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The Ecological Niche: Toward an Architecture of Care

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Abstract

This essay centers on the term "Ecological Design" in architecture, tracing its development from natural history and evolutionary theory to contemporary architectural theory. Beginning with the term's biological origins in the work of Darwin and Haeckel in Europe, as well as Swallow in the U.S., the article charts how ecological thinking has shaped the evolution of architectural practice, from nineteenth-century analogies with nature to twentieth-century critiques of technologically driven sustainability and, finally, to contemporary shifts to post-human matters of care. The concept of the niche is proposed to support the translation of ecology into architecture, offering a generative model that pushes beyond normative site responsiveness. Instead, niche thinking considers design as co-evolution between the built form and the environment, structured by cultural and social practice.

Keywords: ecological design; architecture; niche theory; environmental humanities; sustainability; site; context; care; carbon form; architectural theory

1. Introduction: Ecology Beyond Sustainability

The term "ecological design" was coined by Sim van der Ryn and Stuart Cowan in 1996, defined as "any form of design that minimizes environmentally destructive impacts by integrating itself with living processes" [1]. Today, according to ecological design scholar Lydia Kallipoliti, while widely used, the term has become alarmingly broad. In *Histories of Ecological Design: An Unfinished Cyclopedia*, Kallipoliti lists the term's various meanings to include "the restitution of moral values in design thinking, the substitution of performance for function, the post-structuralist denunciation of environmental improvement, and the critical recognition of waste and pollution as generative potential for design" [2]. With the list, Kallipoliti demonstrates how the diluted concept potentially signals virtue without necessarily delivering.

By retracing the term from its non-architectural origins, this essay searches for a renewed deployment of ecological methodologies in design today—one that moves beyond sustainability towards both care and legibility.

2. The Origins of Ecology

In *On the Origin of Species*, Charles Darwin put forth his renowned theory of evolution, in which small changes in combination with environmental fitness result in evolutionary success. "Variations," he wrote, "however slight and from whatever cause proceeding, if they be in any degree profitable to the individuals of a species, in their infinitely complex relations to other organic beings and to their physical conditions of life, will tend to the preservation of such individuals, and will generally be inherited by the offspring" [3]. These physical conditions of life (climatic, material, parasites, predators. . .) are a mesh that are woven into the animal's specifics from which the animal cannot be separated.

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This network between the animal and the environment is what Ernst Haeckel, a few years after Darwin's world-changing publication, would call oekologie: "the comprehensive science of the relationships of the organism to its surrounding environment, where we can include, in the broader sense, all "conditions of existence" [4].

It is Haeckel's definition that the British Medical Journal would soon adopt, describing oekology as a branch of morphology and physiology based on the "exploitation of the endless phenomena of animal and plant life as they manifest themselves under natural conditions" [5]. However, it is very much worth noting that, in 1892, chemist Ellen Swallow Richards proposed an alternative version of ecology that was tied more closely to the etymology of the word. Swallow, based in Boston and fluent in German, dug into the etymology of the newly minted term: "Oik," meaning singular house, and "oek," for universal house. Swallow saw a clear correlation between the physical and social environment and felt that the human–environment relationship could be seen most clearly at its atomic level: in the family–home relationship. Where Haeckel's term connected to our universal home— Planet Earth—Swallow connected the term to the domestic, the home, and the community, aspects of the term to which contemporary definitions are returning today [6].

While Swallow's alternative was waylaid, biologists and zoologists continued to define the notion of habitat. In 1917, the term "niche" first appeared in a paper titled "The Niche Relationships of the California Thrasher" [7]. For author Joseph Grinnell, a niche was defined by both the place in which a species lives and its accompanying behavioral adaptations. It is part of the environment, he claimed, but also a subset of the organism. The California thrasher's form, camouflage, and feeding behavior are all inextricable from its chaparral habitat. This builds on Darwin's well-known observations on finches (Figure 1) in the Galápagos, each having evolved in isolation via adaptive radiation to fit local conditions. Ground finches have large beaks for seeds; tree finches, more delicate ones for insects or nectar. Morphologies in beaks, feet, and song co-evolved with niche requirements [3].



Figure 1. Darwin's Galapagos Finches' Niche. Based on a drawing in Biological Science: Molecules to Man [8]. CODA, 2012.

3. Architectural Ecologies

Following the taxonomic organizations of plant and animal species published by eighteenth century naturalists like Carl Linnaeus and Georges-Louis Leclerc, Comte de Buffon, architects began classifying and publishing forms by type. Jean Nicolas Louis Durand and

others proposed systematic methods for deriving architectural form from geometric rules. In 1917, D'Arcy Thompson's diagrams, depicting species and genera through continuous geometric transformations, made the biological development of physical forms in relation to external forces graphically legible. The grid, which represented the forces of deformation across species, suggested an underlying ordering system in the natural world. 'Force,' as understood by Thompson was "the appropriate term for our conception of the causes by which these forms and changes of form are brought about" [8].

In these cases and others, the focus on the object inevitably downplayed the environmental habitat that, if described, was seldom represented. In the mid-twentieth century, figures like Ian McHarg, John McHale, Reyner Banham, and Buckminster Fuller pushed back on decades of similarly object-obsessed modernism, promoting instead design that replicated nature and understood ecological design as the design of the planet as much as the design of an object or a space. McHarg's *Design with Nature* [9] pioneered an approach to landscape architecture and planning based on ecological principles, advocating for the integration of natural systems like geology, hydrology, and vegetation into the design process to create more sustainable and resilient environments. Reyner Banham published *The Architecture of the Well-Tempered Environment* [10], which argued for the inclusion of environmental systems into architecture proper and set the stage for a more technological modus operandi. John McHale's *The Future of the Future* suggested that "humans had enlarged their ecological niche to include the whole planet" [11]. McHale drew sectional diagrams from the earth's core to the sun in order to include the affected ecology into any object. From the inner earth to outer space, these "Superscale Survey" drawings zoomed out to consider how any act could impact multiple layers of the planet and beyond. McHale's representation of the site and use of the term niche is a clear alignment with ecology, though his use of the word is not yet in step with Grinnell's mutually dependent definition. It will not be until the rise and fall of sustainability that the niche will return to architectural discourse.

"Sustainability," coined in 1987, was described as a goal to "meet the needs of the present generation without compromising the ability of future generations to meet their own needs" [12]. While having the best of intentions, environmental architecture faced criticism for potentially being nothing more than "greenwashing": the facade of sustainability without depth. Certifications like LEED (Leadership in Energy and Environmental Design) came under attack for maintaining a status quo and enabling corporate values, rewarding superficial gestures rather than deeper and more meaningful design. Critics (including myself) saw sustainable hi-tech systems applied only after fundamental yet unsustainable moves had been made, as a "remedy" to the problems created by aesthetic choices [13]. Glass towers like Foster and Associates' 30 St. Mary Axe (a.k.a., "The Gherkin") were criticized for labelling themselves "sustainable" while many of the systems were countering aesthetic design choices; for example, fritted glass limiting heat gain in windows when the choice of glass was a fundamentally unsustainable choice in many ways. Likewise, Michelle Addington criticized the tautological logic of "smart facades," claiming that they solved problems created by design choices themselves [14]. To be specific, even when claiming not to, designs often prioritized appearance over site-response, if the latter was considered at all.

Beyond architecture, scholars like Greta Gaard noted that sustainable development is an oxymoron, and that capitalism's relation to nature is inevitably destructive and extractive [15]. As the new millennium approached, the "Anthropocene" came to define an epoch of human transformation of the planet. Philosophy and theory began to reengage in ecological questions through concepts of complexity, entanglement, and more-than-human systems. Deleuze and Guattari's book *A Thousand Plateaus* introduced the concept

of the "rhizome" to describe non-hierarchical, interconnected networks [16]. More recently, Timothy Morton defined the term "hyperobject" as "objects (that) entangle one another in a crisscrossing mesh of spacetime fluctuations" [17].

Eco-feminist scholars have offered a critical foundation for understanding ecological relationships as reciprocal rather than hierarchical, a condition that rethreads the needle back to Darwin. Val Plumwood, for example, wrote of Western culture's binary thinking in the form of what she called a "Master Model" that created an artificial hierarchy [18]. This human/nature (or culture/nature) dualism, she believed, was the true basis of the ecological failings of Western culture. Crucially, she noted that this "apartness" was "shockingly challenged by Charles Darwin in his argument on the descent of species." She believed that Darwin's "insights of continuity and kinship with other life forms"—what she considers the real scandal of his thought—were never integrated into contemporary culture due to our inability to consider our own species as anything but superior: as "set apart and entitled to manipulate and commodify the earth for their own benefit."

Inevitably, contemporary architecture has moved away from the technical language of sustainability and back towards the term "ecological," which aims to consider architecture as a part within a broader system, including not just the original environmental concerns of energy and material but also the social, cultural, and political entanglements that are inextricable components of that complex mesh.

However, while many design practices have moved in this direction, the discipline as a whole still lacks a shared grammar for how ecological design operates in practice.

4. Beyond Context: Leveraging the Niche

While technical definitions of the niche continued to evolve in the fields of ecology and biology, psychologist James Gibson translated the concept into perceptual theory: "Animal and environment make an inseparable pair. Each term implies the other," he wrote [19]. Gibson also recognized that multiple animals could inhabit the same place, each perceiving a different "surrounding." A related idea had previously appeared in Jakob von Uexküll's notion of "Umwelt": the world as it is experienced by a particular organism [20]. According to the theory, animals imbue their environment with meaning as evaluated by their needs, shaped by what he calls "action-possibilities."

One can imagine the organism drawing in, whether literally or metaphorically, representing its own needs relevant to its survival: its niche. In this representation, the figure of the organism disappears. It becomes entangled and interwoven: a mesh of systems and materials, inseparable from its environment.

The alignment of concept of the niche as a design tool in architecture was handed down to me by professors Greg Keefe and Geoff McKennan at the Manchester School of architecture in the late 1990s. Twenty years later, in my book *Niche Tactics: Generative Relationships between Architecture and Site* [21], I argued for a return to an understanding of the architectural terms "site" and "context" as intimately tied to the concept of the niche, i.e., a complex set of relationships between organism and environment defined by reciprocal need-based feedback (Figure 2).

This relationship between the organism and its context has obvious parallels with developments in the field of architecture. Vernacular forms came to be via such a response and adaptation to their respective niches: Mexican adobe construction as a response to heat gain and thermal mass, the jigged entrances of the Scottish stone hut as a response to the cold wind, the steeply pitched roofs of the Malaysian stilt dwelling as a response to heavy rains and uncertain ground conditions. Vernacular architecture shaped forms, construction techniques, material strategies, and social practices. But, for a long stretch

of time, referencing the vernacular was subjugated, as architecture became increasingly disconnected from local knowledge in favor of the homogenizing aesthetics of Modernism.

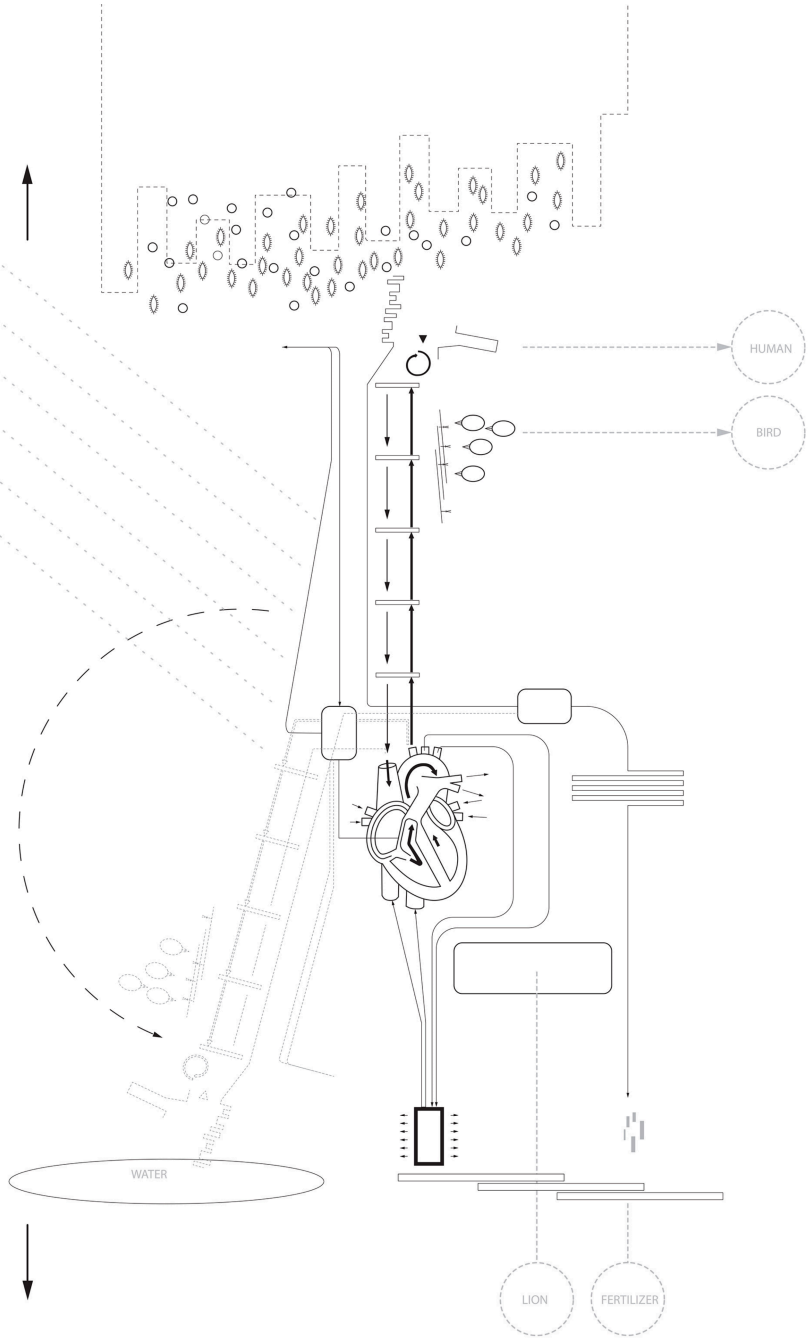


Figure 2. Giraffe Diagram. From Niche Tactics: Generative Relationships between Architecture and Site, Routledge, 2015 [21]. The diagram rejects the figuration of the giraffe in favor of a representation of the niche, including the essential entangled parts of the organism and the environment. CODA, 2012.

In the 1960s, Contextualism arose in opposition to the relentless detachment from place advocated by Modernism. Coined by Stuart Cohen and Steven Hurtt in 1965 at Cornell, the term described a design movement that derived form from a building's surroundings. R.E. Somol would later describe it as a rejection of the "internationalist utopia of nowhere" in favor of the "contextualist nostalgia for somewhere" [22].

At its best, Contextualism succeeded in harmonizing buildings with their surroundings. At its worst, however, it became an architecture of obsequious imitations and deferen-

tial copies. Cohen later lamented that it sometimes meant a "subservient repetition of the building next door," a pseudo renovation disguised as an original [23]. Colin Rowe also later accepted that Contextualism was, at times, a "radical middle of the road" [24], while Mark Wigley decried more forcefully as "an excuse for mediocrity. . . for a dumb servility to the familiar" [25].

Critical Regionalism emerged as a second wave of resistance. Coined by Alexander Tzonis and Liane Lefaivre in the early 1980s, it rejected the mimicry and pastiche for which Contextualism was criticized while upholding "the individual and local architectonic features against more universal and abstract ones" [26].

In the twenty-first century, the conversation around site and context-forward design continued with books such as *Site Matters: Design Concepts, Histories and Strategies* [27] and its 2021 follow-up [28], both of which argued for a renewed engagement with site. With increasing focus on sustainability, architects were urged to treat site as more than surface or setting. Yet, standard site analysis risked being overly generic, something architects could pay lip service to without the results significantly shaping the design that prioritized a preconceived aesthetic.

In *Niche Tactics*, I argued for a return to "site" and "context" as tied to the concept of the niche. I hoped to reconsider the design process as the evolution of form in its projected, extracted environment, i.e., in the same way that the tick, the bee, or the giraffe projected its needs onto the environment and responded primarily to those parts of the environment that were projected back. A niche-tactical design methodology, I wrote, would treat the building as an organism, evolving in dialog with its surroundings, seeking or shunning sun, light, water, space, temperature equilibrium, social and cultural engagement, and so on. The resulting forms could evolve to be ugly, awkward, lop-sided, or twisted, but they would nevertheless communicate their reciprocal relationship. They would make visible those parts of their niche that they connected with, in the same way as the elongated neck of the giraffe pointed to the upper leaves of the acacia tree. Form would emerge from the site-specific pressures of coexistence, and its entanglements would be legible. A niche-based design methodology would involve three specific shifts: (1) identifying the specific material, climatic, and social needs and desires of a design; (2) projecting these needs onto the site; and (3) allowing design to emerge through iterative negotiation. This approach minimizes the risk of an autonomous, preconceived design being modified in response to a generic analysis. The difference is crucial because it interrupts the aesthetic habits inherited from Modernism. It supports a set of responses that may directly oppose ingrained notions of "good" form: instead of a flat roof, a pitched roof; instead of concrete, wood; instead of large, glazed areas, strategic fenestration walls; and so on, coming together in ways that may, to the modern-influenced eye, seem incongruous.

To understand how this may play out, I attempted to implement a niche methodology in my own fledgling design practice. *Party Wall* at MoMA PS1 (CODA, 2013) was an early manifestation that used waste materials (skateboard manufacturing offcuts and leftover steel) and aligned itself with the solar path to produce shade [29]. Using the niche approach, the project's needs for sign, shade, and water were identified and projected onto the site, and the final design emerged as a dialog with existing signage, solar path, water sources, and material opportunities. Not only did the design evolve through dialog with the site, but also, its formal and material strategies made legible those relations; that is, the built could only be understood by zooming out and understanding the relationship between the object, the sun, and the shadow on the ground, which spelled out WALL at noon (Figure 3).



Figure 3. Party Wall, CODA, 2013, MOMA/PS1 Young Architects' Program used skateboard manufacturing offcuts and aligned with the solar path to produce legible shade. Photo: Zachary Tyler Newton.

However, an ongoing frustration with my own niche thinking was that the evolution ended when the design process ended. With José Ibarra, in *Werewolf: The Architecture of Lunacy, Shapeshifting, and Material Metamorphosis* [30], I asked, "What is architecture when it exists in a state of becoming, between nature and culture?" Later iterations of niche thinking in practice, such as *Primitive Hut* (OMG! 2017), began to explore questions of time, decay, and growth wherein architecture continued to evolve within its literal niche, during the life of a building. But still, something was missing (Figure 4).



Figure 4. Primitive Hut, OMG! 2017, in collaboration with Martin Miller. A project at Art Omi, Ghent, NY using decomposable components made of bioresin, hemp, sawdust and manure, built around four maple trees. As the pavilion deconstructed itself, the trees grew.

5. Evolving the Niche

In 2019, Elisa Iturbe guest-edited an issue of *Log*, titled "Overcoming Carbon Form." Her introduction described the underexamined relationship between energy and the built form. She called for an overthrowing of form entangled with extractive energy systems in favor of "a multifaceted project for architecture in which the concept of carbon form gives rise to an alternative history of modern space, linking form and energy in order to expose architecture's entanglements with power—in the sense of both energy and politics—and perhaps to unearth new sites of architectural agency" [31].

When Iturbe challenged architects to set new ambitions for architecture, she mentioned not only the future energy transitions but also social form. Lydia Kallipoliti, too, argued for this kind of ecology: less maintenance-as-burden, more care-as-method. She advocated for attention to flows, dependencies, and the work of keeping things going. Drawing from feminist thinkers, Kallipoliti framed the idea that care, as an ethical framework, may "challenge dominant systems and ideologies through the dimensions of affection, sensitivity

and physical work," so that architects and designers could operate "within the built world as if it were an ecosystem" [2]. In this view, ecological design is a way of dwelling carefully and responsibly in the world.

Joan Tronto and Bernice Fischer described care as "everything that we do to maintain, continue and repair our world so that we can live in it as well as possible. That world includes our bodies, our selves, and our environment, all of which we seek to interweave in a complex, life-sustaining web" [32]. Maria Puig De la Bellacasa followed up by asking: "What is included in "our" world? And why should relations of care be articulated from there?" An architect might be wont to imagine that architecture is included, and they might ask how relations of care can be articulated in the design process and in the resultant building [33].

While my own practice was testing a vision that wove the technical aspirations of sustainability, the perceptual theories of Gibson and von Uexküll, and the real-time engagement of site elements like growth and decomposition, what the projects lacked was a real engagement with the care and ethics of Kallipoliti and Puig de la Bellacasa. Was the concept of the niche flexible enough to include a thoughtful revision that engaged both the human and non-human inhabitant?

In its original conception in architecture, the niche concept tied strongly to Darwin's notion of survival of the fittest, where fit meant reciprocity with the environment. Incorporating contemporary discourse on care suggests perhaps a re-conception of that notion and not so much around the term fit as survival. An ecology of care points to more than survival: it suggests "thrival," where need and pragmatism shift to empathy and uplift, where architecture and architects care. In many ways, this shifting of gears in ecological design may bring us full circle to Ellen Swallow's original definition of ecology as something more care-taking, more homely, more intimate, and more domestic.

In my own practice, an opportunity to test this occurred through the Saltonstall Artists' Residency project (CODA, 2020), an inclusive addition for artists and their carers that incorporated the agency of the user into the design, allowing differently abled users to reformulate (through rotating walls and multi-height surfaces) the spaces (Figure 5). The design rehabilitated an existing building and incorporated a courtyard framed by a folding, charred-cedar façade with benches and planting as part of a social approach that encouraged artists to engage with each other as well as to venture out into nature. This project uplifted ideas of accessibility and community as primary, where the initial projection emerged from the human body and the collective, and the process sought opportunities to reformulate spaces and gather. Rather than creating an object, the project created space, landscape, and multi-affordance surfaces. Here, the wrapping of the skin between the two buildings, the material shift with continuity, and the incorporation of the landscape all contributed to an ecological reading. While previously, the human may have been considered one ingredient that contributed to the dynamism or evolution of the built work, now, there was a care for that inhabitant and the collective. Again, the design object was not a preconceived, harmonious form; rather, it identified and projected its needs onto the site, and its form and materiality reflected the evolution in dialog with the niche.

Better examples, of course, exist outside of my own work. Studio Anna Heringer's METI Handmade School in Dinajpur, Bangladesh (2006) is just one case that demonstrates this contemporary evolution of ecological architecture in which care for the inhabitants—the construction workers, as well as the local community practices and vernaculars—begins to truly shift the understanding of ecology to a care-forward approach. The building is certainly sustainable in terms of energy and material: thick earth-and-straw walls at ground level and triple-layer bamboo upper levels use vernacular strategies for structure, enclosure, and cooling. But the design goes beyond the sustainable to consider

the local construction workers who were, as part of the process, trained in earth and bamboo construction techniques in order to be repeatable and to give back to the built environment and to the people far beyond the building itself. Heringer notes how her own process evolved as she worked alongside the people—how, through talking with the community, she learned that women wanted to work on-site alongside men, and she enabled ways for that to be possible, which, in turn, transformed the end result. She learned things, too, not the least of which being that the best mixing machines were water buffalo. For Heringer, sustainability was less formal problem-solving and more doing things with love and care [34].



Figure 5. Saltonstall Artists' Residency, CODA 2020. An accessible addition for an artist and their career in Ithaca, NY, creating multi-use spaces with flexible walls and a central performance space.

The creased and cleaved mass of the masonry facade of Ningbo History Museum, created by Amateur Architect Studio by Wang Shu and Lu Wenyu, (2008), serves as another excellent example of a contemporary turn in ecological design that focuses more on materiality and cultural engagement. The building is clad in rammed earth construction and, most notably, layers of brick, tile, and stone from the remains of multiple local villages, employing a traditional 'Wapan' technique—an emergency reconstruction system developed by farmers in Zhejiang to rebuild following storm damage in which rubble is stacked and mortared. The architects' instructions allowed local craftspeople to make tactical design decisions, leaving geological vein-like bands of materials.

Above, the in situ concrete expresses the bamboo formwork into which it was cast and leaves another trace of the craftsperson's skill and labor. This commitment to not only local material but also local craft begins to get at what ecological means today. Beyond being ecological, the legibility is fundamental to communicating the ecological nature of the work. In that expression, architecture has the power to connect to economics, social systems, history, politics, culture, and power structures. It draws in the parts of a story it needs to tell.

Both of the above projects exemplify niche thinking because they are forms that clearly could not have emerged without their site reciprocity. Without the material and cultural history of the Ningbo site, the cultural crafts and techniques, the typhoons whose damage produced the Wapan techniques, and the political decisions that razed villages, this building would not have been able to take the form it did. Without a landscape of earth and straw, without a climate that necessitated mass walls and pitched roofs, and without a community committed to preserving their craft and leveraging their animals, METI would not exist as it does. In both cases, the architects cared to listen to the feedback from the niche. Where they stretch the niche definition in positive ways, their caring goes beyond the environment itself and extends to the other co-inhabitants.

6. Conclusions: Toward an Architecture of Care

This essay has argued for a return to the ecological concept of the niche as a more precise and generative methodology so that architecture does not just perform but also cares and communicates its entanglement with its surroundings. Reframed through the concept of the niche, design is a process of negotiation through which form emerges in response to specific conditions of coexistence. The text reflects on my own work, which has long addressed energy, material, and environmental responsiveness, and my work is still in the process of fully incorporating the human dimensions of ecology.

The introduction of "care" as a critical framework extends the niche beyond survival and toward questions of empathy, maintenance, and collective well-being. In "Fifty Cents a Foot, 14,500 Buckets: Concrete Numbers and the Illusory Shells of Mexican Economy," [35] María González Pendás discusses the intentional suppression of labor in the histories of architecture, using Félix Candela's Open Palmira Church as an example of how the traces of labor inscribed through the construction process tell their own truth. She demonstrates how the shells sought to "conceal behind the thinness of the concrete the enormous amount of bodies that went into their making." At the same time, the trace of labor through the imprint of the formwork provides clues to the stories of the process and the lives of the workers. Further, as Maria Puig de la Bellacasa writes: "Care is a human trouble, but this does not make of care a human-only matter" [33]. To take this seriously within architecture requires acknowledging the entangled human and nonhuman components that make up any environment. José Ibarra has recently developed the term, "geoempathy," a deep understanding and representation of the forces, materials, and conditions of a site, such that design emerges from within those conditions rather than being imposed upon them [36]. Reframing design ecology and the niche in these terms challenges the practitioners of today to work in search of "caring obligations that could enact nonexploitative forms of togetherness" [33]. Thinking with the evolved niche in this way has the potential to reorient ecological architectural practice toward a more empathetic mode, looking beyond simply how buildings perform and into how and for whom they care. Further, the niche's concept of "drawing in" reminds us that architecture has a responsibility not only to "do" but also to "show". How we make the "care" legible in the form and materiality of architecture is, itself, an ecological necessity.

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