings generally follow a tripartite scheme where one frame is a photograph of an event involving a human body or bodies, a second frame is a diagram of movement vectors and nodes transposing the movement in the photograph into a notational diagram, and a third frame develops a spatial or architectural consequence derived from the other two, which is a distorted or transformed version of a recognizable architectural composition. Tschumi uses notational diagrams as a way of capturing aspects of architecture that are immaterial and invisible yet have enormous consequence on the experience of space as he explores potentials for architectural design. Tschumi's diagrams are productively ambiguous in that they point to multiple, equally valid, outcomes. To put it in Deleuze and Guattari's philosophical terms, Tschumi's diagrams are abstract machines that are functional rather than formal, they serve as a type of code for generating spatial potentials.

While Allen and Tschumi write and draw about immaterial aspects of architecture such as event, movement, and relationships between parts, we propose that notational diagrams based on Deleuze and Guattari's concept of the abstract machine might be

28. Stan Allen, "Diagrams Matter," in *Any: Architecture New York,* No. 23, 16.

29. Allen, 16.

30. Stan Allen, *Practice: architecture, technique and representation* (New York, NY: Routledge, 2000) 32.

31. Bernard Tschumi, *Architecture and Disjunction* (Cambridge, MA: the MIT Press, 1998) 139.

used in a similar manner to inform other non-mimetic aspects of architectural representation, the invisible dynamics of the material world. Following Tschumi we argue that architecture–its social relevance and formal invention–cannot be disassociated from the invisible dynamics, including conduction, radiation, convection, and evaporation that happen in it. In a similar manner, we propose to investigate modes of architectural representation that allow these invisible dynamics to become an integral part of generating spatial potentials.

Architectural Representation for Invisible Dynamics of the Material World

The drawings being developed in this research will eventually be organized into five chapters. The first four chapters will cover principles of the four invisible dynamics that impact the experience of buildings: 1) conduction 2) radiation 3) convection 4) condensation/evaporation. Each chapter will be a visual explanation of one of these four phenomena. Visual explanations will be geared toward an audience of architectural students and practitioners without a deep knowledge of building science fundamentals. In addition to offering a visual explanation of each phenomenon, these chapters will develop a notational language that is capable of visually communicating design potentials and outcomes afforded by conduction, radiation, convection, and condensation/evaporation. The fifth chapter will be a series of case studies of buildings from different eras, which explore relationships between architecture and energy, and demonstrate how the building science fundamentals and visual language developed in the first four chapters can be used to represent buildings in terms of invisible dynamics. The goal is to evolve a representational language for architects that gives them the ability to design spaces around invisible dynamics of the material world, as much as they use representation to design the visual aspects of buildings. Three selected drawings will be discussed here to demonstrate how the research is moving toward this goal. The first drawing focuses on radiation as it pertains to atmospheric transparency (Figures 5-7), the second drawing focuses on condensation as it pertains to water collecting on a cold surface, (Figures 8-9), and the third drawing is a case study of conduction in a yakhchāl, a historical Persian building type for producing and storing ice (Figure 10).

The atmospheric transparency drawing describes interaction between electromagnetic radiation and the earth's atmosphere. This is a version of a drawing that, as noted previously, has been done several times in different ways to convey certain relationships between architecture and energy.[32] This drawing explains how the earth's atmosphere creates an environment suitable for life by filtering and capturing specific wavelengths of the electromagnetic spectrum. Our version of this drawing differs from previous versions primarily in that it represents radiation at the molecular scale in relation to the atmospheric scale. The left side of the drawing shows electromagnetic radiation at the atmospheric scale, indicated by vertical pink lines, coming toward the earth from the sun and from deep space (Figure 6). The drawing shows that the shortest

32. See Daniel J. Ryan, "Introduction: redirecting the arrows of climatic design," in *Drawing Climate: Visualizing Invisible Elements of Architecture,* for a synopsis on how different version of this drawing bias different outlooks on the relation between architecture, energy, and the environment.

wavelength, highest energy radiation is blocked by the earth's atmosphere, while longer wavelength, lower energy radiation is allowed through. Lower energy radiation filtering through the atmosphere warms the earth's surface. This range of electromagnetic radiation is called visible light, because our eyes have evolved to detect it. At roughly the midpoint of the drawing, electromagnetic radiation switches from shorter waves received by the earth to longer waves emitted by the earth. Some radiation emitted by the earth escapes into space, and some is trapped in the atmosphere, causing additional warming of the earth's surface.[33]

While these properties of the earth's atmosphere are relatively well known and described by previous versions of this drawing, what is less well known is how electromagnetic radiation and the molecules that make up the atmosphere interact to either absorb radiation or allow it to pass through (Figure 7). The atmosphere is made up of a series of layers with different molecular compositions at different elevations. In the stratosphere, 40-50km above the earth's surface, oxygen and nitrogen molecules absorb short wavelength ultraviolet radiation and transfer energy to heat immediately. As these molecules absorb radiation, their electrons move to higher energy levels. Kinetic energy increases, leading to increased collisions between molecules and thus increased heating. Nitrogen tends to absorb higher energy UV radiation, while oxygen absorbs a larger spectrum of wavelengths that are mainly lower energy UV. At lower a lower elevation in the ozone layer and troposphere, outgoing, long wavelength infrared radiation is absorbed by carbon dioxide, methane, and water molecules in a dipole moment. In a dipole moment, charges of the molecule are asymmetrical, which causes motion that interacts with electromagnetic radiation at a specific wavelength. These molecules do not directly transfer radiation to heat. Instead, CO_2 and H_2O molecules act as conduits to transfer energy from radiation to other molecules like nitrogen and oxygen.[34]

In these detail drawings at the molecular scale, air is not invisible, it is physical matter creating environmental effects outside the range of visual perception. These drawings bring the principles of how the atmosphere interacts with electromagnetic radiation to create a habitable environment at the earth's surface into a graphic language that is accessible to visual thinkers. They introduce notational techniques for visualizing air as a heterogeneous physical material with specific properties in which buildings, bodies, and everything else on the surface of the earth, are immersed in and interact with. We propose that architectural representation must begin to incorporate air as a substance that interacts with buildings and their inhabitants, rather than treated as neutral void. Air has dynamic physical properties that are intimately tied to the qualitative performance of buildings, as well qualitative aspects of the environments in and around them.

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33. This is of course known as the greenhouse effect. As human activity adds more heat trapping gasses such as carbon dioxide and methane to the atmosphere, warming of the earth's atmosphere is increasing.

34. Refer to the following sources for information on the interaction between electromagnetic radiation and the molecular makeup of the earth's atmosphere: S. Pal Arya, Introduction to Micrometeorology, Academic Press, 2001, San Deigo, 28-44. https://scied.ucar.edu/learning-zone/how-climate-works/ car bon-dioxide-absorbs-and-re-emits-infrared-radiation and https://www.ncbi.nlm.nih.gov/books/NBK304366/#:~:text=The%20wavelength%20of%20UV%20radiation,(100%E2%80%93280%20nm).

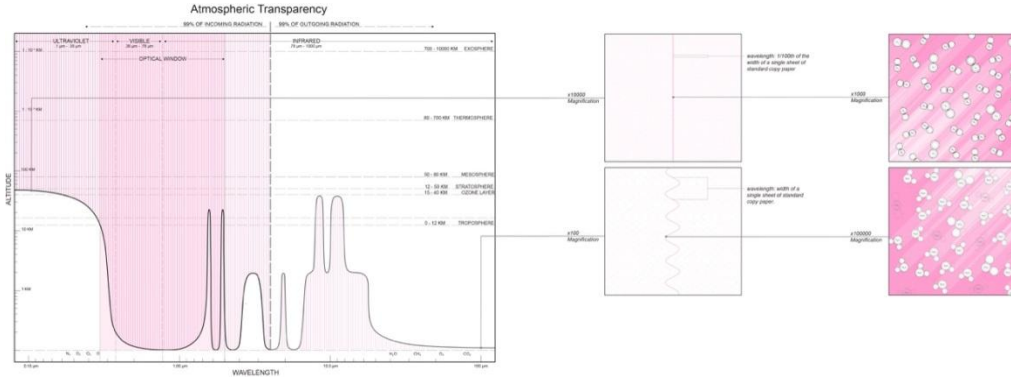

Figure 5. *Atmospheric Transparency – Wavelength Graph with Associated Wavelength Scale and Molecular Scale Detail Call Outs*
Source: The authors.

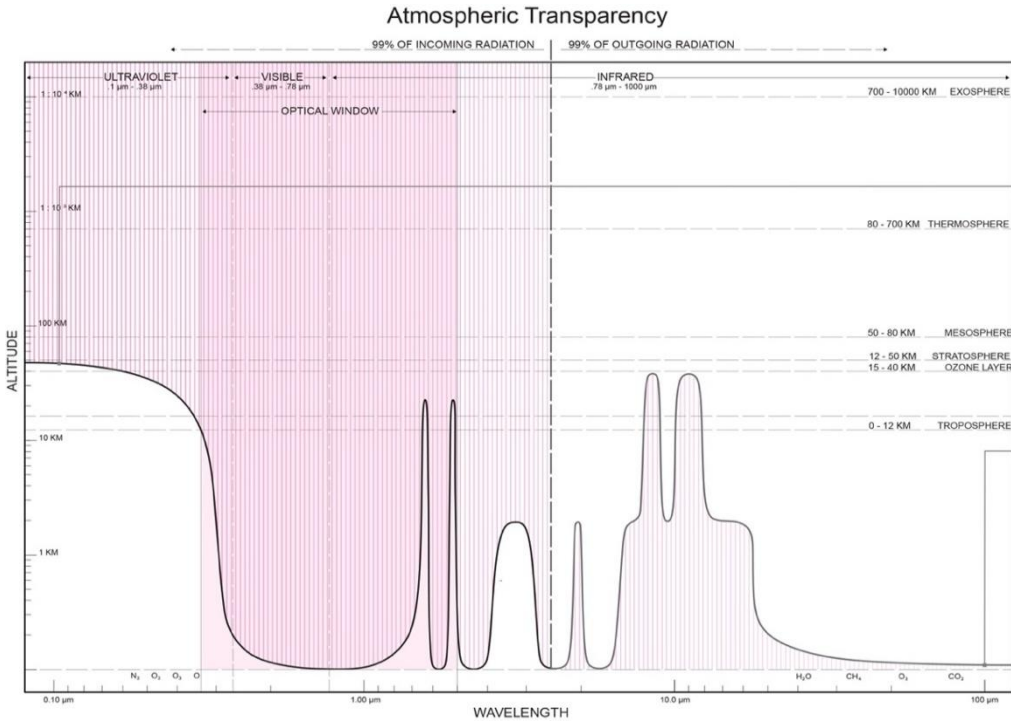

Figure 6. *Atmospheric Transparency – Wavelength Graph*
Source: The authors.

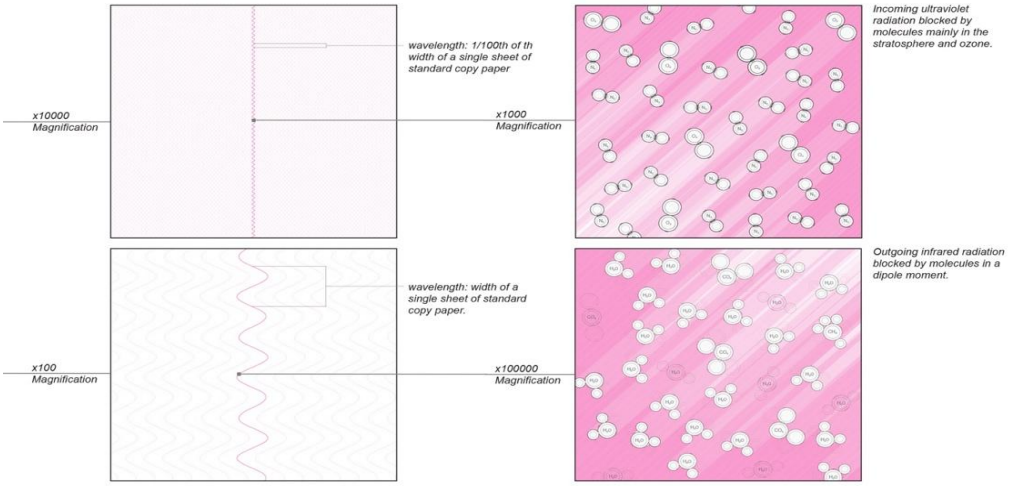

Figure 7. *Atmospheric Transparency – Wavelength Scale and Molecular Scale Detail Call Outs*
Source: The authors.

The condensation drawing (Figure 8) also visualizes air, and the water vapor it contains, at the molecular scale in order to explain an invisible dynamic in the physical world, in this case the phenomenon of water collecting on cold surfaces. The cold body at the center of the drawing, shown in blue, causes the temperature of the air around it to cool in relation to the warmer surrounding environment. This creates a temperature gradient, which is shown in the drawing shifting from pink (warmer) to blue (cooler). At warmer temperatures, air molecules, including nitrogen, oxygen, argon, and other trace gasses, vibrate with greater energy. The space of vibration is represented in the drawing by a greater number of lines surrounding each molecule, showing that a molecule occupies more space. As the cold body causes temperature to decrease nearer to it, air molecules vibrate with less intensity and move closer together. As a result, water molecules suspended within the air molecules also vibrate with less intensity and move closer together. When a certain threshold distance is crossed very close to the cold body, the water molecules slow down to a point where they become close enough together to change phase and form liquid water on the surface of the cold body (Figure 9).

The phenomenon of water condensing on a cold body in a warm environment is intuitively well-known because of experiences such as water collecting on the outside of a cold glass of ice water. What is not as well known by architects are the molecular properties of air and water vapor that cause condensation to happen. Like radiation interacting with the earth's atmosphere, condensation operates at a very small scale outside the range of visual perception. The aim of these drawings is to present a visual demonstration of invisible phenomena that effect the design of buildings. With a more complete understanding of the physics of condensation, architects might design exterior building envelopes that more effectively prevent water vapor from accumulating where it is undesirable, but more interestingly, they might find ways of intentionally introducing condensation to buildings as a design element that increases the tactile pleasure of architecture.

Figure 8. *Condensation around a Cold Body*
Source: The authors.

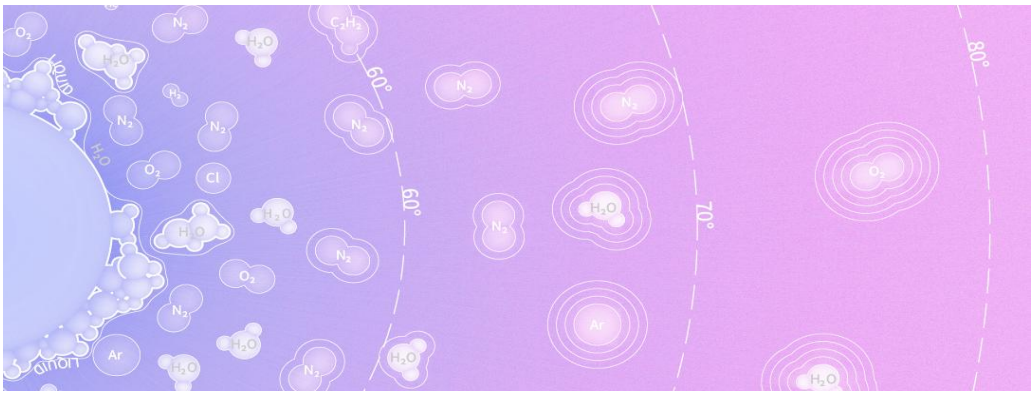

Figure 9. *Condensation around a Cold Body – Detail*
Source: The authors.

Drawing Methodology

The third drawing presented here moves from the general conditions seen in the first two, to interactions between invisible phenomena and architecture, in this case the interaction between conduction and a yakhchāl. The methodology used here is intended to be a step toward integrating tactile qualities of architecture into conventional representational systems that deal with buildings as exclusively visual constructs. The yakhchāl building type was chosen for this exercise because it is an example of a building form that is derived much more from how it interacts with the four invisible dynamics, than from notions of visual composition. These structures have been dated to as far back as 400 BCE. They were constructed in arid regions of present-day Iran from stone and earthen bricks sealed and reinforced with a water-resistant mortar made

of clay, lime, volcanic dust, sand and sometimes animal hair, egg whites, dates, or straw. The structures and the ice they contained were insulated with wood and thatch. A yakhchāl consists of three main components, a below-grade room with a tall conical roof for ice storage, a large, shallow pool of water for ice production, and a shade wall to protect the pool from solar radiation. A yakhchāl is often connected to an aqueduct system that feeds water directly into the ice production pool.

A yakhchāl interacts with all four invisible dynamics discussed here to produce and store ice year-round in a climate where the temperature is often and hot, and only rarely drops below freezing. In this case study, the aim is to draw the building as an organization of invisible dynamics rather than visible form. Presently, the building is described in terms of conduction. It is sectioned, exploded, and shown at a range of scales to show how the conductive properties of the building create temperature gradients that allow ice to be produced and stored. All components of the building are drawn with color gradients and isothermal lines showing how temperature gradients are distributed across all parts of the building. As this drawing, and other case study drawings like it, are developed further, information describing the other three invisible dynamics will be layered into it, creating a comprehensive picture of the building's performance as an ice-production machine. We believe this drawing methodology can then be used to augment conventional architectural representational systems to design contemporary buildings that more effectively deal with invisible dynamics to become not only more energy efficient, but also to become tactilely more pleasurable for their occupants.

Figure 10. *Yakhchāl of Kashmar Showing Icehouse and Shade Wall*
Source: Wikimedia Commons.
https://commons.wikimedia.org/wiki/File:Yakhch%C4%81l_of_Kashmar2021-04-05_17.jpg

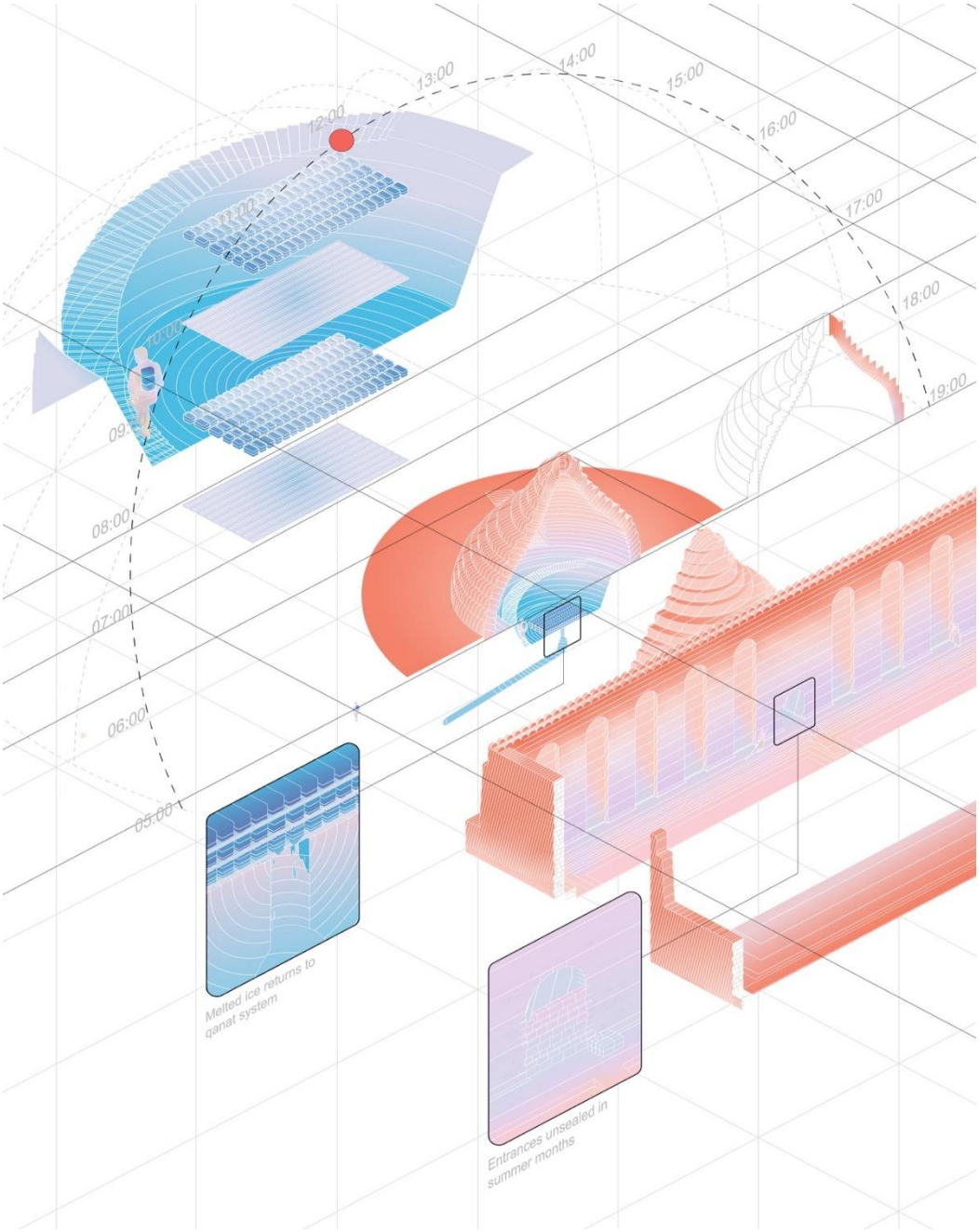

Figure 11. *Yakhchāl Case Study – Conduction*
Source: The authors.

Conclusion

There is a prevailing belief that architecture, and thus architectural representation, resides in a nebulous realm between artistic and technical thinking. There is a romanticism tied to the profession and practitioner in an imagined ability to alchemically combine aspects of artistic and technical practice into a coherent work that both solves a defined problem, and at the same time produces cultural meaning. This imagined mysteriousness is reinforced in a multitude of culturally constructed dichotomies that include the sciences and humanities, machines and organisms, mechanical and thermodynamic systems, the body and the intellect, problem-based reasoning and visual aesthetics, percept and concept, and vision and touch. Architectural representation is a powerful visual language precisely because, in the best cases, it is synthetic rather than dialectic. The best architectural drawings deal with the measurable, quantitative parts of the world, and the immeasurable, qualitative parts of the world by synthesizing them rather than separating them.

Architectural representation in contemporary discipline and practice is a visual medium that deals primarily with the visible world. The proposal at the heart of this research is that it could evolve and be augmented to deal with invisible dynamics in the physical world with a level of sophistication similar to that with which it deals with visible aspects of the physical world. That is to say architectural representation could evolve to deal with measurable, quantitative parts of the invisible world, as well as immeasurable, qualitative parts of the invisible world by synthesizing them rather than separating them. This involves developing representational techniques that are able to describe tactile environments. Tactile environments are by definition invisible. They are not sensed through the eyes, but through the skin. Tactile environments are not static, they are dynamic: molecules move and vibrate, energy flows. Tactile environments operate at very small and very large scales, from the molecular to the atmospheric.

Humans shape the world in relation to our senses. Architectural representation currently deals primarily with shaping the world in relation to vision, sensory inputs received by the eyes. It deals with how visible matter is organized into stable, visible structures. Our proposition is that the world could be shaped more in relation to touch, sensory inputs received by the skin. It is not necessary to conceptualize or interpret tactile aspects of architecture because they are of the material world. They simply happen to be invisible and are thus more challenging to bring into the domain of architectural representation than visual aspects of the world. The aim of the drawings presented here, and the larger body of research this essay initiates, is intended to give architects deeper knowledge of the invisible dynamics – conduction, convection, radiation, and condensation/evaporation – that fundamentally structure the physical world around us, and then suggest a series of representational techniques that can aid in designing the built environment in more effective dialogue with these invisible dynamics.

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The Green Wall: A Project and a Prototype of a Sustainable 3D Printed Bearing Wall with Integrated Vegetation

By Ilaria Cavaliere[*] & Dario Costantino[±]

In a context where the climate change topic is a primary matter of discussion, the use of vegetation to improve the thermal insulation of buildings and biodiversity while contributing to carbon sequestration has become a popular strategy to increase sustainability. This paper aims at presenting a model of a bearing wall made of 3D-printed stone ashlars with integrated greenery. This constructive system has been designed to merge a series of characteristics such as:

- *a simple and fast assembly process, that makes it suitable also for emergency contexts*
- *a good thermal performance due to the presence of the vegetation on the outer surface*
- *the possibility to customise the properties of the ashlars thanks to the use of 3D printing. Blocks can have different dimensions, different overhangs or can be customised to optimise their static behaviour, their thermal performance and their weight by changing their internal porosity*

the possibility to use recycled materials like waste stone powder or debris from demolition, keeping the entire construction process greener.

Introduction

In recent years, environmental sustainability has become a central theme in architectural research and practice, prompting a renewed focus on nature-based and resource-efficient design approaches.

The increasing awareness about the problems related to pollution, the global climate crisis and the waste of resources has pushed governments around the world to adopt strategic initiatives and action programs aimed at safeguarding the environment through more critical design strategies and projects more respectful towards nature. Important examples of this include the New European Bauhaus,[1] which encourages the realisation of increasingly sustainable buildings, the 2015 Paris Agreement,[2] which aims to decarbonise and maintain the planet's temperature increase below 1.5 °C, and the United Nations 2030 Agenda,[3] which aims to create resilient, inclusive and low-emission settlements.

[*]Researcher, Polytechnic University of Bari, Italy.
[±]Researcher, Polytechnic University of Bari, Italy.

1. European Union. *New European Bauhaus*. Retrieved from: www.new-european-bauhaus.europa.eu/index_en?prefLang=it. [Accessed 5 June 2025.]
2. United Nations Climate Change. *The Paris Agreement*. Retrieved from: www.unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement. [Accessed 5 June 2025.]
3. United Nations. *The 17 Goals*. Retrieved from: www.sdgs.un.org/goals. [Accessed 5 June 2025.]

In line with the objectives of these initiatives, the presented research investigates how digital fabrication, sustainable materials and vegetation can be combined in architectural design. The aim is to develop a prototype of a load-bearing wall suitable for Mediterranean contexts, using 3D-printed stone ashlars to ensure thermal performance, recyclability and ease of assembly. Moreover, this study aims to merge Mediterranean tradition and contemporary digital tools while critically assessing the advantages and limitations of the proposed system.

The Relationship between Architecture and Nature

The relationship between architecture and nature is ancient, expressed in diverse places and forms as a symbolic link across cultures and times.

For example, since the first century BC, Vitruvius made this relationship explicit in his *De Architectura*, writing about the first human dwelling, which was a hut made of natural materials such as branches, mud and leaves.

Over time, the hut evolved from a simple shelter into a symbol of humanity's ability to shape nature for protection and survival.

In fact, based on the geographical area, the plant species and water resources available, people have always attempted to create habitats favourable to their lives, first in simple ways, gradually domesticating the vegetation, and then building increasingly complex architectures.

An interesting example is represented by the oasis systems in the Global South, which were real settlements centred on greenery, specifically on the date palm. As early as the first millennium BC, as demonstrated by the findings at Zinkekra, there were attempts made by mankind to domesticate the date palm,[4] starting a process that would then lead to the creation of extremely complex structures, in which they could produce and survive by exploiting the shade produced by these trees. Controlling vegetation meant fighting desertification, creating favourable microclimates and laying the foundations for the creation of durable settlements, made up of both open meeting places and homes made of local materials with a high thermal inertia (e.g., mud, earth, stone, leaves and palm bark). This led to a consistent expansion and to the creation of compact and densely built villages equipped with protective walls, agricultural systems distributed on multiple levels and underground systems for collecting and managing water.[5]

In Europe a similar phenomenon occurred thanks to the massive presence of olive trees. The cultivation of olive trees led to the creation of permanent rural settlements such as underground oil mills (Southern Italy, Greece, Spain),[6] fortified farms and *trulli*

4. Kaczmarek T, Van der Veen M, Ivorra S, Mattingly D, Terral J-F, Gros-Balthazard M (2024) Origins and evolution of oasis agriculture in the Sahara: Evidence from morphometric analyses of archaeological date palm seeds. *The Holocene, 3: 353–365.*

5. Neglia G A (2024) Il palmeto di AlDiriyah come esempio di vivibilità nei paesaggi delle aree desertiche. [The AlDiriyah Palm Grove as an Example of Livability in Desert Landscapes.] *RI-VISTA Research for landscape architecture* 22(1): 218-231.

6. Mazzotti M (2008) Enlightened mills: mechanizing olive oil production in Mediterranean Europe. *Technology and Culture* 45(2): 277-304.

(Sicily and Apulia),[7,8] Andalusian *cortijos* (Spain).[9] Therefore, exactly as in the Sahara Desert, the possibility of creating controlled microclimates by exploiting the properties of local vegetation has allowed the development of the aforementioned architecture-nature relationship in original and effective forms, of which we still have ample evidence today.

Nowadays, the reconnection with nature is central to renewed scientific and architectural interest, countering the effects of rapid urbanisation that have reshaped landscapes and lifestyles.

The governmental initiatives previously mentioned have been combined with an increasing understanding of the advantages of a strategic green approach, and urban vegetation has begun to be considered not only as a furnishing element but also as an active part of architecture, so as an element that works in synergy with design to go beyond the simple aesthetic question.

Combining greenery with buildings improves the microclimate, reduces urban heat islands and enhances citizens' psychological well-being. This approach has led to projects such as the *High Line Park* in New York and the *Bosco Verticale* in Milan.[10]

The path towards bioarchitecture and nature-based solutions has been opened, reviving the ancient tradition of combining anthropic and natural elements, but with a different, contemporary perspective, enhanced by the possibilities offered by new technological tools. These can give new lifeblood to the techniques used to design and realise architectures, and they allow the recovery and improvement of very ancient construction traditions, as dry construction. This, combined with the exponential evolution of three-dimensional modelling software and digital manufacturing tools, has allowed us to work on dry construction in new ways, significantly expanding the spectrum of formal possibilities and usable materials.

Therefore, it becomes possible to develop projects like the one described in this article, which leads to a virtuous combination of effects such as good thermal performance and greenery integration, obtaining a sustainable, adaptive and customisable construction system.

Today, several experiments related to the design of structures composed of interlocking ashlars or complex architectural patterns are underway, often involving the implementation of plant species to enhance their aesthetic and performance characteristics. These examples have been studied to face the design process with awareness.

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7. Lombardo L, Luisi T (2024) Dry-stone architectural heritage in Madonie district.The rehabilitation of ancient rural complexes, as exemplary smart villages. *Sustainable Mediterranean Construction* 7: 15-22.

8. Ruggiero G, Dal Sasso S, Loisi R V, Verdiani G (2013) Characteristics and distribution of trulli constructions in the area of the site of community importance Murgia of Trulli. *Journal of Agricultural Engineering* XLIV: 87-94.

9. Palomares Alarcón S (2022) Olive grove landscape: the hydraulic pressing machine and its importance in the cultural heritage of Andalusia. *Revista de História da Sociedade e da Cultura* 22(1): 213-232.

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Literature Review

Even though the architectural practice of dry construction has aroused renewed and intense interest over the last twenty years– thanks to the advent of new technologies and the rediscovery of techniques –, the possibility of building architectural artefacts without the use of mortars or other adhesives has a long history behind it. Some significant examples are the Sardinian *nuraghi* (1800 BC), the Scottish *brochs* (1st millennium BC), the megalithic walls of the Mycenaean civilisation (3000 BC), the Apulian *trulli* (16th century) or the dry-stone walls widespread in Italy, Greece, Croatia, France, Spain and other regions.[11]

Dry construction has long been associated with sustainability, rapid assembly, microclimatic regulation, durability, and low cost. However, despite craftsmen's expertise, technological limitations confined this practice to the past, hindering modernisation. Today, by combining geometry, technology, and biology, new architectural projects are emerging that expand the boundaries of masonry construction.

Dry Construction Nowadays

A significant example of a contemporary construction system that does not involve the use of mortar or glue is represented by the Putra blocks made at the Universiti Putra Malaysia.[12] This is an innovative system of hollow blocks with interlocking joints that allow the creation of load-bearing and non-load-bearing walls, speeding up the construction process, improving efficiency and reducing costs. In fact, these blocks are modular concrete elements that implement a three-dimensional interlocking mechanism to eliminate the need for mortar, allow automatic alignment during assembly and, consequently, reduce the need for specialised labour and increase the precision of the work. 21 blocks were made, divided into three categories (stretcher, corner, half), each with standard dimensions and tested from different points of view: weight (about 12-14 kg per block), resistance, ease of production and ability to accommodate vertical and horizontal reinforcements. The system was put into practice by creating a 60 m^2 single-level house, and this operation allowed the project's potential to be verified, demonstrating a 30% reduction in construction times compared to traditional construction times.

11. UNESCO. *L'Arte della costruzione in pietra a secco: conoscenza e tecniche, elemento transnazionale (comprendente, oltre all'Italia, Croazia, Cipro, Francia, Grecia, Slovenia, Spagna, Svizzera, Andorra, Austria, Belgio, Irlanda e Lussemburgo)*. [The Art of Dry-Stone Construction: Knowledge and Techniques, a Transnational Element (Including, in addition to Italy, Croatia, Cyprus, France, Greece, Slovenia, Spain, Switzerland, Andorra, Austria, Belgium, Ireland and Luxembourg).] Retrieved from: www.unesco.it/it/iniziative-dellunesco/patrimonio-culturale-immateriale/larte-della-costruzione-in-pietra-a-secco-conoscenza-e-tecniche-elemento-transnazionale-comprendente-oltre-allitalia-croazia-cipro-francia-grecia-slovenia-spagna-svizzera/. [Last accessed 5 June 2025.]

12. Thanoon W A, Jaafar M S, Abdul Kadir M R, Abang Ali A A, Trikha D N, Najm A M S (2004) Development of an innovative interlocking load bearing hollow block system in Malaysia. *Construction and Building Materials* 18(6): 445–454.

Another project that follows the same logic was developed at the University of Innsbruck between 2022 and 2025.[13] In this case, too, interlocking ashlars were created through digital stereotomy and robotic cutting. Specifically, three types of ashlars were made, and each one was used to build a prototype. So, in the end, there were three architectural prototypes, each with a different level of porosity. The first prototype, called *G4*, was a room designed using G-shaped ashlars, which were interconnected with vertical and horizontal joints, taking advantage of the planar faces and ultimately obtaining an architecture with a porosity level of 61% (i.e., only 39% of the walls are actually full). This architecture was stable enough and easy to create, but at the same time it had a rigid shape, so it was not very interesting formally. Moreover, it was laterally weak. The second prototype, the *Abeille Crystal*, was built using blocks generated by complex diagonal cuts, which gave rise to asymmetric, sculptural and crystalline geometries with excellent thermal efficiency; however, they were fragile and required high precision in the cutting phase. Furthermore, the assembly process was difficult and required highly skilled workers. The third prototype, called *Woven Masonry*, was obtained from blocks cut in waves, which created a sort of adaptable and resistant wall fabric; nevertheless, it was geometrically very complex and therefore difficult to work with on-site due to the complexity of the alignments.

Despite their differences, these projects demonstrate the potential of customizable block systems to enable new architectural solutions that are efficient and, if carefully designed, practical to implement on site.

However, at the same time, they are bound to an approach that is too constrained by form and technological potential, and only partly it is based on the characteristics of the material. In particular, in the second case, expanded polystyrene was used, limiting the research to a formal test in view of future approaches with real building materials. Moreover, the relationship with greenery is totally absent in all the described case studies.

Integration of Greenery on Vertical Surfaces

Adding greenery to a façade is a practice commonly known as *vertical gardening* or *vertical greening,* and it is not only related to an aesthetic improvement. It is becoming a popular strategy to increase the thermal performance of buildings and outdoor comfort. As a matter of fact, vegetation on the outer side of a wall can help enhance thermal insulation – reducing the need for artificial cooling and heating systems –, it encourages biodiversity by creating habitats for birds and insects, and it helps reduce greenhouse gases.[14]

Nowadays, various vertical greening solutions are available on the market, but they mainly consist of coating systems that involve hanging vases or non-woven fabric pockets.

Some experimental tiling systems aimed at hosting greenery have also been developed thanks to the help of digital fabrication technologies. Two significant examples are the 3D printed hexagonal tiles developed by Emerging Objects for the

13. Hua H (2024) Porous interlocking assembly: performance-based dry masonry construction with digital stereotomy. *Architectural Intelligence*, 3: 55–72.

14. Jain R (2016) Vertical Gardening: A New Concept of Modern Era. In N L Patel, S L Chawla, T R Ahlawa (eds), 527-536. *Commercial Horticulture*. New Delhi: New India Publishing Agency.

pavilion called *Cabin of 3D Printed Curiosities*[15] (Figure 1a) and the 3D printed cladding system *CO-mida*, designed and realised by the Advanced Architecture Group of the Institute for Advanced Architecture in Catalonia (IAAC)[16] (Figure 1b).

However, both these examples deal with a cladding system, which has no structural function.

Several projects consider the possibility of integrating vegetation with modular structural elements similar to those analysed in the previous paragraph and made with contemporary construction tools – such as 3D printers –, innovative materials and experimental techniques.

An example is an ashlar designed at the Polytechnic University of Bari,[17] which was conceived to be 3D printed using clay and to be completely hollow, allowing the insertion of insulation and metallic reinforcements. The problem is that vegetation is not designed together with the ashlars, but it is conceived as an additional element that improves their characteristics; therefore, the final result does not differ from those previously described in terms of green design.

15. Rael R, Sanfratello V (2018) *Printing Architecture. Innovative Recipes for 3D Printing*. New York: Princeton Architectural Press.

16. Farinea C, Awad L, Dubor A, El Atab M (2020) Integrating biophotovoltaic and cyber-physical technologies into a 3D printed wall. Anthropologic: architecture and fabrication in the cognitive age. In *Proceedings of the 38th eCAADe Conference* Volume 2 (Berlin, Berlin, Germany, 16–18 September 2020). Berlin: eCAADe, 463–472.

17. Volpe S, Sangiorgio V, Petrella A, Coppola A, Notarnicola M, Fiorito F (2021) Building Envelope Prefabricated with 3D Printing Technology. *Sustainability*, 13(16): 8923.

Figure 1. a) *the 3D printed hexagonal tiles developed by Emerging Objects for the pavilion called Cabin of 3D Printed Curiosities; b) CO-mida, designed and realised by the Advanced Architecture Group of the Institute for Advanced Architecture in Catalonia (IAAC)*

Source: a) photo by Matthew Millman from www.emergingobjects.com; b) photo from https://advancedarchitecturegroup.net/projects/co-mida/.

Furthermore, adding greenery to a project and not planning it in the design phase means running into possible unforeseen events and damages due to the implementation of irrigation systems and the maintenance of the chosen species.[18]

Nevertheless, in some cases a design upgrade is made, attempting to overcome the simple juxtaposition and thinking of green walls that, in addition to possessing all the characteristics of previous projects – modularity, ease of production, speed of assembly – also present all the advantages of the superficial application of vegetation, such as the improvement of air quality, the improvement of physical and psychological well-being, the enhancement of architectural thermoregulation. Moreover, the shape is designed to

18. Zuniga-Teran A, Staddon C, de Vito L, Gerlak AK, Ward S, Schoeman Y, Mumme S (2020) Challenges of mainstreaming green infrastructure in built environment professions. *Journal of Environmental Planning and Management*, 63(4), 710–732.

accommodate different plant species. The project of a porous wall developed at the Beirut Arab University is emblematic, especially because it was applied to the theoretical case study of the Jarjouh Healing Resort in southern Lebanon.[19] A physical model on a small scale was built, and its ashlars were 3D printed with a self-compacting concrete. Their shape was organic, modular and vertically assembleable, and it was conceived as a pocket that could accommodate vegetation. Additionally, each block included internal channels to facilitate drainage and had a textured surface to allow vegetation attachment and drip irrigation. In this case, form and function were developed simultaneously and in the service of the vegetation. Moreover, this work was not limited to the laboratory, but the researchers attempted to contextualise it in Lebanon, even if only theoretically. This was an important step because it added a further degree of complexity, in terms of both design and social aspects. However, the formal complexity of the project brought with it problems even in the small-scale prototype: the project showed low structural resistance (with a deformation of 25 mm under simulated load) and, finally, the preparation of this type of model required advanced software and skills.

Another valuable example is represented by the *3D-VtGW* project, developed and realised in Nanjing (China).[20] This is a model of a wall composed of 3D-printed blocks shaped with a pocket to host vegetation and juxtaposed in staggered rows. An accurate simulation of the thermal performance has revealed a potentially good behaviour from the thermal point of view; however, the prototype has been realised with 3D printed concrete, which does not represent a sustainable solution due to its high value of embodied carbon. Moreover, the system does not integrate interlocking joints, which can help an easier and safer construction process.

The project Brick By Bit[21] by Victoria Roznowski (Figure 2) represents a significant solution for an interlocking self-bearing system. The geometry of the ashlars has been obtained through parametric modelling optimising the thermal performance. Some blocks have been shaped with a pocket to host vegetation, while others have been shaped to convey them water. The prototype has been 3D printed using clay. Even if this is a good example of interlocking system with the integration of greenery, information about more technical aspects (e.g., the optimisation and modelling process, the fabrication process, design criteria, etc.) are not available.

19. Chahin S, Afify A, Mohsen H, Youssef M (2022) Role of 3D Printed Green Walls in Healing Architecture. *BAU Journal – Health and Wellbeing* 5(1).

20. He Y, Zhang Y, Zhang C, Zhou H (2020) Energy-saving potential of 3D printed concrete building with integrated living wall. *Energy & Buildings* 222.

21. PA Editorial Team (2024) Victoria Roznowski's Brick By Bit redefines clay bricks with 3D printing. *Parametric Architecture*: https://parametric-architecture.com/brick-by-bit-redefines-cla y-bricks-with-3d-printing/ [Accessed 11 October 2025].

Figure 2. *The prototype of the project Brick By Bit by Victoria Roznowski*
Source: Photo from https://parametric-architecture.com/brick-by-bit-redefines-clay-bricks-with-3d-printing/.

All these aspects, together with the pros and cons found in the analysed case studies, have been considered during the design process of the *Green Wall*.

Methodology: The Steps of the Design Process of the *Green Wall*

The *Green Wall* is a prototype of a self-bearing wall designed specifically for the Mediterranean context. This choice reflects the research focus of the Architecture Department at the Polytechnic University of Bari, which investigates stone in architecture and Mediterranean identity.

The design phase started from three main objectives:

1. the first objective was to design a constructive system suitable for the Mediterranean basin from various points of view, such as the formal language, the material used, and the thermal performance;
2. the second objective dealt with the ease of the construction process, in order to keep the final product suitable also for emergency contexts;
3. the third objective consisted in obtaining a sustainable architectural system, considering matters as recyclability, use of waste materials and adaptability to different contexts.

The Mediterranean Identity of the *Green Wall*

The Mediterranean area has a strong architectural tradition, based especially on the use of stone, which has been declined through the centuries in various ways: cities like Alberobello (Italy), Matera (Italy), Cyprus (Greece) or Mardin (Turkey) are very different from one another, but they are all expressions of the Mediterranean architectural language.

Stone is a material with high thermal inertia, and this characteristic helps obtain a good thermal performance. For this reason, stone is the material chosen for the *Green Wall*, even if in recomposed or 3D printed form.

Moreover, a particular language linked to stone architecture was chosen as an inspiration for this project: it is rustication, also known as *bugnato*. Rustication is a practice aimed at giving a stone surface a plastic appearance by protruding or tridimensionally finishing the front face of each ashlar.

Even if rustication was antiquely used by Greeks and Romans, it massively spread in Italy during the Renaissance period, when it was largely employed for private and public buildings, but it has also been used in other Mediterranean regions.[22]

There are different types of rustication: some of them have a rawer appearance (Figure 3a), while some of them have a more refined appearance (Figures 3b and 3c), but all of them give the façade strength and rhythm.

Figure 3. *Different typologies of rustication: a) the façade of the Medici-Riccardi palace in Florence (1444-1484, Italy); b) the southern façade of the Palace of Charles V in Granada (1527-1623, Spain); a detail of the House of the Beaks in Lisbon (Portugal, 1523)*

Source: a) photo by Sailko, Wikimedia Commons; b) photo by Rose Selavy from Wikimedia Commons; c) photo by Andreas Manessinger from Wikimedia Commons.

The inspiration to rusticated stone is linked not only to the will of respecting a Mediterranean aesthetic, but also to sustainability considerations. As a matter of fact, corrugations on a surface exposed to direct sunlight help produce shades on this surface, thus reducing the surface temperature and acting as a passive cooling strategy.[23]

The Constructive System

According to the choice of reinterpreting rusticated stone through the language of digital 3D modelling, a set of staggered blocks has been modelled to form a tridimensional pattern when put together.

The design process has followed these steps (Figure 4):

1. a set of cubic boxes has been made;

22. Acocella A (2004) *L'architettura di pietra. Antichi e nuovi magisteri costruttivi* [Stone architecture. Ancient and modern constructive skills]. Milan: Skira-Lucense.

23. Shahda M (2020) Self-Shading Walls to Improve Environmental Performance in Desert Buildings. *Architecture Research* 10(1): 1-14.

2. the front face of each block has been implemented with a volume shaped as a slightly twisted pyramid trunk;
3. the pyramid trunk has been excavated on the upper part to obtain a pocket for vegetation;

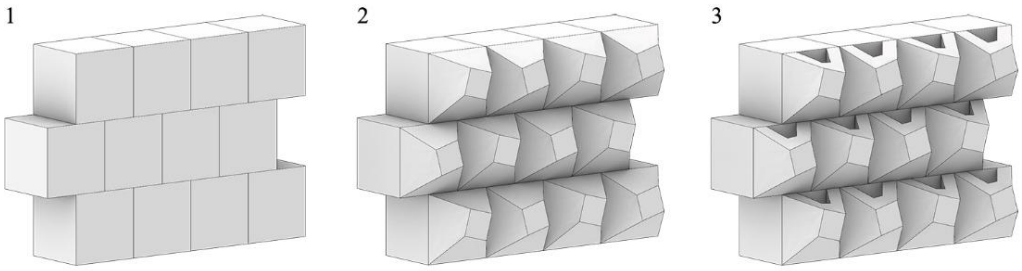

Figure 4. *Scheme of the modelling phases*
Source: drawings by the authors.

The interlocking system has been conceived to be as simple as possible and to guarantee that the ashlars could be reciprocally fixed without mortar or glue. Each ashlar was conceived with reciprocal male and female geometries: protrusions on the lower surface and corresponding cavities on the upper face of the block ensure that all the elements fit together in a self-aligning manner, guaranteeing both stability and ease of construction.

Four ashlar typologies are needed for a complete system: two for the planar part of the wall and two for the corners (Figure 5).

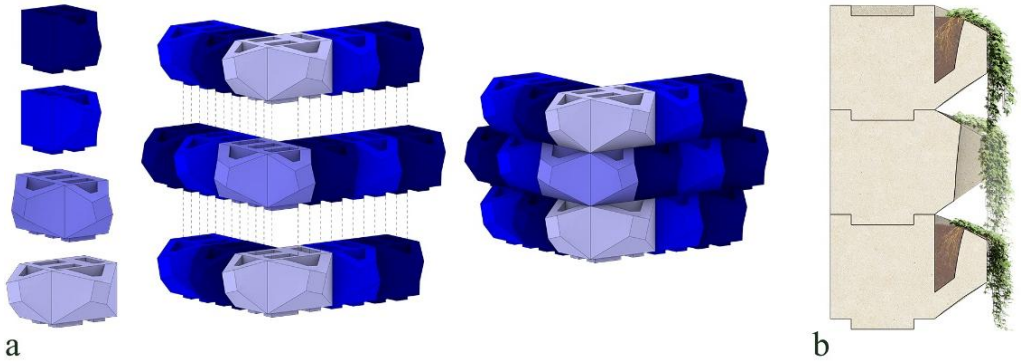

Figure 5. *Scheme of the constructive system: a) the four typologies of ashlars – marked by different colours – and an assembly scheme; b) a cross section showing the interlocking joint and the placement of vegetation.*
Source: drawings by the authors.

This basic pattern can be varied according to the design needs, thanks to the implementation of parametric modelling. For example, the ratio between length and height of the ashlars can be modified, the overhangs can vary to obtain wider holes for different vegetation species, or the pattern can be deformed to tessellate curved surfaces instead of planar ones (Figure 6).

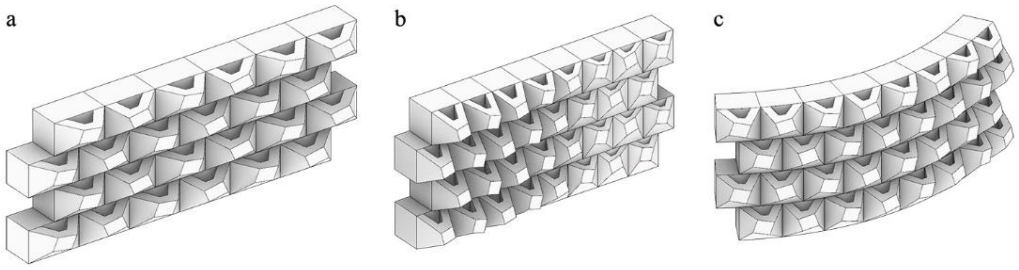

Figure 6. *Some possible variations of the pattern: a) variation of proportions; b) variation of overhangs; c) tessellation of a curved wall allowed by the deformation of the ashlars*
Source: drawings by the authors.

In the case of a real application, some precautions should be taken for the proper functioning of the *Green Wall*. Small holes at the bottom of the vases would prevent rotting by helping water in excess flow, for example in case of rain. This way, water would not be wasted, but it would be collected by the vases underneath. Moreover, a waterproof coating should be placed inside the cavities that host vegetation, in order to prevent stone imbibition.

The *Green Wall* can work exploiting passive irrigation: as a matter of fact, 3D printed stone is a porous material that favours moisture condensation. The collection of moisture condensation is a strategy commonly used especially in areas characterised by a very warm climate and by lack of water to favour cultivation. This is basically how dry stone walls work.[24]

However, the integration of an irrigation system could be investigated in order to make the system more flexible. A plausible hypothesis would involve external tubes for drip irrigation: this way, an easy application and maintenance would be guaranteed.

The Use of 3D Printed Stone

As noted earlier, the project aimed to explore an innovative use of stone to create a solution coherent with Mediterranean architectural traditions, while ensuring high thermal inertia suitable for warm climates without thick insulating layers.

However, traditional stone carving poses significant limitations in terms of precision, waste, and labour intensity, especially when producing complex geometries like those required for the *Green Wall*.

Given the modularity of the elements that compose this constructive system, a good fabrication solution could be the use of traditional recomposed stone through moulds, which would surely help reduce costs in case of mass production.

However, in this case stone 3D printing through binder jetting technology was investigated. Differently from the more common extrusion technology, the binder jetting process consists of depositing layers of binder on progressive layers of inert powder. The pile of powder that is generated during the printing process works as a

24. Laureano P (2007) Ancient water catchment techniques for proper management of Mediterranean ecosystems. *Water Supply* 7(1): 237-244.

support for the portions on which binder is sprayed, allowing the realisation of complex shapes and significant overhangs.

Additive manufacturing flexibility would allow for easy application of the previously mentioned variation of the system according to the project needs, without the necessity to produce specific moulds from time to time. Moreover, the shape complexity that can be obtained using the binder jetting technology allows for further customisation of the construction system by changing the porosity of the ashlars through lattice optimisation. This permits adjusting the weight of the ashlars, keeping their robustness optimal, or also obtaining internal cavities that can remain empty or filled with other materials, as specific insulants.

Binder jetting 3D printing technology applied to stone has already been experimented with, for example for some prototypes exposed at the international exhibition Marmomac Meets Academies in the 2023 and in the 2024 editions. The prototype *Technovauld* by Dustin White[25] and *Doppionodo* by Giuseppe Fallacara and Marco Massafra,[26] both realised using Lecce stone powder, demonstrate that the appearance of 3D printed stone is very similar to natural stone, keeping this technology very suitable for contemporary architectural applications (Figure 7).

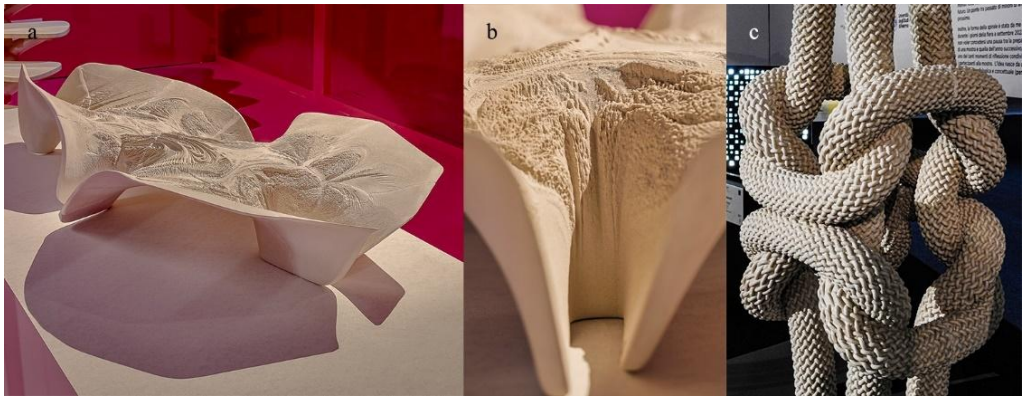

Figure 7. *Some prototypes realised through Lecce stone 3D printing with the binder jetting technology: a) Technovauld by Dustin White; b) a detail of Technovauld that shows the finishing of 3D printed stone; c) Doppionodo by Giuseppe Fallacara and Marco Massafra*

Source: a) and b) photos by Gaz Blanco; c) photo by the authors.

Additive manufacturing allows also for a greener fabrication process not only by reducing waste production, but also by giving the possibility of using waste powder from stone manufacturing or debris from demolition.

25. White D (2023) Technovauld. In G Fallacara (ed), 76-79. *Marmomac Meets Academies. Advanced research, lithic experimentation*. Ferrara: Media MD.

26. Fallacara G, Massafra M (2024) Doppionodo. In G Fallacara (ed), 62-63. *Ceci n'est pas un fossile. Marmomac Meets Academies 2024*. Ferrara: Media MD.

The 3D Printed Prototype

A physical prototype of the *Green Wall* was produced on the occasion of the exhibition Marmomac Meets Academies 2024, curated by prof. Giuseppe Fallacara and held in Verona from 24 to 27 September 2024. The prototype consisted of a fragment of a wall corner, which was placed on a podium with a surface of 60 cm × 60 cm.

The dimensions of the prototype and its components are shown in Figure 8. However, in the case of a real application, they can be scaled according to construction needs.

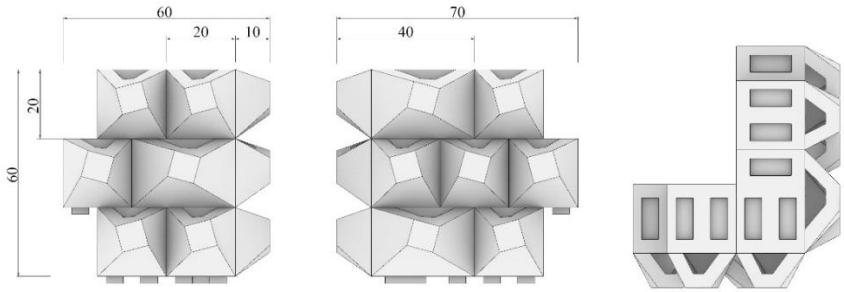

Figure 8. *A scheme of the prototype. All the measures are in cm.*
Source: photos by the authors.

The blocks were produced by the company D-Shape, a pioneer in large-scale binder jetting 3D printing. In this case, ashlars were fabricated using a standard 3D printed concrete. The machine used is meant for large-scale objects, so it has a low printing resolution, and, because of that, the tolerances of the interlocking systems had to be recalibrated, while the produced objects needed post-production to remove imperfections. Despite this, the ashlars resulted endowed with a rough superficial texture that gave them a strong resemblance to porous natural stone typical of the Mediterranean area (Figure 9). This phase represented a transition from speculation to physical experimentation, establishing a foundation for further development and deployment.

Figure 9. *The prototype of the Green Wall, exposed at Marmomac Meets Academies 2024*
Source: photos by the authors.

Possible Architectural Design Applications

The *Green Wall* offers a series of different architectural applications that span from the urban dimension to landscape applications. As a matter of fact, even if its initial formulation is suitable for self-bearing façades or boundary walls, the potential of the system extends far beyond these basic configurations.

The simplest application is the integration of portions made through the *Green Wall* system in private and public buildings, enriching cities with green areas that can improve the appearance and reduce heat islands.

Integrated cavities can host not only ornamental plants but also herbs and small-scale food crops, and the ashlars can be employed to create private and public hydroponic gardens. When equipped with passive or active hydroponic systems, these walls could contribute to urban food resilience and serve also educational or therapeutic functions in schools, healthcare facilities, or public housing. This way, the wall transforms into an infrastructure for urban agriculture, reconciling the built environment with the rhythms of plant growth and food production.

A more massive application of the *Green Wall* constructive system can lead to the realisation of urban micro-agglomerates composed of small, clustered units that can form the basis for sustainable settlements. These clusters could be deployed in peri-urban or rural areas to support agricultural communities, ecological resorts, or co-housing environments. In this case, the *Green Wall* can become a spatial device capable of organising and supporting social, productive, and ecological activities.

The ease of assembly, together with the capacity for bioclimatic adaptation, keeps the system highly suitable for incremental construction and self-built communities, also in emergency contexts.

At a landscape level, portions of the *Green Wall* could be used as a reinterpretation of ancient dry walls. Traditional dry walls, which are a distinctive trait of the Mediterranean landscape, are known to bring a series of environmental benefits, such as the creation of a local micro-climate, the creation of micro-habitats that enhance biodiversity, and the protection from wind and bad weather conditions[27].

In the Mediterranean context, the *Green Wall* system resonates deeply with regional architectural traditions while offering a path to future-oriented sustainability, and it can become a contemporary response to ancient environmental wisdom, and a tool for creating urban and architectural ecosystems that are resilient, expressive, and deeply rooted in the cultural identity of the Mediterranean basin.

27. Solomou A D, ProutsosN, Karetsos G, Tsagkari K (2020) Impact of Stone Terraces and Walls' Micro-environment on Biodiversity Conservation: A Case Study in the Mediterranean Island of Kythira-Greece. In *Proceedings of the 9th International Conference on Information and Communication Technologies in Agriculture, Food & Environment* (Tessaloniki, Greece, 24-27 September 2020). 549-547.

Figure 10. *Some examples of architectural applications of the* Green Wall
Source: a), b) and c): renderings by the authors; d): rendering by the authors edited on a photo by Fabio Boccuzzi, taken from Alamy Foto Stock.

An Evaluation of the Thermal Performance of the *Green Wall* System

During the description of this work, a great emphasis has been placed on the potentially good thermal performance of the *Green Wall* system. As a matter of fact, it is known that the high thermal inertia of massive materials like stone can help reduce the internal temperature of a building,[28] while the application of vegetation on roofs and façades helps improve both indoor and outdoor comfort due to shading combined with evapotranspiration.[29]

Therefore, some analyses have been run to evaluate the impact of the use of the *Green Wall* System, comparing it to more common construction systems: an external cavity wall with full-fill insulation and a simple stone wall, both 30 cm thick.

For this purpose, a small unit has been modelled in two versions: the first one as a simple square box with openings on the northern and southern sides, the second one with a simplified model of the *Green Wall* system placed on the outer faces (Figure 11a). This was obtained by considering the overhanging vases as a composition of stone faces 6 cm thick; to simulate vegetation, tridimensional shaders approximating the plants' volume were modelled (Figure 11b).

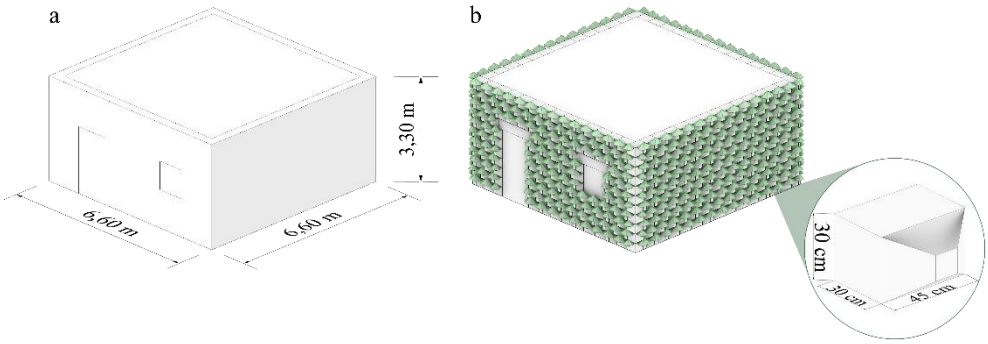

Figure 11. *3D model of the designed unit: a) unit with simple walls; b) unit with the Green Wall system applied*
Source: image by the authors.

All the analyses were performed using Honeybee, an add-on for the Rhinoceros plug-in Grasshopper.

The characteristics of the models were established by defining their materials and, consequently, their thermal parameters.

For the simple stone wall and the *Green Wall*, the thermal characteristics of an extra soft limestone were chosen, considering the UNI EN ISO 10456:2008 standards. Moreover, a solar absorptance value compatible with a light-coloured material has been chosen (Table 1).

28. Goussos J (2023) The Impact of Using Natural Stone on Thermal Performance of Building Envelopes in Hot Regions: Case of Al-Karama Town. *Civil Engineering and Architecture* 5A(11): 3125–3141.

29. Cascone S, Coma J, Gagliano A, Pérez G (2019) The evapotranspiration process in green roofs: A review. *Building and Environment* 147: 337–355.

Table 1. *The Thermal Characteristics of Extra Soft Limestone According to UNI EN ISO 10456:2008 Standards*

Material	Density [kg/m^3]	Conductivity [W/(m·K)]	Specific heat [J/(kg·K)	Solar absorptance
Extra soft limestone	1600	0.85	1000	0.4

The external cavity wall with full-fill insulation was characterised as described in Table 2. The thermal properties of each material were taken from technical sheets of products compliant to international standards, while the solar absorptance of the visible plastered surfaces has been chosen to be compatible with a very light colour.

Table 2. *The Characteristics of the Chosen External Cavity Wall with Full-Fill Insulation*

Material	Thickness [cm]	Density [kg/m^3]	Conductivity [W/(m·K)]	Specific heat [J/(kg·K)	Solar absorptance
External plaster[30]	1.5	1400	0.54	1000	0.3
External layer of semi-solid clay blocks[31]	12	889	0.25	840	-
Rockwool[32]	10	80	0.035	1030	-
Internal layer of hollow bricks[33]	8	600	0.23	840	-
Internal plaster	1.5	1400	0.54	1000	0.3

Analyses of the internal and external perceived temperature according to the Universal Thermal Climate Index (UTCI) were performed considering the city of Bari, in Southern Italy, as the construction site. The weather file referring to the 2020 meteorological data for this location was used to perform the analyses, which were run on 17 August, the first day of the hottest week of the year.

The analysis of the indoor comfort, which was run on the internal room with no ventilation or air conditioning, showed some promising results concerning the thermal performance of the *Green Wall*. Figure 12 displays through a colour gradient the mean temperature in the room taken from 6 A.M. to 8 P.M. (respectively dawn and sunset time in Bari on 17 August).[34] The external cavity wall with full-fill insulation resulted

30. Thermal parameters taken from: https://www.ferrimix.it/wp-content/uploads/2017/10/ST-FC19-INTONACO-TERMICO.pdf [Accessed 9 October 2025]

31. Thermal parameters taken from: https://www.stabila.it/wp-content/documentazione/Comune/Doppio%20Uni%2012%20VR/ST_R_DOPPIO_UNI_12.pdf [Accessed 9 October 2025].

32. Thermal parameters taken from: https://www.rockwool.com/siteassets/rw-it/documentazione-tecnica/schede-tecniche---gamma-edilizia/labelrock.pdf [Accessed 9 October 2025].

33. Thermal parameters taken from: https://www.stabila.it/wp-content/documentazione/Schede_Techiche_TRAMEZZE_ICMQ/ST_R_TRAMEZZA_8-25.pdf [Accessed 9 October 2025].

34. Data taken from: https://www.timeanddate.com/sun/italy/bari?month=8&year=2025 [Last accessed 9 October 2025].

the worst system, with a mean temperature of about 36 °C. An envelope made of a simple stone wall shows a better result, with a mean temperature of about 34.5 °C. As expected, the *Green Wall* is the most performing envelope, with a mean temperature of 32.5 °C. Figure 13 shows the variation of temperature during the entire day for the three envelopes.

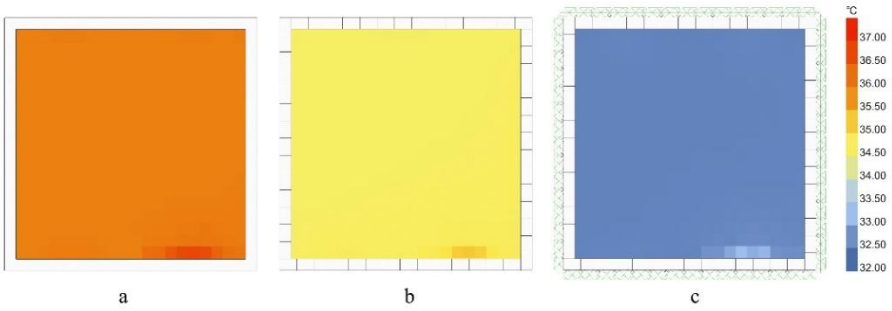

Figure 12. *Schemes showing the internal mean perceived temperature from 6 A.M. to 8 P.M. on 17 August in Bari: a) external cavity wall with full-fill insulation; b) simple stone wall; c)* Green Wall
Source: Schemes by the authors.

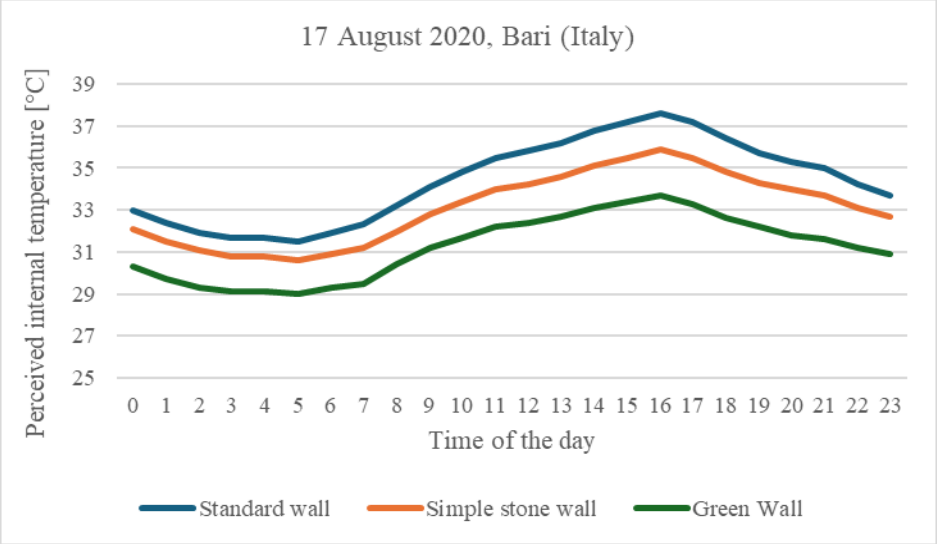

Figure 13. *Graph showing the variation of mean internal perceived temperature on 17 August in Bari: a) external cavity wall with full-fill insulation; b) simple stone wall; c)* Green Wall
Source: Graph by the authors.

It is essential to note that, although the lowest temperature reached using the *Green Wall* system (approximately 29 °C) is still too high to be considered comfortable, the analyses pertain to a room with no ventilation throughout the day. Air flow through the windows represents one of the primary passive cooling strategies and would improve the indoor comfort of the unit.

Moreover, Honeybee for Grasshopper does not allow the simulation of plants' evapotranspiration, whose effect can furtherly reduce internal temperature.[35]

The outputs of the analyses of outdoor comfort (Figure 14) revealed that the behaviours of the external cavity wall with full-fill insulation and the simple stone wall are similar, while the *Green Wall* shows a slightly better behaviour, by reducing the perceived temperature near the building of about 0.4 °C.

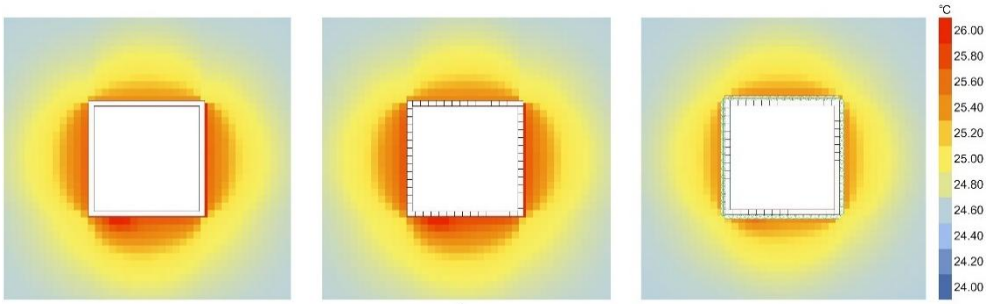

Figure 14. *Schemes showing the external mean perceived temperature from 6 A.M. to 8 P.M. on 17 August in Bari: a) external cavity wall with full-fill insulation; b) simple stone wall; c)* Green Wall
Source: Schemes by the authors.

Even if the benefit brought by the *Green Wall* system can seem irrelevant, once again we must underline that the evapotranspiration effect has not been considered: the slight cooling shown in the schemes is produced only by the shading of plants and by the self-shading of the pattern. Some studies show that evapotranspiration can impact on outdoor temperature,[36] therefore it is credible that the *Green Wall* would perform better than how the scheme shows.

Discussion and Conclusions

The *Green Wall* project is an example of how digital tools, traditional materials and ecological strategies can converge to produce a new Mediterranean architectural language. It takes inspiration from vernacular architecture built with stone and integrates it with contemporary parametric modelling and additive manufacturing, presenting a possibility for innovative buildings that are both structurally autonomous and environmentally integrated.

The *Green Wall* project addresses key challenges such as climate adaptation, urban resilience and biodiversity support, and it shows considerable potential from the point of view of thermal performance. As a matter of fact, digital simulations show it to be

35. Bagheri Moghaddam F, Fort Mir J M, Navarro Delgado I, Redondo Dominguez E (2021) Evaluation of Thermal Comfort Performance of a Vertical Garden on a Glazed Façade and Its Effect on Building and Urban Scale, Case Study: An Office Building in Barcelona. *Sustainability* 13(12): 6706.

36. Dehghan Lotfabad A, Hosseini S M, Dabove P, Heiranipour M, Sommese F (2025) Impacts of Vertical Greenery on Outdoor Thermal Comfort and Carbon Emission Reduction at the Urban Scale in Turin, Italy. *Buildings* 15(3): 450.

more efficient than more traditional systems, by reducing both internal and external perceived temperature on hot days.

At the same time, the project offers practical advantages, including ease of assembly, material reuse and adaptability to multiple contexts.

Nevertheless, several challenges remain to be addressed before the *Green Wall* system can evolve from a prototype to a widely applicable solution. Long-term durability could be a critical aspect, since the response of 3D-printed stone to weathering, vegetation growth and maintenance operations has not been investigated yet. Moreover, irrigation systems – both passive and active – require careful integration that must be deeply studied to avoid clogging, water leakage and expensive maintenance costs, especially when scaled up to large facades. Another important topic is the economic feasibility of binder jetting technology. While it offers great flexibility in form and material reuse, its current costs are still high compared to other contemporary technologies and methods. A preliminary assessment of cost scalability will be essential to determine whether this approach can really move from theory to practice in the near future.

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The Intersection of Education and Neighborhood Revitalization: The Importance of Neighborhood Schools in Community Stabilization

*By Catalina Freixas**

This paper presents the B.E.S.T. Approach, a phased intervention strategy for distressed urban areas emphasizing neighborhood-level engagement through local schools. The approach utilizes the elementary school as the venue to apply "Wraparound Theory" to comprehensively address educational and service needs. Over the past thirty years, community schools have emerged as collaborative solutions, integrating resources from the school, residents, and community partners to enhance student, family, and community outcomes. Originating in efforts to address issues in a St. Louis neighborhood plagued by population loss and hyper-vacancy, B.E.S.T. seeks to reshape the traditional public-school model by fostering partnerships among local organizations and leaders to promote sustainability within the neighborhood. The first phase of the proposed intervention focuses on making the area livable through Beautification (B), strengthening Education (E), ensuring Service and Safety (S), and providing Technical Assistance (T) to local organizations. B.E.S.T. employs interdisciplinary methodologies, including spatial and data analysis, and a community-engagement approach. An external evaluator assesses the effectiveness of this approach, with findings indicating that the strategy positively impacts neighborhood stabilization, resident satisfaction, and academic performance. However, it also highlights the need for further research on population dynamics, emphasizing the importance of the community's role in advancing urban development.

Introduction

Like many American post-industrial cities, St. Louis, Missouri, confronts ongoing challenges due to its significant population decline and economic deterioration. This situation has been further exacerbated by entrenched racial segregation and structural racism. While the city as a whole and numerous inner-ring suburbs have experienced difficulties over the last generation, the plight in North St. Louis—predominately Black—reveals stark disparities evidenced by expansive swathes of the urban landscape plagued with vacant lots and boarded-up structures.[1]

The ramifications of decline have not gone unnoticed by White nor Black St. Louisans. African American leaders have rightfully called attention to the historical inequities in investment and budget allocations from city administrations, which have fueled the growing geographical divide within St. Louis. Although attempts have been made to address these disparities through initiatives aimed at redressing these

*Associate Professor, Washington University in St. Louis, USA

1. A. Malach, *The Divided City: Poverty and Prosperity in Urban America* (Washington, DC: Island Press, 2018).

inequities—such as housing developments, economic programs, and infrastructure improvements—these measures have often yielded minimal to no tangible impact, with outcomes often falling short of expectations.

In response to this pervasive lack of success, the St. Louis Association of Community Organizations (SLACO)—a local non-profit dedicated to advocating for neighborhood improvement—has been working on the development of a more effective and inclusive intervention strategy. While SLACO has members from both North and South St. Louis as well as across the metropolitan area, many of the neighborhoods it serves are in the distressed northside. Over the past decade, SLACO has focused on addressing vacancy in many of these communities. Out of these efforts, in 2021, SLACO initiated the KingsVille B.E.S.T. Collective (KBC), a collaborative venture involving community groups (KingsVille Corporation and the Urban League St. Louis) and institutional partners (St. Louis Public Schools, SLPS; Harris-Stowe State University, HSSU, and Washington University in St. Louis), WashU aimed at creating a comprehensive approach to neighborhood stabilization.

Central to this approach is the principle that neighborhood stabilization must precede housing redevelopment and economic revitalization attempts. The overarching goal is to breathe new life into the community by changing the prevailing negative perception of the neighborhood as a desirable place to reside and raise a family. For KBC, this vision encompasses beautifying the physical environment (B), addressing the academic challenges of the local school (E), ensuring the safety and service access of the residents (S), and providing technical support to the community organizations (T).

Figure 1. *KingsVille Target Area, Catalina Freixas 2025*

Recognizing the critical role that the elementary school plays in urban planning, KBC chose the KingsVille community (Figure 1) due to the presence of a strong neighborhood school—Hickey Elementary School (HES). KingsVille (KV), a member of SLACO, covers a twenty-block area that spans the underserved neighborhoods of Kingsway East and The Greater Ville. Given its socioeconomic hurdles and manageable size, KV was an ideal candidate for this pilot study.

With HES and its surrounding community as its starting point, the project was grounded in a school-oriented intervention methodology. KBC sought a theoretical framework to inform and guide its initiative, presenting a constructive pathway forward. Given the professional backgrounds of many of its partners in education, the group gravitated toward Wraparound Theory (WT).[2] This theory, which originates from an educational discourse, underscores the necessity of a comprehensive, coordinated, and community-based approach to fulfill the needs of individuals and families. In short, KBC envisioned the B.E.S.T. Approach as a school-centered intervention utilizing WT at the neighborhood level.

With a firm grasp of the necessity for a strategic framework, KBC developed a comprehensive action plan and established clear evaluation metrics to measure progress. This methodical approach guaranteed that resources and efforts were utilized efficiently, and that meaningful change could be assessed quantitatively and qualitatively.

As a result, the collective devised a scalable, community-engaged approach for highly distressed neighborhoods aimed at enhancing the physical environment, strengthening the quality of the local school, improving community service delivery, ensuring resident safety, and bolstering the organizational capacity of local groups.

The pilot study of the KV B.E.S.T. Approach is guided by several explicit research questions aimed at evaluating the program's effectiveness and potential for community stabilization and revitalization. First, the intellectual framework is predicated on whether the neighborhood school can act as a catalyst for change in a highly distressed community, functioning not merely as an educational institution but also as a critical focus for this intervention strategy. HES was an ideal focus for exploring the role of neighborhoods schools in an intervention strategy due to its central role within the community and its alignment with a school-centered intervention methodology.

Second, this paper examines how the various B.E.S.T. domains contribute to measurable outcomes. Therefore, under beautification, it explores the extent to which beautification efforts—such as property stabilization initiatives, demolitions, vacant-lot maintenance, and improvements to the tree canopy—enhance neighborhood livability and positively affect resident perceptions. Additionally, under education, the research attempts to assess the impact of initiatives—such as attendance supports, after-school programs, literacy enhancements, and tracking of test scores— on improving student outcomes and school enrollment. Furthermore, under safety and service, the research delves into strategies—such as walkability improvements, crime prevention programs, and service referrals—to determine their effectiveness in reducing crime and increasing service delivery. Lastly, under technical assistance, the research explores the role of professional support—such as organizational training, grant support, and memorandums of understanding (MOUs)—in bolstering neighborhood organizational capacity and ensuring project sustainability.

Finally, the research aims to determine whether the approach has the potential of being replicable and sustainable. By establishing benchmarks and through an analysis of pilot outcomes, the Principal Investigator (PI) intends to evaluate the likelihood that the B.E.S.T. Approach could be adapted to comparable neighborhoods in St. Louis and

2. K. Soon, J.C. Suter, O. Linkous, C.A. Davis, and E.J. Bruns, Adapting Community-Based Wraparound for Use as an Intensive Intervention in School. *Journal of Positive Behavior Interventions*, 0(0) (2025).

other American cities. Additional inquiries focus on what data or conditions are necessary to support such replication and what policy levers at the district or municipal level are essential for institutionalizing and scaling the B.E.S.T. Approach. The overarching goal of this comprehensive assessment framework is to lay the foundation for policy changes at the district or municipal level, necessary to institutionalize and scale the B.E.S.T. Approach.

Intellectual Framework

Historical Overview of American Neighborhood Planning

Neighborhood planning in the United States has evolved over a century and a half, with various approaches. The B.E.S.T. Approach is a contemporary framework that draws inspiration from this legacy but is not itself a historic model. In the first half of the nineteenth century, American planning primarily revolved around establishing new towns and providing essential infrastructure such as water, sanitation, and green common space within existing urban areas. However, as industrialization and urbanization surged in the latter half of the century, planners began to confront the emergent challenges in residential areas, acknowledging the existence and intricacies of neighborhoods within the emerging streetcar city. In this early neighborhood planning, early reforms, such as the New York tenement laws of the 1880s and 1890s, were among the initial attempts by urban officials to address housing needs.[3]

Although most of the practitioners of the emerging field of urban planning at the beginning of the twentieth century focused on instilling order in the American city by creating master plans or comprehensive plans for the entire metropolis, some recognized the necessity of formulating strategies at the neighborhood scale. Notable figures like Henry Wright, in the 1907 St. Louis Civic League Plan, advocated for the establishment of community centers to address the pressing needs of St. Louis's growing immigrant population by providing essential amenities—such as community baths—emphasizing a holistic approach to urban living.[4,5,6]Although Daniel Burnham is widely recognized for his ambitious vision for public space in Chicago's 1909 Comprehensive Plan, he also proposed extensive improvements that ultimately were not included in the final document due to reservations by the Commercial Club.[7]

The true foundation for American neighborhood planning was laid in the 1920s by Robert Park and his colleagues at the University of Chicago. By examining indicators such as growth trends, demographic shifts, and living conditions, members of the

3. C. Silver, "Neighborhood Planning in a Historical Perspective," *Journal of the American Planning Association,* 51, no. 2 (1985): 161-174.

4. M. Abbott, "The Master Plan: Life and Death of Ideas" (Lafayette: Master Thesis, Purdue University, 1985).

5. M. Abbott, "Déjà vu All Over Again? St. Louis Master Plan and the Dream of the Democratic Community," *Gateway Heritage* (1999): 4-19.

6. M. Abbott, "A Document that Changed America: The 1907 A City Plan for St. Louis," in *St. Louis Plans: The Ideal and The Real St. Louis* (ed.) M. Tranel (St. Louis: Missouri Historical Society, 2007), 17-54.

7. D. Burnham, *Plan of Chicago* (Chicago: Great Books Foundation, 2009).

Chicago School established the groundwork for Neighborhood Studies.[8] This new wave of sociologists inspired urban planners like Clarence Perry[9] (Figure 2) and Clarence Stein[10] to reimagine urban life from the neighborhood perspective during the late 1920s. Even Harland Bartholomew—best known for his work on zoning and comprehensive planning, urban renewal, and early planning for the American interstate system—was instrumental in suggesting ways urban planners could shape existing urban neighborhoods in the 1930s. Like many contemporary neighborhood planners, Bartholomew advocated for urban neighborhoods' enhancements through tools like building codes, historic preservation, and infill demolition/development aimed at safeguarding the character of neighborhoods.[11,12]

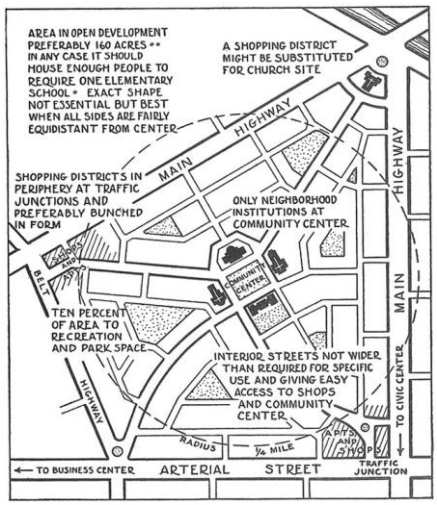

Figure 2. *The Basic Components of Clarence Perry's Neighborhood Unit, Perry 1929*

However, Bartholomew and most American planners in the 1940s and 1950s took a different approach, prompted by concerning signs of stagnation in urban growth, declining residential conditions, and the necessity of accommodating the automobile. This shift led post-war urban planners to push for large-scale urban clearance, with the assumption that neighborhoods built a century earlier could not be updated to meet modern amenities—such as indoor plumbing, central heating, and electricity. Consequently, existing neighborhoods were replaced with whole-sale large-scale public housing complexes. The high-profile case of Pruitt-Igoe exemplifies the catastrophic results of this mindset. By the early 1960s, a backlash against this model began to coalesce.[13]

8. R. Park, E. Burgess and R. McKenzie, *The City* (Chicago: The University of Chicago Press, 1925).

9. C. Perry, *Neighborhood and Community Planning: Comprising Three Monographs: The Neighborhood Unit* (New York: Arno Press, 1929).

10. C. Stein, *Toward New Towns for America* (New York: Reinhold, 1959).

11. M. Abbott, "Who Knew? Harland Bartholomew as Neighborhood Conservationist" (Presentation, 57th Annual Missouri Conference on History, St. Louis, MO, March 11-13, 2015).

12. H. Bartholomew, "Neighborhood Rehabilitation and the Taxpayer," *American City* 53 (February 1938), 57.

13. J.C.C. Teaford, *The Rough Road to Renaissance: Urban Revitalization in America*, (Maryland: John Hopkins University Press, 1990).

Amid these debates, some urban theorists, including Reginald Issacs, contended that urban planners should abandon the concept of neighborhoods, claiming they only entrenched racial, social, and economic segregation.[14] However, a prominent discourse emphasizing the importance of preserving the historic role of neighborhoods emerged as well. Jane Jacobs became a powerful voice against urban renewal and the need to retain the historic fabric in her influential book, *Death and Life of Great American Cities*.[15] Jacobs argued that neighborhoods were essential for understanding how cities function and criticized urban renewal for dismantling the heterogenic interactions at the neighborhood level. While acknowledging the existence of slums in mid-twentieth-century American cities, she argued that the process of "unslumming" should proceed cautiously to preserve the vital workings of the existing neighborhood.

Due to the influence of Jane Jacobs and her followers, a mass movement of young professionals flocked to American inner cities in search of what they perceived as "authentic" urban living. Moving into what had become, in many cases, severely distressed neighborhoods, these urban pioneers settled in neighborhoods that, in many cases, had fallen into severe distress. Their intent was to transform these downtrodden communities into spaces that embodied "Jacobs" ideals of a vibrant, mixed-use neighborhood. However, this revitalization often resulted in the gentrification of these areas, changing them into middle-class, white neighborhoods.[16] Many city planners supported this process by helping these newcomers establish historic preservation districts and legislating favorable tax and zoning initiatives that facilitated development.[17]

In response to the gentrification of lower-income neighborhoods—many predominantly Black—a new generation of planners emerged in the late 1960s. They viewed their role as protectors of vulnerable communities, advocating for residents at risk of displacement with no viable alternatives. This cohort of planners—sympathetic to the plight of the communities—worked closely with these marginalized neighborhoods, assisting residents in creating the tools necessary for self-driven revitalization. Key initiatives included forming community development corporations (CDC), establishing neighborhood association collectives, and offering various forms of technical assistance.[18]

However, by the 1980s and 1990s, many planners became disheartened by their inability to effect meaningful change in distressed neighborhoods. As a result, they shifted their focus to remaking the American downtown. One of their many goals was to repurpose commercial spaces—no longer needed with the emergence of suburban shopping malls—into apartments and condominiums. In short, planners aimed to recreate downtown neighborhoods characterized by a mix of shops, theaters, restaurants, and other amenities reminiscent of historic urban areas.[19]

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14. R. Isaacs, "The 'Neighborhood Unit' is an Instrument for Segregation," *Journal of Housing,* no. 5 (1948): 215-218.

15. J. Jacobs, *The Death and Life of Great American Cities* (New York: Random House, 1961).

16. S. Osman, *The Invention of Brownstone Brooklyn: Gentrification and the Search for Authenticity in Postwar New York* (New York: Oxford University Press, 2011).

17. H. Gillette, "The Evolution of Neighborhood Planning from the Progressive Era to the 1949 Housing Act," *Howard Journal of Urban History* 9, no. 4 (1983): 421-444.

18. P. Moskowitz, *How to Kill a City* (New York: Bold Type Books, 2015).

19. J. C. C. Teaford, *The Rough Road to Renaissance: Urban Revitalization in America*, (Maryland: John Hopkins University Press, 1990).

This renewed emphasis on the revitalization of downtown and its abutting neighborhoods contributed to a stagnation in the field of neighborhood planning throughout the 1980s, 1990s, and even into the twenty-first century within American urban planning practice. While many cities concentrated on stimulating downtown revitalization and enhancing gentrified inner-city neighborhoods through new sports arenas, light rail/rapid bus transit systems, and research campuses, they drastically reduced or even eliminated their neighborhood planning departments and programs. Although a subset of urban planners worked outside traditional municipal planning agencies with CDCs and other non-profit community organizations, the overall lack of sustained efforts to address the deterioration of most neighborhoods exacerbated the phenomenon of the "Divided City." As a result, many American cities evolved into two starkly contrasting urban realities: one marked by rich and thriving downtowns adorned with new skyscrapers and magnificent urban parks adjacent to up-and-coming residential areas, and the other poor and struggling plagued by increasing urban decay and abandonment.[20]

Over the last quarter-century, the neighborhood has begun to receive renewed attention as part of a broader effort to revitalized areas marked by urban decay. This shift stems from an increasing recognition that the devastation of the "Divided City" results not solely from the de-industrialization and other economic upheavals since the 1960s is also deeply rooted in systemic issues of structural racism. Urban planners have started to embrace the challenge of reclaiming all neighborhoods, including those that are highly distressed.[21] Recent scholarship underscores the importance of viewing neighborhoods as dynamic entities shaped by both social and physical factors. For instance, Emily Talen's research highlights the necessity of understanding the everyday experiences of residents and the significance of promoting walkable, mixed-use neighborhoods. This perspective aligns with the notion that vibrant neighborhoods are not merely clusters of buildings but rather vital environments that nurture social connections and community identity.[22]

While planners have long aknowledged the importance of community involvement in neighborhood planning, often paying lip service to this principle for over fifty years,[23] recent insights reveal that facilitating authentic engagement is far more complex than it may appear. On one hand, empowering residents to voice their opinions in neighborhood development decisions can lead to challenges, as vested interests may result in the rejection of necessary initiatives aimed at promoting equitable growth.[24] Past planning efforts are often leveraged to obstruct racially equitable development that

20. A. Mallach, *The Divided City: Poverty and Prosperity in Urban America* (Washington, DC: Island Press, 2018).

21. A. Brumfield, *Rethinking the ways cities can invest in vital neighborhoods* (American City County, May 13, 2021). Retrieved from: https://www.americancityandcounty.com/economy-finance /rethinking-the-ways-cities-can-invest-in-vital-neighborhoods. [Accessed December 2024].

22. E. Talen, *Neighborhood* (New York: Oxford University Press, 2019).

23. S. Arnstein, "A Ladder of Citizen Participation," *Journal of The American Institute of Planners* 35, no.4 (1969): 216-244.

24. J. Demsas, *The Truth of NIMBYs* (The Atlantic, January 7, 2025). Retrieved from: https://www. theatlantic.com/podcasts/archive/2025/01/why-people-are-nimbys/681225/. [Accessed December 2024].

could benefit the broader community.[25] Conversely, unfettered civic engagement may lead to displacement in these distressed neighborhoods, as gentrification efforts can emerge, pricing-out long-term residents.[26] Thus, neighborhood planners face the intricate task of balancing the needs of the most marginalized groups in the city, while simultaneously fostering economic growth.[27] This balance is crucial in shaping a future where all community members feel valued and included in the revitalization process. This is why the B.E.S.T. Approach places such a heavy emphasis on community engagement and creating an active role for the residents in the planning process.

The Role of the Elementary School in Neighborhood Planning

A pivotal component in achieving this balance in neighborhood stabilization is the neighborhood school, a concept first advocated by Clarence Perry. While Perry has often faced criticism for framing the relationship between schools and neighborhoods primarily in physical terms, his work reveals a keen interest in the social and economic potential schools hold within their communities in nurturing neighborhood life.[28] Unlike other tools for revitalization, the neighborhood school is inherently connected to the residents it serves.

As neighborhood planners increasingly recognized, schools can serve not only as educational institutions but also as vital centers for social services and community engagement. They can act as focal points around which neighborhood residents can gather, self-organize and collaborate, instilling a sense of community and belonging among families. In essence, the school can play a critical role in shaping neighborhood identity, thereby, transforming the even the most distressed areas into a community.

While Perry championed the school's potential in shaping neighborhood life, urban theorists and planners also began to expand this view in the early 1950s to encompass a broader, non-educational context. Influential thinkers like Nathan Glazer,[29] observed that schools were instrumental not only in integrating the education of Black and White students but also stabilizing neighborhoods experiencing racial transitions, particularly in the wake of landmark court cases such as, *Shelley v. Kramer*[30] and *Brown v. Board of Topeka,*[31] fostering integration and social cohesion amid changing demographics. Principally, they became venues for community engagement and involvement, allowing residents to collaborate on maintaining their neighborhoods' stability and safety. In this turbulent period, the local elementary school acted as a bridge between differing racial and cultural groups, facilitating dialogue and understanding.

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25. R. Dubicki, *Neighborhood Plans are High Minded Gatekeeping*, (The Urbanist, February 25, 2022). Retrieved from: https://www.theurbanist.org/2022/02/25/neighborhood-plans-are-high-minded-gatekeeping/. [Accessed December 2024].

26. T. Grevstad-Nordbrock and I. Vojnovic, "Heritage-fueled Gentrification: A Cautionary Tale from Chicago," *Journal of Cultural Heritage* 38 (2019): 261-270.

27. R. Silverman, H. Taylor Jr., and C. Crawford, "The role of citizen participation and action research principles in Main Street revitalization," *Action Research* 6 no.1, (2019): 69-91.

28. H. Gillette, "The Evolution of Neighborhood Planning from the Progressive Era to the 1949 Housing Act," *Howard Journal of Urban History* 9, no. 4 (1983): 421-444.

29. N. Glazer, "The School as an Instrument in Planning," *Journal of the American Institute of Planners* 25, no. 4 (1959): 191-199.

30. *Shelley v. Kraemer*, 334 U.S. 1 (1948).

31. *Brown v. Board of Education of Topeka*, 347 U.S. 483 (1954).

As the Urban Crisis intensified in the 1960s and 1970s, educators across the United States sought to address the multifaceted challenges faced by the families of their students. This led to the emergence of the Community School movement, beginning in 1970s and 1980s, which expanded the role of institutions to serve as a community hubs, providing various medical and social services. By opening their doors in this manner, schools had the potential to become catalysts for positive change, strengthening the social fabric of their neighborhoods and facilitating a more comprehensive approach to community revitalization. In summary, the role of the elementary school extended far beyond education; it became integral to the health and vitality of neighborhoods, serving as a cornerstone for community engagement, social support, and identity formation, ultimately, fostering resilient and thriving communities.[32]

Despite the declining enrollment in public schools and shrinking budgets that prompted many major city school districts to reduce or eliminate community schools in the 1990s and early 2000s, neighborhood planners began envisioning the neighborhood school as a foundation for revitalization in severely distressed areas. Leading this transformative approach was the firm of McCormick, Baron, and Salazar. As Moore and Glassman[33] of Urban Strategies, the firm non-profit affiliate, have argued, schools play a pivotal role in attracting families to neighborhoods, which in turns stimulates residential investment and economic growth. For them, their work with the HOPE VI program nationwide illustrates how residents and other stakeholders in struggling communities have started to see schools are more than just educational institutions; they now recognize their potential as catalysts for spearheading local revitalization. In their minds, by investing in school infrastructure and programming, neighborhoods position themselves for broader economic advancement, ultimately enhancing property values and strengthening community stability.

Alongside this development, a new planning strategy known as School-Oriented Development (SOD) has emerged, aimed at linking the neighborhood school with community revitalization efforts. This innovative strategy focuses on fostering neighborhood growth that aligns not only with educational needs and infrastructure of local schools but also on creating walkable, vibrant communities. In this framework, schools serve as stimulants for informed planning and development decisions. By integrating educational facilities into the broader vision of neighborhood design, planners can ensure that schools remain central to community dynamics, fostering environments conducive to both learning and living (Figure 3).[34] Consequently, the neighborhood school provides the optimal venue for the implementation of the B.E.S.T. Approach.

32. J. Quinn and M. Blank, "Twenty Years, Ten Lessons: Community Schools as an Equitable School Improvement Strategy," *Voices in Urban Education* 49, no. 2 (2020): 44-53.

33. S. Moore and S. Glassman, *The Neighborhood and Its School in Community Revitalization: Tools for Developers of Mixed-Income Housing Communities* (St. Louis: Urban Strategies Inc., 2007).

34. C. Reid, "School-Oriented Development: A New Paradigm for Neighborhood Planning" (Tempe: Master Thesis, Arizona State University, 2011).

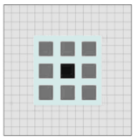
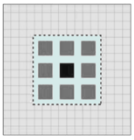
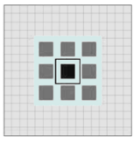
	NEIGHBORHOOD CENTER	FAMILY SCHOOL	CULTURAL HUB
Description	 Community uses are integrated on the school site, so that the school serves community interests while additional facilities augment the services that the school can provide to students. Serves as, or contributes to, the central civic space for a community.	 Includes uses on site that cater to the students as well as their families, providing before and after school options for students, their siblings, and parents. Has support services for families only, and is not open to the general public.	 Partnerships with nearby cultural facilities like museums and theaters provide active learning experiences which are built into students' curriculum. Can be based on co-location with one institution or proximity to several institutions
Community-School Relationship	• two-way • unrestricted	• two-way • restricted	• one-way • unrestricted
Characteristics	• provides the basis for a complete community • is the most inclusive SOD type, in terms of catering to the full range of community stakeholders • can be adapted to large or small scales • co-located uses must be sensitive to age of students that attend the school	• can supplement social services for underserved populations including low-income and immigrant families • exclusivity can benefit high-crime or high-intensity urban areas by providing a safe haven for children and families • may be most appropriate for elementary and middle schools, since younger students are more dependent on parental involvement	• will tend to locate in city centers where cultural institutions cluster • can serve as opportunity for magnet school that focuses on arts or sciences particularly (depending on institutional partnerships) • may be most appropriate for smaller scale if curriculum is specialized
Private Frontages	Front Plaza Front Steps Overhang Entrance	Vestibule Private Courtyard	Front Steps Overhang Entrance
Outdoor Space Elements	Outdoor Classroom Community Garden	Outdoor Classroom Student Learning Garden	Outdoor Classroom Student Learning Garden
Examples	Inderkum High School (Sacramento, CA) City Heights K-16 Educational Collaborative (San Diego, CA) Neptune Community School (Neptune, NJ)	Tenderloin Community School (San Francisco, CA) PS 5, The Ellen Lurie School (New York, NY)	Moore Square Museums Magnet Middle School (Raleigh, NC) School of Environmental Studies (Minneapolis, MN) Henry Ford Academy (Dearborn, MI)

Figure 3. *Types of School Oriented Development, Reid 2011*

Application of Wraparound Theory at the Neighborhood Level

The neighborhood school serves not only as the ideal cornerstone for the implementation of the B.E.S.T. Approach but also plays a vital role in defining its theoretical framework. Educators and social workers alike have long recognized that interventions targeting specific issues, such as academic deficiencies or substance abuse, must be approached in a holistic manner. For example, students facing academic challenges frequently contend with underlying family issues. When a family grapples with economic, social, or medical obstacles, students are less likely to overcome their educational struggles without addressing these interconnected problems.

This comprehensive method of tackling challenges is commonly referred to as "Wraparound Theory" (WT) (Figure 4). According to the National Wraparound Initiative, WT is a comprehensive approach designed to support individuals and families through community-based services. By integrating various support systems and recognizing the multifaceted nature of student needs, WT emphasizes the importance of a coordinated response that nurtures both the individual and their broader community context.[35] The B.E.S.T. Approach aims to apply WT at the neighborhood level.

35. T. Donnelly, K. Coviello, K. Estep, and J. Walker, *The Wraparound Process User's Guide: A Handbook for Families* (Portland: National Wraparound State Initiative Portland State University, 2024).

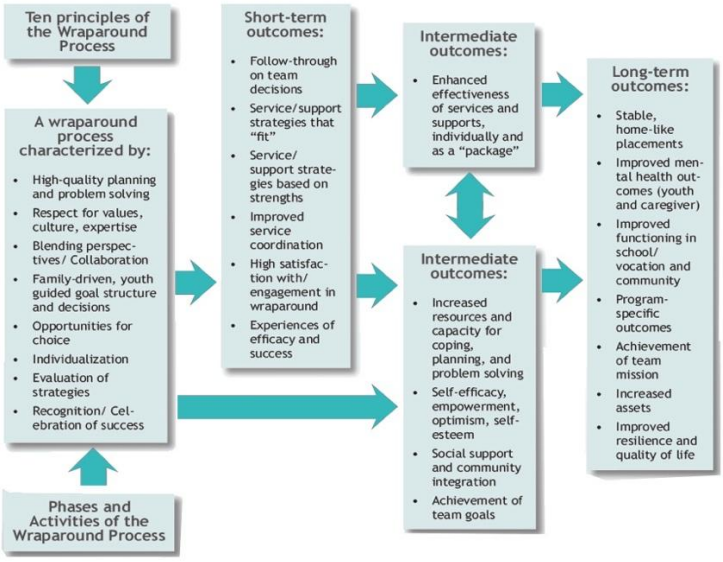


Figure 4. *A Theory of Change for Wraparound: Overview, Walker 2008*

A significant aspect of WT as a theoretical framework for neighborhood planning, particularly in highly at-risk communities, is that it is based on foundational principles familiar to contemporary urban planners. Like most urban planning practices, WT assumes that intervention occurs in loops or stages. One must complete the prerequisites steps before moving forward with subsequent phases of a plan. This iterative methodology allows for ongoing assessment and refinement of strategies. But more importantly, as with any planning endeavor, a plan grounded in WT starts with a thorough assessment of all of the factors impacting the problem at hand. Consequently, a neighborhood plan informed by WT begins with a comprehensive evaluation of the multifaceted community challenges.

Additionally, like most urban planning practices, WT-based neighborhood planning processes are data-driven. In this case, the evidence-based decision-making ensures that neighborhood initiatives align with community priorities and effectively address them. Finally, neighborhood planning shaped by WT is inherently community-driven. As with any planning project, stakeholder engagement is essential. Only through active community participation in both the planning and implementation phases of the plan will a sense of ownership and accountability toward the intervention be achieved.[36] Therefore, the B.E.S.T. Approach embodies a collaborative partnership between neighborhood planners and community stakeholders. The core assumption is that through collaboration and a commitment to holistic solutions, even the most challenging neighborhoods can experience transformative growth, paving the way for a brighter future (Figure 5).

36. Ibid.

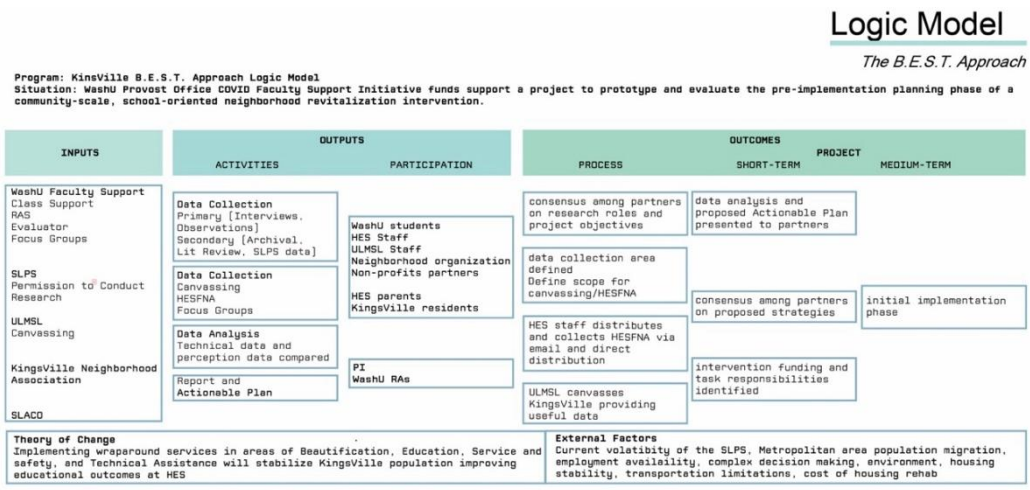


Figure 5. *External Evaluator Logic Model, Tranel 2025*

Methodology

Given that the B.E.S.T. Approach centers around an existing school where real-time interventions were attempted amid complex social and political dynamics, the pilot required a flexible assessment methodology where data was collected in phases as the pilot unfolded. This flexibility was essential to accommodate the concurrent planning and implementation stages, as well as their respective feedback loops. Therefore, the PI and KBC agreed to test the B.E.S.T. Approach through a mixed-methods, phased case-study design aligned with the B.E.S.T. logic model and WT postulates.

The four postulates of WT shaped the phasing and structure of the project (Figure 6). Hence, the data collection process, the actions undertaken, and those proposed to address the four targeted domains occurred in loops that were comprehensive in scope as additional needs of the stakeholders were identified through primary and secondary sources.

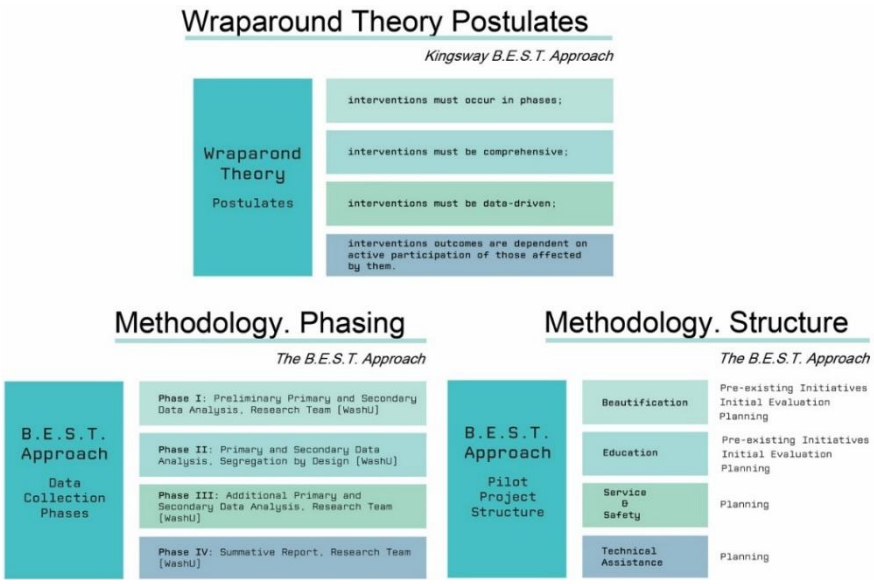


Figure 6. *Wraparound Theory Application in the B.E.S.T. Approach, Freixas 2025*

Assuming that enhancing livability is the first priority of a highly distressed neighborhood, KBC initiated actions to beautify the area, strengthen the local school, address the residents' safety and service needs, and provide essential professional or technical assistance for measuring the pilot's success.

As the project progressed, KBC collected data on current conditions and established metrics for actions underway. In the planning phase, KBC developed alternative action sets, defined criteria for short-term and long-term success, and identified potential partnerships and programs to support these initiatives.

Data Collection Phases

The data for the B.E.S.T. Approach was gathered in four different phases (Figure 7).

Time Period	Description	Key Activities	**Outcomes**
Phase I			
Summer 2022	Preliminary Primary and Secondary Data Analysis: PI (WashU) - Involved a funded research proposal	- Conducted systematic observations of physical conditions. - Collected archival demographic data. - Initiated conversations with neighborhood groups and stakeholders.	Baseline neighborhood conditions and community profile established.
Phase II			
Fall 2022	Primary and Secondary Data Analysis: Segregation by Design (SBD, WashU)	- Conducted historical analysis and additional field observations. - Collected secondary archival data.	A course book which synthetized background findings and mitigation

Time Period	Description	Key Activities	**Outcomes**
	- Involved research from the seminar SBD offered by the WashU architecture program.	- Performed 2 rapid literature reviews. - Created informative maps. - Undertook a Sidewalk Survey with HES 5th-graders. - Led semi structured stakeholder interviews. - Analyzed historical/current policies. - Developed graphics for various indicators.	recommenda-tions was produced.
Phase III			
Fall 2022 - 2023	Additional Primary and Secondary Data Analysis: PI (WashU). - Involved external evaluator assistance in developing an assessment for scalability.	- Engaged external evaluator in developing the theory of change. - Continued baseline data analysis. - Performed additional data collection on the 4 domains of B.E.S.T. - Conducted door-to-door canvassing and focus groups. - Petitioned SLPS for data retrieval. - Designed the HESFNA survey.	Student course book was refined and expanded by WashU faculty.
Phase IV			
2024	Implementation Strategy: PI (WashU). - Involved the evaluation of data analysis and the creation of an action plan.	- Summarized data analysis. - Proposed potential implementation tactics. - Disseminated Summative Report among KBC partners. - Developed an evaluation plan to assess the potential for project scalability.	Summative Report to be used by partners as a roadmap for implementing the B.E.S.T. Approach.

Figure 7. *Data Collection Phases, Freixas 2025*

Pilot Project Structure

The pilot project was organized around the four targeted domains shaped by the B.E.S.T. Approach: Beautification, Education, Safety & Services, and Technical Assistance. The specific actionable strategies were prioritized based on ongoing initiatives and community concerns (Figure 8).

On-going Community Initiatives	Initial Annual Target Measures	Planning Tactics
Beautification		
- Improving LRA properties through the Prop NS program. - Recommending the demolition of derelict properties beyond repair. - Promoting home-improvement through available home-repair programs. - Lobbying for city services. - Beautifying streetscapes through community cleanup events. - Enhancing local community gardens and streetscape.	- Nomination and approval of 5 properties for stabilization. - Demolition of 5 derelict properties. - Submission of 20 Citizen's Service Bureau (CSB) requests. - Allocation of home improvement funding to 10 properties. - Organization of 2 community cleanup campaigns. - Establishment of 1 new community garden. - Planting 10 trees on HES premises.	- Conducting a thorough survey of KV buildings. - Creating a prioritized list of properties recommended for demolition. - Compiling a repository of available home improvement programs. - Engaging the NIS in advocating for essential city services. - Expanding beautification efforts to cover additional community cleanups and maintenance of vacant lots. - Developing an urban agriculture program to promote local food production.
Education		
- Improving school attendance. - Providing student academic support. - Fostering a dialogue with HES administration.	- Attainment of SLPS district goal of 90% daily attendance by 90% of students - Median achievement on basic state standardized tests. - Monthly meetings with HES principal.	- Addressing the state-mandated transportation gap for students within 1-mile radius of the neighborhood school. - Conducting a comprehensive Assessment of the educational quality at HES. - Recruiting college students for mentoring/tutoring before and after school. - Establishing a MOU between KBC and HES, SLPS, and other partners. - Securing SLPS approval for conducting research using confidential data. - Enhancing student literacy by expanding the HES

On-going Community Initiatives	Initial Annual Target Measures	Planning Tactics
		library collection to feature works by non-white authors and characters. - Installing a Little Library on HES premises to promote community literacy. - Improving cradle-to-career outcomes by identifying regional resources to better prepare pre-K students for elementary school and beyond. - Enhancing parental perception of HES. - Formalizing a community partnership agreement with SLPS.
Safety and Services		
None.	None.	- Conducting an initial assessment of community conditions and needs through canvassing, /HEFNA, stakeholder interviews, and focus groups - Implementing a walkability strategy that encompasses street calming measures and necessary infrastructure improvements. - Developing a crime prevention program in collaboration with SLMPD to online effective crime prevention strategies. - Identifying potential nonprofit service providers to support these efforts.
Technical Assistance		
Participation of the neighborhood organization in the SLACO Advocacy Committee, which was in the process of developing an intervention strategy for neighborhoods like KV.	None.	- Providing training to the local neighborhood organization to build capacity (board development, membership recruitment, best practices, grant writing, fundraising). - Creating a neighborhood strategic plan (community assets/resources, challenges,

On-going Community Initiatives	Initial Annual Target Measures	Planning Tactics
		goals/objectives, partners, success measures). - Forming partnerships with local educational institutions, nonprofits, governmental agencies, private firms for professional expertise (legal, medical, design, accounting).

Figure 8. *Pilot Project Structure, Freixas 2025*

Evaluation Methodology

The Principal Investigator attempted to assess the effectiveness of the B.E.S.T. Approach by measuring short- to mid-term outcomes across the four B.E.S.T. domains. Data streams included SLPS and St. Louis City records, field systematic observations, structured surveys (HESFNA), semi-structured interviews/focus groups, and external evaluator review. Phases I–IV provided baseline and follow-up measurement points (Figure 9).

Time Period	Key Indicators	Primary Data Sources
Beautification		
Baseline (Phase I–II); Follow-up (Phase III–IV); Monitoring (Ongoing).	Prop NS nominations; demolitions; CSB requests; home-repair completions; community cleanups; community gardens; tree canopy projects**.**	Prop NS, city permit records, LRA/ULSTL reports, CSB data, SLACO program logs, Forest ReLeaf reports, field observations, HESFNA.
Education		
Baseline (Phase II); Follow-up (Phase III–IV); Monitoring (Ongoing).	Enrollment; daily attendance (90-by-90 target); STAR growth; state test cohort change; after-school participation; library holdings; parental satisfaction; change in SLPS transportation policy; community partnerships formed.	SLPS aggregated administrative data (demographics, STAR benchmarks), program rosters, MOUs, HESFNA.
Safety & Services		
Baseline (Phase IV); Follow-up (Ongoing).	Crime counts/hotspots; traffic accidents; Neighborhood Watch events; city service requests/responses; service providers identified.	SLMPD neighborhood statistics, City service request logs, KBC event records, surveys, observations, HESFNA.
Technical Assistance		

Time Period	Key Indicators	Primary Data Sources
Baseline (Phase I–II); follow-up (Phase III–IV); Monitoring (Ongoing).	Trainings delivered; grants secured; MOUs signed; organizational capacity assessment results.	SLACO records, training logs, organizational self-assessments, MOUs, grant award notices, SBD course book, SBD research book, Summative Report, HESFNA.

Figure 9. *Pilot Project Evaluation Overview, Freixas 2025*

External Evaluator Framework

This pilot involved repeated measures and multiple data streams. The pilot analyzed four spatial scales: KV target area, HES service area, Kingsway East & Greater Ville neighborhoods, and the City of St. Louis. The external evaluator recommended adding matched comparison neighborhoods or pre- and post-longitudinal baselines for scalability testing. To date, formal control neighborhoods have not been identified.

In addition, the external evaluator suggested using an alternative measure of community needs since the door-to-door canvassing was suspended. The collection of neighborhood wide primary data remains a challenge. Other data gaps include full SLPS confidential student records beyond aggregated STAR/demographics,

Ethics, Approvals, and Data Governance

The research project underwent WashU's Institutional Review Board (IRB) process and subsequently received grant approval. Additionally, for work conducted at the HES, the study adhered to St. Louis Public Schools' (SLPS) "Requirements to Conduct Research to Obtain Confidential Data." All activities conducted at the school involving students and families complied with SLPS protocols, and no additional consent was required.

Results

While it is still too early to discern definitive progress with regards to reducing vacancy and population loss, the impact of the B.E.S.T. Approach on neighborhood livability is evident. The cleanliness of alleys has improved, and vacant lots are now regularly maintained. Landscape improvements have been designed. The after-school program has seen a significant expansion, Community safety and service needs have been identified and prioritized. New partnerships have been established. Programs have been identified. Grant proposals have been submitted. In summary, KBC has completed the preliminary work for an action plan, establishing a clear pathway toward sustainable stabilization with outlined next steps and measurable outcomes.

Below see findings from the initial assessment of the initiatives in place as well as those determined at the planning phase (Figure 10).

Goal	Initial Objective (annually) (before Fall 2021)	Revised Objective (annually) (Fall 2021-Fall 2024)	Outcomes
Beautification			
Stabilization of abandoned properties	Nominate and approve 5 properties for stabilization	Nominate and approve 5 properties for stabilization	- KBC nominated 18 properties for funding under Prop NS. While not all nominated properties have received funding, ten have been recommended for it.[37] - Cote Brilliante Presbyterian Church, through its Housing Corp., secured $700K for rental unit rehabilitation in Kingsway East.[38]
Demolition of unsalvageable properties	Demolish 5 recommended properties to the city	Demolish 5 recommended properties to the city	- Out of the 3,353 permits from 2019 to 2024, 395 were in the Greater Ville or Kingsway East, accounting for over 10% of the total citywide permits.[39] - ULSTL was responsible for 7 more demolitions in Kingsway East as part of its Operation Clean Sweep campaign.[40]
Renovation of low-income units	Receive funding to renovate 10 properties	Receive funding to renovate 10 properties	SLACO made 25-30 yearly referrals for home improvement renovations to various local programs.[41]
Improve-ment of Citizen Service	Submit 20 community service bureau complaints	Submit 20 community service	The two NISs assigned to KV submitted 168 requests for City services between 2019-2023.[42]

37. City of St. Louis, *Prop NS Program* (City of St Louis, 2023). Retrieved from: https://www.stlouis-mo.gov/government/departments/sldc/real-estate/prop-ns/index.cfm. [Accessed December 2024].

38. City of St. Louis, *City of St. Louis Community Development Administration Housing Production Awards* (City of St. Louis, 2023). Retrieved from: https://www.stlouis-mo.gov/government/departments/community-development/documents/upload/CDA-NTG-HUD-HP-NOFA-2023-Funding-Awards-w-Map.pdf. [Accessed December 2024].

39. City of St. Louis, *Demolition Permits by Neighborhood* (City of St. Louis, n.d.). Retrieved from: https://www.stlouis-mo.gov/data/dashboards/demolition-permits/neighborhoods.cfm. [Accessed December 2024].

40. J. O'Dea, '*Rebuilding a city:' Demolition activity up one year after Krewson outlined vacancy plan*, (St. Louis Dispatch, July 8, 2023). Retrieved from: https://www.stltoday.com/news/local/metro/rebuilding-a-city-demolition-activity-in-st-louis-up-one/article_52a99fa3-bba5-5c19-9b79-17e7b1e73cd6.html. [Accessed December 2024].

41. K. McKinney, phone call with the Executive Director, SLACO on December 18th, 2023.

42. B. Potts, email message for NIS for The Ville and the Greater Ville, regarding city services in KingsVille, on December 19th, 2023.

Goal	Initial Objective (annually) (before Fall 2021)	Revised Objective (annually) (Fall 2021-Fall 2024)	Outcomes
Bureau (CSB) response rate		complaints by NISs	
Enhancement of neighbor-hood alleys and vacant lots	Complete 2 community cleanup campaigns	Complete 2 community cleanup campaigns and undertake maintenance of vacant lots	- SLACO undertook two neighborhood-wide cleanup campaigns as part of its initial Keeping It Clean (KIC) program. - SLACO received a Neighborhood Transformation grant from the Community Development Administration (CDA) to expand its Keeping It Clean (KIC) program by including mowing services.[43] - ULSTL, through its Operation Clean Sweep program, conducted a cleanup/build-up campaign in Kingsway East that covered 10 miles of alleyways and involved around 200 volunteers.
Repurpose of vacant lots	Establish 1 community garden	Transform the 2 existing community gardens into an urban agriculture system	- Rev. Crumpton has expanded the Cote Brilliante Community Garden thanks to volunteer work. - Rev. Crumpton contacted Lincoln University to support urban farming in KV.
Increase tree canopy		Implement tree lawn and canopy improve-ments around HES and along St. Louis Ave.	Project ReLeaf and Resource Environmental Solutions[44] is in the process of forging an agreement with MSD to begin street improvement project.
Education			
Improvement of school attendance	Meet district objective of 90 by 90 school attendance goal	Expand school transportation to students living within 1 mi. of the	- HES was unable to maintain improved attendance rates. - KBC failed to organize a walking school bus due to the Family

43. City of St. Louis, *Neighborhood Transformation Grant Awards* (City of St. Louis, 2023). Retrieved from: https://www.stlouis-mo.gov/government/departments/communitydevelopment/documents/upload/CDA-NTG-HUD-HP-NOFA-2023-Funding-Awards-w-Map.pdf. [Accessed December 2024].

44. City of St. Louis, *Street Trees Inventory* (City of St. Louis, 2023). Retrieved from: https://www.stlouis-mo.gov/government/departments/parks/forestry/trees/tree-inventory.cfm. [Accessed 2024 December].

Goal	Initial Objective (annually) (before Fall 2021)	Revised Objective (annually) (Fall 2021-Fall 2024)	Outcomes
		neighborhood school	Educational Rights and Privacy Act (FERPA). - KBC identified exemption to the state-mandated exclusion of transportation boundary. - KBC was unable to persuade SLPS to follow up.
Enhancement of HES's curriculum	Improved test scores	Enhance parental and community perception of HES	- HES increased enrollment by almost 50% over the last 5 years (2018-2024). - KBC recruited college students to assist in the after school. - HES increased enrollment in the after-school program. - HES students achieved a marked improvement in state scores from year to year during the pilot. - Parental satisfaction with HES showed 86% approval on the HESFNA survey.
Solidification of partnership with HES administration	Monthly meetings with HES principal	Formal agreement between KBC and HES/SLPS	- KBC signs an initial MOU with SLPS. - WashU receives approval from SLPS to conduct research with confidential data. - SLACO is recognized as a community partner by SLPS, authorizing it to implement a B.E.S.T. Approach pilot project.
Strengthening of student literacy		Expand and enhance HES library holdings	A local private school donated 800 books to the library, predominantly featuring non-white authors and characters.
Enrichment of community literacy		Provide additional literacy opportuni-ties in the community	KBC installed 2 "Little Libraries" in KV.
Improvement of cradle-to-career outcomes		Identify regional resources to better prepare pre-K students for elementary	- KBC partnered with Trailnet to organize a Ruby Bridges Walk to School Day. - KBC partnered with Forest ReLeaf STEM-focused activity.

Goal	Initial Objective (annually) (before Fall 2021)	Revised Objective (annually) (Fall 2021-Fall 2024)	Outcomes
		school and beyond	- KBC produced a Summative Report identifying potential partnerships and programs for implementing recommended action items.
Safety and Services			
Improvement of pedestrian safety		Assess walking conditions through a sidewalk survey	- WashU produced a walkability strategy by recommending street calming measures. - Installation of additional stop signs and speed humps in proximity to HES and Cote Brilliante Presbyterian Church was a direct outcome of these recommendations.
Reduction of neighborhood crime rate		Analyze SLMPD neighborhood crime statistics to identify crime trends in hotspots	- KBC partnered with SLMPD and local Criminal Justice programs to develop crime prevention strategies.[45] - KBC launched a Neighborhood Safety Program. - KBC organized National Night Out in both 2022 and 2023. - KBC organized a Neighborhood Watch initiative through the Nextdoor app. - KBC facilitated the installation of security cameras at Cote Brilliante Presbyterian Church and selected properties in the neighborhood. - Cote Brilliante Presbyterian Church has implemented a youth self-efficacy program that includes activities to promote youth crime prevention.
Identification and delivery of needed services		Survey residents to evaluate community needs	- KBC performed an extensive needs assessment through canvassing, HESFNA, key stakeholder interviews, and focus groups. - WashU produced a Summative Report prioritizing community needs and identifying activities, community partners, and resources.

45. St. Louis Metropolitan Police Department, *SLMPD 2024 Homicide Analysis* (SLMD, 2024). Retrieved from: https://slmpd.org/wp-content/uploads/2024/12/HomicideStatsforWebsite.pdf. [Accessed December 2024].

Goal	Initial Objective (annually) (before Fall 2021)	Revised Objective (annually) (Fall 2021-Fall 2024)	Outcomes
			- KBC is engaging with local Master of Social Work (MSW) programs to recruit practicum students to assist the HES social worker manage cases within the KV community.
Technical Assistance			
Development of organizational capacity		Assess skill sets of local community organizations to determine gaps in professional expertise	- SLACO offered organization training (board development, membership recruitment, organizational best practices, and grant writing and fundraising) to local community organizations. - SLACO received several grants to support various neighborhood initiatives, during the pilot phase of the project, including monies to expand KIC into KV. - Cote Brilliante Presbyterian Church was awarded a grant of $700K for rental unit rehabilitation in Kingsway East.[46] - WashU architecture students and faculty worked on a planning framework for KV which included recommendations for vacant lot improvements and climate change initiatives. - WashU faculty generated a Summative Report on current conditions, potential resources, and as well as presenting a framework for an action plan.

Figure 10. *Assessment Summary, Freixas 2025*

Disscusion

In today's rapidly evolving society, the potential role of educational institutions extends far beyond the classroom. The B.E.S.T. Approach aligns with other place-based, cradle-to-career and community-school models that position schools as anchors for neighborhood revitalization. Lessons from Promise Neighborhoods indicate that

46. City of St. Louis, *City of St. Louis Community Development Administration Housing Production Awards.*

integrated, cross-sector partnerships and coordinated cradle-to-career supports can produce measurable gains when coupled with rigorous implementation and evaluation plans.[47,48] The Community School and Full-Service Community School (FSCS) literature similarly demonstrates how schools acting as hubs for health, social services, and extended-learning opportunities can support student outcomes and community well-being when sustained partnerships and resources are present.[49,50,51] Systematic reviews and syntheses underscore that community schools are a promising equitable school-improvement strategy, but effects are contingent on fidelity, resourcing, and the stability of partnerships.[52,53]

To strengthen the manuscript's analytic claims, we mapped observed outputs and outcomes to the project logic model and to the core WT postulates.

Domains	**WT Postulate(s) Supported**				**Outputs (Activities)**	**Outcomes**
	1	**2**	**3**	**4**		
Beautification	X	X	X	X	Participate in the Prop NS program Lobby the city to demolish unsalvageable properties Implement a property rehabilitation program. Submit Citizen Service Bureau (CSB) complaints/petitions Organize neighborhood clean-up campaigns Maintain and repurpose vacant lots Participate in the Forest	- Enhanced physical appearance of neighborhood - Improved livability - Increased tree canopy - Improved resident satisfaction - Increased safety - Reduced vacancy and population loss

47. P. Tatian, "Evaluating Programs and Impact within Promise Neighborhoods: A Guide to Planning Successful Evaluations" (December 2020) Urban Institute. https://www.urban.org/sites/default/files/publication/103418/evaluating-programs-and-impact-within-promise-neighborhoods_0.pdf

48. M. Gallagher, "Keeping a Promise: Case Studies and Annotated Resources for Promise Neighborhoods Sustainability" (April 2024) Insight Policy Research. U.S. Department of Education. https://promiseneighborhoods.ed.gov/pdf/SustainabilityBriefKeeping-a-Promise-Revised-April2024.pdf

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Domains	WT Postulate(s) Supported 1	2	3	4	Outputs (Activities)	Outcomes
					ReLeaf program	
Education	X	X	X	X	Design initiatives to improve school attendance Enlarge HES after school program Create new STEM programs for HES's curriculum Solidify partnership between KBC and HES/SLPS Augment HES's library holdings Create a Little Library program in KV Initiate programs to enhance cradle-to-career outcomes Enlarge HES's role in the community	- Increased retention/ measured attendance - Increased test scores/ literacy - Increased after school participation - Enhanced library usage - Enhanced family /school relations - Improved cradle-to-career outcomes - Increased use of the school as a community anchor
Safety and Services	X	X	X	X	Design and implement traffic calming measures Partner with SLMPD and local Criminal Justice programs to develop crime prevention strategies Participate in the National Night Out program Organize a Neighborhood Watch initiative Install security cameras Survey residents to evaluate community needs Identify potential service providers Recruit MSW practicum student(s)	- Increased resident perception of safety - Improved livability - Enhanced understanding of resident service needs - Identified potential service resources and providers
Technical Assistance	X	X	X	X	Offer organizational board training and capacity building assistance	- Developed neighborhood organizational capacity

Domains	WT Postulate(s) Supported 1	2	3	4	Outputs (Activities)	Outcomes
					Provide grant writing and fundraising support	- Secured grant funding - Provided planning framework - Created Summative Report
					Extend design and planning assistance	
					Extend research technical support	

Figure 11. *Pilot Outputs, Outcomes and WT Postulates, Freixas 2025*

What the B.E.S.T. Approach adds to this body of work dealing with community or neighborhood schools is the assumption that through the applicatioon of WT at the neighborhood level, the school can be instrumental in stabilizing highly distressed neighborhoods. Unlike most contemporary planning theory, the B.E.S.T. Approach is predicated on the belief that distressed neighborhoods need to be rebuilt from the ground up in incremental stages. Once they made the community slightly more attractive and livable through beautification efforts, KBC recognized that the next step was to tackle the academic and social challenges faced not only by the students and their families but the community at large. In short, they understood that their goal was to apply WT at the neighborhood level. Ultimately, KBC confirmed that HES would not only serve as the conduit for addressing the needs of students and families but also to act as the catalyst for long-term community redevelopment.[54]

Community research occurs in real time and in the real world, where variables can never be completely controlled or anticipated. The work was impacted by various challenges that KV and HES faced, including community violence and municipal upheavals. A significant obstacle in terms of research was the collection of primary data. Initially, the ULSTL committed to conducting a door-to-door canvassing of the pilot area. However, after several incidents, the ULSTL had to reassess its commitment and ultimately discontinued the initiative. Moreover, before the planned issuance of the inaugural HESFNA survey, a shooting occurred in close proximity to the school. Consequently, the PI believed that launching the survey would skew the results. Thus, the PI shifted the distribution of HESFNA from the end of the 2022-2023 to the beginning of the 2023-2024 academic year. As a result, the PI was unable to collect adequate baseline data to identify the needs of the entire community, not just those involving HES parents and students.

Additionally, the school and SLPS both experienced significant administrative changes. At the school, Principal Dr. Michael Blair, a strong advocate for the initiative, transitioned to a new role within the district in the spring of 2024. The new principal, Dr. Cynthia Williams-Peters, while supportive of the project, faced constraints in assuming her new position due to instability within SLPS. When KBC was formed, the superintendent at the time,

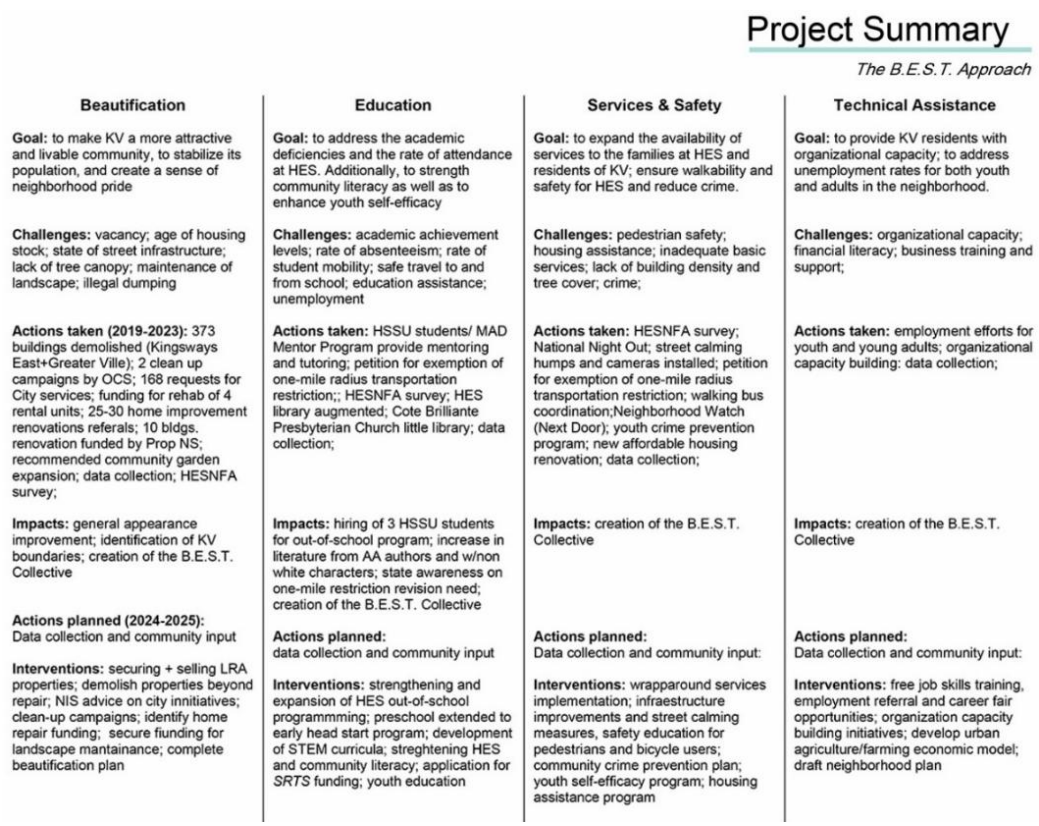
54. Reid, "School-Oriented Development."

Dr. Kelvin Adams, was a proponent of the collective and pushed through an agreement with the SLPS Board that recognized the district's commitment to the project. Although Dr. Keisha Scarlet, the incoming superintendent, did not actively oppose this agreement after Dr. Adams retired, it was not a major priority for her administration. But after Dr. Scarlet was terminated, Dr. Millicent Borishade was appointed her replacement and mandated that all existing research and community partnership agreements be renegotiated. While KBC successfully resumed collaboration with SLPS, HES participation has been adversely affected by the principal's lack of autonomy to act decisively and promptly on KBC initiatives.

Another challenge that KBC encountered was inadequate community involvement. Although the fledging neighborhood association had a strong board of directors, it struggled to build membership and establish a robust community presence. Similarly, even though Dr. Williams-Peters was an enthusiastic supportive of an active Parent/ Teacher Organization (PTO), she faced administrative hurdles in creating one. Consequently, KBC did not achieve the level of community engagement it had envisioned.

Despite these daunting challenges, preliminary results from KBC's pilot study suggest that the B.E.S.T. Approach has begun to slow the neighborhood's decline. KBC's efforts have reduced the rate of new vacancies and population loss. While the area still suffers from abundant vacant lots and boarded-up buildings, KBC's beautification initiatives have significantly improved the neighborhood's physical conditions and appearance. Although HES test scores remain unacceptable, tracking student cohorts reveals considerable academic improvement among HES students during the pilot period. While KV is still not a safe place, KBC has started formulating initiatives to enhance walkability and reduce crime. Additionally, KBC has identified and prioritized the residents' needs. Notwithstanding the inability to build the organizational capacity of the primary neighborhood association, KBC has provided considerable community support through professional assistance.

Regarding next steps, KBC's primary objective is to foster a stronger sense of community and place. To achieve this, KBC plans to focus on forming an active PTO at HES. KBC's second objective is to gain a comprehensive understanding of resident needs through the collection of additional primary data and the adoption of evaluation designs appropiate for place-based initiatives—such as matched comparison cohorts, stepped-wedge/phased rollouts, and longitudinal community tracking—to better isolate program effects and assess scalability. Once that is obtained, KBC will be better equipped to identify and prioritize potential service providers and necessary resources. A third objective for KBC is to implement initiatives identified in the action plan for each of the four B.E.S.T. Approach domains. By focusing on these key areas, KBC will prioritize projects that enhance the physical environment, improve educational outcomes, provide needed services, ensure the safety of residents, and provide technical assistance to empower individuals and local organizations. Through this holistic approach, KBC aims to create a more livable, safe, and supportive community for all residents in KV (Figure 12).



Project Summary

The B.E.S.T. Approach

Beautification	Education	Services & Safety	Technical Assistance
Goal: to make KV a more attractive and livable community, to stabilize its population, and create a sense of neighborhood pride	**Goal:** to address the academic deficiencies and the rate of attendance at HES. Additionally, to strength community literacy as well as to enhance youth self-efficacy	**Goal:** to expand the availability of services to the families at HES and residents of KV; ensure walkability and safety for HES and reduce crime.	**Goal:** to provide KV residents with organizational capacity; to address unemployment rates for both youth and adults in the neighborhood.
Challenges: vacancy; age of housing stock; state of street infrastructure; lack of tree canopy; maintenance of landscape; illegal dumping	**Challenges:** academic achievement levels; rate of absenteeism; rate of student mobility; safe travel to and from school; education assistance; unemployment	**Challenges:** pedestrian safety; housing assistance; inadequate basic services; lack of building density and tree cover; crime;	**Challenges:** organizational capacity; financial literacy; business training and support;
Actions taken (2019-2023): 373 buildings demolished (Kingsways East+Greater Ville); 2 clean up campaigns by OCS; 168 requests for City services; funding for rehab of 4 rental units; 25-30 home improvement renovations referals; 10 bldgs. renovation funded by Prop NS; recommended community garden expansion; data collection; HESNFA survey;	**Actions taken:** HSSU students/ MAD Mentor Program provide mentoring and tutoring; petition for exemption of one-mile radius transportation restriction;; HESNFA survey; HES library augmented; Cote Brilliante Presbyterian Church little library; data collection;	**Actions taken:** HESNFA survey; National Night Out; street calming humps and cameras installed; petition for exemption of one-mile radius transportation restriction; walking bus coordination;Neighborhood Watch (Next Door); youth crime prevention program; new affordable housing renovation; data collection;	**Actions taken:** employment efforts for youth and young adults; organizational capacity building: data collection;
Impacts: general appearance improvement; identification of KV boundaries; creation of the B.E.S.T. Collective	**Impacts:** hiring of 3 HSSU students for out-of-school program; increase in literature from AA authors and w/non white characters; state awareness on one-mile restriction revision need; creation of the B.E.S.T. Collective	**Impacts:** creation of the B.E.S.T. Collective	**Impacts:** creation of the B.E.S.T. Collective
Actions planned (2024-2025): Data collection and community input	**Actions planned:** data collection and community input	**Actions planned:** Data collection and community input:	**Actions planned:** Data collection and community input:
Interventions: securing + selling LRA properties; demolish properties beyond repair; NIS advice on city innitiatives; clean-up campaigns; identify home repair funding; secure fiunding for landscape mantainance; complete beautification plan	**Interventions:** strengthening and expansion of HES out-of-school programmming; preschool extended to early head start program; development of STEM curricula; streghtening HES and community literacy; application for *SRTS* funding; youth education	**Interventions:** wrapparound services implementation; infraestructure improvements and street calming measures, safety education for pedestrians and bicycle users; community crime prevention plan; youth self-efficacy program; housing assistance program	**Interventions:** free job skills training, employment referral and career fair opportunities; organization capacity building initiatives; develop urban agriculture/farming economic model; draft neighborhood plan

Figure 12 *Project Summary, Freixas 2025*

Conclusion

The pilot study of the KV B.E.S.T. Approach was designed to assess the effectiveness of the program in promoting community stabilization and revitalization. This evaluation was framed around several explicit research questions, which guided the analysis of various aspects of the program's implementation and outcomes. The primary findings reveal critical insights into the potential of neighborhood schools as drivers of community rejuvenation and the effectiveness of the B.E.S.T. domains in achieving measurable results.

One of the key questions of the study was whether neighborhood schools could act as catalysts for community stabilization and revitalization. The findings indicate a mixed positive outcome. On one hand, HES (the neighborhood school) experienced a significant enrollment increase of nearly 50 percent from 2018 to 2024. This growth was also accompanied by a rise in participation in after-school programs, suggesting that families have become more engaged with the school. However, despite these positive changes, issues such as vacancy rates and population loss persist, indicating that full neighborhood stabilization has not yet been realized.

The evaluation also delved into how the various domains of the B.E.S.T. Approach contributed to measurable outcomes. In terms of beautification efforts, KBC's nomination of eighteen properties for Prop NS funding, along with the demolition of seven buildings under Operation Clean Sweep and SLACO's expansion of

cleanup/mowing services showcased tangible improvements in the maintenance of alleys and vacant lots.

Regarding education, significant positive change was reflected by the rise in HES enrollment, the year-to-year improvement by cohorts on standarized tests and by the fact that parental satisfaction via HESFNA reached 86 percent. However, attendance goals set for the school remained unmet due to the inability to create a walking school bus because of FERPA constraints and the lack of success in lobbying the district to alter its policy with respect to state transportation funding. In addition, the research was impacted by the district's reluctance to share data after the change in administration.

In terms of safety, KBC was able to enhance neighborhood walkability with the implementation of traffic calming measures—like additional stop signs and speed humps—and the establishment of community safety initiatives—such as Neighborhood Safety Program, National Night Out events, a Neighborhood Watch, and selected camera installations. Nonetheless, the study did not report a significant, sustained decline in crime rates directly attributable to these pilot efforts. Regarding Services, KBC identified potential service resources and providers as well as prioritizing resident service needs through the HESFNA survey. However, KBC has been unable to date to adequately address them.

The provision of technical assistance was the fourth domain of the B.E.S.T. Approach in the pilot. KBC was successful in providing needed professional assistance. SLACO offered organizational support with training in essential areas—such as board development and grant writing, WashU faculty generated an Summative Report on current conditions and presented an action plan. In addition, WashU architecture faculty and students developed a communtiy planning framework. However, the neighborhood continues to face challenges requiring additional professional assistance.

The third major research question of the study considered the replicability and sustainability of the B.E.S.T. Approach. The findings would seem to be cautiously optimistic. The pilot demonstrated tangible outputs, including property nominations, demolitions, and grant acquisitions, suggesting potential for scaling up. But the PI recongnizes the need for further validation. An external evaluator recommended that additional primary data collection and a complete implementation cycle be conducted to affirm the approach's long-term viability. Furthermore, the findings highlighted the necessary policy adjustments essential for institutionalizing and scaling the B.E.S.T. approach. Operational policy constraints were identified, including the need for streamlined MOUs and data-sharing protocols with the school district, as well as the impact of FERPA-like regulations on transportation and walking school initiatives. Effective scaling would also benefit from established funding streams, guidance on privacy-compliant data sharing, and coordinated city-level strategies that align housing, public works, and school policies.

In short, the pilot study of the KV B.E.S.T. Approach reveals both promising outcomes and critical challenges. While significant strides were made in community engagement and educational improvements, persistent issues of vacancy and safety require ongoing attention and collaboration across various sectors to achieve sustained community revitalization.

Yet, while KBC and the PI have seemingly reached a consensus that the B.E.S.T. Approach has merit in providing a pathway to stabilize highly distressed communities,

a pressing reality persists. Many urban areas in the U.S., like KV, now face the absence of a local school. The alarming rate at which neighborhood-based schools have been closed across the country stems from a combination of declining inner-city populations and the rise of magnet and charter schools (Figure 13). As a result, many areas in American post-industrial cities have become "school deserts," where the lack of educational institutions not only hinders efforts to address student academic deficiencies, but also complicates the delivery of essential services to residents and weakens the sense of community.

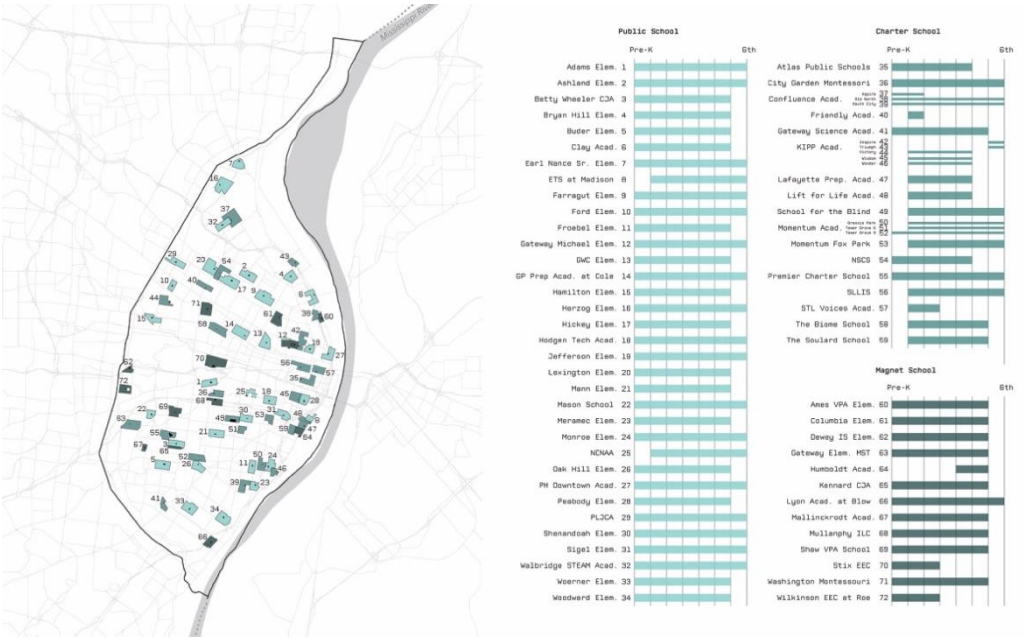


Figure 13: *St. Louis Elementary School Distribution*, *Freixas 2025*

In the past, churches and places of worship often served as alterntive community anchors, providing support and sense of belonging. However, most church congregations are no longer neighborhood-based, further exacerbating the challenges encountered in these areas. The absence of an institutional presence in the most vulnerable neighborhoods highlights a significant gap in community infrastructure.

The main takeaway from this research, therefore, is that the first step in revitalizing highly distressed urban areas may not necessarily involve constructing new housing or pursuing economic development initiatives. Instead, it may be essential to prioritize preserving existing neighborhood schools or introducing alternative community-based bodies.

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Villa Adriana as Collection. Hearst Castle and The Getty Center

*By Gregorio Froio**

This essay explores the enduring influence of the Villa Adriana on modern literature, film and architecture. Built by Emperor Hadrian near Tivoli, the villa is much more than just an ancient Roman site. Over time, it has evolved into a powerful symbol: an open, ever-changing space that continues to inspire writers, artists and architects alike. These themes also feature in films such as The Belly of an Architect (1987) and Angels in America (2003), in which the villa provides the backdrop to tales of loss, change and history. The second part of the essay looks at two modern buildings in the United States that were inspired by Villa Adriana: Hearst Castle and the Getty Center. Both were commissioned by wealthy collectors, William Randolph Hearst and John Paul Getty, who saw themselves as modern-day emperors. Designed by Julia Morgan, Hearst Castle is an eclectic mix of styles and artefacts from across Europe. It reflects Hearst's desire to collect and control history. The Getty Center, designed by Richard Meier, is a modern 'city of art' built on a hill in Los Angeles. Its design, with overlapping grids and the use of travertine stone, recalls the structure and spirit of Villa Adriana. The essay concludes by linking these contemporary spaces to the concept of the 'villa-museum': a setting that encompasses both art and memory. These museums are not just buildings. They are complex worlds that blend history, identity and imagination. The Getty Center, in particular, demonstrates how ancient concepts can be reimagined in contemporary forms. In this way, Villa Adriana continues to inspire new stories and spaces, acting as a timeless link between the past and the present.

Introduction

Villa Adriana is more than just a late-imperial Roman villa. The villa of an emperor has over time become an open text capable of regenerating itself and taking on ever-new forms, as many as the impressions it has inspired in artists, writers and architects.

The author has recently conducted a series of studies on this theme, which have culminated in a monographic work[1]. The compositional nature of the villa has also been addressed in other recent scholarly publications.[2]

This essay explores a specific literary dimension, taking a similar approach to recent research on the composition of the Villa[3]. This literary dimension is examined

*Adjunct Professor, University of Calabria, Italy,

1. G. Froio. *Attualità di Villa Adriana. Nuove ricerche*. (Soveria Mannelli: Rubbettino, 2025).

2. G. Froio. *La componente archeologica nel progetto moderno*. (Soveria Mannelli: Rubbettino, 2013); G. Froio. *Fragment and composition. Hadrian's dispositio in the modern architecture*. || *FAmagazine 32* (2015): 49-56. G. Froio (2025) *Archaeology and modern architecture: A comparative reading*. || Athens Journal of Architecture 11(2): 181-200.

3. P. Caliari. *Tractatus logico sintattico. La forma trasparente di Villa Adriana*. (Roma: Edizioni Quasar, 2012); P. Caliari. *La composizione policentrica di Villa Adriana e il tecnigrafo post-alessandrino.* || *Ananke 84*. (2018): 67-69; P. Caliari. *Nuovi contributi sulla composizione architettonica di Villa Adriana*.

within a broader framework that seeks to identify narrative and cinematic references related to the Hadrianic theme from the twentieth century, revealing new and hidden meanings.[4]

This study addresses the following question: Have specific formal outcomes in subsequent architecture resulted from the Hadrianeum model as a major cultural artefact? If so, in what terms?

The primary objective of this research is to emphasise the dual cultural and artistic significance of Hadrian's architectural project at his villa in Tivoli. We aim to establish a connection between the literary associations of this iconic villa and the formal outcomes of modern architectural projects.

A secondary objective, closely related to the primary objective, is to determine Emperor Hadrian's intentions or desires, as evidenced in the relevant literary references (both contemporary and modern). We will also explore whether subsequent authors have adopted these intentions and, if so, how they have realised them.

In a second part, we will mention two contemporary examples of villas. Their design was inspired by the ancient world through specific iconic references: the Getty Center and Hearst Castle. The founders of these villas, Jean Paul Getty and William Randolph Hearst respectively, can be seen as mirrored figures of Emperor Hadrian, who wanted to recreate the topological and spatial geographies of the world he had travelled in the ancient villa at Tivoli, as focused in important publications. [5]

Villa Adriana has inspired many films and books. One notable example is Peter Greenaway's 1987 film *The Belly of an Architect.* The film tells the story of an American architect working on an exhibition about Boullée in Rome. Some scenes were filmed at Villa Adriana, where the architect searches for inspiration. The film reflects on time and decay, depicting the ruins as symbols of a world that is fading away. Another example is the TV series *Angels in America* (2003), directed by Mike Nichols. Based on Tony Kushner's play, one scene features parts of Villa Adriana alongside a ruined San

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Bruciati et al. *Le grandi ville romane del territorio tiburtino*. (Tivoli: Tipografia Palombi, 2021); G. E. Cinque e E. Lazzeri. *Analisi geometriche e progettuali in alcuni complessi di Villa Adriana || Romula 1*, 2011; G. E. Cinque, *Approcci preliminari allo studio della Villa Adriana di Tivoli*. || *Romula 9*, 2011; G. E. Cinque. *Le componenti progettuali nell'architettura della villa Adriana: il nucleo centrale*. R. Hidalgo, P. León (Eds). *Roma, Tibur, Baetica. Investigaciones Adrianeas*, Sevilla 2013; A. Viscogliosi. *L'architettura adrianea: di Adriano, per Adriano, sotto Adriano, dopo Adriano*. || *Adventus Hadriani. Investigaciones sobre arquitectura adrianea*, R. Hidalgo, G. E. Cinque, A. Pizzo, A.Viscogliosi. (eds) || «Hispania Antiqua. Serie Arquelogica» 11 (2020): 11-36; Michael R. Ytterberg. *The Hidden Order of Hadrian's Villa, and the Order of Modern Architecture*. || *Nexus 2012*: *Relationships Between Architecture*. 127-154 and Mathematics, Milan. 11-14 June 2012; M. D'Alessandro (2022). *Oswald Mathias Ungers at Belvederestrasse: Self-portrait in the studio*. || Athens Journal of Architecture 8(4): 405-438; P. Burlando, S. Grillo (2019). *Complexity vs simplicity: The contrasts of architectural language in the past and in the present.* || Athens Journal of Architecture 5(2): 127-146.

4. F. Slavazzi. *Villa Adriana nel Novecento. L'archeologia e la cultura (architettura, letteratura, cinema, teatro)* in: M. Boldacci, L. De Franceschi, M. E. Micheli. *Leggere nel Novecento. Leggere il Novecento*, Franco Angeli, Milano 2020, pp. 146-156; G. Pucci, *L'ombra lunga di Villa Adriana,* in: A. Bruciati, M. Eichberg, G. Proietti (eds), *Le Grandi Ville romane del territorio Tiburtino*, Tipografia Palombi e Lanci, Tivoli 2021: 245-250.

5. Victoria Kastner. *Julia Morgan. An Intimate Biography of the Traiblazing Architect*. (San Francisco: Chronicle Books, 2021); M. Costanzo, V. Giorgi, M. G. Tolomeo (eds). *Richard Meier Frank Stella*. (Milano: Electa, 1993); Richard Meier. *On the Spirit of Architecture,* || *Architectural Digest*, 1981.

Francisco following the 1906 earthquake. This lends the show a poetic quality and blends ancient and modern tragedies.[6]

I will analyze below two contemporary literary works, as different as they are evocative: *Notizie dagli scavi* by Franco Lucentini (1964) and the more recent *L'Enigma di Boussois. I Misteri di Villa Adriana* by Pier Federico Caliari (2022). Although stylistically distinct, both novels revolve around the mysterious ruins of the Villa at Tivoli as their narrative core. They are part of a rich body of contemporary Hadrianic literature, whose most eminent literary figure is Marguerite Yourcenar. The Belgian-French writer revived, in her *Memoirs of Hadrian*, a new and at the same time unprecedented portrayal of Emperor Hadrian: a literary invention and evocative philological reconstruction of his human story. [7]

Cinema and Literature Background

Franco Lucentini's 1964 novel *Notizie dagli scavi* tells the story of a porter in a shady Roman guesthouse, known as 'the professor'. Following a series of strange events, he finds himself wandering through the ruins of Villa Adriana. He follows the usual tourist routes, such as the Muro del Pecile and the Accademia. He reads from a guidebook which explains the uncertain history of places such as the *Cento Camerelle*. His thoughts become jumbled, much like the confusing landscape. He wonders, for example, whether the tower was built before or after the farmhouse to which it is attached. This sense of uncertainty persists as he visits the *Teatro Marittimo* (Figure 1), where the reflections on the water make the ruins seem even more mysterious. Lucentini uses these scenes to explore the concept of time and how ruins can make us feel caught between the past and the present. The villa appears both real and dreamlike, unfinished and outside of time. [8]

Lucentini also explores these concepts in his short philosophical work, 'Epigrafia e metafisica'. He argues that ruins are the true shape of our world — everything is merely fragments left behind by time. He suggests that if time didn't exist, nothing would happen and not even ruins would exist. To him, matter itself is already a kind of ruin.

These themes also appear in cinema. In Rossellini's 1954 film Journey to Italy, a British couple visit Pompeii. The ancient ruins provide the backdrop to a personal crisis, demonstrating the ongoing influence of the past on our lives.

Pier Federico Caliari's novel, *L'Enigma di Boussois*, begins in 1911 and continues beyond 1924. It is set during Mussolini's rise to power in Italy. Once again, the main setting is Villa Adriana. The protagonist, Charles Boussois, is based on a real person but is given a fictional second life in the novel. In 1911, he visits the villa with the architects Frank Lloyd Wright and Le Corbusier. Le Corbusier even sketches the villa during this visit.

6. M. Giori, Villa Adriana come Paradiso "favoloso". || "LANX" 7 (2010): 198-216.

7. M. Yourcenar. *Mémoires d'Hadrien*. (Paris: Librairie Plon, 1951); M. Yourcenar. *Opere/1. Romanzi e racconti.* (Milano: Classici Bompiani, 1986); M. Yourcenar, *Opere. saggi e memorie*. (Milano: Classici Bompiani, 1992; M. Yourcenar, *Les Yeux Ouverts*. (Paris: Editions du Centurion, 1980).

8. F. Lucentini, *Notizie dagli scavi*. (Milano: Einaudi, 1965) 39.

Figure 1. *Teatro Marittimo at Villa Adriana*
Source: Froio 2025

Later, in 1924, Boussois begins investigating strange and mysterious events at the villa. He falls in love with a young woman named Marguerite Cleenewerck de Crayencour — who would become known as Marguerite Yourcenar. Together, they investigate rumours of secret rituals tied to ancient Egyptian beliefs that occur at specific times, such as solstices and equinoxes. Marguerite was fascinated by the blend of architecture, religion and mystery at the villa. She dreams of writing a book dedicated to Emperor Hadrian. The group attempts to unravel the mystery of a ritual scheduled for the summer solstice in 1924. The key to the mystery may lie with Antinous, Hadrian's young companion, who plays an important symbolic role. Boussois believes the Villa was designed with hidden meanings, using precise geometry and mathematical structures. He thinks the central part of the Villa is the Piazza d'Oro, which everything else connects to. The Villa is not just a collection of ruins—it's a sacred and symbolic space.

In her own memoir *A occhi aperti*, Yourcenar recalls how she found the draft of *Memoirs of Hadrian* in a trunk in 1948. That discovery led her to finish the book. She says the real inspiration came not from Hadrian himself, but from his Villa. She writes that Villa Adriana reminded her of Piranesi's drawings—overgrown, wild, mysterious. She felt that through the ruins, she could truly understand Hadrian.

In *Memoirs of Hadrian*, she didn't choose the format of a diary like Marcus Aurelius's *Meditations*, but instead wrote a monologue—a direct speech from Hadrian to the reader. During a public talk, the fictional version of Yourcenar in Caliari's novel says: "Hadrian and his Villa are one and the same. I got to know Hadrian through the ruins of his Villa. I love him because I love that place. The fact that it's in ruins helps

me understand his mind, especially at the end of his life. Only in that place could I truly see who Hadrian was—in his human and earthly truth". [9]

Heast Castle by Julia Morgan

The figure of Emperor Hadrian, central to Yourcenar's masterpiece, is closely linked to his Villa Tiburtina. The indissoluble bond between the emperor and his villa is the essential point emphasised here. In the modern era, two figures in particular mirror this complex relationship with Hadrian: William Randolph Hearst and John Paul Getty, both of whom became symbolically and architecturally linked to the emperor. Their lives are well documented in major biographies. One of the most evocative literary descriptions of Hearst appears in *The Big Money* by John Dos Passos, the final volume of his *USA Trilogy* (preceded by *The 42nd Parallel* and *Nineteen Nineteen*). Dos Passos refers to Hearst as a 'newspaper maniac', detailing the rise and fall of his journalistic empire: "And more and more the emperor of the newspapers withdrew to his fiefdom in San Simeon on the Pacific Coast [...] he built himself an Andalusian palace and a Moorish banquet island, and spent his final years amid the flattering praise of starlets, press agents, scriptwriters, organisers and editors, and millionaire publishers".[10] The image of a 'decrepit Caesar' also serves as the narrative core of Orson Welles' Citizen Kane (Figure 2). This majestic film recounts the life of American magnate Charles Foster Kane, culminating in the haunting, Piranesian mansion of Xanadu. The film's closing scenes cast a visionary light on this labyrinthine villa, with its vast accumulations of ancient objects piled within the walls. This modern hoard of artefacts encapsulates the antiquarian, esoteric and Hadrianic ambitions of its founder — William Hearst's alter ego.

9. P. F. Caliari. *L'enigma di Boussois. I misteri di Villa Adriana*. (Torino: Robin Editori) 322.
10. J. Dos Passos, *Un mucchio di Quattrini*. (Milano: Mondadori, 2019) 904.

Figure 2. Sequence from Orson Welles's film *Citizen Kane* (1941)
Source: Public domain.

Hearst had his home, later known as Hearst Castle, built on a hill along California's coast, designed by architect Julia Morgan. Located along the Pacific Ocean, San Simeon is traversed by the arterial road Highway 1, approximately 390 km north of Los Angeles and 340 km south of San Francisco, at the point where the coastline curves into a small gulf at the base of the Rocky Mountains. The influence of Spanish colonisers is still clearly evident in this region, as in the wider Californian territory, in the names of streets and districts.

The castle is situated roughly 8 km inland and nestles in a panoramic position on the hillside. Although Hearst named the estate *La Cuesta Encantada* (The Enchanted Hill), it was commonly referred to as the Ranch by Hearst himself and others alike. Filmmaker Orson Welles famously renamed it *Xanadu* as the setting for his celebrated film *Citizen Kane* (1941). A searing social critique, the film depicts the rise and fall of media tycoon Charles Foster Kane, an unsettling alter ego of Hearst. Xanadu, relocated from California to an undefined region in Florida, becomes the most potent symbol of an alternative form of power: the pervasive and ubiquitous influence of the American press, capable of shaping public consciousness.

The extensively documented design history of Hearst Castle reveals a dynamic and continuous exchange of ideas between the client and the Californian architect Julia Morgan (1872–1957). The choice of site, the layout of the buildings, and the architectural style were consistently determined through a dense and lively epistolary dialogue.

During his numerous trips to Europe, Hearst assembled an extraordinary and eclectic art collection. The villa at the heart of California was thus conceived as a museum capable of accommodating this multifaceted assemblage of statues, paintings,

and artifacts of all kinds, initiating a continuous process of art accumulation that extended beyond Hearst's lifetime.

About San Simeon Julia Morgan wrote: "We are building for him a sort of village on a mountain-top, miles from any railway, and housing… his collections as well as his family. Having different buildings allows the use of varied treatments… So far we have received from him, to imcorporate in the new buildings, some twlve of thirteen train carloads of antiques, brought from the ends of the earth and from Prehistoric down to late Empire in period, the majority however, being of Spanish origin".[11]

Similar to other American magnates such as John Paul Getty, Hearst's collecting activities, combined with a socially philanthropic intention, reproduce a tendency already present in Europe during the Grand Tour of the eighteenth and nineteenth centuries. This cultural attitude, driven by a mania for remembrance and souvenirs, merged with American sensibilities to generate a speculative-financial form of collecting, resulting in monumental villa-collections: architectural containers became themselves repositories of memory. The contents are displayed with a conspicuous, often indulgent, sense of accumulation, an eclectic and stratified fetishism of the *objet trouvé*.

According to Salvatore Settis (2006), Hearst Castle is an example of "historicist" eclecticism, and the Californian climate stressed its anthology-like character. Architectural fragments are drawn from across Europe. Much like the Getty Villa in Malibu, Hearst Castle was built through accumulation: a visionary compendium of European art suspended between romantic nostalgia and the aesthetics of an antique shop.[12]

At Hearst's Californian estate, themes are fused together, intertwining the memory of past colonisations with the widespread influence of Spanish missions to produce a compelling contrast. Antiquarian tastes — reverence for Greek, Egyptian, Roman, Gothic and Renaissance antiquity — are combined with Baroque-inspired styles, reflecting a flamboyant colonial expression alongside the simpler local Mexican tradition. "I have thought a great deal over whether to make this whole group of building Baroc, in the Eighteenth Century style, or Renaissance. Is is quite a problem. I started out with the Baroc in mind, as nearly all the Spanish architecture in America is of that character."[13]

Emulating Emperor Hadrian or a modern-day Kubla Khan, Hearst/Kane adorned the interiors of his villa with ancient marbles, pristine Canova statues, Gothic tapestries, Italian Gothic and Renaissance paintings, busts of Roman emperors, 16^(th)-century maiolica and an assortment of bronze candelabras. The exteriors follow a similar theme:

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11. From Julia Morgan's 1921 correspondence as reported in: V. Kastner, *Julia Morgan. An Intimate Biography of the Trailblazing Architect*. (San Francisco, California: Chronicle Book LLC, 2021) 126.

12. Another example of villa collection is The Huntington Art Gallery in San Marino, once the home of Henry E. Huntington. He collected rare books and artworks with a clear focus on English and American history, as well as 18th- and early 19th-century English and French art. The gallery, in a grand Beaux-Arts building, features works by artists like Gainsborough, Reynolds, and Turner. It became a public museum in 1927. In contrast, Hearst Castle, which opened to the public in 1958, has a more varied and mixed collection. By 1968, these two museums showed different styles—Huntington's being refined and focused, and Hearst's being broad and eclectic—but both reflected the personalities and tastes of their wealthy Californian founders. See: S. Settis. *Il Pompeianum di Getty*. || *Il sole 24 Ore*, 05/02/2006.

13. From Hearst's 1919 correspondence as reported in: T. Coffmann, *The Story of William Randolph Hearst and San Simenon*. (Santa Barbara CA: Sequoia Book, 1985) 36.

the Neptune Pool is adorned with groups of mythological and human statues, featuring a Greek temple pronaos and a semicircular colonnade. These elements evoke the water basins of Hadrian's Villa, particularly the Canopus, with its crocodile statues, caryatids, and slender colonnade encircling the pool (Figure 3).

Shaped by a thriving market, today's tourist guides have projected these associations onto a global stage, endowing the site with the gently fantastical quality typical of modern Disneyland-style villages. With its terraces, temple-like pools, palatial exoticism, statues and sometimes grotesque or fantastical decorations, the complex evokes the admirable layout of Villa Adriana, which was also articulated through a sequence of scenographic spatial experiences.

Figure 3. *Neptune Pool at Hearst Castle*
Source: Public domain.

The hilltop site is irregularly oval in shape and oriented along the east-west axis. Two main terraces run parallel to this axis, one to the north and one to the south. The northern entrance is marked by a grand staircase that splits symmetrically into two parallel ramps, leading to the first and most prominent terrace. This terrace is longitudinal in shape and flanked by two circular exedras that overlook the landscape.

The plan reveals a series of pavilions distributed along the slopes of the hill. The central representative building, *Casa Grande*, stands along the main east-west axis. It is composed of a central volume and two lateral wings, joined perpendicularly by a thinner volume. This building's façade forms the backdrop to the central plaza, around which the three lower pavilions (*Casa del Mar*, *Casa del Monte* and *Casa del Sol)* are arranged in a fan-like layout. In particular, Casa del Sol is slightly rotated from the principal axis, which disrupts the symmetry of the composition. The volumes of the elliptical Neptune Pool and the rectangular Indoor Pool are subject to double geometric displacement. Orthogonal in their respective orientations, they are first rotated 45 degrees from the main axis and then shifted off the symmetrical centre along the secondary north-south axis, which aligns the descending sequence of staircases.

These staircases constitute another architectural motif of the complex: a continuous sequence of terraced platforms connected by elliptical and rectangular stairways, which serve both functional and formal purposes. Conceptually "exploding" the entire complex would leave only skeletal building frames and the solid masses of the terraced planes. The footprints of the pools and fountains would also be visible, as would the porous volume of the Indoor Pool, embedded in the northern part of the hill — a contemporary reinterpretation of Roman imperial baths.

The Getty Center by Richard Meier

In Ridley Scott's 2017 film *All the Money in the World*, we witness the peculiar story of controversial oil tycoon John Paul Getty and his heirs. Set in 1973 Rome, reminiscent of Fellini's *La Dolce Vita*, the film tells the true story of Paul Getty's kidnapping. The young man is kidnapped by a group of criminals and held hostage while they wait for the ransom money to arrive. One scene depicts a family memory: the grandfather takes his eight-year-old grandson to Rome to visit Villa Adriana, the Emperor's House. The wealthy, elderly tycoon speaks of Hadrian as his alter ego and of the villa's ruins as the ancient space he would like to claim as his own. The film's screenplay is based on John Pearson's 1995 book *Painfully Rich*[14]. According to this biography, the magnate truly believed he was the reincarnation of Emperor Hadrian. Some hypotheses suggest that this belief may have originated during an early visit to the villa, after the purchase of a neoclassical sculpture discovered there at the end of the 18-th century.[15]

In one scene of Scott's film, the snow-covered Villa Adriana appears as if in a memory, symbolising John Paul Getty's desire to recreate the ancient villa of Emperor Hadrian in America.

For Jean Paul Getty, collecting was an all-consuming passion, leading him to amass an immense collection of artistic treasures. The Getty Center in Los Angeles, designed by Richard Meier, houses part of his invaluable art collection. Described as a 'city of art'[16], it is an acropolis-like citadel perched on a hill overlooking Los Angeles towards the Santa Monica and Hollywood Hills. Like other Meier museums, the Getty Center can be described as a 'museum of light' or a 'shining mountain'. A theological space. (Purini, 1993). In Meier's work, the theme of interior as interiority is a constant.

In 1953, Paul Getty built his personal residence in Malibu, which would become the prototype for the concept of a house museum. The Malibu villa was one of the sources of inspiration for the Getty Centre. As Meier himself stated: "When I first visited this building, I was struck by the importance of the relationship between the inside and outside. Its beauty comes from this fluidity of space, from the movement between the exterior and interior".[17] The design — with its open, see-through walls and overlapping spaces — forces people to look in a very detailed and descriptive way. It doesn't let the viewer have a fixed, controlling gaze. This challenges the traditional idea of space being neatly divided and filled with meaning, like in religious or moral systems.

Following his time at the American Academy in Rome, Meier introduced a compositional element that would feature prominently in many of his subsequent projects: the superimposition of two orthogonal grids, shifted or rotated relative to one another (Einaudi, 1993).

Among his artistic and architectural references, two modernist pioneers stand out in particular: Le Corbusier and Wright. Speaking of Wright's influence, Meier said: 'What was important to me back then, having read everything by Frank Lloyd Wright

14. J. Pearson, *Painfully Rich*. (London: Macmillan Pub Ltd, 1995).

15. G. Pucci, *L'ombra lunga di Villa Adriana,* in: A. Bruciati, M. Eichberg, G. Proietti (eds). *Le Grandi Ville romane del territorio Tiburtino*. (Tivoli: Tipografia Palombi e Lanci, 2021): 245-250.

16. Sivio Cassarà (ed). *Richard Meier*. (Bologna: Zanichelli, 1995) 126.

17. K. Frampton. *Richard Meier*. (Milano: Electa, 2003) 191.

as a student, was the visual extension of interior space into the landscape — the way in which Fallingwater extends into the surrounding environment.'[18] For Meier, the most important aspect is the nature of space as a relationship, the connection between the objects that generate a space.

A significant milestone in the American architect's career began in 1973 when he became a resident architect at the American Academy in Rome. During this period, which coincided with a break from his long academic teaching career at American universities, Meier adopted a cultural attitude reminiscent of the 19th-century Grand Tour. He visited notable historical sites in Rome, followed by Villa Adriana and Pompeii. It was during this period that he began to reflect on the use of overlapping and rotated orthogonal grids, a concept that would come to characterise his future projects. But where does this shift in language come from? As Roberto Einaudi explains: "The displacement of axes and the layering and partial overlap of plans are implicit in the city of Rome... The shift of axes is common in ancient Roman houses in Pompeii and Villa Adriana, where complex compositions of orthogonal groupings meet at different angles and enrich each other". [19]

Meier himself stated how important Villa Adriana was in the genesis of the Getty Center. The layout of the Getty Center is so similar to Villa Adriana that you might mistake one for the other at first. Both have buildings that shift direction to follow the natural landscape and include complex water features. This shows a strong awareness of historical context and a deep understanding of Rome's architectural past.

In his 1993 text, 'Volumes Under the Light', Michele Costanzo provides a clear analysis of Meier's artistic journey and the evolution of his formal language throughout his long career, from his involvement with the Five Architects group in the 1960s to the present day. While designing his first villas, Meier started to define his style in terms of the spatial relationship between the elements that contain and define space. Meier is interested in space, especially how it is shaped and organized by light and by proportions that feel right for people. Another key concept in Meier's work is the constant interplay between exteriority and interiority — the relationship between outside and inside — which manifests as a fluid spatial articulation of the connective system (reminiscent of the promenade architecturale), where the path becomes a regulating sequence of space. "This itinerary, in its unfolding both inside and outside the building, is based on this dual function, seeing it as both a structure designed to fulfil specific project functions and an ideal medium of communication between the general terms of the artificial and the natural."[20]

One of the projects that marks a move away from the rigidity of orthogonal rules is the Atheneum (1975–79). Here, we sense a transition from the concept of a house to that of a public building. The museum is presented as a grand house, 'the place of memory, the house where Mnemosyne, the mother of the Muses, lives... the museum as a space of recollection and communication, an environment destined to preserve and safeguard the testimonies of origin'. The museum theme thus becomes central to

18. C. Jencks. *Interview with Richard Meier*, in *Richard Meier, Building and Projects 1979–89*, London, 1990, 33.

19. Interview by Roberto Einaudi with Meier, 1993.

20. M. Costanzo. *Volumi sotto la luce*. In: M. Costanzo, V. Giorgi, M. G. Tolomeo (eds). *Richard Meier Frank Stella*. (Milano: Electa, 1993).

Meier's work. A key milestone in this research is the unbuilt Villa Strozzi project in Florence (1973), in which Meier reflects on the historical value of the context and its contents, i.e. the relationship between the new and the old. The concept of the museum as a 'container' of spatial objects is evident in the design of the future Getty Center.

Figure 4. *Getty Center at Los Angeles*
Source: Public domain.

The formal and linguistic idea we started with — the accumulation of forms as a kind of souvenir of memories — becomes the expressive endpoint that links European Western culture and American culture, living in a symbiotic relationship with the premises and goals of founder John Paul Getty. Meier's architectural research in the museum projects of the 1980s, leading up to the Getty Center, shows the sedimentation of a series of themes that reappear in the Los Angeles project: the idea of expansion and multiplication of volumes; the relationship with the urban character; the superimposition of grids "allowing for the reconciliation between site axes and formal organisation"; the progressive assimilation of the idea of the museum as an osmosis between outside and inside; the coexistence of order and disorder; the pure and skillful use of light (natural and artificial); the transparent visual destination of buildings; the interplay of pathways; the city in miniature — all these are progressive acquisitions in a formulation of space that converge and find synthesis in the Getty Center, Meier's most complex and demanding project (Figure 4).

However, another factor comes into play here that transcends the strictly compositional process: the cultural connection, the Hadrianic reference and the topological dimension of the site. The result is a sense of complementarity, particularly in the use of travertine. According to Costanzo, this shows a connection between the museum's location and the collection it holds. Using a 'historical' material (like stone or classical forms) creates a symbolic link, shaping how the museum is seen by giving it a meaningful, almost iconic image. The imposing use of travertine also conveys an idea

of temporality that defies the passage of time, with patina being valued as a temporal layer that records the fluid passage of time itself. This effect is further enhanced by the use of split-face slabs, which are reminiscent of the Roman bugnato technique.

Conclusion

We can conclude that a very close link between literature and design is confirmed by the Hadrianic model. The concept of collecting in the time of Hadrian remains one of the interpretive keys that enables us to comprehend the modernity projects we have discussed.

Both Getty and Hearst were obsessed with amassing wealth and antiquities, a passion reflected in their monumental villa-museums. The Getty Center and the dreamlike Xanadu of Hearst are clear expressions of this obsession with collecting — a modern echo of Hadrian's encyclopaedic and imperial imagination.

The Getty Center, in particular, represents the culmination of a new reflection in Meier's language. Arising from cultural premises discussed at the beginning, it ultimately marks a departure from Le Corbusier's purism and an arrival at a broader *en plein air* vision — one that brings us once again back to the Hadrianic cultural project. Returning, then, to the literary dimension from which we started, the Getty Center represents one of the modern museums of hyperconsumption, where a specific kind of *heterotopia* is realized. Franco Purini (2002) explains that modern museums, like the Getty Museum by Richard Meier, have changed to look and function more like cities. Instead of just hinting at urban design, they now actively imitate it, using complex forms and organized layouts similar to those found in real urban environments.

Like other contemporary museums, the Getty Museum refers to an infinite idea of the contemporary metropolis, of which it is a remarkable echo: "The presence of the urban model within the typological formulation of hyperconsumption museums or the interiorization within them of the undeniable vastness of the metropolis means that museum space can never be truly governed, only partially controlled. It is an intrinsically dangerous space, because the art it houses is itself dangerous — and not fully embraced by it. In Tim Burton's 1989 film *Batman*, where the Joker, played by Jack Nicholson, revives in a sacrilegious ritual the subversive hermeneutics of the avant-garde, art is pushed into an extreme position of risk by the museum, threatening its very survival. This risk lies not only in the art's presence but in the coexistence within the museum of different works that expose their mutual incompatibilities".[21]

The recent and dramatic catastrophe that struck Los Angeles — an apocalyptic wildfire — shifts the story from an unprecedented urban devastation to a literary sublime: the Los Angeles of *Blade Runner* or *Apocalypse Now*, with fires emerging from buildings in an eerie nocturnal view. The Getty Center fits powerfully into this scenario, having withstood the impact. The travertine protected the building.

21. F. Purini. *I Musei* dell'iperconsumo. || Lotus Navigator, 2002: 10-19.

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