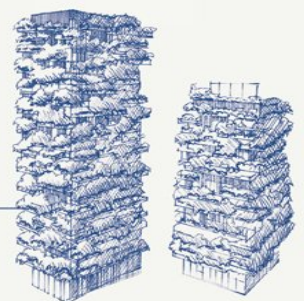
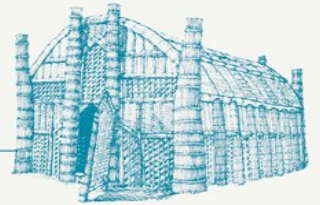


DWELLING ON EARTH

The Past and
Future of
the Places
We Call Home
STEFAN AL



For Natalie

By means of our hands we struggle to create, as it were, a second world
within the world of nature.

—MARCUS TULLIUS CICERO, *ON THE NATURE OF THE GODS* 2.61,
TRANSLATION ADAPTED FROM H. RACKHAM

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DWELLING ON EARTH

Introduction

Dwelling on Earth

One of the oldest known traces of early human habitation lies deep in Olduvai Gorge in Eastern Africa and dates back nearly two million years—marked by little more than scattered stone tools and fossilized animal bones. Though the first gestures of dwelling likely began even earlier and are lost to time, their significance was profound. When our ancestors began returning to familiar ground and reshaping their surroundings, they did more than rewrite human destiny—they began to rewrite the story of the Earth itself.

From these humble beginnings, our dwellings rose ever higher. Temporary shelters of mammoth bones gave way to Mesopotamian mud brick homes. In time, Roman multistory apartment buildings rose over ancient cities, housing thousands in the early concrete structures called *insulae*, meaning “islands,” rising from streets like stone archipelagos. Today, skyscrapers of glass and steel pierce the clouds in Shanghai and Dubai. And now, in our quest for survival and adaptation, we dare to imagine homes on distant planets—carrying the ancient idea of dwelling beyond our world.

As we shaped our dwellings to suit our needs, they in turn shaped us. In an era when survival meant grappling with the elements and nomadic wandering in search of resources, permanent dwellings emerged as sanctuaries. They sheltered us from storms, provided comfort and security, and became the seedbeds of civilization.

Dwellings allowed us to store possessions and accumulate wealth, luxuries that had eluded hunter-gatherers. They offered new degrees of privacy without the risk of venturing far from the community. As populations concentrated, these clusters of dwellings functioned as social catalysts. Larger settlements accelerated the rapid exchange of ideas and spurred cultural development. In a single day, a villager might encounter more people than a forager met in months—sometimes years.

Homes also became places to make sense of the world and express shared values. We filled them with symbols of belief, setting aside spaces for ritual and ceremony. About nine thousand years ago in the Stone Age town of Çatalhöyük on the Southern Anatolian Plateau, residents built walls incorporating vulture beaks and human skulls—precursors, perhaps, to the souvenirs and portraits we display on mantelpieces today.

Behind these walls and under these roofs, an extraordinary transformation took place, altering our habits, relationships, and the course of civilization. With shelter securing our fundamental requirements—anchored at the base of Maslow’s hierarchy of human needs—people could turn their energy to higher pursuits: building villages, founding cities, and raising monumental temples and pyramids.

Between our first basic huts and today’s towering structures lies an extraordinary and hard-won journey of innovation—from Roman concrete to modern steel frames, from wood-burning fireplaces to smart thermostats, from candlelight to LEDs. Many advancements arrived through trial and error, and sometimes at great human cost. The densely packed houses of Çatalhöyük, for instance, used flat roofs as streets, with roof openings doubling as chimneys and entrances accessed by ladders—a design that likely bred respiratory illnesses, frequent falls, and fractured bones. As much as human dwellings showcase our genius for adaptation, they also reveal our knack for creating the very risks they were meant to prevent.

The walls we built to keep nature out also created boundaries between people—inevitably fueling envy, suspicion, and inequality. In the earliest settlements, there was little differentiation among dwellings. But as settlements grew into cities, wealth inequality became visible. In Ur, one of the first cities in Mesopotamia, wealthy residents lived in durable homes made of courses of fired brick, while commoners occupied sun-dried mud brick structures prone to decay. Some had no secure shelter at all. Permanent settlement may have safeguarded the weak from the wild, yet its benefits were unevenly distributed.

Millennia later, the pattern persists. Luxury towers rise while people without shelter sleep in their shadows, as the gap between wages and housing costs widens. Even in wealthy nations, housing insecurity undermines health and well-being, particularly for vulnerable groups like children, who suffer developmental setbacks. Studies consistently show that stable housing improves quality of life, reduces healthcare costs, and lowers rates of intimate-partner violence.¹

And yet, even when architects set out to improve how we live, well-meaning efforts sometimes perpetuate social problems. In the 1920s, the modernist Frankfurt Kitchen introduced a streamlined workspace based on principles of scientific management and time-and-motion efficiency. Though intended to liberate women from domestic drudgery, its compact design—optimized for a single user—often left them working in isolation, with little space for conversation or supervising children. Rather than challenging traditional gender roles, it may have quietly entrenched them.

Our homes and neighborhoods also impact our health—influencing how we move, breathe, and sleep. Even seemingly comfortable homes can harbor hidden hazards. In car-centric suburbs, daily walks give way to long commutes behind the wheel, contributing to rising rates of diabetes, heart disease, and obesity. While our hunter-gatherer ancestors often walked on the order of 16,000 to 17,000 steps per day, the average American today takes about 4,000 to 5,000 steps. Studies indicate that people living in car-dependent areas face a significantly higher risk of developing type 2 diabetes and obesity.² Obesity, in turn, can reduce life expectancy by years, in severe cases comparable to the effects of lifelong smoking.³

Dense apartment living can present its own challenges, such as limited natural light, which can negatively affect mental health⁴—though apartment living can also foster social connection between neighbors.⁵ And those who live in a house with stairs may live longer and healthier lives, benefiting from the daily cardiovascular exercise of climbing them.⁶ Indoor air quality poses another challenge, especially with nearly airtight modern construction. Common building materials release volatile organic compounds, while poor ventilation allows pollutants to build up. Outside, those picture-perfect lawns surrounding suburban homes often rely on pesticides and herbicides such as 2,4-Dichlorophenoxyacetic acid that not only can contaminate groundwater but are so toxic that they pose serious risks to children and pets.⁷

Most people now spend the majority of their lives inside their residences. Americans devote about 90 percent of their time to interior spaces, two-thirds of that at home. Inside, design choices impact well-being. Natural light influences mood and sleep patterns,⁸ while clutter can elevate anxiety and dull focus.⁹ Views of nature or even simple natural elements have been shown to reduce stress and enhance cognitive function.¹⁰ Yet homes may also shape our inner lives in subtler, more poetic ways. “Thanks to the house, a great many of our memories are housed,” philosopher Gaston Bachelard observed, “and if the house is a bit elaborate, if it has a cellar and a garret, nooks and corridors, our memories have refuges that are all the more clearly delineated.”¹¹

“We shape our buildings; thereafter they shape us,” Winston Churchill once famously said when advocating to rebuild the bomb-damaged House of Commons to its original design. He believed its layout—two opposing banks of benches—was responsible for the two-party system and the very nature of British parliamentary democracy.

What holds for the House of Commons holds for the home as well. Dwelling is not merely a physical structure but a way of being—both noun and verb—woven into the fabric of human culture. Our homes are not just where we live. They are how we live.

Crafting Our Niche

It was our capacity to dwell that gave us a unique evolutionary advantage. While Darwin focused primarily on how species adapt to fit their environment, modern researchers emphasize that some animals form significant two-way relationships with their surroundings. Humans belong to this group—we engage in what researchers call “niche construction.” Like beavers building dams, we create environments that often afford us advantages. These “ecosystem engineers” pass down construction behaviors through generations.

Some animal-made niches rival even the ingenuity of our own creations. Mound-building termites in Australia are renowned for their monumental towers, sometimes reaching about 800 times their body length—the equivalent of skyscrapers taller than any built by humans.¹² They have even developed temperature control systems. Inside, these insects maintain constant temperatures through intricate systems of vents and flues, even as desert temperatures swing dramatically between day and night.¹³ Similarly, bees create precise hexagonal honeycomb patterns. This shape makes efficient use of space, eliminating gaps that would occur with circular cells. It uses less wax than triangles or squares would require to enclose the same area while still providing structural strength—a design so efficient that humans now use it in engineering applications. These remarkable structures, however, emerged over millennia as insects whose genes produced more efficient structures had greater reproductive success, passing their genetic traits to subsequent generations.

Humans, by contrast, accelerate architectural innovation through our ability to make tools, think abstractly, and cooperate intentionally. We leverage geometry, mathematics, and engineering to solve new problems within single lifetimes. We create scalable social networks that allow us to transmit new ideas and coordinate construction projects through planned collaboration rather than genetic instinct. Our earliest homes used simple round forms, as circles and ovals distribute the weight of the roof more evenly and round pits were straightforward to excavate. But we soon developed rectangular structures as our needs evolved, because right angles simplify expansion and partitioning into multiple rooms. We later clustered homes into blocks and orthogonal grids, creating ever-larger cities. We mastered arches and vaults, forged steel, and engineered vertical structures that scrape the sky. No species has ever reshaped its environment so swiftly or completely.

Yet this power comes at a cost. Species that construct niches inevitably alter the ecosystems around them. Just as beavers build dams that transform entire watersheds into lakes of their own making, our ability to modify our environment has fundamentally altered Earth’s ecosystems. In our relentless expansion and pursuit of ever-greater comfort, we invented machines that moved

mountains and paved vast road networks, and built climate control systems that burn through enormous amounts of energy.

Today, the built environment accounts for almost 40 percent of global carbon emissions, much of it from constructing, heating, and cooling residential buildings.¹⁴ And the problem is growing. By 2050, urban populations will increase by 2.5 billion, with cities housing over two-thirds of humanity. To meet this demand, we will need to build roughly the equivalent of a new New York City every month for the next three decades.¹⁵ Meanwhile, as the middle class in emerging economies is expected to double over the next decade, we may see a rise in consumerism mirroring Western patterns, further stoking demand for more floor space. In the US, even as household size halved, floor space per capita doubled from 400 to 800 square feet between 1891 and 2010¹⁶—contributing to a tenfold increase in total housing volume.

Our homes make up much of our built environment, driving economic activity and demand for land, infrastructure, and resources. This bond is etched into language itself: both “economy” and “ecology” spring from the Greek *oikos*, which means “house” or “household.” The ancient Greeks coined the term *oikonomia* (economy) as the management of the household, reflecting the house as society’s basic economic unit. Centuries later, German biologist Ernst Haeckel introduced *Ökologie* (ecology), to refer to the study of organisms in their habitats, their “houses.”

Perhaps even cities arose from the house. Archaeologists once believed the first cities, such as Uruk in Mesopotamia, sprang from the centralized power of temples and palaces. But archaeological finds at the earlier site of Tell Brak suggest another path: incremental growth, household by household, forming neighborhoods that collectively housed tens of thousands before any dominant civic structure emerged. This is what archaeologists call a “proto-city,” a large, densely occupied settlement with urban traits but with little or no early evidence of centralized authority. Like the “swarm intelligence” behind the complex structures built by termites, these larger settlements may have scaled up through the cumulative interactions of many independent households rather than through the top-down direction of political elites. Even when monumental buildings appeared later, they often mimicked domestic architecture. In Mesopotamia, many temples were essentially enlarged houses.

Today, the way we build shapes the planet more than ever before. From the clearing of forests for materials to the carbon footprint of buildings, our housing choices are transforming the environment. In our continuing pursuit to build ever more comfortable homes, we now face climate change and related challenges that threaten the very comfort we sought to create.

From Huts to High-Rises

How did our homes evolve from simple huts made of animal skins and bones to “smart” sensor-equipped buildings? What technological breakthroughs, societal shifts, and cultural currents sparked new ways of dwelling? And how has the evolution of our homes shaped humanity in return—reconfiguring our cities and neighborhoods, raising standards of comfort, and establishing social norms around privacy and domesticity? This book probes these questions, ultimately asking: How did the remarkable story of dwellings redefine our lives and the planet—and how might we build more sustainably in the future?

Dwelling on Earth traces the long, captivating evolution of human habitation and its entangled relationship with the environment. The story of the home is inseparable from the story of humanity itself, unfolding alongside our societal evolution. From brush huts to high-tech habitats, our dwellings have not only shaped how we live but also transformed our world.

For much of history, residential architecture was largely overlooked by architectural historians and archaeologists, who favored monumental temples and palaces. When ancient homes did enter the scholarly spotlight, conclusions were sometimes distorted by outdated science or cultural presumptions. Take the case of the Peking Man discovered in a cave at Dragon Bone Hill near

Beijing, dated to about 400,000 years ago. Early excavators proclaimed the site the home of the first caveman—and supposedly a cannibal, based on bite marks found on bones. Decades later, high-resolution microscopes and modern forensic techniques overturned the tale. The marks match those of gigantic hyenas, suggesting the cave was their den, where they dragged in and gnawed human remains.¹⁷

These interpretive problems had deep roots. One example is the eighteenth-century “primitive hut” theory of architecture, proposed by French priest Marc-Antoine Laugier, who imagined the first homes as sloped roofs supported by wooden columns—a form that conveniently mirrored classical Greek architecture.¹⁸ Until recently, the oval-shaped huts at Terra Amata in Nice, France, were considered the earliest purpose-built homes based on rings of stones found in a beach alcove—a conclusion perhaps skewed by the desire to declare a definitive “first” home. However, new archaeological evidence using micromorphology, which studies soil slices under polarized light, now indicates these rings were not human-built foundations, but likely resulted from naturally occurring stream flows.¹⁹ Nevertheless, the oval hut reconstructions live on, lingering in textbooks and museum displays.

Today, a range of cutting-edge tools enriches our understanding of early homes. DNA analysis reveals familial relationships and migration patterns among ancient residents. Satellite imagery detects settlements where none were expected. Pollen analysis reconstructs ancient climatic conditions. These and other methods provide new insights into early dwellings and settlements.

Yet even with such tools at our disposal, this book does not attempt to provide a complete global history of every dwelling type. Instead, it traces four major transformations: the Agricultural Revolution, the Urban Revolution, the Industrial Revolution, and the ongoing Sustainability Transition. The first three marked transformations from which there was almost no turning back, establishing new levels of complexity, enabling unprecedented forms of settlement, and fundamentally altering how humans could live. The fourth, however, is different—it compels us to choose how we dwell without destroying what sustains us. We’ll explore key innovations and how homes evolved through these turning points, from the first vertical apartment blocks of ancient Rome built by unscrupulous speculators to the early terraced row houses in Liverpool created by forward-thinking industrialists.

Before agriculture, dwellings were temporary—grassy beds, huts made of reeds and animal hides—and most vanished without a trace. But around 12,000 years ago, the Agricultural Revolution allowed us to invest more deeply in permanent settlements. Communities like the Natufians in modern-day Israel and Palestine built circular dwellings of stone and mud as they domesticated plants and animals. Similar round pit houses emerged independently around the globe—solutions to the same problems, arrived at separately.

However, with permanence came peril. Settled communities placed themselves in the path of natural disasters. Floods, droughts, and hurricanes posed considerable risks to their well-being. Communities also significantly modified their natural environments—clearing forests for farms, fuel, and building materials, which exposed topsoil to wind and rain, washing away fertile earth needed for crops. In doing so, they inadvertently contributed to the very “natural” disasters they feared. In many cases, these environmental missteps set the stage for collapse—a harsh reminder of the responsibilities that came with settled living.

The Urban Revolution, roughly six thousand years ago, gave birth to the city and new living spaces. As the demands of irrigation and agriculture favored extended family households, homes began to expand. Circular huts gave way to rectangular forms, far easier to expand and cluster in growing settlements.

With increased settlement size came greater social, economic, and political complexity—and homes evolved in tandem. A growing division of labor gave rise to professional builders. Growing populations and social specialization spurred innovative dwelling types, including row houses and even multistory apartment buildings.

Remarkably, several of these urban forms—such as the atrium house and the organized street grid—emerged independently in different parts of the world, in cultures with no direct contact. In ancient Rome, breakthroughs in materials like concrete made it possible to construct vertical apartment buildings, housing large numbers of urban residents. These unprecedented housing forms enabled more people to live in closer proximity, fostering new kinds of interaction.

Did settled life make us happier? While agricultural settlement is often viewed as inevitable progress, some anthropologists highlight the advantages of nomadic lifestyles. They cite the example of the nomadic !Kung people of the Kalahari, who spend only roughly 40 percent of their time securing food, dedicating the remainder to socializing, dancing, and other pursuits.²⁰ By contrast, settled life often brought increased labor demands—from dawn-to-dusk farming to endless home maintenance.

Even as the cities of the classical world grew, nomadic people persisted, offering a different model entirely. In the fifth century BC, the ancient Greek historian Herodotus described the nomadic peoples on the Eurasian steppe: “Having neither cities nor forts, and carrying their dwellings with them wherever they go: accustomed, moreover, one and all of them, to shoot from horseback; and living not by husbandry but on their cattle, their wagons the only houses that they possess, how can they fail of being unconquerable, and unassailable even?”²¹ These societies had mastered animal domestication but chose not to cultivate crops. As historian Spiro Kostof noted, “They had no use for settled permanence except as their last resting place.”²²

And yet the agglomeration of urban populations brought undeniable advantages. Larger scales of social organization fueled economic productivity and wealth creation—a pattern that continues from ancient cities to modern metropolises.²³ While early productivity manifested in temples and elite housing, today we measure it in GDP. Urban concentration consistently drives innovation.²⁴ In the United States, large cities produce about twice as many patents per person as smaller ones.²⁵ Cities became the engines of civilization.

But even these had limits. Preindustrial cities faced hard constraints to growth. Inadequate sanitation and insufficient agricultural output restricted their population. These barriers would not be broken until the Industrial Revolution, which introduced new energy sources and more efficient means of production—enabling urban growth on an unprecedented scale.

The Industrial Revolution reshaped residential architecture and cities as a whole. Steam trains enabled suburban expansion, while breakthroughs in steel production, construction equipment, and elevators revolutionized building height in cities like Chicago and New York. Meanwhile, a growing bourgeoisie redefined domestic life around the nuclear family—evident in seventeenth-century Dutch row houses, where, to the shock of foreign guests, visitors were expected to remove their shoes.

But industrialization came with a darker side. In many cities, the working class lived in overcrowded, unsanitary tenements. Polluted air, contaminated water, and squalid housing conditions made cities deadly environments, where mortality rates outpaced births. In response to these grim realities, reformers pioneered early planning reforms and regulations that led to better housing initiatives, exemplified by the terraced rows in Liverpool. The construction of modern sewage systems and clean water infrastructure eventually vastly improved urban life.

The twentieth century witnessed a bold modernist movement of urban living that reimagined the home as an efficient machine. This approach manifested in neatly organized rows of apartment blocks and tall towers set in parks. While some cities like Singapore and Hong Kong embraced vertical urbanism, elsewhere, particularly in the United States, domestic life increasingly migrated to automobile-oriented suburban developments.

As we prepare to build many more homes in the twenty-first century, we face new challenges. Today, our homes confront growing environmental threats, from rising temperatures to floods and wildfires. In response, architects are being called on to design more resilient and sustainable

dwellings. These range from entire floating neighborhoods to structures made from bio-based materials like mass timber—large engineered-wood panels strong enough to stand in for concrete.

Simultaneously, emerging technologies are transforming how we build and live. Where Mesopotamians once painstakingly molded clay bricks by hand, robotic arms now extrude concrete with precision. Digital design and automated manufacturing such as 3D printing are revolutionizing how we build, even enabling the design of prototypes for Martian habitats. Artificial intelligence is already beginning to generate home designs and manage domestic systems.

Yet amid this wave of innovation, we're also rediscovering the wisdom of time-tested preindustrial traditions. Passive heating and cooling, natural ventilation, and bio-based materials are making a return—not as nostalgic gestures, but as proven solutions. In many respects, our ancestors may have built more sustainably. Mesopotamian cities largely disappeared into the earth. Ours, by contrast, may be remembered by future archaeologists for their concrete debris.

As we confront the intertwined challenges of climate change and rapid urbanization, the long history of dwelling becomes more than a source of insight. It offers a foundation for reimagining how we live. This book traces that history to understand how we arrived at this moment, and to explore what it will take to build more sustainably.

Homes for Tomorrow

As a professor of architecture and urban planning, I've been fortunate to witness an extraordinary diversity of global housing solutions. My journey has taken me from the informal settlements of southern China to Manhattan's supertall skyscrapers, from Hong Kong's meticulously planned public housing estates to the Netherlands' experimental floating homes. Along the way, I've seen how seemingly technical policies—from zoning resolutions to building codes, even landscaping requirements—significantly shape the way we live. In the United States, for instance, regulations meant to keep neighborhoods orderly have inadvertently nudged out “missing middle” housing—such as row houses, duplexes, and apartment buildings that bridge the gap between single-family homes and large apartment blocks. They have also limited mixed-use blocks where apartments sit above corner cafés or neighborhood shops. The result? Fewer affordable, walkable choices in many communities. In Singapore, by contrast, urban planning policies have deliberately cultivated tall buildings that weave greenery into the skyline, proving how intentional policy design can achieve both density and livability.

As a practicing architect, I've watched the profession transform from hand-drawn blueprints to algorithm-driven modeling and AI-assisted renderings. Construction methods, too, have evolved. Brick walls once laid by hand can now arrive as factory-made panels or be installed by robotic arms. Drones monitor progress from above while robotic dogs patrol sites from the ground. Alongside these technical advances, our profession has championed more sustainable buildings, from advocating for stricter energy codes to embracing renewable materials like cross-laminated timber and bio-based finishes.

As a resident, my own experience of home began in a Dutch town. I grew up in a narrow row house, almost identical to its neighbors, each with its own modest backyard. No one had air-conditioning—we didn't need it. Thick brick walls, external shading, and cross ventilation kept interiors cool. The wide sidewalks fostered a sense of community. Most neighbors knew each other. As a child, I could bike safely to school and play in the street.

When I began my studies in Delft, I moved into student housing that was part of a bold experiment in 1970s architecture. Architects had reimagined the conventional layout, centering each floor around a communal kitchen. Most roommates took turns cooking for one another. There were no formal rules requiring this arrangement. The layout encouraged it. It nurtured collaboration and community. To our surprise, one roommate became the town's youngest mayor.

In Barcelona, I lived in a compact apartment in the old town. Despite the limited space, I was steps from shops, cafes, and public transit. Paris offered a similar lifestyle, with its Haussmann-era walk-up courtyard buildings. In New York, I lived in elevator buildings. Hong Kong immersed me in its vertical labyrinth of skyscrapers and “pencil towers.” Apartments were small but utilized every square inch through sliding walls, foldout furniture, and built-in storage tucked into every nook.

These cities share an important quality. Most daily activities are within a fifteen-minute walk or bike ride. They are examples of what planners now call the “15-minute city.” This experience taught me that quality of life isn’t necessarily tied to the size of one’s home but to the richness of the walkable surroundings.

My path later led me back to suburban life—to a midcentury modern villa in California, a townhouse in Virginia, and a century-old Colonial Revival house in a New Jersey railroad town. Each move brought new daily routines. In Manhattan, movement was built into everyday life, from walking to stores to catching the subway. In the New Jersey suburbs, staying active often requires a gym membership.

In the chapters ahead, we will explore the larger story of human habitation—from the first fired bricks of Mesopotamia to the modular 3D-printed homes of tomorrow. We’ll examine engineering feats that made cities possible, and social experiments that redefined domestic life. We’ll uncover innovations we now take for granted—like how the humble corridor reconfigured privacy. We will explore movements shaped by cultural and economic shifts, from Bauhaus to Brutalism.

While we will examine the physical structure of buildings, we will also consider the social structures they create. Each housing type has the ability to shape urban landscapes, daily experiences, and interactions across different walks of life. Even seemingly innocuous design choices can influence social dynamics. As Amos Rapoport observed in *House Form and Culture*, the placement of American dining counters—like the arrangement of chairs in psychotherapy sessions or courtroom layouts—is “remarkably indicative of the roles of the people involved.”²⁶

Throughout history, the concept and form of home have continually evolved. Unlike the Darwinian evolution of species shaped by natural selection, architecture evolves through artificial selection—driven by human intention. It is up to us to actively shape our built environment. We didn’t accept rock shelters as our final dwelling place. We built our way from mud huts to towers of steel and glass—not by chance, but by choice, and through the same cooperative intelligence that first forged our settlements to meet shared challenges. If we could once raise Gothic cathedrals stone by stone, we can certainly reimagine the homes we build today.

Today, we can create homes that do less harm to the planet. Addressing carbon emissions in the built environment is inherently complicated, involving trade-offs across materials, operations, infrastructure, and transportation. But due to advances in digital design, performance simulation, and life-cycle modeling, we now have the tools to understand and optimize these interactions with unprecedented precision. The technology exists. What remains is the collective will to act.

In our quest to build better homes, it’s tempting to focus on the newest technologies—solar panels, smart thermostats, superinsulation. But progress won’t come from buildings alone. It depends equally on what happens beyond the property line: the design of streets and the shape of neighborhoods. These decisions often lie outside the architect’s control, shaped instead by planners and policymakers. And yet, they have an enormous influence. Architects can design exceptional houses. However, they cannot overcome zoning laws that mandate excessive parking or the absence of safe sidewalks and crossings.

Growing up in the Netherlands quickly teaches you that landscapes are made, not given. Hardly a square inch remains untouched. One-fifth of the country is polder—land wrested from sea and river. You realize that the ground beneath your feet is engineered. If we can conjure land from water, surely we can reshape the land we have with equal ingenuity.

As a phrase attributed to Buckminster Fuller puts it, “We are called to be architects of the future, not its victims.” We are not prisoners to our surroundings, because we are their authors. The path

forward begins with reimagining how we dwell. For dwelling is more than walls and roofs. It's about who we are, how we relate to one another, and how we care for the Earth that remains our only home.

One

A Permanent Place

Fire and Shelter

In 1753, the Jesuit priest Marc-Antoine Laugier described the origin of dwelling by imagining a lone “savage” troubled by nature’s extremes. This “primitive man,” seeking refuge from scorching heat and torrential rain, initially fled to a cave but found it too dark and filled with “foul air.” Upon leaving the cave, he embarks on a mission. “Resolved to make good by his ingenuity the careless neglect of nature,” Laugier writes, “he wants to make himself a dwelling.”¹

As Laugier’s story continues, the man wanders through a forest, stumbles upon fallen branches, and has an epiphany. “He chooses four of the strongest, raises them upright and arranges them in a square.” With surprising engineering intuition, he lays four more branches across their tops to create a frame. He then crowns it with a pitched triangle, making a roof truss, and covers it “with leaves so closely packed that neither sun nor rain can penetrate. Thus man is housed.”

This tale of instant architecture became the foundation of Laugier’s influential theory, championing the simplicity of a “primitive hut,” a pitched roof supported by columns, over the theatrical flourishes of High Baroque architecture. While the story shaped architectural thinking for generations, it is far from the historical reality. Rather than a single stroke of genius, the story of human habitation is one of gradual evolution, unfolding over millions of years through the collaborative acts of countless generations. And this story begins not with *Homo sapiens* but with our distant ancestors.

This history begins in the trees, roughly 14 to 18 million years ago, according to evolutionary biologists, when our great ape ancestors likely developed sleeping platforms.² They would bend and weave together branches, twigs, and leaves, creating what we might call the first beds. Building these rudimentary and temporary platforms—something modern gorillas, orangutans, and chimpanzees still do—would have offered protection from predators and blood-sucking insects. Perhaps they offered escape from ground-level humidity as well.³

But the real transformation came when our hominin predecessors, the forebears of Neanderthals and *Homo sapiens*, broke from this pattern. While apes continued to build fresh nests each night, abandoning them in the morning, our hominin ancestors began experimenting with something surprisingly revolutionary: permanence.⁴

One of the earliest traces of this practice was found in Olduvai Gorge, Tanzania, dating back to around two million years ago. Archaeologists discovered stone artifacts associated with early hominin species. Most importantly, these were clustered in specific locations. This suggests our ancestors were creating the first “places,” sites they would return to again and again.

Why bother establishing a favored place at all? Unlike most primates, who consume what they find on the spot, early hominins began carrying food back to a central place to share. Such behavior would have improved the odds of reproduction. “The extraordinarily long period of juvenile dependency necessitates high levels of cooperation and resource sharing by both parents, by other children, and sometimes by other members of the society,” evolutionary anthropologists Steven Kuhn and Mary Stiner observe.⁵ “It takes a village to raise a child, but it also takes a long time.”

Regardless of intent, this seemingly simple change—the creation of places to return to—marked one of the most significant transformations in human evolution. Unlike the solitary nests of apes, these early campsites became the first community spaces in human history.

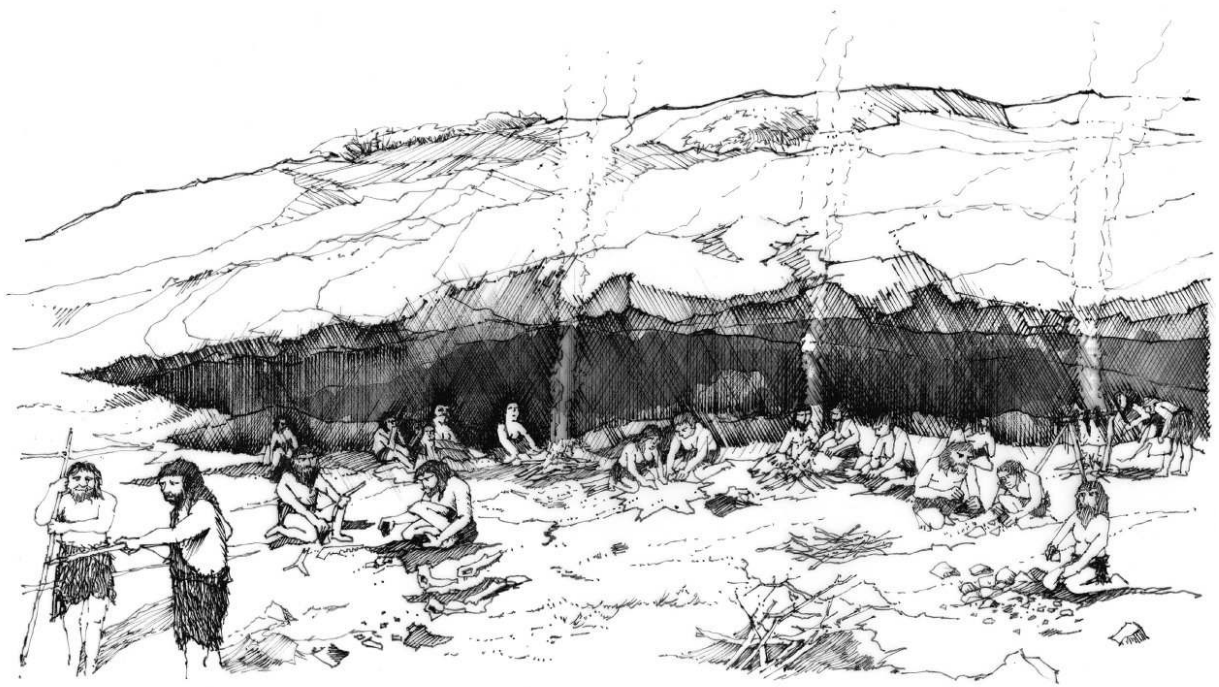
Here, our ancestors did more than rest—they slept, shared food, crafted tools, and passed down knowledge. As several anthropologists have noted, these sites became “arenas for social learning that had not existed previously.”⁶ This new social environment may have even helped shape our brains, particularly the neocortex—the region responsible for advanced cognitive functions such as emotional control and planning.⁷ This new lifestyle not only set human habitation apart from that of apes, it may have redefined who we were.

This would also have accelerated one of our signature strengths: our ability to make tools, positioning us, as several archaeologists describe, as “ultrasocial engineers.”⁸ The earliest known trace of this engineering impulse surfaces at Kalambo Falls, Zambia. There, excavators discovered two interlocking timbers dated to roughly 476,000 years ago—evidence that, as the researchers describe it, offers “a glimpse of a capacity to create a built environment” long before *Homo sapiens*.⁹

The next major revolution came with the habitual use of fire, beginning around 400,000 years ago. Fire changed human habitation in ways our ancestors could hardly have imagined. It kept predators at bay, illuminated the darkness, provided warmth, and unlocked new food sources, making previously inedible items like grains digestible. This transformed our relationship with time, cutting the time spent chewing raw foods and extending our days beyond sunset.

Around the same period, our ancestors began to more frequently occupy rock shelters and caves. Fire made the inhospitable conditions of caves more bearable, as caverns were often cold, dark, damp, and home to other residents like lions, bears, and hyenas, which had to be displaced. With fire, these places stayed occupied longer.¹⁰ But fire did more than make campsites and caves more comfortable.

“Home is where the hearth is” goes the saying, and in prehistoric times, the hearth was truly the center of the home. Our ancestors gathered around fires to share food, tell stories, and strengthen social ties. As archaeologists Desmond Clark and Jack Harris observed, fire “helped to weld early hominid groups into the coherent family units that are characteristic of human society.”¹¹



Rock-shelter, Abrigo de Navalmaíllo, Spain, ca. 73,000 BC. ¹²

These more permanent places likely changed our trajectory. They provided safe havens, helping to protect the young and vulnerable and extending the lifespan of the physically compromised. ¹³ Previously, a bone fracture would have meant certain death. Now, there was hope for recovery.

In some ways, a permanent place made survival easier. But it also required more advanced social skills. This could have affected our evolution. Natural selection could have increasingly favored those better at cooperation, communication, and conflict resolution. The use of fire for cooking reduced the size of our teeth, leaving them smaller than those of other animals. Some archaeologists have proposed that dwelling may have changed our brains. It established a feedback loop: Humans were creating homes, and homes were shaping humans. This process may have influenced the development of future generations in a nonlinear way. As Kuhn and Stiner observed, “More and more, hominins were coevolving with the world that they modified.”

These early settlements proved attractive to other hominins, drawing them in with the promise of food, resources, and companionship. Yet this closeness came at a cost. Exposure to smoke from open fires harmed lungs. Meanwhile, the close proximity of people hastened the transmission of mycobacterial diseases through coughing. ¹⁴ Tuberculosis, for instance, is estimated to have caused about a billion deaths across history, more than all famines and wars combined. ¹⁵

Managing fire brought other challenges as well. Early humans had to master the delicate balance between warmth and smoke inhalation. Recent studies of sites like Lazaret Cave, occupied approximately 170,000 years ago, reveal advanced spatial thinking. Hearths were strategically placed in “sweet spots” that maximized heat and light while allowing smoke to escape. ¹⁶ Too deep in the cave meant safety from predators but poor ventilation. Too near the entrance meant better air but exposure to cold and danger. This spatial problem-solving reflects not only an awareness of these practical challenges but also an ability to overcome them.

Meanwhile, the control of fire enabled our ancestors to venture into regions like northern Europe during periods when nearly 30 percent of the continent lay under ice, dramatically expanding our territory. It also marked humanity's first major impact on the Earth. Long before industrial emissions, our ancestors wielded flames as environmental engineering tools. They managed burn zones that promoted fruit- and nut-bearing plants in the postfire regrowth vegetation.¹⁷ Fire became a powerful hunting aid, exposing the nests of small game and driving larger prey into traps. It effectively shrank the "radius of a meal"¹⁸—the distance humans needed to travel to find enough food. Our ancient use of fire has influenced many ecosystems and spurred the rise of fire-adapted plant species (pyrophytes).

As our ancestors' mastery of fire grew, so did their ingenuity in creating comfort. More than 200,000 years ago, evidence of the first intentionally created bedding appeared in southern African rock shelters.¹⁹ Early *Homo sapiens* carefully constructed beds of broad-leaved grasses to enhance their comfort. They placed them close to the hearth—and, judging from the scorched ends of the grasses, sometimes too close. This arrangement mirrors modern hunter-gatherer camps, where people still gather to sleep around the fire.²⁰

Neanderthals displayed architectural capabilities of their own. Around 176,000 years ago, deep within Bruniquel Cave in France, they ventured more than a thousand feet from the entrance. Working by torchlight, they deliberately stacked hundreds of stalagmite pieces into two broad rings, some bearing traces of fire.²¹ This wasn't shelter but one of humanity's earliest monuments. The sheer effort required speaks to sophisticated planning and cooperation.

By 100,000 years ago, hominin settlements show evidence of complex spatial organization. The popular image of Neanderthals living deep in caves turns out to be wrong. Archaeologists found they preferred more accessible spaces near cave entrances and under rock shelters. There, they created distinct zones for different activities, including hearths for cooking and areas dedicated to toolmaking and butchering.²² They even buried their dead beneath the cave floors and engaged in symbol making, adorning stalagmites with abstract designs using red ochre pigments.

When Neanderthals tracked game, they constructed temporary windbreaks from wood and mammoth bones. One striking example comes from La Folie, a 60,000-year-old site in west-central France. In this harsh, cold environment of Ice Age Europe, Neanderthals created what archaeologists believe was a base camp. Preserved post holes suggest a circular wooden structure, likely supporting brush or hides, serving as a windbreak. Within this 30-foot diameter space, they carried out several activities. They rested, shaped stone tools, and prepared meals. They may have even laid mats to soften the floor.²⁴



Temporary Neanderthal camp “La Folie,” near present-day Poitiers, France, ca. 60,000 BC. ²³

As the Neanderthals gradually disappeared around 40,000 years ago—partly due to competition with our own species—*Homo sapiens* began taking shelter-building in new directions. In the Dordogne region of France, they occupied rock shelters and decorated them. They made engravings and stained them with red, yellow, and brown ochre, sometimes starting with a preparatory charcoal sketch. Among these earliest artistic expressions were hand stencils, geometric patterns, and animal figures. One of the oldest symbols was probably a representation of the vulva. ²⁵ These endeavors revealed not only the unique symbolic capacity of our species but also an emerging desire to make living spaces distinctly our own.

The limitation of caves, of course, is that they have a predetermined location. However, modern humans also built more impressive temporary shelters in open locations. One example comes from Mezhirich, Ukraine, dating back around 15,000 years ago. Here, a group of Ice Age hunter-gatherers constructed oval and circular huts from 120 to 240 square feet in size. They were built mostly from mammoth bones and are among the earliest examples of architecture. The largest of these structures, weighing approximately 50,000 pounds, would have required ten people over five days to erect. ²⁶ Given the extraordinary effort required to build them, these structures may have held ceremonial or symbolic meaning beyond simple shelter.

The mammoth-bone huts represent a level of architectural skill that sets them apart from the instinctive nest building of our ape ancestors. The builders demonstrated a rudimentary understanding of engineering, deliberately placing each bone to exploit its natural geometry. They created a precise oval or circular foundation and arranged leg bones and jaw bones at regular intervals. They positioned the jaws chin down. The leg bones probably upheld a roof, although it is likely that wooden elements would have helped support it as well. The entrance was marked by large upright mammoth tusks. The wall displayed a careful repetition and symmetry using pieces of the vertebral column. Remnants of hearths inside the dwellings indicate the use of bones as fuel. The final effect must have been striking—like igloos made of bone rather than blocks of ice.



Bone hut, Mezhirich, Ukraine, ca. 15,000 BC.

Several of these mammoth-bone dwellings have been found across Eastern Europe and Russia. They helped the builders cope with the frigid temperatures near the end of the last Ice Age when ice sheets stretched far into Europe. Archaeologist Steven Mithen describes what these homes might have been like inside: “The floor is soft, carpeted with hides and furs that surround a central ash-filled hearth. Mammoth skulls and leg bones provide furniture; an assortment of leather bags, bone and wooden bowls, antler and stone tools are scattered by the walls and hung from the rafters—a scene of Stone Age domestic clutter.” ²⁷



[Follow for extended description](#)

Traditional Inuit igloo, Nunavut, Canada.

In a twist of prehistoric irony, our ancestors' hunting skills proved too effective, leading to the extinction of mammoths around 10,000 years ago—and mammoth-bone dwellings with them. However, humans also used other building materials, particularly wood. Yet these more perishable materials present a challenge for modern archaeologists. Wooden structures rarely survive. Even when promising sites are discovered, researchers struggle to interpret them, due to their decay. As archaeologist John Yellen noted, “Paleolithic Pompeiis are unknown.”²⁸ Most of these ancient homes have long since returned to the soil, leaving archaeologists to piece together their stories from fragmentary evidence.

However, on rare occasions nature preserves a snapshot of prehistoric domestic life. One such example was a fisher-hunter-gatherer base camp of six huts on the shore of Israel's Sea of Galilee dating back 23,000 years. These Paleolithic homes survived thanks to a curiously helpful sequence of events: a fire followed by submergence under lake water, which protected them from decay. They might have remained hidden forever, until a recent drought when water was pumped from the lake. Archaeologists found that the site's foragers had crafted small huts from brushwood, weaving them into dome-like structures enclosing a central hearth. Near the perimeter, they covered the floor with thick bunches of grass laid out in a tile-like pattern on top of a solid layer of clay.²⁹

Yet even these well-crafted dwellings were not meant to last forever. This pattern of temporary settlement continues among modern hunter-gatherers today, like the !Kung people in the Kalahari Desert. They rarely stay in one place for more than a few months due to the intrusion of insects that inevitably follows human habitation.³⁰ Nevertheless, in these fleeting shelters we find humanity's first steps toward permanent places in the landscape. What began as simple returns to favored spots evolved into increasingly sophisticated and enduring manipulations of space that would ultimately distinguish us from every other species on Earth.



Brush hut at Ohalo II, Sea of Galilee, Israel, ca. 21,000 BC.³¹

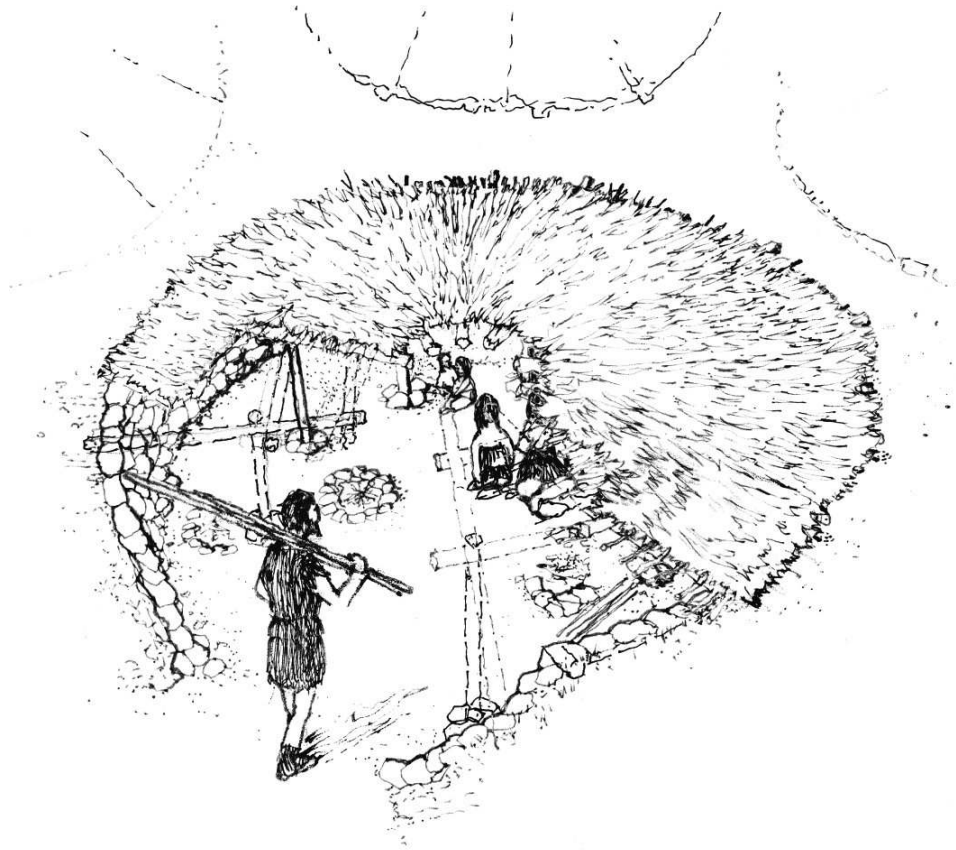
Digging In

Roughly 20,000 years ago, the last great Ice Age drew to a close. As the world began to warm, the ice sheets, which once cloaked nearly a quarter of the Earth's land, started to recede. Their retreat did more than reshape the terrain. In the Eastern Mediterranean, they created the perfect laboratory for human innovation. Once-barren steppes flourished into lush woodlands teeming with olive, pistachio, and oak trees, alongside fields of wild wheat and barley. Here, humanity would take major strides toward permanent settlement.

The Natufians, a hunter-gatherer culture inhabiting what would become modern-day Israel and Palestine, were the first to seize this opportunity. Around 14,500 years ago, surrounded by abundant almond and pistachio trees and calorie-rich plants, they chose a different path. They stopped following the seasonal migrations of animals and plants. Instead, they decided to make the land work for them. They settled down.

Their solution to permanent housing, the pit house, was both simple and ingenious. By excavating circular or oval depressions in the earth and roofing them over, they created dwellings that were easy to construct and durable. Without the masonry skill to erect freestanding walls, the Natufians used the earth itself to provide natural walls. Better still, these semisubterranean structures offered superior insulation, remaining warm in winter and cool in summer.

The pit house proved so effective that it emerged in other cultures as well. In Eastern Europe, hunter-gatherers first constructed mammoth-bone huts partially buried in circular pits to ward off the cold. The Yellow River Valley of China saw pit houses emerge around 6,500 years ago as shelter from harsh weather. Native Americans in the Sonoran Desert, about 4,000 years ago, also dug oval pits several feet deep for their dwellings to escape the summer heat. While these cultures developed their solutions independently, they all discovered the same solution. The pit house was nearly ideal, requiring minimal resources while being adaptable to almost any climate.



Natufian pit dwellings, 'Ain Mallaha ('Eynan), Israel, ca. 12,500 BC. ³²

Most archaeologists would agree that the round and oval houses of the Natufians represented the earliest structures to echo our modern notion of a home, marking a key step toward permanent settlement. ³³ The Natufians did not just dig a hole and cover it with branches. Instead, they used rocks to stabilize the pit's sides, creating a rudimentary retaining wall. Inside, they built a ring of evenly spaced posts that supported the roof, and anchored the posts with rocks. They likely created a roof from branches or reeds. These homes were modest in size, spanning 10 to 20 feet in diameter. They featured one or several stone hearths. ³⁴

The circular design of Natufian houses offered several other advantages as well. Round pits were easier to dig than rectangular ones. Round shapes also distributed structural forces more evenly, increasing resistance to wind forces. Unlike their rectangular equivalents, round buildings avoided collapsing corners. Without corners, construction became simpler. The circular design also proved highly efficient, as round shapes enclose maximum space using minimal materials. The presence of a central hearth could warm the interior evenly, ensuring optimal warmth throughout the dwelling. These benefits help explain why round forms dominated early architecture across widely separated cultures from Africa to the Americas. ³⁵

Perhaps most impressive was the geometric precision of some of the dwellings. One of the excavated remains featured perfectly circular foundations. Elsewhere, researchers found a circular limestone disk tool about eight inches in diameter. Both artifacts exhibit a surprisingly high level of symmetry. This likely reflected the Natufians' deliberate intent to build circular forms. ³⁶ These homes suggest they had planned their buildings in advance, challenging our assumptions about when such deliberate architecture emerged.

Their settlements featured both large and small single-room houses. However, their specific purpose remains uncertain. Curiously, house size showed no correlation with family size or social status—a finding consistent with the absence of evidence of social stratification among the Natufians. As a result, archaeologists suggest the variation in size was tied to function rather than social hierarchy.³⁷ The larger structures might have functioned as communal spaces or workshops.

For the first time in history, people began living together in such large numbers. Natufians clustered their homes into small hamlets, which supported estimated populations of around 150 individuals. This was a major increase from the typical hunter-gatherer groups of about 15 to 50 people.³⁸ The Natufians were not full-fledged farmers yet, as they cultivated wild cereals while preserving their hunting practices. Nevertheless, their dwellings represent a major step toward a sedentary existence.

These early villages were likely quite vibrant. Much of life occurred beyond individual dwellings in shared outdoor spaces, such as communal cooking and food preparation. François Valla, one of 'Ain Mallaha's original excavators, argued that life in these communities differed sharply from scattered bands.³⁹ They likely hosted feasts, ceremonies, and social events. These activities may have been similar to the periodic gatherings of later hunter-gatherer societies, like the seminomadic Inuit in the Arctic, who lived in tents in summer and igloos in winter.

But humanity's first experiment with permanent settlement also attracted unexpected visitors. As the settler populations expanded, so did house mice populations, drawn by the concentrated food waste in villages. House mice emerged around the same time as the first Natufian settlements and quickly outcompeted native wild mice.⁴⁰ The ripple effects of this ecological change extended further up the food chain. The abundance of food waste and the mice, in turn, drew wolves closer to human communities. Some scholars suggest that this influx of wolves may have triggered the domestication of dogs—a relationship immortalized in the burial of an elderly Natufian woman, her hand resting gently on a puppy.⁴¹

In response, the Natufians adapted their structures, modifying the smaller circular buildings between their dwellings—likely granaries—with suspended, sloped floors that deterred rodents and enhanced air circulation to prevent food spoilage.⁴² Thus, the Natufians had to adjust to environmental challenges they themselves unintentionally created.

The price of permanence grew steeper with each generation. Fixed settlements introduced water pollution, as accumulated garbage and human waste began to taint their water sources. The constant harvesting of local plants and the overhunting of animals led to gradually diminishing resources. In some cases, it led to local extinctions.

Yet this human-environment dynamic was more nuanced than just exploitation. The Natufians, like other early settlers, pioneered land management practices that reshaped landscapes in both costly and fruitful ways. Through selective harvesting, they unintentionally dispersed seeds. This created new vegetation patterns across their lands. Controlled burning promoted secondary forest growth, drew game animals, and fostered the growth of new plant species. The resulting ash boosted soil nutrients, often increasing local biodiversity and ecological productivity in ways that benefited both human communities and local ecosystems.

Remarkably, evidence reveals that as far back as 12,000 years ago, three-quarters of Earth's land bore subtle marks of human activity.⁴³ This finding upends our notion of “untouched” and “pristine” nature. The wilderness we now idealize was likely shaped by millennia of interaction between humans and their environment.

However, permanent settlement exposed humans to new vulnerabilities. With fixed dwellings and stored food supplies, communities lost the option to simply pack up and leave. Settlements in river valleys faced flooding, while those in drier areas were vulnerable to drought. Villages in woodlands risked wildfires. Resource depletion added pressure as intensive hunting and gathering began to outstrip natural regeneration. The Natufians found themselves in an increasingly adversarial

relationship with nature, both subject to its forces and unintentionally worsening the frequency and severity of disruptive environmental events. These challenges occasionally delivered stark reminders about the increased vulnerability and responsibility tied to their fixed abodes.

These risks intensified with growing populations. Permanent settlement allowed for larger families. With a stable home base, parents could more easily care for multiple children without the strain of continuous movement. This reduced the need to space births widely. The growing economic value of children in early farming and foraging activities likely spurred population growth as well.⁴⁴ But larger families strained food supplies. Archaeological evidence from gazelle bones indicates that the Natufians mostly hunted larger males.⁴⁵ This would have likely shrunk gazelle populations and meat yields over time. They also overharvested wild plants, reducing their capacity to regenerate.

Around 10,500 BC, the climate suddenly plunged back toward Ice-Age conditions—a brief cold spell known as the Younger Dryas. It likely struck a fatal blow to the Natufians' sedentary life. They abandoned their villages and reverted to nomadism. Nevertheless, they still established smaller, semipermanent camps to exploit seasonal resources.

While their 2,000-year experiment in settled life ended, it was far from a failure. The Natufians pioneered innovations from durable pit houses to sophisticated granaries. Their hard-earned lessons helped pave the way for their descendants to transition from foragers to farmers and continue the trajectory toward permanent human habitation.

Breaking the Circle

One of the few places to witness the evolution from hunter-gatherer encampments to agricultural settlements is Beidha in southern Jordan. Unlike its famous neighbor Petra, whose striking tomb facades carved into red rocks draw crowds and feature in movies like *Indiana Jones and the Last Crusade*, Beidha offers little spectacle. It appears unremarkable—just ancient stone foundations. But what Beidha lacks in grandeur, it makes up for in historical significance. The site provides a key to understanding how so many of us came to inhabit rectangular buildings today.

Beidha was a seasonal encampment around 11,000 BC established by the Natufians, who used the site as a base for hunting activities. It was then abandoned, perhaps due to depleting resources and a cooling climate. Around 9600 BC, after enduring a thousand-year drought, temperatures rose. This dramatic change to warmer and wetter weather likely prompted a new society, descended from the Natufians, to try their luck at permanent settlements.

Perhaps realizing that wild crops would eventually be depleted with continued harvesting, these people began cultivating them. They grew rye, wheat, and barley in the fertile alluvial valley soils. Knowing that solely hunting wild gazelles was no longer sustainable due to overhunting, they started to domesticate sheep and goats. They became farmers.

This was the beginning of the Neolithic period, or the New Stone Age (from the ancient Greek *neos* meaning “new” and *lithos* meaning “stone”). The shift to agriculture enabled these early settlers to produce surplus food and invest more heavily in their dwellings. But by settling in permanent locations to manage their crops, they also had to safeguard them from others who might, quite literally, pick the fruits of their labor. As the architectural historian Spiro Kostof noted, “A fixed place under the sky—that is the Neolithic legacy.”⁴⁶

This culture is known to archaeologists as the Pre-Pottery Neolithic people. This name highlights their lack of pottery-making technology, such as the ability to fire clay. Yet what they lacked in ceramic skills, they made up for in their buildings. Returning to villages the Natufians had previously abandoned, these people began using more durable materials like stone and experimenting with innovative construction methods. One of these was the invention of mud bricks.

Mud bricks were one of humanity's first widely used building materials. Mud was available in many parts of the world, but brick making was labor-intensive. It required that villagers laboriously dig clay from the valley floor. They then often kneaded it with straw for greater resilience. They

molded this mixture into oblong forms, leaving them to sun-dry for a few weeks. Once hardened, the villagers stacked them and bonded them with mud mortar to raise walls. These mud walls also offered some welcome insulation from both heat and cold. All these efforts demonstrate their dedication to permanent settlement.

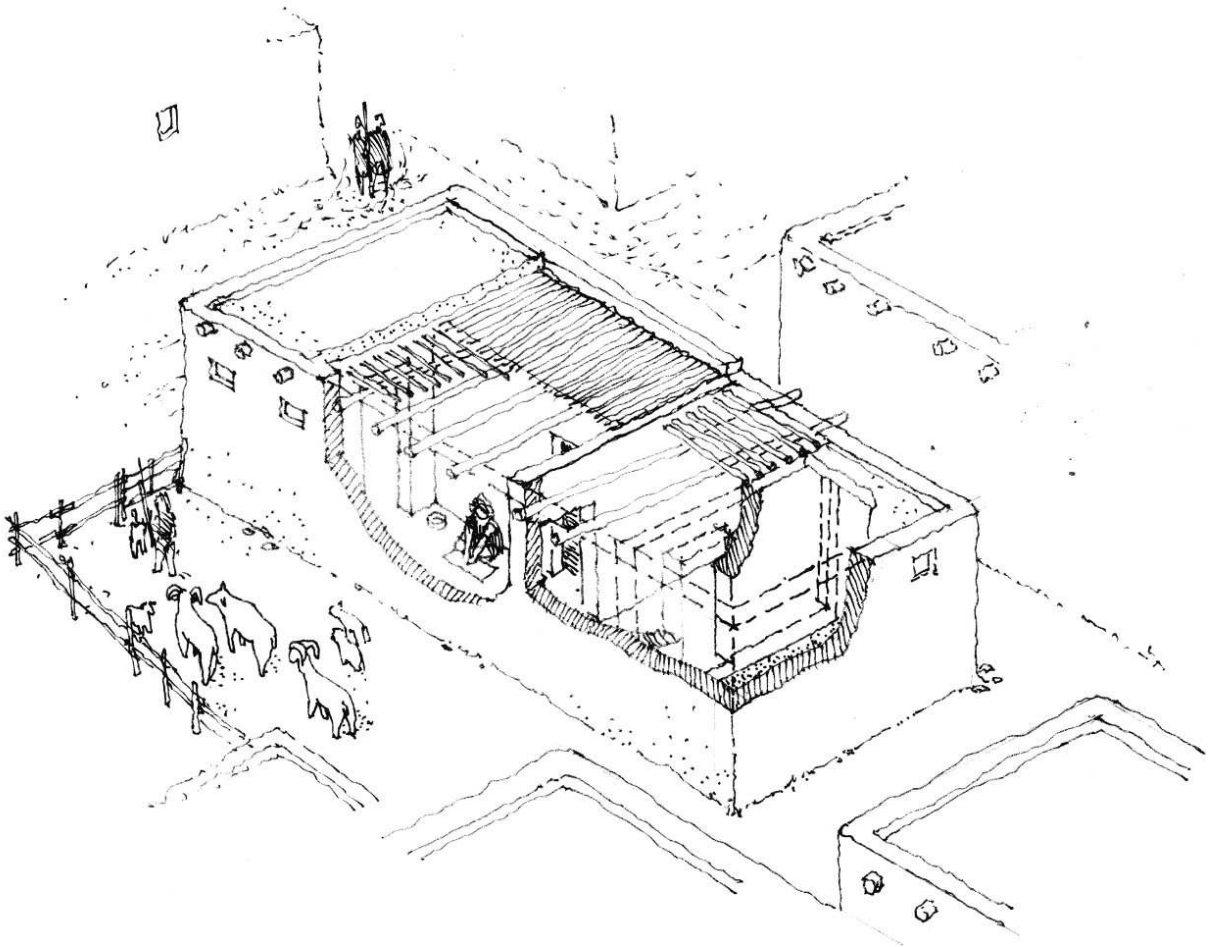
Their methods proved successful. The Pre-Pottery Neolithic people expanded across the Middle East. By 8000 BC, agropastoral villages thrived throughout the Levant in the eastern Mediterranean, from the highland regions above the Euphrates River in Syria northward into Anatolia. Some of these villages boasted hundreds of well-constructed houses.⁴⁷ One of the smaller settlements was Beidha.

At Beidha, the villagers herded goats, sowed barley and wheat, and also hunted game and foraged nuts.⁴⁸ In the beginning, they built pit houses with sunken floors, stone foundations, and wooden posts supporting roofs. But around 6650 BC, their homes were destroyed by fire.

From those ashes rose a new beginning. Departing from the old semisubterranean pit dwellings, they built aboveground designs. They erected walls of mud bricks and sandstone slabs and topped them with flat roofs. They covered floors in plaster and even decorated some with black paint or burnished black-and-red patterns.⁴⁹

Most importantly, their buildings were no longer round but rectangular.

Erecting rectangular houses demanded advanced building techniques, such as joining perpendicular walls at ninety-degree angles. But it gave them significant benefits. These homes could be more easily divided into multiple rooms, each space tailored to a specific purpose. They could more easily be expanded, with additional rooms built adjacent to existing ones. Flat roofs also provided new opportunities, such as the potential for upward expansion and rooftop private outdoor space. The shift to rectangular buildings fostered denser communities by allowing for more tightly knit, organized settlements.



Five-room mud brick house, Abu Hureyra, Syria, ca. 6500 BC.

Over time, Beidha's population doubled to a few hundred people. Residents built larger houses with up to five rooms, replacing the single-room homes of their earlier pit dwellings. Where circular homes could house one or two individuals, the rectangular multiroom structures could accommodate entire extended families. As agriculture led to an increase in village populations and social complexity, the rectangular plan offered a more practical dwelling arrangement.

This wasn't unique to Beidha. Across the Levant, a pattern emerged. As communities developed their farming and herding skills, they would shift from building circular dwellings to rectangular ones. For instance, Jericho, located in today's West Bank, began as a settlement of circular pit dwellings established by the Natufians. The Pre-Pottery Neolithic people initially continued this tradition of circular pit homes. By 9600 BC, the inhabitants had constructed a wall partially enclosing their village, perhaps to protect from floods, making it the first known fortified town.⁵⁰ Their crowning achievement was the Tower of Jericho, a 28-foot-tall round stone structure considered humanity's first work of monumental architecture. It may have had a ceremonial purpose, maybe as a landmark to draw outsiders into their communal way of life.⁵¹

Around 7000 BC, Jericho became one of the largest villages of its time, housing possibly up to 3,000 individuals. The village architecture of rectangular homes built from mud bricks reflected this. Even the bricks evolved. Where initially bricks had flat bottoms and rounded tops, they became perfectly cuboid, allowing better stacking and creating more stable construction.⁵²

This transition from round to rectangular dwellings happened not only in the Near East, but in agricultural societies worldwide, from Mesoamerica to Asia.⁵³ People arrived at rectangular building independently, suggesting it was a widely favored solution as communities became better farmers. Archaeologist Kent Flannery⁵⁴ noted how food storage played an important role in this transition. He found that in early villages with circular or oval-shaped huts, storage facilities typically stood out in the open. This pointed to food being shared communally. This practice resembles the egalitarian culture still observed by hunter-gatherers today, which reduces individual risk as environmental conditions change.⁵⁵ But the rise of rectangular homes with multiple rooms brought a major change. Increasingly, one room within the dwelling itself was specifically dedicated to storage. As agricultural societies advanced, the rectilinear house gave households a greater autonomy in managing surplus resources.

This architectural shift came along with a change in social dynamics. As Flannery emphasized, it changed the risk and reward equation for households. When storage was communal, individual households had little incentive to maximize resources for themselves, since everything was likely shared. Private storage changed this. Suddenly, houses within the village had an incentive to compete, each family striving to maximize resources for their own household. At the same time, as early farming villages expanded, it was likely that fewer families were closely related by blood. This could have made them increasingly less inclined to share resources with their neighbors.

One researcher noted that communities with privatized storage had a more “closed” site layout. They featured “either widely spaced household units or closed-in eating and storage areas, in order to avoid the jealousy and conflict which might arise from one household visibly having more than another.”⁵⁶

Yet paradoxically, the very walls hiding indoor activities may have intensified jealousy as well. As anthropologist Peter Wilson argued, the presence of walls fundamentally altered our ancestors’ visual attention, reshaping their drives and emotions. Hunter-gatherers could carry only what they could move, but once people settled in dwellings, they could accumulate, conceal, and display food, wealth, and status. This shift toward village life, Wilson suggests, was as transformational as when our distant ancestors descended from living in trees to living on the ground, which freed our hands from grasping. Villagers, he argued, became “domesticated people,” psychologically and socially distinct from those in roaming bands.⁵⁷

Meanwhile, the number of farmers was growing, outperforming hunter-gatherer societies. By cultivating crops and domesticating animals, agricultural communities could produce food more reliably and efficiently than through foraging alone. This sustained growing populations and more complex societies. Archaeologist Gordon Childe, who coined the term “Neolithic Revolution,” or Agricultural Revolution, estimated that in aboriginal America, unimproved land could sustain a population ranging from about .05 to .1 person per square mile. In contrast, Neolithic societies on the Pacific Islands today can sustain populations of approximately thirty or more people per square mile.⁵⁸ The transition from a hunter-gatherer lifestyle to an agricultural one dramatically expanded the Earth’s “human carrying capacity,” the maximum number of people that could be supported.

Given these advantages, it should be no surprise that the agricultural transition ultimately unfolded independently in at least eleven different regions worldwide.⁵⁹ This revolutionary shift began about 10,000 to 12,000 years ago, spanning from the cultivation of rice in East Asia to the domestication of squash in the Americas. As agricultural knowledge spread, in regions like the Mediterranean, humans selected and cultivated hundreds of varieties of crops, from olives to grapes.⁶⁰ Farming produced the surplus food that enabled more populous, specialized, and socially complex societies—though some might argue it was a double-edged sword.

Farming led to intensified resource exploitation and fierce competition for scarce resources within defined territories.⁶¹ Close contact with domesticated animals and wild pests, such as rodents, increased the incidence of zoonotic diseases like influenza. Dense, sedentary populations, with their

higher rates of contact, created perfect conditions for the spread of diseases like measles and smallpox. Farmers and their settlements contributed to deforestation, soil erosion, and water pollution. At times, the very practices that enabled growth also sowed the seeds of their own destruction. Even Beidha was eventually abandoned, perhaps due to the depletion of grazing lands, firewood, and fertile soil.⁶²

When I visited Beidha, it was difficult to imagine it was once a much greener place, with grasslands and trees. Today it is an arid desert. As the climate grew more arid over time, the once fertile land became less capable of supporting agriculture. People abandoned village life.

My stay at a Bedouin camp in Wadi Rum a few hours away provided a stark contrast. This otherworldly red desert—immortalized as alien terrain in films like *Star Wars* and *Dune*—at first seems a barren wasteland. Yet the Bedouins, with their goat- and camel-wool tents, seem well adapted to desert life. Their nomadic life in tents, radically different from agricultural communities in houses, shows that settled life is not the only way.

While the transition to rectangular buildings may have been an important step in human development, it wasn't the only path—or an irreversible one. Some societies, after embracing rectangular structures with private storage, returned to circular dwellings and shared storage, perhaps to share the burden of risk in changing economic conditions. And though permanent settlements are the norm for most of us, nomadic and seminomadic traditions persist today.

Many Bedouins clearly prefer it that way. Life in tents immerses them in the sweeping desert landscape and the unpolluted night sky. An archaeologist once observed how Bedouins have a fierce disdain for city life, citing a “mystical hatred of the roof” and a “religious revulsion to the house.”⁶³ Their rejection of rigid walls echoes the ancient Rechabites who, as Jeremiah chronicled, swore, “We do not drink wine.” And commanded: “You must never build houses, sow seed or plant vineyards; . . . [you] must always live in tents. Then you will live a long time.”⁶⁴ And so, not all succumbed to the comforts—and constraints—of rectilinear life.

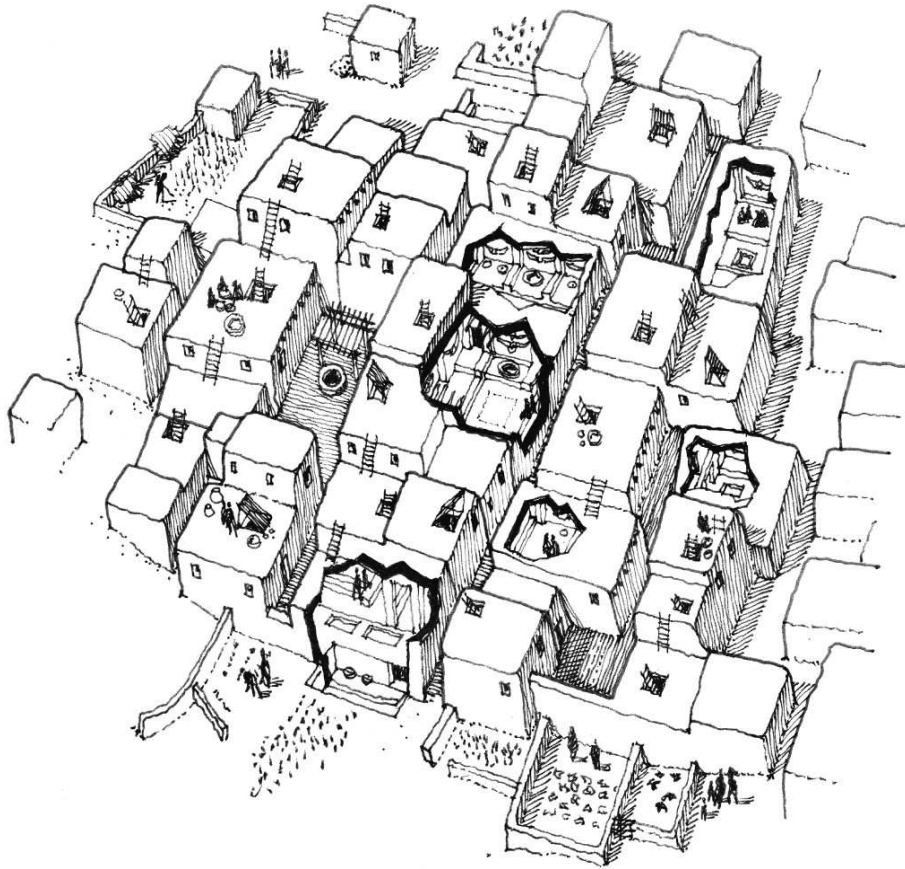
When Homes Touch

“On a cold November day in 1958, just before nightfall,” British archaeologist James Mellaart recalled, he finally “reached the double mound of Çatal Hüyük.”⁶⁵ He had first spotted the mound, “a third of a mile in length,” while exploring the Konya plain of the Anatolian plateau in 1952. But, as he admitted, “dysentery and lack of transport prevented its more formal discovery.”

Arriving with a team of archaeologists, he found: “Much . . . was covered by turf and ruin-weed (*Peganum harmala*) but where the prevailing south-westerly winds had scoured its surface bare there were unmistakable traces of mud-brick buildings, burned red in a conflagration contrasting with patches of grey ash, broken bones, potsherds and obsidian tools and weapons. To our surprise these were found not only at the bottom of the mound, but they continued right up to the top, some 15 metres above the level of the plain.”

Thus began the “discovery” of Çatalhöyük—though locals had long been aware of it. The settlement grew as an important supplier of obsidian, a volcanic rock prized for crafting blades. Occupied for over two millennia, it likely peaked at about 800 people in 6500 BC, far below earlier estimates of several thousands.⁶⁶ Nevertheless, it was one of the largest Neolithic villages of the time.

The village was essentially a massive honeycomb of cuboid houses pressed against each other without ground-level streets. Çatalhöyük was unlike anything seen since. Perhaps its closest modern parallel is found in dense informal settlements such as Rio de Janeiro's favelas, where houses are packed so closely that they seem a continuous mass.



Village of Çatalhöyük, Turkey, ca. 6700 BC. ⁶⁷

The wheel had not yet been invented, so streets were not necessary for wheeled transport. Instead, residents descended into their homes not through front doors but through roof hatches using wooden ladders. This arrangement may have offered some advantages, such as defense. Large windows and doors would have made the interior too hot. And similar to Middle Eastern cities today, these rooftops were active living spaces. Some roofs even had ovens. However, entering homes by ladder would have made life challenging, especially for the elderly and pregnant women.

The sight of Çatalhöyük, with people living in adjacent boxes, would have likely stunned the hunter-gatherers of the time. They might have encountered more people in a single day than they would have seen in their entire lifetime. Their camps were open and transparent. But Çatalhöyük was a maze of enclosed spaces. Activities that had been public were now hidden behind walls.

The appeal of living in Çatalhöyük in terms of quality of life was not immediately obvious, aside from participation in the obsidian trade. Most houses had no windows and only had roof openings. These openings doubled as access into the dwelling and smokestacks for hearths located beneath them, filling interiors with smoke. The word “window” itself, derived from Old Norse *vindauga* (“wind eye”), speaks to this early form of ventilation. Yet this rudimentary arrangement brought health hazards. Skeletal remains showed the buildup of sooty black deposits on the inside of rib cages of older residents, probably a consequence of life in smoke-filled homes. ⁶⁸

The village also struggled with hygiene. When a family vacated a home, it often became a dump for waste, including human and animal feces. ⁶⁹ Infectious diseases spread easily in such unsanitary conditions, with up to a third of human bones showing signs of infected lesions. ⁷⁰

But villagers did not just have to endure bad smells. ⁷¹ Çatalhöyük's homes required constant upkeep. Built largely from mud brick, the houses were vulnerable to rain. Mud brick deteriorates quickly when wet. Lacking proper drainage or strong foundations, homes demanded frequent repair or rebuilding.

Residents invested significant labor in maintenance. They replastered walls and sleeping platforms with white clay, gypsum, or lime to keep their interiors fresh and clean. ⁷² This maintenance process may have occurred up to three times a year. Some houses had been replastered about 450 times, ⁷³ lasting up to a hundred years. Builders then leveled entire homes and constructed new ones on top of the old foundations. Some structures had been rebuilt up to six times. Over generations, this practice caused the settlement to rise ever higher, eventually reaching sixty-six feet—roughly the height of a modern six-story building.

Villagers may have been willing to endure these challenges not only for economic reasons but also because they were deeply attached to their homes: Wall paintings were found in almost every house and often included elaborate symbols.

Residents divided their homes into two distinct zones. One was a small room centered around a hearth. It may have functioned as a kitchen area, judging by the ovens and clay bins for storing food found there.

But it was the main room that made Çatalhöyük famous. This room, typically cleaner than the other, had sleeping platforms. The walls and the platforms were covered with paintings, some bearing up to forty layers of plaster and paint. These murals offer windows into their worldview. Some images were morbid, showing vultures pecking at human corpses. Others featured abstract geometric designs, like a nine-foot mural possibly depicting a leopard skin. Many murals depicted wild animals and hunting scenes, even as the villagers increasingly domesticated animals, perhaps to evoke memories of the past.

Most dramatic were the protruding bull horn decorations, or *bucrania*, often set into the wall. Some were placed on small columns inside the room. They were often covered with plaster and painted with ochre red. In one example, three sets of bull horns were stacked one above the other on a wall, with a large human figurine above, its legs splayed wide. The walls also featured platforms with animal skulls, beaks, teeth, and tusks. The residents seemed to choose, above all, the pointier animal remains.

All of this may have been quite shocking to an outsider. Archaeologist Steven Mithen likened it to a “monstrous scene of bulls bursting from the wall. There are three of them at about waist-height—white heads striped with black and red, from which sprout enormous pointed horns. . . . Around the bulls the walls are painted with bold geometric designs—sharp, oppressive images above handprints in red and black.” ⁷⁴

Other symbolic components were found throughout the home and the village. Small figurines, often quickly made and discarded, were thought to be part of daily spiritual practices, akin to prayers. In other villages, archaeologists have also found decapitated animal figures that seem to have been ritualistically “killed.” ⁷⁵

Residents may have also been attached to their abodes because, unlike today, home was also a burial site. Ancestors were buried in fetal positions beneath the platforms. Some bodies were exhumed, their skulls possibly removed for use in ceremonies. These were placed in wall niches, almost as if they were watching over their descendants.

Anthropologist Ian Hodder, who spent decades excavating the site, identified a special category of dwellings. He called them “History Houses.” ⁷⁶ These featured more symbolism and more burials, one holding as many as sixty-two bodies. Though these houses likely held special religious significance, they showed no signs of greater wealth or storage capacity. This suggests a society where religious status did not bring material advantage. The archaeological evidence also hints at a

relative, if gruesome, gender equality: Both male and female skulls were used.⁷⁷ Men and women also had similar levels of darkened lungs, suggesting they spent equal time at home.

Importantly, these history houses had longer lifespans than other buildings. “Houses with many burials tend to be long lasting,”⁷⁸ observed Hodder. He argued that “making history” was essential in agricultural communities where labor had delayed payoffs. In contrast to the immediate return of foraging, farming required a “greater sense of temporal depth, history, and memory.”⁷⁹ Hodder notes, “The emergence of greater temporal depth was a necessary condition for dense settled life, the delayed returns of intensive subsistence systems.” The repeated rebuilding of homes, the burials, and the elaborate symbolism—all played out within the fabric of domestic life—maintained a shared sense of historical community.

Yet this ambitious experiment in communal living eventually faced significant challenges. Demand for wooden building materials led to extensive deforestation around Çatalhöyük. As trees vanished, residents had to travel farther for resources, adding new burdens to their daily work. The stresses of village life may have taken a toll as well. Evidence of interpersonal violence is found in the skulls of residents—of ninety-three skulls examined, twenty-five showed healed fractures, mostly among women, often from blows to the back of the head with round objects. Given that most of the head injuries occurred during the period of highest population density, some believe elevated stress and conflict may have been due to overcrowding.⁸⁰

By 6000 BC, Çatalhöyük was abandoned. It was part of a broader collapse of Neolithic settlements across the region. From Israel to Palestine, farming villages were deserted. People likely scattered into smaller hamlets. While changing climate patterns, including a drop in temperatures, played a role, the inhabitants themselves contributed significantly to the downfall of their villages. Deforestation, overcultivation, and overgrazing depleted the soil’s fertility. The pollution from human and animal waste further strained the ecosystems they were living in.⁸¹

At ‘Ain Ghazal in the Jordan Valley, the houses themselves contributed to the village’s decline. Villagers upgraded their homes by plastering floors with lime, which made them more water-resistant. Some builders spread the lime plaster as high as six inches up walls, posts, and hearths. But producing lime required burning limestone, heating it to between 750 and 850 degrees Celsius and accelerating deforestation. Trees vanished within a three-kilometer radius of ‘Ain Ghazal.⁸² Without the stabilizing tree roots, the soil eroded during periods of rainfall and became less fertile. With the soil already exhausted from overcultivation, crop yields shrank and the village was abandoned. Although other factors such as water pollution from human waste likely also played a role, the reliance on plaster technology influenced its downfall.⁸³

As archaeologists Nigel Goring-Morris and Anna Belfer-Cohen observed, permanent settlement during this time became increasingly unsustainable: “The whole fragile Neolithic network collapsed in upon itself.” By contrast, “the long duration of earlier mobile hunter-gatherer adaptations had enabled the ‘fine-tuning’ balance between people, the environment, and the resources necessary to avoid overexploitation.”⁸⁴

As our ancestors experimented with agriculture, housing, and construction techniques, they created larger and more permanent habitats. In the process, they faced new challenges. They lacked sewers and safe drinking water. They lacked reliable agriculture to support growing populations. Without workable solutions to these challenges of collective life—not realized until the Early Bronze Age—these villages hit a ceiling. Today, Çatalhöyük is a mound in the Turkish landscape, although one recognized by UNESCO as “a site of great importance for our understanding of the first steps toward ‘civilization.’”⁸⁵

When our ancestors transitioned from nomadic to settled life, they entered a new “indoor” phase of human existence. The walls they built reshaped not only their physical and mental world but also their relationship with nature. The problems they faced, from resource depletion to environmental degradation, echo those we struggle with today. As landscape architect Anne Whiston Spirn noted,

“Modern urban problems are no different, in essence, from those that plagued ancient cities, except in degree, in the toxicity and persistence of new contaminants, and the extent of the earth that is now urbanized.” ⁸⁶

The issue of home maintenance persists as well. As an owner of a mere hundred-year-old home, I find myself painting basement floors, clearing French drains, and repairing endless small failures. With a drill in hand to hang a family photo, I sense an odd parallel between those ancient residents who carved niches in their walls for ceremonial skulls. They worried about deteriorating mud brick. I worry about asbestos in insulation and lead in old paint. The tools and decorations have changed, but our desire to make our mark on these walls remains deeply human—even if there are hidden dangers in living a settled life.

Two

Cities of Mud

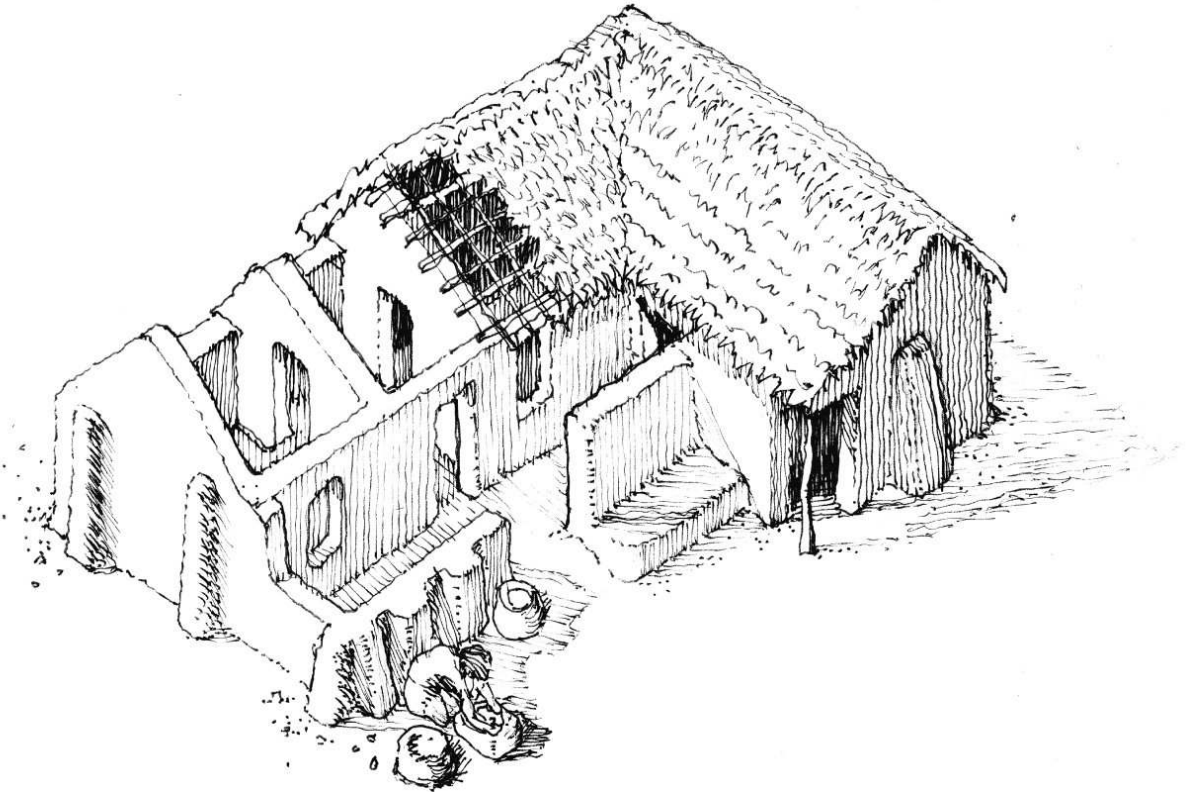
The Extended House

“In those ancient days . . . the lord of broad wisdom, Enki, the master of destinies . . . founded dwelling places; he took in his hand waters to encourage and create good seed; he laid out side by side the Tigris and the Euphrates, and caused them to bring water from the mountains; he scoured out the smaller streams, and positioned the other watercourses. . . . Enki made spacious sheepfolds and cattle-pens, and provided shepherds and herdsmen; he founded cities and settlements throughout the earth, and made the black-headed [Sumerians] multiply.”¹

In “Debate Between Bird and Fish,” a Sumerian essay dating back to the third millennium BC, it was Enki, the god of water, who created the world by laying out the great rivers. This belief reflects the reality of life in Mesopotamia. For it was in this “land between rivers”—for that is what *Mesopotamia* means in ancient Greek—that a new chapter in human history began.

Around 6000 BC, as farming villages in present-day Jordan, Israel, and Palestine were being abandoned, a new wave of settlement emerged in the foothills of Northern Mesopotamia. The twin waterways of the Euphrates and Tigris, born in the highlands of eastern Turkey and stretching to the Persian Gulf, provided the water, reeds, and clay that would build their world. These rivers—one fast flowing and unpredictable, the other broad and steady—would become both a lifeline and a challenge to the people who settled their banks.

The settlement of Tell Hassuna stood along the Tigris River. It was part of the Hassuna culture—one of the earliest farming societies in Northern Mesopotamia, centered in what is now northern Iraq. Villagers built small homes for nuclear families, consisting of just a few rooms. Excavators in 1943 found “the walls were built of lumps of mud of various sizes in a manner approximating the local modern practice. Smaller lumps were used to fill the gaps, and the faces were smoothed.”² These rudimentary buildings were likely topped with low-pitched roofs made of branches and covered in mud.



[Follow for extended description](#)

Packed-mud house, Tell Hassuna, Northern Iraq, ca. 5500 BC. ³

However, as agriculture intensified over the centuries, the villagers added rooms to their homes, seemingly at random. Their homes grew into sprawling complexes of fifteen to twenty rooms. Drawing on broader patterns, archaeologist Kent Flannery observed that this was the “next stage of village development, the replacement of nuclear households by extended family households.” ⁴ This likely resulted from the demands of early farming: “The combination of two tasks—cereal agriculture and the grazing of herd animals—requires a division of labor beyond the capacity of a nuclear family.” Success required an extended family of fifteen to twenty people to manage fields, tend herds, and diversify into activities such as craft making.

Over time, the villagers expanded their houses into complexes of grouped homes arranged around large open courtyards. This enabled them to enclose flocks at night. These homes, according to the excavators, “show the first clear signs of planning.” ⁵

Eventually, the fifteen- to twenty-room complexes began to appear in regularized forms. Previously, houses had a larger main room with one or more smaller side rooms. But the internal organization of the new complexes now introduced three distinct types of rooms. The larger rooms of 150 square feet or more were likely used as central gathering areas for communal activities. Elongated rooms of around 100 square feet served as sleeping or working areas. And square-shaped rooms of approximately 20 square feet were probably used for storage. ⁶ Residents were now intentionally building structures with specialized rooms for the extended family from the start.

This transformation from improvised to planned construction has been described as the “florescence of architecture.” ⁷ With their larger homes incorporating various room types, the inhabitants of Tell Hassuna contributed to a broader trend toward increased social and economic

complexity. The new houses were also more efficient, allowing for population densities of up to an estimated 160 people per acre—a figure that rivals some of the most densely populated areas in the world today. Archaeologist Kent Flannery noted, “It is clear that planned, extended family households can produce much higher densities.”⁸

But as the residents built up their village, they had to contend with the tensions of their growing settlement. The people of the Hassuna culture used stamped seals to impress clay, probably to mark ownership and safeguard property. The 1943 discovery of 2,400 clay balls hints at a darker side of this new societal development. They were quite likely used as sling missiles, either for hunting or defending what had been built.

Slightly later in time and a few hundred miles downstream toward the south, the people of Tell es-Sawwan faced a different challenge. They belonged to the Samarra culture, an early farming society in what is now north-central Iraq, about seventy miles north of modern-day Baghdad. Located below the 200-millimeter rainfall line, where annual rainfall drops below eight inches, Tell es-Sawwan lacked sufficient water for stable agriculture.

The farmers dug small ditches to channel the Tigris floods to their fields, allowing them to cultivate barley, wheat, and linseed. This mastery over water would come to define Mesopotamian civilization. It increased food security and population density in otherwise marginal lands, while the labor-intensive demands of water management spurred greater social complexity and stratification.⁹

The residents also had to innovate in construction. Unlike in the north, they did not have access to stone and wood. Without forests or quarries, they had no choice but to exploit the abundant clay in the region’s alluvial plains. They built their homes with mud bricks—the primary building material of Southern Mesopotamia.

Mud bricks improved upon earlier packed-earth techniques, which demanded skilled workers and precise attention to make sure the foundations and walls were consistently wide enough. The bricks, in contrast, allowed for simplified, more standardized construction. And they could be more easily transported, whereas packed mud relied on the material being available closer to the site.

However, the river clay was often too sandy. So the residents needed to refine the river clay’s consistency. They mixed it with chopped straw, creating a composite material, much like how rebar reinforces modern concrete. Straw and mud together create a substance stronger than either by itself. Dried mud is good at withstanding squeezing. Straw is good at preventing tearing. Combined, they balance each other’s weaknesses. Straw alone crumbles when you squeeze it, and dried mud pulverizes when you tear it apart. To further reduce brittleness, they also added dung, which, like straw, helped bind the mud particles together, making it less prone to cracking.¹⁰

They then pressed this mixture into molds that were open at both ends. After letting them bake for a few weeks, they had long cigar-shaped bricks, roughly the size of a loaf of bread. Builders arranged them in precise patterns, like the header-and-stretcher fashion—alternating layers of bricks laid with their short ends (headers) and long sides (stretchers) parallel to the wall’s surface. Finally, they sealed them with clay plaster, creating thick, strong walls that better resisted cracking and crumbling.

As simple as it sounds, it was a labor-intensive process. Producing the straw alone demanded a significant amount of land. A mere hundred bricks would have required at least 130 pounds of straw, the yield of roughly a third of an acre.¹¹ A single house would have required several acres of cultivated land.

The Samarrans carefully planned their homes as well. The buildings were uniquely recognizable by an enfilade: a sequence of aligned doorways along a central axis. This arrangement created a direct line of sight through the building. It offered an imposing view as well as a more efficient means of movement within the home. It was, in effect, a precursor to the modern corridor.

Villagers arranged their houses in clusters, with courtyards between the buildings. These accommodated ovens and granaries, suggesting a collective approach to resource management and irrigation.¹² By around 5900 BC, Tell es-Sawwan was surrounded by a deep ditch and a buttressed

wall. Throughout Samarran villages, clay jars were found with gypsum lids and seal impressions, marking ownership. These developments, along with the presence of clay balls possibly used as sling missiles, indicate a growing anxiety over property protection—and possibly a fear of outsiders pillaging the toils of their irrigated fields.

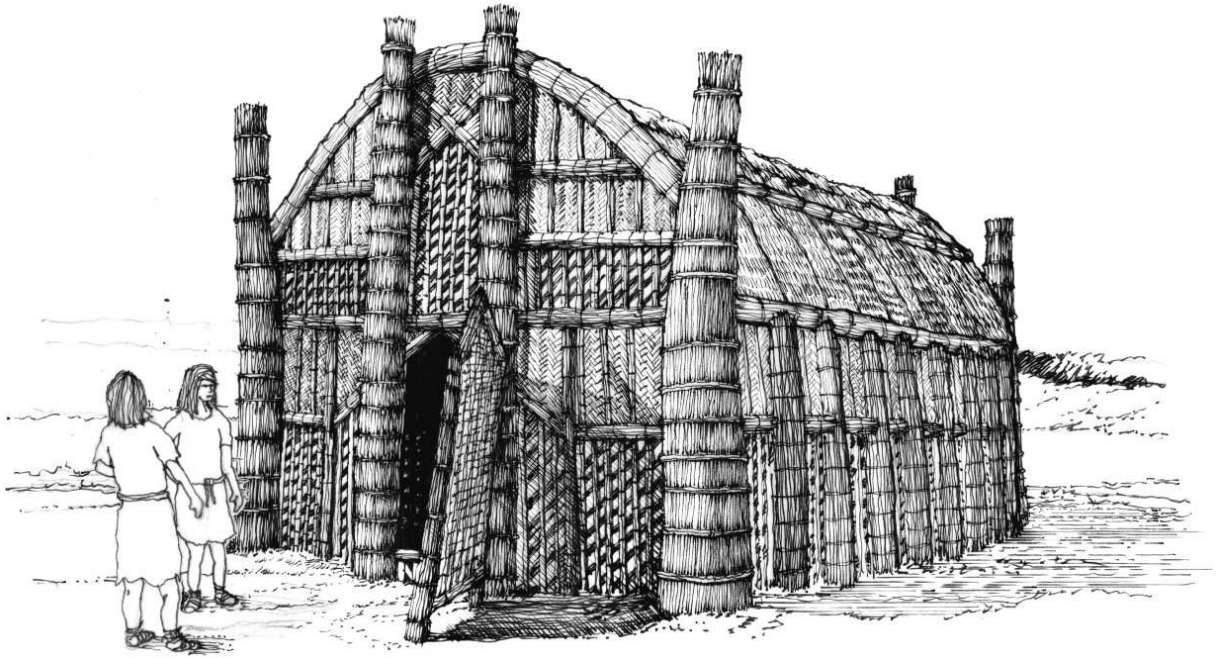
Farther south near the head of the Persian Gulf, the Ubaid people took their architecture one step further. Their beginnings overlap with the Samarra culture around the sixth millennium BC but endured much longer—until about 3800 BC. At the time, the gulf’s shoreline extended far inland, deep into what is now southern Iraq. As archaeologist Leonard Woolley vividly describes it, the Ubaid came to a land of marshes, “dense with reeds and opening out here and there into lagoons or clear channels. . . . It was a country rich enough in promise to make a certain amount of hardship well worthwhile.” ¹³

In these marshy southern reaches of Mesopotamia, reeds became an abundant and adaptable building material. Lacking access to timber or stone, the Ubaid built simple reed huts. They even built larger structures entirely from reed. These consisted of reed bundles, some up to three feet thick, bent into arches. Reed mats covered these arches to create long tunnel-shaped buildings.

These structures left little trace in the archaeological record, apart from depictions on Mesopotamian cylinder seals. Yet similar vernacular forms exist in Iraqi wetlands today. One such example is the *mudhif*—a long, arched guesthouse used by the Marsh Arabs. ¹⁴ Their contemporary reed canoes also look surprisingly like a model canoe found in a later Mesopotamian royal cemetery. ¹⁵

“Now a Mudhif you can’t picture until you have seen it,” wrote the English traveler Gertrude Bell in 1920. “It is constructed of reeds, reed mats spread over reed bundles, arching over and meeting at the top, so that the whole is a perfectly regular and exquisitely constructed yellow tunnel, 50 yards long. . . . the whole lighted by fire and a couple of small lamps, and the end of the Mudhif fading away into a golden gloom. Glorious.” ¹⁶

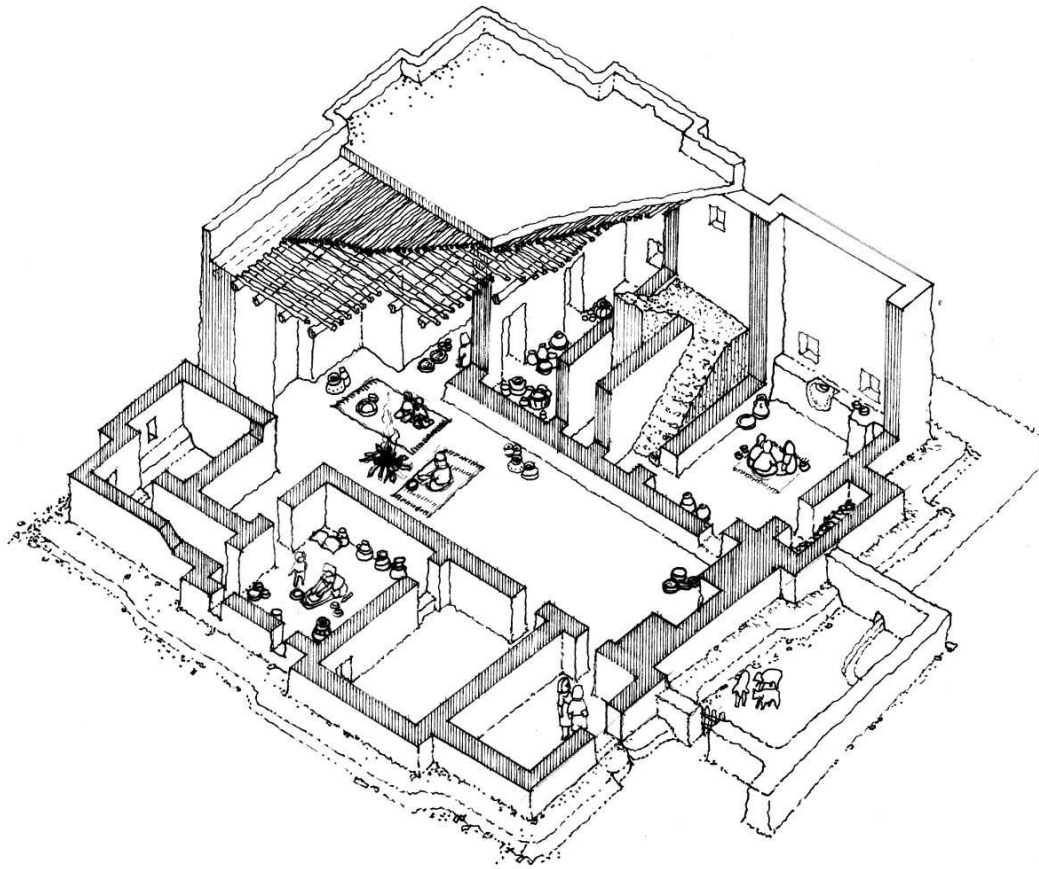
While poorer inhabitants likely dwelled in marshland reed huts, the Ubaid people also built more substantial permanent dwellings than the cultures before them. Some were as large as two thousand square feet and were built from molded mud bricks. These were organized around a central hall flanked by smaller rooms on each side, known as the tripartite design. Ubaid builders may have inherited the house plan from the Samarrans and possibly expanded the enfilade into a broad central hall, though this remains uncertain.



Traditional reed house (*mudhif*), Southern Iraq.

The tripartite design created a hierarchy of spaces. The deeper one moved through successive rooms, the more intimate they became. Private areas like storage spaces and bedrooms required passage through multiple chambers. Meanwhile, the central hall served as a versatile space, lending the building a monumental quality.

As Ubaid settlements grew in scale, social hierarchy became visible in the built environment. At Tell Gawra around 4400 BC, a few larger houses dominated access to communal granaries.¹⁷ They were often visible from afar, serving as focal points.¹⁸ These “prestige houses,” typical of larger Ubaid villages, may have distributed food to other houses, or they could have had a spiritual or political purpose. Across ancient societies, leaders often operated from their homes, and their homes were typically larger to accommodate social gatherings.²⁰ This tripartite design, with its central communal area, was ideal for these domestic and civic purposes.



Tripartite house, Tell Madhur, Iraq, ca. 4500 BC. ¹⁹

The tripartite house design also influenced religious architecture. In fact, it appears more frequently in what are believed to be public or ceremonial buildings than in domestic ones. Early temples adopted this layout of a central hall lined by smaller side rooms. Builders further distinguished these buildings with features such as niche-and-buttress facades that created striped visual effects and dynamic shadows. As archaeologist Pascal Butterlin observed, the house became “a symbolic unit that could be domestic, prestigious, or religious.” ²¹ It offered a versatile spatial form, adaptable to shifting social, spiritual, and political roles.

Some Ubaid temples may have even adhered to standardized measurements. One scholar proposed the existence of an “Ubaid cubit,” a standard unit measuring approximately twenty-eight inches. He concluded that this was used at the Temple VI in Eridu (around 4000 BC), suggesting an advanced level of abstract planning. ²² However, there is no evidence of a standardized system across the broader Ubaid world.

Still, the Ubaid cultural footprint stretched from the Persian Gulf to northern Syria, bringing cultural norms with them. One of their most important legacies was the tripartite house. “The formula proved remarkably durable,” noted Butterlin. ²³ He argued it became an important element of social organization. “The intensive use of tripartite buildings probably permitted the emergence of chiefdoms and states in a proto-urban context.” It was, he concluded, “a true archetype . . . frequently related to the birth of the first cities.” After thousands of years of building homes in Mesopotamia, in these Ubaid tripartite houses of mud brick, we may finally see the early outlines of future urban civilization.

The Ubaid builders' tripartite design accomplished something architects still strive for today: a thoughtful balance between communal and private space. Modern homes continue to follow this logic. They have larger shared living areas and smaller private rooms—and an intuitive flow connecting them. It almost certainly did not spring from a single source of invention. The Ubaid solution, like many others across time and place, reflects a universal logic of habitation—born from the practical realities of how people live together. In the end, there are only so many ways to shape space around the patterns of daily life.

The Ubaid homes also offer lessons in sustainable architecture. While today's energy-efficient buildings rely on composites, laminates, and synthetic insulators, Ubaid builders created relatively durable homes from only earth and sun. Their thick mud brick walls, typically eighteen to twenty-four inches wide, helped regulate indoor temperatures by absorbing heat throughout the warm day and releasing it during the cooler night. And where most of our construction material ends up in landfills, these ancient homes returned, in time, to the soil they rose from. They gradually accumulated into layered mounds—known as tells—that today form the archaeological signature of the region.

In our era of increasing environmental concerns, these elegant, low-tech solutions deserve renewed attention. Nevertheless, the Mesopotamians had environmental problems of their own. The irrigation channels that gave life to their fields slowly filled with silt, demanding constant maintenance. Inhabitants were caught in a perpetual struggle with the very force that had allowed their civilization to flourish: the water flowing from the rivers. It was a constant reminder of the delicate balance they had struck with nature.

Proto-cities

In 1937, mystery writer Agatha Christie accompanied her archaeologist husband Max Mallowan on various digs in Syria. She had first met him seven years earlier at an excavation site. Over the following decades, she joined him on numerous expeditions across the region, cleaning and cataloging artifacts, and even developing film. As she described later in a poem, "A-Sitting on a Tell," she met an archaeologist amid the trenches of a dig. While he passionately extolled the nuances of measuring prehistoric pots, her mind wandered to plotting murders—imagining ways to "kill a millionaire," and stash the body in a "Frigidaire."²⁴

Little did Christie know that she was witnessing the discovery of an intriguing mystery—one that would change the origin story of urbanism. During this time, Mallowan made what would prove to be one of his most fortunate discoveries. In Syria, he was the first to excavate a site known as Tell Brak. There, he found an ancient temple filled with enigmatic figurines with distinctive eye motifs. Tell Brak, along with Khirbat al-Fakhar, would fundamentally challenge our understanding of how early cities began.

For millennia, the pattern of village life in Mesopotamia had followed a predictable cycle: When a settlement grew too large, when tensions arose between families or resources grew scarce, it would split like a cell dividing. One group would move away to establish a new settlement. But around 4000 BC, Tell Brak and Khirbat al-Fakhar departed from this pattern. Instead of splitting apart, they grew. Households clustered together in several neighborhood groups separated by open spaces. Each cluster functioned almost like a traditional village, but now these village-like units were part of something larger. Their scale was immense. Khirbat al-Fakhar sprawled across 750 acres, equal to five hundred football fields. Tell Brak was about 130 acres, still larger than other settlements.

These settlements were remarkable for their structure as well. Instead of a dense, cohesive urban core, they resembled a patchwork of household clusters interspersed with open spaces.²⁵ All of this defied conventional ideas of urbanism. They were too expansive to be called a village. At the same time, they could not be called cities, since they showed no signs of central authority. They had no

grand palaces, no soaring temples rising above the skyline. Scholars would come to refer to them as “proto-cities.”

This discovery upended the story of urbanization, as traditionally told. Scholars long believed that cities began from the minds of powerful rulers or the necessities of complex irrigation systems. But the evidence from Tell Brak and Khirbat al-Fakhar offers a fascinating alternative: Some cities could have emerged organically, shaped by the collective actions of countless households rather than the decrees of a central authority.²⁶ Complexity here was not imposed from above but grew from below.

This was no isolated phenomenon. Around the same time, ancient Trypillia settlements in present-day Ukraine exhibited similar traits. These settlements spanned up to 300 hectares, yet they lacked monumental buildings and evidence of centralized power structures. The parallel emergence of such settlements suggests a shared pattern of urban development across different regions, pointing to a broader decentralized model of early urbanization.²⁷

What drove people to create these unprecedented communities in Mesopotamia? One clue lies in a piece of volcanic glass. Obsidian, prized for its ability to be made into sharp tools, was likely the economic engine. Imported from hundreds of miles away, this precious resource attracted people from far and wide. Each household became a workshop, which contributed to a network of decentralized production and trade. Organizing such exchanges required communication, coordination, and trust—which put these communities on a path toward growing complexity, a path toward urbanism.

Yet with this growth came entirely new social challenges. Without centralized institutions to enforce order, residents needed to develop novel ways to manage conflict.

Archaeological evidence reveals that these communities were not quite egalitarian. At Tell Brak, the distribution of animal remains tells a story of social stratification. Pig remains—a cheaper source of meat—were found at the periphery, suggesting that poorer migrants lived in the outer clusters, much like the informal settlements that ring many megacities in the developing world today.²⁸

One peculiar aspect of the Mesopotamian proto-cities was the open spaces between clusters of households. These areas may have served as garden plots, like those in ancient Mesoamerican cities. Or they could have been buffers between groups to reduce conflict.²⁹ By maintaining physical separation, rather than living together in a single dense urban core, the inhabitants of Khirbat al-Fakhar and Tell Brak may have found a way to mitigate the social tensions associated with growing population density.

This evidence points to a new tentative conclusion. Some cities may have formed from a self-organizing process, emerging from the interactions of many independent agents rather than being directed by political elites. The pattern bears a resemblance to what biologists call “emergence”—as with termite mounds. These structures form without a leader directing the process, driven instead by individuals following simple rules—like following trails laid down by others, exchanging information, and building according to instinct.

Households likely didn’t set out to form large settlements from the beginning.³⁰ Instead, the settlement was the organic result of their collective motivations—which may have included feeding dependents, expanding households, and preserving autonomy. As archaeologist Jason Ur, who has studied these proto-cities in Mesopotamia, noted: “Urbanism does not appear to have originated with a single, powerful ruler or political entity. Instead, it was the organic outgrowth of many groups coming together.”³¹

The stories of Tell Brak and Khirbat al-Fakhar reveal two possible trajectories for these proto-cities. Between 4000 and 3800 BC, Tell Brak rapidly expanded, possibly housing up to 20,000 people within 300 acres.^{32, 33} Since nearby settlements were abandoned, it may be that migration drove this expansion. As the population increased, the settlement transformed its structure. Unlike traditional cities that expanded outward from a center, its suburbs grew inward, merging with the central core.

The outskirts became specialized zones for various functions. There was an industrial area equipped with bread ovens and pottery kilns. Another area was essentially a massive two- to three-hectare trash mound. This suggested that the inhabitants pushed such less-desirable activities to the periphery, as happens in modern cities.³⁴

But Tell Brak's growth reached natural constraints. Northern Mesopotamian settlements relied on cultivating a growing hinterland, leaving traces that persist to this day—over six thousand kilometers of “hollow ways,” the sunken paths formed by humans and livestock walking through agricultural fields.³⁵ Yet dry farming in Northern Mesopotamia had its limits, bounded by the land's productive capacity and the practical distance over which food could be transported. The more the settlement grew, the longer the farmers' commutes. These challenges capped the population at around 20,000 inhabitants.³⁶ Once a settlement reached this ceiling, it became increasingly vulnerable to environmental pressures. Fluctuations in rainfall or periodic droughts could lead to food shortages and social unrest.

As Tell Brak grew, its society became increasingly complex and hierarchical. Archaeologists have uncovered over one thousand clay seals used to secure jars and baskets or mark ownership of goods and raw materials. These artifacts reveal deepening social divisions within the community—potential sources of social stress.³⁷ Indeed, the challenges we associate with modern urban life were present from humanity's first experiments with urban living: from industrial hazards to long commutes and social inequities.

These tensions probably erupted into violence. Archaeologists discovered mass graves on the edge of Tell Brak containing skeletal remains with clear signs of trauma, especially blunt-force fractures to several skulls, indicating deliberate killings. The demographic profile of the victims—including women and children—suggests these graves may have been the result of internal conflict, rather than attacks by foreign invaders. The presence of animal remains buried alongside the human victims suggests the killings may have been followed by a feast or ritual.³⁸

The response to these growing challenges represented a turning point. As Tell Brak expanded, it built two impressive monumental buildings. First came a structure known as the Red Building, with walls up to six feet thick of distinctive red mud bricks. It stood near the industrial area and likely served as an early administrative center, overseeing production. By now, Tell Brak had firmly adopted centralized institutions.

But it was the second structure—the Eye Temple that Max Mallowan first discovered—that revealed something new about early urban society. The temple's design followed the same tripartite layout as a typical house but on a much larger scale. The builders had taken the familiar form of domestic architecture and transformed it, expanding the central hall into a sacred space and elevating the building on an artificial platform. “Archaeologists call it a ‘temple,’” explains Jason Ur, “but to the people of Brak, it was another household—this time the household of a god.”³⁹

This architectural choice was not accidental. It reflected deeply held beliefs that the divine realm was organized in families, and human society—especially its most important institutions—was modeled on this divine template. So naturally, the gods would dwell in houses and require the same provisions as people. Palaces and temples across Mesopotamia retained house-like forms. In fact, the terms for temple or palace in later Sumerian literally translated to “big house.” This shows that the house played a major role in shaping larger collectives and providing the structure for the first institutions. It became a template for organizing society at every scale, from family dwellings to divine spaces.

The temple's most distinctive feature—the thousands of “eye idols” found within—offers a window into the soul of early urban society. Made from clay or stone, they were simple enough that anyone could make them. There were so many of them that they appear to be a form of religious expression available to everyone, regardless of status. The ritual associated with the eye idols may have helped bind together an increasingly complex urban community.⁴⁰ While their purpose remains

a mystery, with no clear parallels except at Khirbat al-Fakhar, they speak to the role of shared symbols in urban life.

Their allure endures. At the Metropolitan Museum of Art, I stood before a display case of eye idols, each about the size of my palm. These idols felt quite intimate. A pair of oversized eyes tops their trapezoid-shaped bodies, making a profile similar to Mickey Mouse ears. Some larger idols featured smaller child figures carved onto their bodies, evoking parent-child relationships. Other idols had multiple sets of eyes. These wide owl-like eyes may have symbolized attentiveness to the gods, which was a recurring theme in later Mesopotamian art.

The remarkable resilience of these early urban settlements appears to have rested on more than just economics. Religion and shared belief systems likely anchored these communities as well.

With their oversized eyes and single unbroken eyebrow—a feature considered attractive in later Mesopotamia—the eye idols may have offered their users a common purpose. While most idols were found within the Eye Temple, many appeared in domestic spaces—perhaps as protective symbols, extending the divine presence into the intimate sphere of home.

We may never understand their true meaning. Yet the role of shared symbols endures. At the museum, I watched many visitors drifting to the gift shop to investigate designer pottery and fridge magnets depicting ancient art. These souvenirs may represent a similar desire for belonging—to carry home pieces of something greater than ourselves.

In time, this marvel of bottom-up urbanism gave way to a new order. By 3800 BC, Khirbat al-Fakhar was abandoned, its inhabitants relocating to Tell Hamoukar, a new site about a mile to the north. Archaeological evidence of over 1,200 clay projectiles suggests the city's fall. Around 3500 BC, Hamoukar's mud brick walls likely crumbled under assault, as attackers unleashed thousands of these sling "bullets." Perhaps it was the southern Uruk civilization, which was beginning to extend its influence into the region.⁴¹ After breaching the walls, the invaders set the city ablaze.

Tell Brak's fate was different. The city survived, but only as a colony of Uruk. Its distinctive culture faded away, and the production of eye idols ceased. A new urban age had begun. As the center of civilization shifted toward the south, the decentralized household-driven model that had defined Tell Brak gave way to a new urban form—one that would face challenges of its own.

The Courtyard House

In one of the earliest myths told by the Sumerians, "Inana and Enki," the goddess Inana challenges the god Enki to a drinking contest. She emerged victorious with the *mes*, divine decrees symbolizing the core elements of Sumerian civilization. "Holy Inana received the craft of the carpenter, the craft of the coppersmith, the craft of the scribe, the craft of the smith, the craft of the leather-worker, the craft of the fuller, the craft of the builder, the craft of the reed-worker,"⁴² the ancient myth recounts. However, these divine gifts, which enabled the functioning of their cities, were not all purely beneficial. Alongside civilization's advances, Inana also received "deceit" and "the plundering of cities" and "making lamentations." Bearing these powerful gifts, Inana returns triumphant to Uruk, the city under her protection, where she is greeted with a grand feast.

This myth captures the essential duality that would define early urban life, when humans first gathered in large numbers. On one hand, extraordinary innovations. On the other, formidable challenges. It was in Uruk where this new urban form of human dwelling would first take shape: the city, forever transforming humanity's relationship with the environment and with each other.

Uruk emerged around the fifth millennium BC on the fertile banks of the Euphrates River in Southern Mesopotamia, about 250 kilometers south of modern-day Baghdad. Natural barriers like the Zagros Mountains to the east and the Arabian Desert to the west provided the Sumerians with relative isolation, at least until horses were increasingly used in warfare. But they had to contend with an unforgiving environment. The scorching summers and arid climate spurred them to innovate. By

harnessing the annual floods of the Euphrates and Tigris Rivers through a vast network of canals, they transformed barren salt flats and marshes into fertile fields of barley, dates, figs, and chickpeas.

The irrigation system catalyzed a transformation in society. Building and maintaining canals required coordinated labor, technical planning, and centralized oversight. Dams were constructed to regulate water flow. Whether bureaucracy emerged to manage irrigation or irrigation expanded under a rising elite remains debated. Regardless, by the fourth millennium BC, state-level governance had formed—likely driven by the demands of infrastructure and the growing trade in vital and luxury goods.

Uruk benefited from significant technological advances. The wheel enabled oxen to pull three times their usual load. Plows boosted agricultural productivity. Boats waterproofed with natural tar, or bitumen, could move heavier cargo. By 3600 BC, Uruk had grown to 250 hectares. It had become the largest and most influential settlement of the region. With monumental temples and a centralized administration, it merited the title of “city.” Around 3000 BC, at its peak, it housed as many as 50,000 people—enough to fill a modern-day arena. With this large population, Uruk benefited from economies of scale, reducing labor costs and amassing larger military forces to defend its granaries, often relying on slave labor.⁴³

Much of Uruk’s domestic life remains elusive. Archaeological excavations often favored temples and palaces, leaving limited evidence of what ordinary homes looked like. The city’s earliest layers lie buried under more than eighty feet of later occupation, with only 0.1 percent of the lowest levels excavated.⁴⁴ Yet Uruk’s colonies, particularly Habuba Kabira, reveal how the earliest city dwellers adapted to urban life.

Habuba Kabira was established around 3500 BC about 800 miles upstream from the mother city. Many of the houses centered on open courtyards, departing from earlier Ubaid dwellings, which were organized around enclosed halls. Several elite residences featured both courtyards and halls. These halls likely served as reception areas and reflected a growing emphasis on privacy within domestic spaces.⁴⁵ This made them similar to the later *liwan*—a long room traditionally used for greeting guests in certain Middle Eastern homes. Some believed that this was a natural progression from the Ubaid house. As archaeologist Michael Roaf noted, “The tripartite house of the Ubaid period became a courtyard house, with a reception room along one side of the courtyard.”⁴⁶

The courtyard, meanwhile, helped bring light and fresh air into the building’s interior without compromising security, avoiding the need for windows in the building’s exterior walls. Though buildings had courtyards before, the courtyard house became increasingly prevalent, shaping Middle Eastern architecture for millennia.

These homes tell a story of increasing sophistication. The use of sun-dried bricks of standardized sizes suggests a degree of mass production. The roofs were likely flat, made from reed mats laid over beams and coated with mud. Pivot stones at wall openings point to early door mechanisms, allowing doors to swing, long before modern hinges. Terra-cotta pipes beneath mud floors point to early forms of drainage.

Habuba Kabira’s layout represented a departure from earlier Neolithic villages, which lacked planned streets, like Çatalhöyük, where houses abutted each other in one continuous mass. Instead, Habuba Kabira had a hierarchy of streets. Straight main roads likely went the full length of the settlement, while narrower lanes led to residential areas. It even featured an early attempt to manage stormwater. A few streets had drains lined with stone slabs and terra-cotta pipes that connected the town’s drainage to the surrounding countryside.⁴⁷ Other Sumerian cities may have had similar systems.⁴⁸ And although these systems did not extend into homes, Uruk itself may have housed one of the world’s earliest toilets—a deep cylinder-shaped pit inside a small room in a religious building dating back to around 3200 BC.⁴⁹

The skyline of Uruk embodied a new urban order. In the Eanna District, the brick temple complex of Inanna featured thousands of clay cones whose painted, flattened ends—set into wet plaster in

zigzag and diamond-shaped patterns, imitating textiles and mats—formed one of the world’s first mosaics. Another district featured the White Temple, dedicated to the sky god Anu, rising forty feet above the city on its massive platform. They were a constant reminder of divine power.

But perhaps Uruk’s greatest legacy came from the humble materials of everyday life: clay and reeds.⁵⁰ Before writing emerged, people used clay tokens to calculate and account for goods in increasingly complex economies. These tokens eventually gave rise to simple pictographs as the volume and variety of goods outstripped the capacity of the token system. These then evolved into the more abstract *cuneiform*, after the Latin term for “wedge,” named for the distinctive wedge-shaped marks made by pressing reeds into soft clay.

This invention revolutionized human civilization. Writing enabled not only complex urban administration but also the preservation of knowledge, stories, and ideas across generations. While some tablets were intentionally fired to make them permanent, most remained unbaked and were even reused, meaning vast amounts of early writing have vanished. Yet some remarkable examples endure. One of the earliest surviving tablets, dating to around 3100 BC, offers administrative records for brewing beer, complete with pictographs of a building, a chimney, and an ear of barley in a jar.⁵¹ Urbanization had ushered in a new era of human progress—beer included.

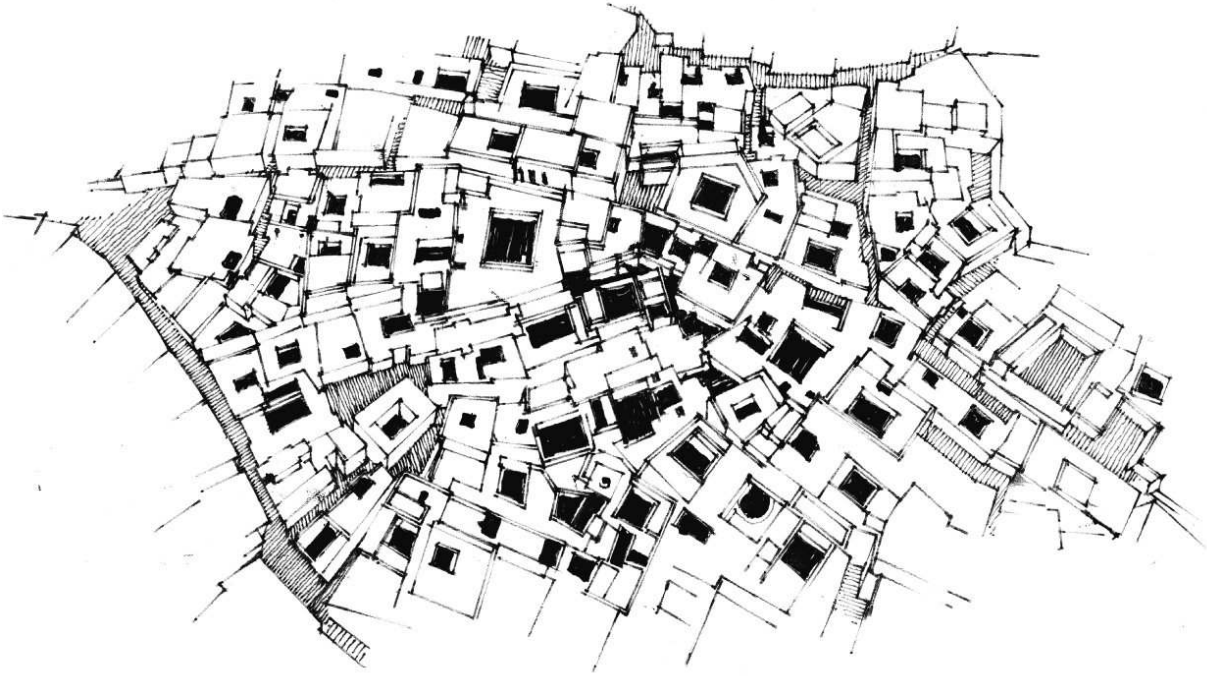
Writing, monumental architecture, specialized labor, political organizations, dense populations—all these were part of a dramatic transformation in human societies that Gordon Childe termed as the “Urban Revolution.” He saw this occurring independently across the ancient world, from the Indus Valley to Egypt and China. With urbanization came a fundamental shift in human relationships. Historian Lewis Mumford likened cities to pressure cookers: “As with a gas, the very pressure of the molecules within that limited space produced more social collisions and interactions within a generation than would have occurred in many centuries if still isolated in their native habitats, without boundaries.”⁵² Architectural historian Spiro Kostof described this as “energized crowding”⁵³—the essence of cities, where proximity to others led to greater opportunities, connections, and innovations.

The concentration of thousands of people in cities also created unprecedented environmental challenges, straining water and agricultural systems and sometimes contributing to their decline. During the late Uruk period, around 3200 to 3100 BC, the region likely experienced increased aridity. The marshes gradually receded. Subsistence agriculture became increasingly difficult. Initially, this crisis may have driven people toward urban centers, where large-scale reserves acted as a buffer against unpredictable crop yields.

However, these people then found themselves subject to political regimes. Uruk seemingly experienced escalating internal and external violence during this period. Seals depict prisoners, with their hands tied behind their backs, kneeling before spear-wielding soldiers. Artifacts such as maceheads, slingshot balls, and arrowheads point to violent confrontations. Meanwhile, urban existence in Uruk may have teetered precariously on the edge.⁵⁴

By 3000 BC, Uruk’s influence ended. Colonies such as Habuba Kabira were abandoned. Artifacts from the Uruk culture, once found as far away as central Iran and Egypt’s Nile Delta, stopped appearing, suggesting the city’s trade networks collapsed. The causes of this decline remain a mystery. They could be internal tension resulting from environmental stress, intrusions by people from Eastern Anatolia and Transcaucasia, or an influx of Semitic-speaking people from the west.⁵⁵

Uruk’s influence declined, but many of the architectural solutions found in its settlements lived on. One of the most enduring strategies was the courtyard house, which would go on to define urban form across North Africa to the Indus Valley. It offered a practical solution: thick mud-brick walls that moderated temperature swings through thermal mass. The courtyards brought light and air into the home while preserving privacy. Even the narrow streets, hardly wide enough for a single donkey cart, had their role. They cast shade and channeled cooling breezes, creating favorable microclimates throughout the city.⁵⁶



Traditional courtyard houses, Marrakech, Morocco.

These were not unique inventions of Uruk but shared adaptive responses to life in warm environments. They emerged independently across regions facing similar conditions. The courtyard house still offers comfort in hot weather today, from the *siheyuan* of Beijing to the *riads* of Fez. In these early settlements, we find not only the building blocks of urban life but also an architecture in dialogue with the earth and the sun.

Clay into Rock

A text from 2152 BC describes Gudea, a Sumerian ruler, in a temple's brick-laying ceremony: "Gudea put the blessed water in the frame of the brick mould. . . . He set up the appropriate brick stamp so that (the inscribed side) was upwards. . . . He raised the impeccable carrying-basket and set it before the mould. Gudea put the clay in the mould, he acted precisely as prescribed, and behold he succeeded in making a most beautiful brick for the house. . . . He struck the brick mould: the brick emerged into the daylight. He looked with complete satisfaction at the stamp (impression) on the clay. . . . raised the brick out of the frame of the mould: he carried the brick—a lovely tiara . . . which reached up to heaven—and went among his people." ⁵⁷

Nearly four millennia later, we still mark the beginning of construction projects with ceremony, although with golden shovels and photo opportunities. Yet these modern rituals pale in comparison to the profound significance that brickmaking held for the ancient Mesopotamians. Rulers like Gudea often depicted themselves carrying a basket of clay on their head, containing the first brick. They inscribed bricks with their names. They boasted about the number of bricks used in their works. So important were bricks that there was a brick god, Kulla, who was invoked during the laying of the first brick. In a society unable to use stone for building, creating bricks was nothing less than manufacturing artificial rock—a godlike act of transforming mud into the building blocks of civilization.

The story of the brick is, in many ways, the story of human dwelling itself. They are part of humanity's journey from temporary shelters of straw and wood to more permanent structures of brick and stone. In Mesopotamia, this evolution of bricks would reshape not only houses but also the fabric of human society—though it came at a cost.

By the middle of the third millennium BC, an unprecedented urban revolution was sweeping across Southern Mesopotamia. The once-sparse landscape had blossomed into a network of thriving cities, each spanning hundreds of hectares. The promise of opportunity drew villagers by the thousands, until an astounding 80 percent of the population lived in urban centers larger than forty hectares.⁵⁸ More than simple cities, these were city-states, complete with suburbs, satellite villages, and agricultural hinterlands, all governed by dynastic kings and temple elites.

But this urban explosion created an urgent challenge: how to house such dense populations safely and permanently. Houses were often not built safely, sometimes leading to collapse. So serious was this risk that the world's first building code, the Code of Hammurabi (circa 1750 BC), addressed it with chilling clarity. "If a builder constructs a house for a man but does not make it conform to specifications so that a wall then buckles, that builder shall make that wall sound using his silver."⁵⁹

But cases could be far more severe. "If a builder constructs a house for a man, but does not make his work sound, and the house that he constructs collapses and causes the death of the householder, that builder shall be killed. If it should cause the death of a son of the householder, they shall kill a son of that builder."

One problem lay with sun-dried brick. The traditional sun-dried mud bricks that had served village builders for generations proved dangerously inadequate for urban life. When exposed to moisture, these bricks could deteriorate and disintegrate⁶⁰—sometimes catastrophically. This is why builders frequently plastered sun-dried brick walls with fresh mud or gypsum to shield them from moisture and erosion, often reapplying it several times a year. Over time, they knocked down entire structures and rebuilt new ones atop earlier foundations. Life in early Mesopotamian settlements was defined by constant upkeep.

Several Mesopotamian cities show evidence of devastating floods, which would have destroyed most homes. Around 3500 BC, the city of Ur experienced a flood leaving up to eight feet of silt, leading excavator Leonard Woolley to believe it was evidence of the "Great Flood." While this is debated since it was more likely a local event, ancient Mesopotamians understood the limitations of their sun-dried brick homes. So they found a new solution. They began baking bricks. The Bible later echoes a similar turning point in Genesis, when humanity, after the Great Flood, resolves to rebuild: "They said to each other, 'Come, let's make bricks and bake them thoroughly.' They used brick instead of stone."⁶¹

Fired brick offered a more durable solution to the problem of moisture. By heating bricks to around 900°C to 1,000°C, a process called vitrification begins, where some of the silica and alumina in the clay fuse together, making the brick harder and more like a ceramic material. This firing removes chemically bound water and significantly reduces the porosity found in sun-dried bricks. However, Mesopotamian kilns rarely reached full vitrification. Nevertheless, the resulting bricks were still much more durable than sun-dried ones.

But fired bricks were a luxury, requiring both fuel and skilled labor. Economic records show that transporting 370 burnt bricks to a construction site cost one silver shekel—roughly 8.4 grams of silver.⁶² These expenses restricted their use to urban centers with the resources and artisans to produce them.

The impact of this innovation was clearly visible in Ur. While ceramics and bricks had been fired since the fourth millennium BC, it was in this port city—where the Euphrates once met the sea—that fired bricks became increasingly common. During the Third Dynasty of Ur (2112–2004 BC), a period later called the Sumerian Renaissance, the city became the capital of an empire known for its major building projects. Appropriately, one of the most iconic depictions of King Ur-Nammu, an early ruler

who founded the Third Dynasty, shows him carrying a basket of mud on his head, symbolizing the laying of the first brick.⁶³

By the height of Ur's power, fired bricks had become symbols of urban prosperity. They were increasingly used in private buildings—especially in courtyards, bathrooms, and wall footings prone to water damage. Baked bricks were laid at the base of walls as damp courses, to protect against moisture from rain and groundwater. This seemingly modest innovation greatly enhanced durability. While the sun-dried bricks above have mostly eroded, the fired bricks remain.

There were other techniques for managing moisture as well. A typical house featured an entry vestibule, “sometimes provided with a water-jar and a drain for the washing of the feet of those entering,”⁶⁴ imagined the excavator Leonard Woolley. It led into a courtyard paved with brick, with a carefully constructed drain at its center. Not yet able to make long pipes, builders stacked interlocking baked clay rings—an early plumbing method also used in their first toilets. These rings had holes along the sides to let water escape. Builders surrounded them with broken pottery to act like a filter, preventing clogging. This made it conceptually similar to a modern perforated drainpipe surrounded by gravel, like a French drain. As Woolley described, “a round pipe, 20 or 30 feet long, made of terra-cotta rings set one above the other; there were holes in the sides of the rings and round them there was a packing of broken pottery which kept the earth from blocking the holes.”

This central placement of the drain was used to move water away from the building's walls. Such was the importance of proper drainage that an ancient text warned: “If the water in the court runs to the back, expense will be continual; if the water in the court runs to the middle of the court, that man will have wealth.”⁶⁵

Mesopotamians also used bitumen, a sticky, waterproof material that was a naturally occurring tar found along the Tigris and Euphrates Rivers. They used it to waterproof their boats and their homes as well. Bitumen helped seal floors and also served as a mortar to bind bricks. Since it was stronger than mud mortar, it was especially useful for lower courses. Bitumen was likely also applied to coat roofs—similar to the use of asphalt roofs today.

To create flat waterproof roofs, Sumerian builders layered beams, reed mats, mud, and bitumen plaster. Even the *Epic of Gilgamesh*, the world's oldest known work of fiction, nods to the eternal challenge of roof maintenance, cursing a sacred prostitute with a leaky roof: “The roof of your house, no builder shall plaster!”⁶⁶

The widespread use of bricks, however, did put its limitations on domestic architecture. Mud bricks are strong under compression—like handling downward pressure from gravity. That makes them appropriate for walls. However, they are weak in tension and can crack or fail under the tensile forces that develop when spanning an opening, such as a window or doorway. Brick lintels had to be short, limiting window sizes. Therefore, homes faced the challenge of dark interiors.

Mesopotamian builders eventually got around this by using bricks to build arches, which primarily work under compression. This allowed them to span larger spaces with bricks alone, but this is not something they did for dwellings. Builders likely used timber beams to span window openings or support roofs.⁶⁷ However, wood was scarce in ancient Mesopotamia.

And it was their lack of wood that likely prevented multistory buildings. Several houses at Ur show remnants of staircases, and the brick walls were often quite thick. This led some to suggest they had a second story, while others propose they simply provided access to the roof. Roof space was almost certainly used—especially in dense cities where street-level space was limited. However, full multistory construction would have been prohibitively expensive. A second floor in a courtyard house would require additional timber not only for stairs but also for balconies to support upper-level access.

Archaeologist William Hafford proposed that many homes may have featured a “hybrid second story”:⁶⁸ partially enclosed rooms or shelters on the roof, perhaps made of reeds or brick, which expanded living space without the cost of full vertical construction. Most Sumerian houses likely had

For Natalie

By means of our hands we struggle to create, as it were, a second world
within the world of nature.

—MARCUS TULLIUS CICERO, *ON THE NATURE OF THE GODS* 2.61,
TRANSLATION ADAPTED FROM H. RACKHAM

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DWELLING ON EARTH

Introduction

Dwelling on Earth

One of the oldest known traces of early human habitation lies deep in Olduvai Gorge in Eastern Africa and dates back nearly two million years—marked by little more than scattered stone tools and fossilized animal bones. Though the first gestures of dwelling likely began even earlier and are lost to time, their significance was profound. When our ancestors began returning to familiar ground and reshaping their surroundings, they did more than rewrite human destiny—they began to rewrite the story of the Earth itself.

From these humble beginnings, our dwellings rose ever higher. Temporary shelters of mammoth bones gave way to Mesopotamian mud brick homes. In time, Roman multistory apartment buildings rose over ancient cities, housing thousands in the early concrete structures called *insulae*, meaning “islands,” rising from streets like stone archipelagos. Today, skyscrapers of glass and steel pierce the clouds in Shanghai and Dubai. And now, in our quest for survival and adaptation, we dare to imagine homes on distant planets—carrying the ancient idea of dwelling beyond our world.

As we shaped our dwellings to suit our needs, they in turn shaped us. In an era when survival meant grappling with the elements and nomadic wandering in search of resources, permanent dwellings emerged as sanctuaries. They sheltered us from storms, provided comfort and security, and became the seedbeds of civilization.

Dwellings allowed us to store possessions and accumulate wealth, luxuries that had eluded hunter-gatherers. They offered new degrees of privacy without the risk of venturing far from the community. As populations concentrated, these clusters of dwellings functioned as social catalysts. Larger settlements accelerated the rapid exchange of ideas and spurred cultural development. In a single day, a villager might encounter more people than a forager met in months—sometimes years.

Homes also became places to make sense of the world and express shared values. We filled them with symbols of belief, setting aside spaces for ritual and ceremony. About nine thousand years ago in the Stone Age town of Çatalhöyük on the Southern Anatolian Plateau, residents built walls incorporating vulture beaks and human skulls—precursors, perhaps, to the souvenirs and portraits we display on mantelpieces today.

Behind these walls and under these roofs, an extraordinary transformation took place, altering our habits, relationships, and the course of civilization. With shelter securing our fundamental requirements—anchored at the base of Maslow’s hierarchy of human needs—people could turn their energy to higher pursuits: building villages, founding cities, and raising monumental temples and pyramids.

Between our first basic huts and today’s towering structures lies an extraordinary and hard-won journey of innovation—from Roman concrete to modern steel frames, from wood-burning fireplaces to smart thermostats, from candlelight to LEDs. Many advancements arrived through trial and error, and sometimes at great human cost. The densely packed houses of Çatalhöyük, for instance, used flat roofs as streets, with roof openings doubling as chimneys and entrances accessed by ladders—a design that likely bred respiratory illnesses, frequent falls, and fractured bones. As much as human dwellings showcase our genius for adaptation, they also reveal our knack for creating the very risks they were meant to prevent.

The walls we built to keep nature out also created boundaries between people—inevitably fueling envy, suspicion, and inequality. In the earliest settlements, there was little differentiation among dwellings. But as settlements grew into cities, wealth inequality became visible. In Ur, one of the first cities in Mesopotamia, wealthy residents lived in durable homes made of courses of fired brick, while commoners occupied sun-dried mud brick structures prone to decay. Some had no secure shelter at all. Permanent settlement may have safeguarded the weak from the wild, yet its benefits were unevenly distributed.

Millennia later, the pattern persists. Luxury towers rise while people without shelter sleep in their shadows, as the gap between wages and housing costs widens. Even in wealthy nations, housing insecurity undermines health and well-being, particularly for vulnerable groups like children, who suffer developmental setbacks. Studies consistently show that stable housing improves quality of life, reduces healthcare costs, and lowers rates of intimate-partner violence.¹

And yet, even when architects set out to improve how we live, well-meaning efforts sometimes perpetuate social problems. In the 1920s, the modernist Frankfurt Kitchen introduced a streamlined workspace based on principles of scientific management and time-and-motion efficiency. Though intended to liberate women from domestic drudgery, its compact design—optimized for a single user—often left them working in isolation, with little space for conversation or supervising children. Rather than challenging traditional gender roles, it may have quietly entrenched them.

Our homes and neighborhoods also impact our health—influencing how we move, breathe, and sleep. Even seemingly comfortable homes can harbor hidden hazards. In car-centric suburbs, daily walks give way to long commutes behind the wheel, contributing to rising rates of diabetes, heart disease, and obesity. While our hunter-gatherer ancestors often walked on the order of 16,000 to 17,000 steps per day, the average American today takes about 4,000 to 5,000 steps. Studies indicate that people living in car-dependent areas face a significantly higher risk of developing type 2 diabetes and obesity.² Obesity, in turn, can reduce life expectancy by years, in severe cases comparable to the effects of lifelong smoking.³

Dense apartment living can present its own challenges, such as limited natural light, which can negatively affect mental health⁴—though apartment living can also foster social connection between neighbors.⁵ And those who live in a house with stairs may live longer and healthier lives, benefiting from the daily cardiovascular exercise of climbing them.⁶ Indoor air quality poses another challenge, especially with nearly airtight modern construction. Common building materials release volatile organic compounds, while poor ventilation allows pollutants to build up. Outside, those picture-perfect lawns surrounding suburban homes often rely on pesticides and herbicides such as 2,4-Dichlorophenoxyacetic acid that not only can contaminate groundwater but are so toxic that they pose serious risks to children and pets.⁷

Most people now spend the majority of their lives inside their residences. Americans devote about 90 percent of their time to interior spaces, two-thirds of that at home. Inside, design choices impact well-being. Natural light influences mood and sleep patterns,⁸ while clutter can elevate anxiety and dull focus.⁹ Views of nature or even simple natural elements have been shown to reduce stress and enhance cognitive function.¹⁰ Yet homes may also shape our inner lives in subtler, more poetic ways. “Thanks to the house, a great many of our memories are housed,” philosopher Gaston Bachelard observed, “and if the house is a bit elaborate, if it has a cellar and a garret, nooks and corridors, our memories have refuges that are all the more clearly delineated.”¹¹

“We shape our buildings; thereafter they shape us,” Winston Churchill once famously said when advocating to rebuild the bomb-damaged House of Commons to its original design. He believed its layout—two opposing banks of benches—was responsible for the two-party system and the very nature of British parliamentary democracy.

What holds for the House of Commons holds for the home as well. Dwelling is not merely a physical structure but a way of being—both noun and verb—woven into the fabric of human culture. Our homes are not just where we live. They are how we live.

Crafting Our Niche

It was our capacity to dwell that gave us a unique evolutionary advantage. While Darwin focused primarily on how species adapt to fit their environment, modern researchers emphasize that some animals form significant two-way relationships with their surroundings. Humans belong to this group—we engage in what researchers call “niche construction.” Like beavers building dams, we create environments that often afford us advantages. These “ecosystem engineers” pass down construction behaviors through generations.

Some animal-made niches rival even the ingenuity of our own creations. Mound-building termites in Australia are renowned for their monumental towers, sometimes reaching about 800 times their body length—the equivalent of skyscrapers taller than any built by humans.¹² They have even developed temperature control systems. Inside, these insects maintain constant temperatures through intricate systems of vents and flues, even as desert temperatures swing dramatically between day and night.¹³ Similarly, bees create precise hexagonal honeycomb patterns. This shape makes efficient use of space, eliminating gaps that would occur with circular cells. It uses less wax than triangles or squares would require to enclose the same area while still providing structural strength—a design so efficient that humans now use it in engineering applications. These remarkable structures, however, emerged over millennia as insects whose genes produced more efficient structures had greater reproductive success, passing their genetic traits to subsequent generations.

Humans, by contrast, accelerate architectural innovation through our ability to make tools, think abstractly, and cooperate intentionally. We leverage geometry, mathematics, and engineering to solve new problems within single lifetimes. We create scalable social networks that allow us to transmit new ideas and coordinate construction projects through planned collaboration rather than genetic instinct. Our earliest homes used simple round forms, as circles and ovals distribute the weight of the roof more evenly and round pits were straightforward to excavate. But we soon developed rectangular structures as our needs evolved, because right angles simplify expansion and partitioning into multiple rooms. We later clustered homes into blocks and orthogonal grids, creating ever-larger cities. We mastered arches and vaults, forged steel, and engineered vertical structures that scrape the sky. No species has ever reshaped its environment so swiftly or completely.

Yet this power comes at a cost. Species that construct niches inevitably alter the ecosystems around them. Just as beavers build dams that transform entire watersheds into lakes of their own making, our ability to modify our environment has fundamentally altered Earth’s ecosystems. In our relentless expansion and pursuit of ever-greater comfort, we invented machines that moved

mountains and paved vast road networks, and built climate control systems that burn through enormous amounts of energy.

Today, the built environment accounts for almost 40 percent of global carbon emissions, much of it from constructing, heating, and cooling residential buildings.¹⁴ And the problem is growing. By 2050, urban populations will increase by 2.5 billion, with cities housing over two-thirds of humanity. To meet this demand, we will need to build roughly the equivalent of a new New York City every month for the next three decades.¹⁵ Meanwhile, as the middle class in emerging economies is expected to double over the next decade, we may see a rise in consumerism mirroring Western patterns, further stoking demand for more floor space. In the US, even as household size halved, floor space per capita doubled from 400 to 800 square feet between 1891 and 2010¹⁶—contributing to a tenfold increase in total housing volume.

Our homes make up much of our built environment, driving economic activity and demand for land, infrastructure, and resources. This bond is etched into language itself: both “economy” and “ecology” spring from the Greek *oikos*, which means “house” or “household.” The ancient Greeks coined the term *oikonomia* (economy) as the management of the household, reflecting the house as society’s basic economic unit. Centuries later, German biologist Ernst Haeckel introduced *Ökologie* (ecology), to refer to the study of organisms in their habitats, their “houses.”

Perhaps even cities arose from the house. Archaeologists once believed the first cities, such as Uruk in Mesopotamia, sprang from the centralized power of temples and palaces. But archaeological finds at the earlier site of Tell Brak suggest another path: incremental growth, household by household, forming neighborhoods that collectively housed tens of thousands before any dominant civic structure emerged. This is what archaeologists call a “proto-city,” a large, densely occupied settlement with urban traits but with little or no early evidence of centralized authority. Like the “swarm intelligence” behind the complex structures built by termites, these larger settlements may have scaled up through the cumulative interactions of many independent households rather than through the top-down direction of political elites. Even when monumental buildings appeared later, they often mimicked domestic architecture. In Mesopotamia, many temples were essentially enlarged houses.

Today, the way we build shapes the planet more than ever before. From the clearing of forests for materials to the carbon footprint of buildings, our housing choices are transforming the environment. In our continuing pursuit to build ever more comfortable homes, we now face climate change and related challenges that threaten the very comfort we sought to create.

From Huts to High-Rises

How did our homes evolve from simple huts made of animal skins and bones to “smart” sensor-equipped buildings? What technological breakthroughs, societal shifts, and cultural currents sparked new ways of dwelling? And how has the evolution of our homes shaped humanity in return—reconfiguring our cities and neighborhoods, raising standards of comfort, and establishing social norms around privacy and domesticity? This book probes these questions, ultimately asking: How did the remarkable story of dwellings redefine our lives and the planet—and how might we build more sustainably in the future?

Dwelling on Earth traces the long, captivating evolution of human habitation and its entangled relationship with the environment. The story of the home is inseparable from the story of humanity itself, unfolding alongside our societal evolution. From brush huts to high-tech habitats, our dwellings have not only shaped how we live but also transformed our world.

For much of history, residential architecture was largely overlooked by architectural historians and archaeologists, who favored monumental temples and palaces. When ancient homes did enter the scholarly spotlight, conclusions were sometimes distorted by outdated science or cultural presumptions. Take the case of the Peking Man discovered in a cave at Dragon Bone Hill near

Beijing, dated to about 400,000 years ago. Early excavators proclaimed the site the home of the first caveman—and supposedly a cannibal, based on bite marks found on bones. Decades later, high-resolution microscopes and modern forensic techniques overturned the tale. The marks match those of gigantic hyenas, suggesting the cave was their den, where they dragged in and gnawed human remains.¹⁷

These interpretive problems had deep roots. One example is the eighteenth-century “primitive hut” theory of architecture, proposed by French priest Marc-Antoine Laugier, who imagined the first homes as sloped roofs supported by wooden columns—a form that conveniently mirrored classical Greek architecture.¹⁸ Until recently, the oval-shaped huts at Terra Amata in Nice, France, were considered the earliest purpose-built homes based on rings of stones found in a beach alcove—a conclusion perhaps skewed by the desire to declare a definitive “first” home. However, new archaeological evidence using micromorphology, which studies soil slices under polarized light, now indicates these rings were not human-built foundations, but likely resulted from naturally occurring stream flows.¹⁹ Nevertheless, the oval hut reconstructions live on, lingering in textbooks and museum displays.

Today, a range of cutting-edge tools enriches our understanding of early homes. DNA analysis reveals familial relationships and migration patterns among ancient residents. Satellite imagery detects settlements where none were expected. Pollen analysis reconstructs ancient climatic conditions. These and other methods provide new insights into early dwellings and settlements.

Yet even with such tools at our disposal, this book does not attempt to provide a complete global history of every dwelling type. Instead, it traces four major transformations: the Agricultural Revolution, the Urban Revolution, the Industrial Revolution, and the ongoing Sustainability Transition. The first three marked transformations from which there was almost no turning back, establishing new levels of complexity, enabling unprecedented forms of settlement, and fundamentally altering how humans could live. The fourth, however, is different—it compels us to choose how we dwell without destroying what sustains us. We’ll explore key innovations and how homes evolved through these turning points, from the first vertical apartment blocks of ancient Rome built by unscrupulous speculators to the early terraced row houses in Liverpool created by forward-thinking industrialists.

Before agriculture, dwellings were temporary—grassy beds, huts made of reeds and animal hides—and most vanished without a trace. But around 12,000 years ago, the Agricultural Revolution allowed us to invest more deeply in permanent settlements. Communities like the Natufians in modern-day Israel and Palestine built circular dwellings of stone and mud as they domesticated plants and animals. Similar round pit houses emerged independently around the globe—solutions to the same problems, arrived at separately.

However, with permanence came peril. Settled communities placed themselves in the path of natural disasters. Floods, droughts, and hurricanes posed considerable risks to their well-being. Communities also significantly modified their natural environments—clearing forests for farms, fuel, and building materials, which exposed topsoil to wind and rain, washing away fertile earth needed for crops. In doing so, they inadvertently contributed to the very “natural” disasters they feared. In many cases, these environmental missteps set the stage for collapse—a harsh reminder of the responsibilities that came with settled living.

The Urban Revolution, roughly six thousand years ago, gave birth to the city and new living spaces. As the demands of irrigation and agriculture favored extended family households, homes began to expand. Circular huts gave way to rectangular forms, far easier to expand and cluster in growing settlements.

With increased settlement size came greater social, economic, and political complexity—and homes evolved in tandem. A growing division of labor gave rise to professional builders. Growing populations and social specialization spurred innovative dwelling types, including row houses and even multistory apartment buildings.

Remarkably, several of these urban forms—such as the atrium house and the organized street grid—emerged independently in different parts of the world, in cultures with no direct contact. In ancient Rome, breakthroughs in materials like concrete made it possible to construct vertical apartment buildings, housing large numbers of urban residents. These unprecedented housing forms enabled more people to live in closer proximity, fostering new kinds of interaction.

Did settled life make us happier? While agricultural settlement is often viewed as inevitable progress, some anthropologists highlight the advantages of nomadic lifestyles. They cite the example of the nomadic !Kung people of the Kalahari, who spend only roughly 40 percent of their time securing food, dedicating the remainder to socializing, dancing, and other pursuits.²⁰ By contrast, settled life often brought increased labor demands—from dawn-to-dusk farming to endless home maintenance.

Even as the cities of the classical world grew, nomadic people persisted, offering a different model entirely. In the fifth century BC, the ancient Greek historian Herodotus described the nomadic peoples on the Eurasian steppe: “Having neither cities nor forts, and carrying their dwellings with them wherever they go: accustomed, moreover, one and all of them, to shoot from horseback; and living not by husbandry but on their cattle, their wagons the only houses that they possess, how can they fail of being unconquerable, and unassailable even?”²¹ These societies had mastered animal domestication but chose not to cultivate crops. As historian Spiro Kostof noted, “They had no use for settled permanence except as their last resting place.”²²

And yet the agglomeration of urban populations brought undeniable advantages. Larger scales of social organization fueled economic productivity and wealth creation—a pattern that continues from ancient cities to modern metropolises.²³ While early productivity manifested in temples and elite housing, today we measure it in GDP. Urban concentration consistently drives innovation.²⁴ In the United States, large cities produce about twice as many patents per person as smaller ones.²⁵ Cities became the engines of civilization.

But even these had limits. Preindustrial cities faced hard constraints to growth. Inadequate sanitation and insufficient agricultural output restricted their population. These barriers would not be broken until the Industrial Revolution, which introduced new energy sources and more efficient means of production—enabling urban growth on an unprecedented scale.

The Industrial Revolution reshaped residential architecture and cities as a whole. Steam trains enabled suburban expansion, while breakthroughs in steel production, construction equipment, and elevators revolutionized building height in cities like Chicago and New York. Meanwhile, a growing bourgeoisie redefined domestic life around the nuclear family—evident in seventeenth-century Dutch row houses, where, to the shock of foreign guests, visitors were expected to remove their shoes.

But industrialization came with a darker side. In many cities, the working class lived in overcrowded, unsanitary tenements. Polluted air, contaminated water, and squalid housing conditions made cities deadly environments, where mortality rates outpaced births. In response to these grim realities, reformers pioneered early planning reforms and regulations that led to better housing initiatives, exemplified by the terraced rows in Liverpool. The construction of modern sewage systems and clean water infrastructure eventually vastly improved urban life.

The twentieth century witnessed a bold modernist movement of urban living that reimagined the home as an efficient machine. This approach manifested in neatly organized rows of apartment blocks and tall towers set in parks. While some cities like Singapore and Hong Kong embraced vertical urbanism, elsewhere, particularly in the United States, domestic life increasingly migrated to automobile-oriented suburban developments.

As we prepare to build many more homes in the twenty-first century, we face new challenges. Today, our homes confront growing environmental threats, from rising temperatures to floods and wildfires. In response, architects are being called on to design more resilient and sustainable

dwellings. These range from entire floating neighborhoods to structures made from bio-based materials like mass timber—large engineered-wood panels strong enough to stand in for concrete.

Simultaneously, emerging technologies are transforming how we build and live. Where Mesopotamians once painstakingly molded clay bricks by hand, robotic arms now extrude concrete with precision. Digital design and automated manufacturing such as 3D printing are revolutionizing how we build, even enabling the design of prototypes for Martian habitats. Artificial intelligence is already beginning to generate home designs and manage domestic systems.

Yet amid this wave of innovation, we're also rediscovering the wisdom of time-tested preindustrial traditions. Passive heating and cooling, natural ventilation, and bio-based materials are making a return—not as nostalgic gestures, but as proven solutions. In many respects, our ancestors may have built more sustainably. Mesopotamian cities largely disappeared into the earth. Ours, by contrast, may be remembered by future archaeologists for their concrete debris.

As we confront the intertwined challenges of climate change and rapid urbanization, the long history of dwelling becomes more than a source of insight. It offers a foundation for reimagining how we live. This book traces that history to understand how we arrived at this moment, and to explore what it will take to build more sustainably.

Homes for Tomorrow

As a professor of architecture and urban planning, I've been fortunate to witness an extraordinary diversity of global housing solutions. My journey has taken me from the informal settlements of southern China to Manhattan's supertall skyscrapers, from Hong Kong's meticulously planned public housing estates to the Netherlands' experimental floating homes. Along the way, I've seen how seemingly technical policies—from zoning resolutions to building codes, even landscaping requirements—significantly shape the way we live. In the United States, for instance, regulations meant to keep neighborhoods orderly have inadvertently nudged out “missing middle” housing—such as row houses, duplexes, and apartment buildings that bridge the gap between single-family homes and large apartment blocks. They have also limited mixed-use blocks where apartments sit above corner cafés or neighborhood shops. The result? Fewer affordable, walkable choices in many communities. In Singapore, by contrast, urban planning policies have deliberately cultivated tall buildings that weave greenery into the skyline, proving how intentional policy design can achieve both density and livability.

As a practicing architect, I've watched the profession transform from hand-drawn blueprints to algorithm-driven modeling and AI-assisted renderings. Construction methods, too, have evolved. Brick walls once laid by hand can now arrive as factory-made panels or be installed by robotic arms. Drones monitor progress from above while robotic dogs patrol sites from the ground. Alongside these technical advances, our profession has championed more sustainable buildings, from advocating for stricter energy codes to embracing renewable materials like cross-laminated timber and bio-based finishes.

As a resident, my own experience of home began in a Dutch town. I grew up in a narrow row house, almost identical to its neighbors, each with its own modest backyard. No one had air-conditioning—we didn't need it. Thick brick walls, external shading, and cross ventilation kept interiors cool. The wide sidewalks fostered a sense of community. Most neighbors knew each other. As a child, I could bike safely to school and play in the street.

When I began my studies in Delft, I moved into student housing that was part of a bold experiment in 1970s architecture. Architects had reimagined the conventional layout, centering each floor around a communal kitchen. Most roommates took turns cooking for one another. There were no formal rules requiring this arrangement. The layout encouraged it. It nurtured collaboration and community. To our surprise, one roommate became the town's youngest mayor.

In Barcelona, I lived in a compact apartment in the old town. Despite the limited space, I was steps from shops, cafes, and public transit. Paris offered a similar lifestyle, with its Haussmann-era walk-up courtyard buildings. In New York, I lived in elevator buildings. Hong Kong immersed me in its vertical labyrinth of skyscrapers and “pencil towers.” Apartments were small but utilized every square inch through sliding walls, foldout furniture, and built-in storage tucked into every nook.

These cities share an important quality. Most daily activities are within a fifteen-minute walk or bike ride. They are examples of what planners now call the “15-minute city.” This experience taught me that quality of life isn’t necessarily tied to the size of one’s home but to the richness of the walkable surroundings.

My path later led me back to suburban life—to a midcentury modern villa in California, a townhouse in Virginia, and a century-old Colonial Revival house in a New Jersey railroad town. Each move brought new daily routines. In Manhattan, movement was built into everyday life, from walking to stores to catching the subway. In the New Jersey suburbs, staying active often requires a gym membership.

In the chapters ahead, we will explore the larger story of human habitation—from the first fired bricks of Mesopotamia to the modular 3D-printed homes of tomorrow. We’ll examine engineering feats that made cities possible, and social experiments that redefined domestic life. We’ll uncover innovations we now take for granted—like how the humble corridor reconfigured privacy. We will explore movements shaped by cultural and economic shifts, from Bauhaus to Brutalism.

While we will examine the physical structure of buildings, we will also consider the social structures they create. Each housing type has the ability to shape urban landscapes, daily experiences, and interactions across different walks of life. Even seemingly innocuous design choices can influence social dynamics. As Amos Rapoport observed in *House Form and Culture*, the placement of American dining counters—like the arrangement of chairs in psychotherapy sessions or courtroom layouts—is “remarkably indicative of the roles of the people involved.”²⁶

Throughout history, the concept and form of home have continually evolved. Unlike the Darwinian evolution of species shaped by natural selection, architecture evolves through artificial selection—driven by human intention. It is up to us to actively shape our built environment. We didn’t accept rock shelters as our final dwelling place. We built our way from mud huts to towers of steel and glass—not by chance, but by choice, and through the same cooperative intelligence that first forged our settlements to meet shared challenges. If we could once raise Gothic cathedrals stone by stone, we can certainly reimagine the homes we build today.

Today, we can create homes that do less harm to the planet. Addressing carbon emissions in the built environment is inherently complicated, involving trade-offs across materials, operations, infrastructure, and transportation. But due to advances in digital design, performance simulation, and life-cycle modeling, we now have the tools to understand and optimize these interactions with unprecedented precision. The technology exists. What remains is the collective will to act.

In our quest to build better homes, it’s tempting to focus on the newest technologies—solar panels, smart thermostats, superinsulation. But progress won’t come from buildings alone. It depends equally on what happens beyond the property line: the design of streets and the shape of neighborhoods. These decisions often lie outside the architect’s control, shaped instead by planners and policymakers. And yet, they have an enormous influence. Architects can design exceptional houses. However, they cannot overcome zoning laws that mandate excessive parking or the absence of safe sidewalks and crossings.

Growing up in the Netherlands quickly teaches you that landscapes are made, not given. Hardly a square inch remains untouched. One-fifth of the country is polder—land wrested from sea and river. You realize that the ground beneath your feet is engineered. If we can conjure land from water, surely we can reshape the land we have with equal ingenuity.

As a phrase attributed to Buckminster Fuller puts it, “We are called to be architects of the future, not its victims.” We are not prisoners to our surroundings, because we are their authors. The path

forward begins with reimagining how we dwell. For dwelling is more than walls and roofs. It's about who we are, how we relate to one another, and how we care for the Earth that remains our only home.

One

A Permanent Place

Fire and Shelter

In 1753, the Jesuit priest Marc-Antoine Laugier described the origin of dwelling by imagining a lone “savage” troubled by nature’s extremes. This “primitive man,” seeking refuge from scorching heat and torrential rain, initially fled to a cave but found it too dark and filled with “foul air.” Upon leaving the cave, he embarks on a mission. “Resolved to make good by his ingenuity the careless neglect of nature,” Laugier writes, “he wants to make himself a dwelling.”¹

As Laugier’s story continues, the man wanders through a forest, stumbles upon fallen branches, and has an epiphany. “He chooses four of the strongest, raises them upright and arranges them in a square.” With surprising engineering intuition, he lays four more branches across their tops to create a frame. He then crowns it with a pitched triangle, making a roof truss, and covers it “with leaves so closely packed that neither sun nor rain can penetrate. Thus man is housed.”

This tale of instant architecture became the foundation of Laugier’s influential theory, championing the simplicity of a “primitive hut,” a pitched roof supported by columns, over the theatrical flourishes of High Baroque architecture. While the story shaped architectural thinking for generations, it is far from the historical reality. Rather than a single stroke of genius, the story of human habitation is one of gradual evolution, unfolding over millions of years through the collaborative acts of countless generations. And this story begins not with *Homo sapiens* but with our distant ancestors.

This history begins in the trees, roughly 14 to 18 million years ago, according to evolutionary biologists, when our great ape ancestors likely developed sleeping platforms.² They would bend and weave together branches, twigs, and leaves, creating what we might call the first beds. Building these rudimentary and temporary platforms—something modern gorillas, orangutans, and chimpanzees still do—would have offered protection from predators and blood-sucking insects. Perhaps they offered escape from ground-level humidity as well.³

But the real transformation came when our hominin predecessors, the forebears of Neanderthals and *Homo sapiens*, broke from this pattern. While apes continued to build fresh nests each night, abandoning them in the morning, our hominin ancestors began experimenting with something surprisingly revolutionary: permanence.⁴

One of the earliest traces of this practice was found in Olduvai Gorge, Tanzania, dating back to around two million years ago. Archaeologists discovered stone artifacts associated with early hominin species. Most importantly, these were clustered in specific locations. This suggests our ancestors were creating the first “places,” sites they would return to again and again.

Why bother establishing a favored place at all? Unlike most primates, who consume what they find on the spot, early hominins began carrying food back to a central place to share. Such behavior would have improved the odds of reproduction. “The extraordinarily long period of juvenile dependency necessitates high levels of cooperation and resource sharing by both parents, by other children, and sometimes by other members of the society,” evolutionary anthropologists Steven Kuhn and Mary Stiner observe.⁵ “It takes a village to raise a child, but it also takes a long time.”

Regardless of intent, this seemingly simple change—the creation of places to return to—marked one of the most significant transformations in human evolution. Unlike the solitary nests of apes, these early campsites became the first community spaces in human history.

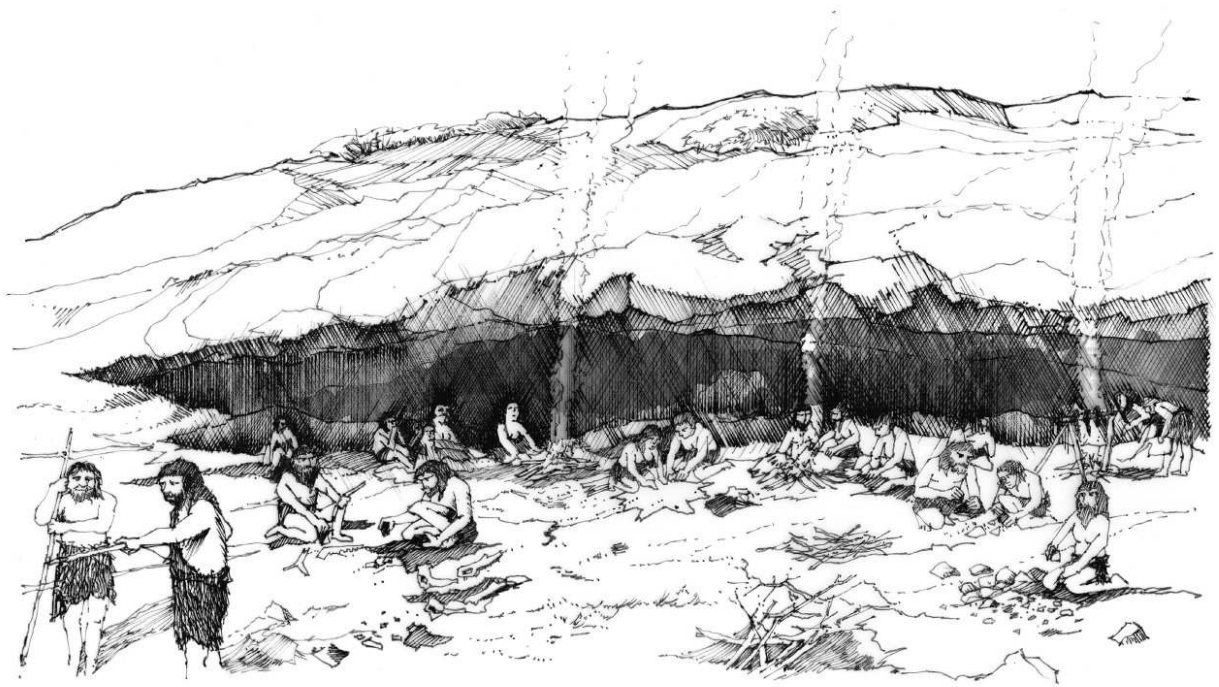
Here, our ancestors did more than rest—they slept, shared food, crafted tools, and passed down knowledge. As several anthropologists have noted, these sites became “arenas for social learning that had not existed previously.”⁶ This new social environment may have even helped shape our brains, particularly the neocortex—the region responsible for advanced cognitive functions such as emotional control and planning.⁷ This new lifestyle not only set human habitation apart from that of apes, it may have redefined who we were.

This would also have accelerated one of our signature strengths: our ability to make tools, positioning us, as several archaeologists describe, as “ultrasocial engineers.”⁸ The earliest known trace of this engineering impulse surfaces at Kalambo Falls, Zambia. There, excavators discovered two interlocking timbers dated to roughly 476,000 years ago—evidence that, as the researchers describe it, offers “a glimpse of a capacity to create a built environment” long before *Homo sapiens*.⁹

The next major revolution came with the habitual use of fire, beginning around 400,000 years ago. Fire changed human habitation in ways our ancestors could hardly have imagined. It kept predators at bay, illuminated the darkness, provided warmth, and unlocked new food sources, making previously inedible items like grains digestible. This transformed our relationship with time, cutting the time spent chewing raw foods and extending our days beyond sunset.

Around the same period, our ancestors began to more frequently occupy rock shelters and caves. Fire made the inhospitable conditions of caves more bearable, as caverns were often cold, dark, damp, and home to other residents like lions, bears, and hyenas, which had to be displaced. With fire, these places stayed occupied longer.¹⁰ But fire did more than make campsites and caves more comfortable.

“Home is where the hearth is” goes the saying, and in prehistoric times, the hearth was truly the center of the home. Our ancestors gathered around fires to share food, tell stories, and strengthen social ties. As archaeologists Desmond Clark and Jack Harris observed, fire “helped to weld early hominid groups into the coherent family units that are characteristic of human society.”¹¹



Rock-shelter, Abrigo de Navalmaíllo, Spain, ca. 73,000 BC. ¹²

These more permanent places likely changed our trajectory. They provided safe havens, helping to protect the young and vulnerable and extending the lifespan of the physically compromised. ¹³ Previously, a bone fracture would have meant certain death. Now, there was hope for recovery.

In some ways, a permanent place made survival easier. But it also required more advanced social skills. This could have affected our evolution. Natural selection could have increasingly favored those better at cooperation, communication, and conflict resolution. The use of fire for cooking reduced the size of our teeth, leaving them smaller than those of other animals. Some archaeologists have proposed that dwelling may have changed our brains. It established a feedback loop: Humans were creating homes, and homes were shaping humans. This process may have influenced the development of future generations in a nonlinear way. As Kuhn and Stiner observed, “More and more, hominins were coevolving with the world that they modified.”

These early settlements proved attractive to other hominins, drawing them in with the promise of food, resources, and companionship. Yet this closeness came at a cost. Exposure to smoke from open fires harmed lungs. Meanwhile, the close proximity of people hastened the transmission of mycobacterial diseases through coughing. ¹⁴ Tuberculosis, for instance, is estimated to have caused about a billion deaths across history, more than all famines and wars combined. ¹⁵

Managing fire brought other challenges as well. Early humans had to master the delicate balance between warmth and smoke inhalation. Recent studies of sites like Lazaret Cave, occupied approximately 170,000 years ago, reveal advanced spatial thinking. Hearths were strategically placed in “sweet spots” that maximized heat and light while allowing smoke to escape. ¹⁶ Too deep in the cave meant safety from predators but poor ventilation. Too near the entrance meant better air but exposure to cold and danger. This spatial problem-solving reflects not only an awareness of these practical challenges but also an ability to overcome them.

Meanwhile, the control of fire enabled our ancestors to venture into regions like northern Europe during periods when nearly 30 percent of the continent lay under ice, dramatically expanding our territory. It also marked humanity's first major impact on the Earth. Long before industrial emissions, our ancestors wielded flames as environmental engineering tools. They managed burn zones that promoted fruit- and nut-bearing plants in the postfire regrowth vegetation.¹⁷ Fire became a powerful hunting aid, exposing the nests of small game and driving larger prey into traps. It effectively shrank the "radius of a meal"¹⁸—the distance humans needed to travel to find enough food. Our ancient use of fire has influenced many ecosystems and spurred the rise of fire-adapted plant species (pyrophytes).

As our ancestors' mastery of fire grew, so did their ingenuity in creating comfort. More than 200,000 years ago, evidence of the first intentionally created bedding appeared in southern African rock shelters.¹⁹ Early *Homo sapiens* carefully constructed beds of broad-leaved grasses to enhance their comfort. They placed them close to the hearth—and, judging from the scorched ends of the grasses, sometimes too close. This arrangement mirrors modern hunter-gatherer camps, where people still gather to sleep around the fire.²⁰

Neanderthals displayed architectural capabilities of their own. Around 176,000 years ago, deep within Bruniquel Cave in France, they ventured more than a thousand feet from the entrance. Working by torchlight, they deliberately stacked hundreds of stalagmite pieces into two broad rings, some bearing traces of fire.²¹ This wasn't shelter but one of humanity's earliest monuments. The sheer effort required speaks to sophisticated planning and cooperation.

By 100,000 years ago, hominin settlements show evidence of complex spatial organization. The popular image of Neanderthals living deep in caves turns out to be wrong. Archaeologists found they preferred more accessible spaces near cave entrances and under rock shelters. There, they created distinct zones for different activities, including hearths for cooking and areas dedicated to toolmaking and butchering.²² They even buried their dead beneath the cave floors and engaged in symbol making, adorning stalagmites with abstract designs using red ochre pigments.

When Neanderthals tracked game, they constructed temporary windbreaks from wood and mammoth bones. One striking example comes from La Folie, a 60,000-year-old site in west-central France. In this harsh, cold environment of Ice Age Europe, Neanderthals created what archaeologists believe was a base camp. Preserved post holes suggest a circular wooden structure, likely supporting brush or hides, serving as a windbreak. Within this 30-foot diameter space, they carried out several activities. They rested, shaped stone tools, and prepared meals. They may have even laid mats to soften the floor.²⁴



Temporary Neanderthal camp “La Folie,” near present-day Poitiers, France, ca. 60,000 BC. ²³

As the Neanderthals gradually disappeared around 40,000 years ago—partly due to competition with our own species—*Homo sapiens* began taking shelter-building in new directions. In the Dordogne region of France, they occupied rock shelters and decorated them. They made engravings and stained them with red, yellow, and brown ochre, sometimes starting with a preparatory charcoal sketch. Among these earliest artistic expressions were hand stencils, geometric patterns, and animal figures. One of the oldest symbols was probably a representation of the vulva. ²⁵ These endeavors revealed not only the unique symbolic capacity of our species but also an emerging desire to make living spaces distinctly our own.

The limitation of caves, of course, is that they have a predetermined location. However, modern humans also built more impressive temporary shelters in open locations. One example comes from Mezhirich, Ukraine, dating back around 15,000 years ago. Here, a group of Ice Age hunter-gatherers constructed oval and circular huts from 120 to 240 square feet in size. They were built mostly from mammoth bones and are among the earliest examples of architecture. The largest of these structures, weighing approximately 50,000 pounds, would have required ten people over five days to erect. ²⁶ Given the extraordinary effort required to build them, these structures may have held ceremonial or symbolic meaning beyond simple shelter.

The mammoth-bone huts represent a level of architectural skill that sets them apart from the instinctive nest building of our ape ancestors. The builders demonstrated a rudimentary understanding of engineering, deliberately placing each bone to exploit its natural geometry. They created a precise oval or circular foundation and arranged leg bones and jaw bones at regular intervals. They positioned the jaws chin down. The leg bones probably upheld a roof, although it is likely that wooden elements would have helped support it as well. The entrance was marked by large upright mammoth tusks. The wall displayed a careful repetition and symmetry using pieces of the vertebral column. Remnants of hearths inside the dwellings indicate the use of bones as fuel. The final effect must have been striking—like igloos made of bone rather than blocks of ice.



Bone hut, Mezhirich, Ukraine, ca. 15,000 BC.

Several of these mammoth-bone dwellings have been found across Eastern Europe and Russia. They helped the builders cope with the frigid temperatures near the end of the last Ice Age when ice sheets stretched far into Europe. Archaeologist Steven Mithen describes what these homes might have been like inside: “The floor is soft, carpeted with hides and furs that surround a central ash-filled hearth. Mammoth skulls and leg bones provide furniture; an assortment of leather bags, bone and wooden bowls, antler and stone tools are scattered by the walls and hung from the rafters—a scene of Stone Age domestic clutter.”²⁷



[Follow for extended description](#)

Traditional Inuit igloo, Nunavut, Canada.

In a twist of prehistoric irony, our ancestors' hunting skills proved too effective, leading to the extinction of mammoths around 10,000 years ago—and mammoth-bone dwellings with them. However, humans also used other building materials, particularly wood. Yet these more perishable materials present a challenge for modern archaeologists. Wooden structures rarely survive. Even when promising sites are discovered, researchers struggle to interpret them, due to their decay. As archaeologist John Yellen noted, “Paleolithic Pompeiis are unknown.”²⁸ Most of these ancient homes have long since returned to the soil, leaving archaeologists to piece together their stories from fragmentary evidence.

However, on rare occasions nature preserves a snapshot of prehistoric domestic life. One such example was a fisher-hunter-gatherer base camp of six huts on the shore of Israel's Sea of Galilee dating back 23,000 years. These Paleolithic homes survived thanks to a curiously helpful sequence of events: a fire followed by submergence under lake water, which protected them from decay. They might have remained hidden forever, until a recent drought when water was pumped from the lake. Archaeologists found that the site's foragers had crafted small huts from brushwood, weaving them into dome-like structures enclosing a central hearth. Near the perimeter, they covered the floor with thick bunches of grass laid out in a tile-like pattern on top of a solid layer of clay.²⁹

Yet even these well-crafted dwellings were not meant to last forever. This pattern of temporary settlement continues among modern hunter-gatherers today, like the !Kung people in the Kalahari Desert. They rarely stay in one place for more than a few months due to the intrusion of insects that inevitably follows human habitation.³⁰ Nevertheless, in these fleeting shelters we find humanity's first steps toward permanent places in the landscape. What began as simple returns to favored spots evolved into increasingly sophisticated and enduring manipulations of space that would ultimately distinguish us from every other species on Earth.



Brush hut at Ohalo II, Sea of Galilee, Israel, ca. 21,000 BC.³¹

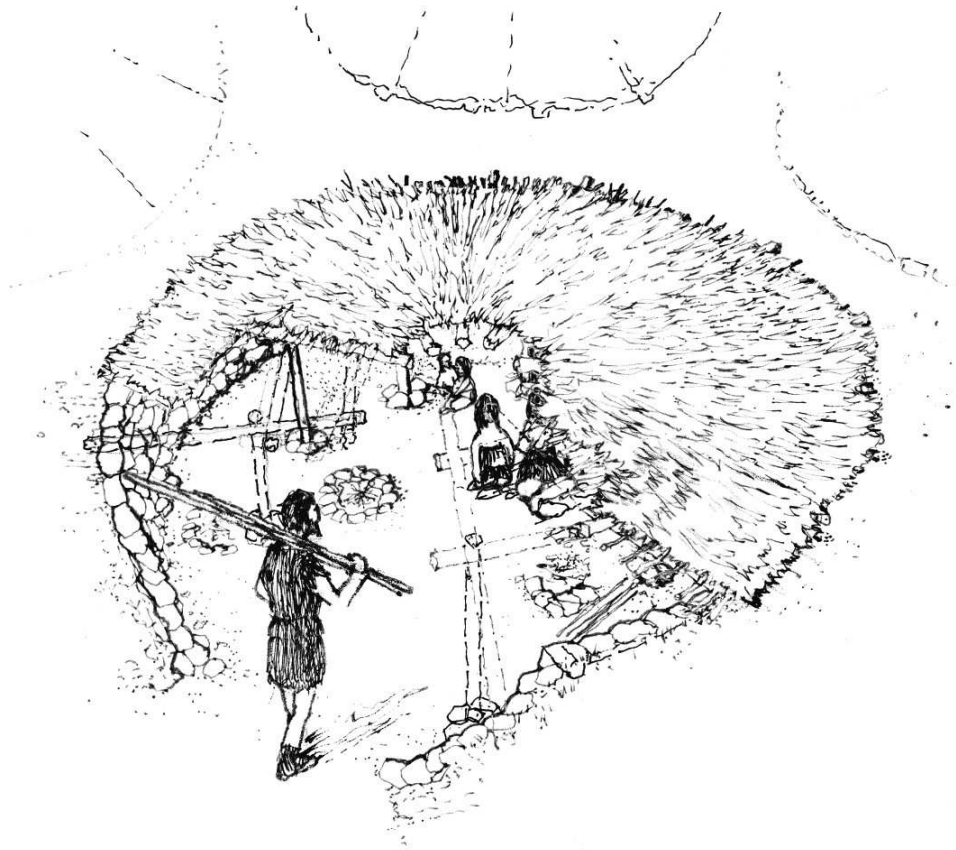
Digging In

Roughly 20,000 years ago, the last great Ice Age drew to a close. As the world began to warm, the ice sheets, which once cloaked nearly a quarter of the Earth's land, started to recede. Their retreat did more than reshape the terrain. In the Eastern Mediterranean, they created the perfect laboratory for human innovation. Once-barren steppes flourished into lush woodlands teeming with olive, pistachio, and oak trees, alongside fields of wild wheat and barley. Here, humanity would take major strides toward permanent settlement.

The Natufians, a hunter-gatherer culture inhabiting what would become modern-day Israel and Palestine, were the first to seize this opportunity. Around 14,500 years ago, surrounded by abundant almond and pistachio trees and calorie-rich plants, they chose a different path. They stopped following the seasonal migrations of animals and plants. Instead, they decided to make the land work for them. They settled down.

Their solution to permanent housing, the pit house, was both simple and ingenious. By excavating circular or oval depressions in the earth and roofing them over, they created dwellings that were easy to construct and durable. Without the masonry skill to erect freestanding walls, the Natufians used the earth itself to provide natural walls. Better still, these semisubterranean structures offered superior insulation, remaining warm in winter and cool in summer.

The pit house proved so effective that it emerged in other cultures as well. In Eastern Europe, hunter-gatherers first constructed mammoth-bone huts partially buried in circular pits to ward off the cold. The Yellow River Valley of China saw pit houses emerge around 6,500 years ago as shelter from harsh weather. Native Americans in the Sonoran Desert, about 4,000 years ago, also dug oval pits several feet deep for their dwellings to escape the summer heat. While these cultures developed their solutions independently, they all discovered the same solution. The pit house was nearly ideal, requiring minimal resources while being adaptable to almost any climate.



Natufian pit dwellings, 'Ain Mallaha ('Eynan), Israel, ca. 12,500 BC. ³²

Most archaeologists would agree that the round and oval houses of the Natufians represented the earliest structures to echo our modern notion of a home, marking a key step toward permanent settlement. ³³ The Natufians did not just dig a hole and cover it with branches. Instead, they used rocks to stabilize the pit's sides, creating a rudimentary retaining wall. Inside, they built a ring of evenly spaced posts that supported the roof, and anchored the posts with rocks. They likely created a roof from branches or reeds. These homes were modest in size, spanning 10 to 20 feet in diameter. They featured one or several stone hearths. ³⁴

The circular design of Natufian houses offered several other advantages as well. Round pits were easier to dig than rectangular ones. Round shapes also distributed structural forces more evenly, increasing resistance to wind forces. Unlike their rectangular equivalents, round buildings avoided collapsing corners. Without corners, construction became simpler. The circular design also proved highly efficient, as round shapes enclose maximum space using minimal materials. The presence of a central hearth could warm the interior evenly, ensuring optimal warmth throughout the dwelling. These benefits help explain why round forms dominated early architecture across widely separated cultures from Africa to the Americas. ³⁵

Perhaps most impressive was the geometric precision of some of the dwellings. One of the excavated remains featured perfectly circular foundations. Elsewhere, researchers found a circular limestone disk tool about eight inches in diameter. Both artifacts exhibit a surprisingly high level of symmetry. This likely reflected the Natufians' deliberate intent to build circular forms. ³⁶ These homes suggest they had planned their buildings in advance, challenging our assumptions about when such deliberate architecture emerged.

Their settlements featured both large and small single-room houses. However, their specific purpose remains uncertain. Curiously, house size showed no correlation with family size or social status—a finding consistent with the absence of evidence of social stratification among the Natufians. As a result, archaeologists suggest the variation in size was tied to function rather than social hierarchy.³⁷ The larger structures might have functioned as communal spaces or workshops.

For the first time in history, people began living together in such large numbers. Natufians clustered their homes into small hamlets, which supported estimated populations of around 150 individuals. This was a major increase from the typical hunter-gatherer groups of about 15 to 50 people.³⁸ The Natufians were not full-fledged farmers yet, as they cultivated wild cereals while preserving their hunting practices. Nevertheless, their dwellings represent a major step toward a sedentary existence.

These early villages were likely quite vibrant. Much of life occurred beyond individual dwellings in shared outdoor spaces, such as communal cooking and food preparation. François Valla, one of 'Ain Mallaha's original excavators, argued that life in these communities differed sharply from scattered bands.³⁹ They likely hosted feasts, ceremonies, and social events. These activities may have been similar to the periodic gatherings of later hunter-gatherer societies, like the seminomadic Inuit in the Arctic, who lived in tents in summer and igloos in winter.

But humanity's first experiment with permanent settlement also attracted unexpected visitors. As the settler populations expanded, so did house mice populations, drawn by the concentrated food waste in villages. House mice emerged around the same time as the first Natufian settlements and quickly outcompeted native wild mice.⁴⁰ The ripple effects of this ecological change extended further up the food chain. The abundance of food waste and the mice, in turn, drew wolves closer to human communities. Some scholars suggest that this influx of wolves may have triggered the domestication of dogs—a relationship immortalized in the burial of an elderly Natufian woman, her hand resting gently on a puppy.⁴¹

In response, the Natufians adapted their structures, modifying the smaller circular buildings between their dwellings—likely granaries—with suspended, sloped floors that deterred rodents and enhanced air circulation to prevent food spoilage.⁴² Thus, the Natufians had to adjust to environmental challenges they themselves unintentionally created.

The price of permanence grew steeper with each generation. Fixed settlements introduced water pollution, as accumulated garbage and human waste began to taint their water sources. The constant harvesting of local plants and the overhunting of animals led to gradually diminishing resources. In some cases, it led to local extinctions.

Yet this human-environment dynamic was more nuanced than just exploitation. The Natufians, like other early settlers, pioneered land management practices that reshaped landscapes in both costly and fruitful ways. Through selective harvesting, they unintentionally dispersed seeds. This created new vegetation patterns across their lands. Controlled burning promoted secondary forest growth, drew game animals, and fostered the growth of new plant species. The resulting ash boosted soil nutrients, often increasing local biodiversity and ecological productivity in ways that benefited both human communities and local ecosystems.

Remarkably, evidence reveals that as far back as 12,000 years ago, three-quarters of Earth's land bore subtle marks of human activity.⁴³ This finding upends our notion of “untouched” and “pristine” nature. The wilderness we now idealize was likely shaped by millennia of interaction between humans and their environment.

However, permanent settlement exposed humans to new vulnerabilities. With fixed dwellings and stored food supplies, communities lost the option to simply pack up and leave. Settlements in river valleys faced flooding, while those in drier areas were vulnerable to drought. Villages in woodlands risked wildfires. Resource depletion added pressure as intensive hunting and gathering began to outstrip natural regeneration. The Natufians found themselves in an increasingly adversarial

relationship with nature, both subject to its forces and unintentionally worsening the frequency and severity of disruptive environmental events. These challenges occasionally delivered stark reminders about the increased vulnerability and responsibility tied to their fixed abodes.

These risks intensified with growing populations. Permanent settlement allowed for larger families. With a stable home base, parents could more easily care for multiple children without the strain of continuous movement. This reduced the need to space births widely. The growing economic value of children in early farming and foraging activities likely spurred population growth as well.⁴⁴ But larger families strained food supplies. Archaeological evidence from gazelle bones indicates that the Natufians mostly hunted larger males.⁴⁵ This would have likely shrunk gazelle populations and meat yields over time. They also overharvested wild plants, reducing their capacity to regenerate.

Around 10,500 BC, the climate suddenly plunged back toward Ice-Age conditions—a brief cold spell known as the Younger Dryas. It likely struck a fatal blow to the Natufians' sedentary life. They abandoned their villages and reverted to nomadism. Nevertheless, they still established smaller, semipermanent camps to exploit seasonal resources.

While their 2,000-year experiment in settled life ended, it was far from a failure. The Natufians pioneered innovations from durable pit houses to sophisticated granaries. Their hard-earned lessons helped pave the way for their descendants to transition from foragers to farmers and continue the trajectory toward permanent human habitation.

Breaking the Circle

One of the few places to witness the evolution from hunter-gatherer encampments to agricultural settlements is Beidha in southern Jordan. Unlike its famous neighbor Petra, whose striking tomb facades carved into red rocks draw crowds and feature in movies like *Indiana Jones and the Last Crusade*, Beidha offers little spectacle. It appears unremarkable—just ancient stone foundations. But what Beidha lacks in grandeur, it makes up for in historical significance. The site provides a key to understanding how so many of us came to inhabit rectangular buildings today.

Beidha was a seasonal encampment around 11,000 BC established by the Natufians, who used the site as a base for hunting activities. It was then abandoned, perhaps due to depleting resources and a cooling climate. Around 9600 BC, after enduring a thousand-year drought, temperatures rose. This dramatic change to warmer and wetter weather likely prompted a new society, descended from the Natufians, to try their luck at permanent settlements.

Perhaps realizing that wild crops would eventually be depleted with continued harvesting, these people began cultivating them. They grew rye, wheat, and barley in the fertile alluvial valley soils. Knowing that solely hunting wild gazelles was no longer sustainable due to overhunting, they started to domesticate sheep and goats. They became farmers.

This was the beginning of the Neolithic period, or the New Stone Age (from the ancient Greek *neos* meaning “new” and *lithos* meaning “stone”). The shift to agriculture enabled these early settlers to produce surplus food and invest more heavily in their dwellings. But by settling in permanent locations to manage their crops, they also had to safeguard them from others who might, quite literally, pick the fruits of their labor. As the architectural historian Spiro Kostof noted, “A fixed place under the sky—that is the Neolithic legacy.”⁴⁶

This culture is known to archaeologists as the Pre-Pottery Neolithic people. This name highlights their lack of pottery-making technology, such as the ability to fire clay. Yet what they lacked in ceramic skills, they made up for in their buildings. Returning to villages the Natufians had previously abandoned, these people began using more durable materials like stone and experimenting with innovative construction methods. One of these was the invention of mud bricks.

Mud bricks were one of humanity's first widely used building materials. Mud was available in many parts of the world, but brick making was labor-intensive. It required that villagers laboriously dig clay from the valley floor. They then often kneaded it with straw for greater resilience. They

molded this mixture into oblong forms, leaving them to sun-dry for a few weeks. Once hardened, the villagers stacked them and bonded them with mud mortar to raise walls. These mud walls also offered some welcome insulation from both heat and cold. All these efforts demonstrate their dedication to permanent settlement.

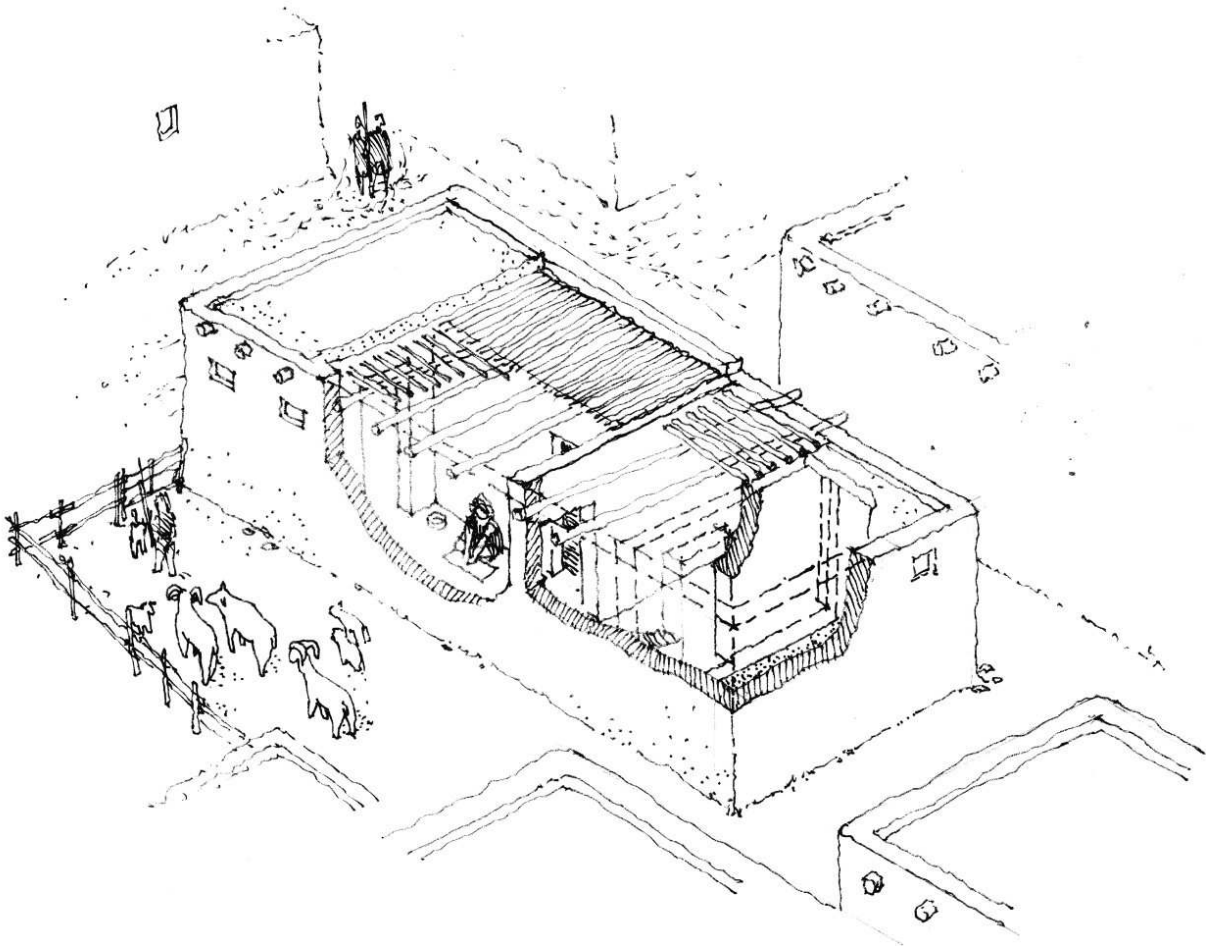
Their methods proved successful. The Pre-Pottery Neolithic people expanded across the Middle East. By 8000 BC, agropastoral villages thrived throughout the Levant in the eastern Mediterranean, from the highland regions above the Euphrates River in Syria northward into Anatolia. Some of these villages boasted hundreds of well-constructed houses.⁴⁷ One of the smaller settlements was Beidha.

At Beidha, the villagers herded goats, sowed barley and wheat, and also hunted game and foraged nuts.⁴⁸ In the beginning, they built pit houses with sunken floors, stone foundations, and wooden posts supporting roofs. But around 6650 BC, their homes were destroyed by fire.

From those ashes rose a new beginning. Departing from the old semisubterranean pit dwellings, they built aboveground designs. They erected walls of mud bricks and sandstone slabs and topped them with flat roofs. They covered floors in plaster and even decorated some with black paint or burnished black-and-red patterns.⁴⁹

Most importantly, their buildings were no longer round but rectangular.

Erecting rectangular houses demanded advanced building techniques, such as joining perpendicular walls at ninety-degree angles. But it gave them significant benefits. These homes could be more easily divided into multiple rooms, each space tailored to a specific purpose. They could more easily be expanded, with additional rooms built adjacent to existing ones. Flat roofs also provided new opportunities, such as the potential for upward expansion and rooftop private outdoor space. The shift to rectangular buildings fostered denser communities by allowing for more tightly knit, organized settlements.



Five-room mud brick house, Abu Hureyra, Syria, ca. 6500 BC.

Over time, Beidha's population doubled to a few hundred people. Residents built larger houses with up to five rooms, replacing the single-room homes of their earlier pit dwellings. Where circular homes could house one or two individuals, the rectangular multiroom structures could accommodate entire extended families. As agriculture led to an increase in village populations and social complexity, the rectangular plan offered a more practical dwelling arrangement.

This wasn't unique to Beidha. Across the Levant, a pattern emerged. As communities developed their farming and herding skills, they would shift from building circular dwellings to rectangular ones. For instance, Jericho, located in today's West Bank, began as a settlement of circular pit dwellings established by the Natufians. The Pre-Pottery Neolithic people initially continued this tradition of circular pit homes. By 9600 BC, the inhabitants had constructed a wall partially enclosing their village, perhaps to protect from floods, making it the first known fortified town.⁵⁰ Their crowning achievement was the Tower of Jericho, a 28-foot-tall round stone structure considered humanity's first work of monumental architecture. It may have had a ceremonial purpose, maybe as a landmark to draw outsiders into their communal way of life.⁵¹

Around 7000 BC, Jericho became one of the largest villages of its time, housing possibly up to 3,000 individuals. The village architecture of rectangular homes built from mud bricks reflected this. Even the bricks evolved. Where initially bricks had flat bottoms and rounded tops, they became perfectly cuboid, allowing better stacking and creating more stable construction.⁵²

This transition from round to rectangular dwellings happened not only in the Near East, but in agricultural societies worldwide, from Mesoamerica to Asia.⁵³ People arrived at rectangular building independently, suggesting it was a widely favored solution as communities became better farmers. Archaeologist Kent Flannery⁵⁴ noted how food storage played an important role in this transition. He found that in early villages with circular or oval-shaped huts, storage facilities typically stood out in the open. This pointed to food being shared communally. This practice resembles the egalitarian culture still observed by hunter-gatherers today, which reduces individual risk as environmental conditions change.⁵⁵ But the rise of rectangular homes with multiple rooms brought a major change. Increasingly, one room within the dwelling itself was specifically dedicated to storage. As agricultural societies advanced, the rectilinear house gave households a greater autonomy in managing surplus resources.

This architectural shift came along with a change in social dynamics. As Flannery emphasized, it changed the risk and reward equation for households. When storage was communal, individual households had little incentive to maximize resources for themselves, since everything was likely shared. Private storage changed this. Suddenly, houses within the village had an incentive to compete, each family striving to maximize resources for their own household. At the same time, as early farming villages expanded, it was likely that fewer families were closely related by blood. This could have made them increasingly less inclined to share resources with their neighbors.

One researcher noted that communities with privatized storage had a more “closed” site layout. They featured “either widely spaced household units or closed-in eating and storage areas, in order to avoid the jealousy and conflict which might arise from one household visibly having more than another.”⁵⁶

Yet paradoxically, the very walls hiding indoor activities may have intensified jealousy as well. As anthropologist Peter Wilson argued, the presence of walls fundamentally altered our ancestors’ visual attention, reshaping their drives and emotions. Hunter-gatherers could carry only what they could move, but once people settled in dwellings, they could accumulate, conceal, and display food, wealth, and status. This shift toward village life, Wilson suggests, was as transformational as when our distant ancestors descended from living in trees to living on the ground, which freed our hands from grasping. Villagers, he argued, became “domesticated people,” psychologically and socially distinct from those in roaming bands.⁵⁷

Meanwhile, the number of farmers was growing, outperforming hunter-gatherer societies. By cultivating crops and domesticating animals, agricultural communities could produce food more reliably and efficiently than through foraging alone. This sustained growing populations and more complex societies. Archaeologist Gordon Childe, who coined the term “Neolithic Revolution,” or Agricultural Revolution, estimated that in aboriginal America, unimproved land could sustain a population ranging from about .05 to .1 person per square mile. In contrast, Neolithic societies on the Pacific Islands today can sustain populations of approximately thirty or more people per square mile.⁵⁸ The transition from a hunter-gatherer lifestyle to an agricultural one dramatically expanded the Earth’s “human carrying capacity,” the maximum number of people that could be supported.

Given these advantages, it should be no surprise that the agricultural transition ultimately unfolded independently in at least eleven different regions worldwide.⁵⁹ This revolutionary shift began about 10,000 to 12,000 years ago, spanning from the cultivation of rice in East Asia to the domestication of squash in the Americas. As agricultural knowledge spread, in regions like the Mediterranean, humans selected and cultivated hundreds of varieties of crops, from olives to grapes.⁶⁰ Farming produced the surplus food that enabled more populous, specialized, and socially complex societies—though some might argue it was a double-edged sword.

Farming led to intensified resource exploitation and fierce competition for scarce resources within defined territories.⁶¹ Close contact with domesticated animals and wild pests, such as rodents, increased the incidence of zoonotic diseases like influenza. Dense, sedentary populations, with their

higher rates of contact, created perfect conditions for the spread of diseases like measles and smallpox. Farmers and their settlements contributed to deforestation, soil erosion, and water pollution. At times, the very practices that enabled growth also sowed the seeds of their own destruction. Even Beidha was eventually abandoned, perhaps due to the depletion of grazing lands, firewood, and fertile soil.⁶²

When I visited Beidha, it was difficult to imagine it was once a much greener place, with grasslands and trees. Today it is an arid desert. As the climate grew more arid over time, the once fertile land became less capable of supporting agriculture. People abandoned village life.

My stay at a Bedouin camp in Wadi Rum a few hours away provided a stark contrast. This otherworldly red desert—immortalized as alien terrain in films like *Star Wars* and *Dune*—at first seems a barren wasteland. Yet the Bedouins, with their goat- and camel-wool tents, seem well adapted to desert life. Their nomadic life in tents, radically different from agricultural communities in houses, shows that settled life is not the only way.

While the transition to rectangular buildings may have been an important step in human development, it wasn't the only path—or an irreversible one. Some societies, after embracing rectangular structures with private storage, returned to circular dwellings and shared storage, perhaps to share the burden of risk in changing economic conditions. And though permanent settlements are the norm for most of us, nomadic and seminomadic traditions persist today.

Many Bedouins clearly prefer it that way. Life in tents immerses them in the sweeping desert landscape and the unpolluted night sky. An archaeologist once observed how Bedouins have a fierce disdain for city life, citing a “mystical hatred of the roof” and a “religious revulsion to the house.”⁶³ Their rejection of rigid walls echoes the ancient Rechabites who, as Jeremiah chronicled, swore, “We do not drink wine.” And commanded: “You must never build houses, sow seed or plant vineyards; . . . [you] must always live in tents. Then you will live a long time.”⁶⁴ And so, not all succumbed to the comforts—and constraints—of rectilinear life.

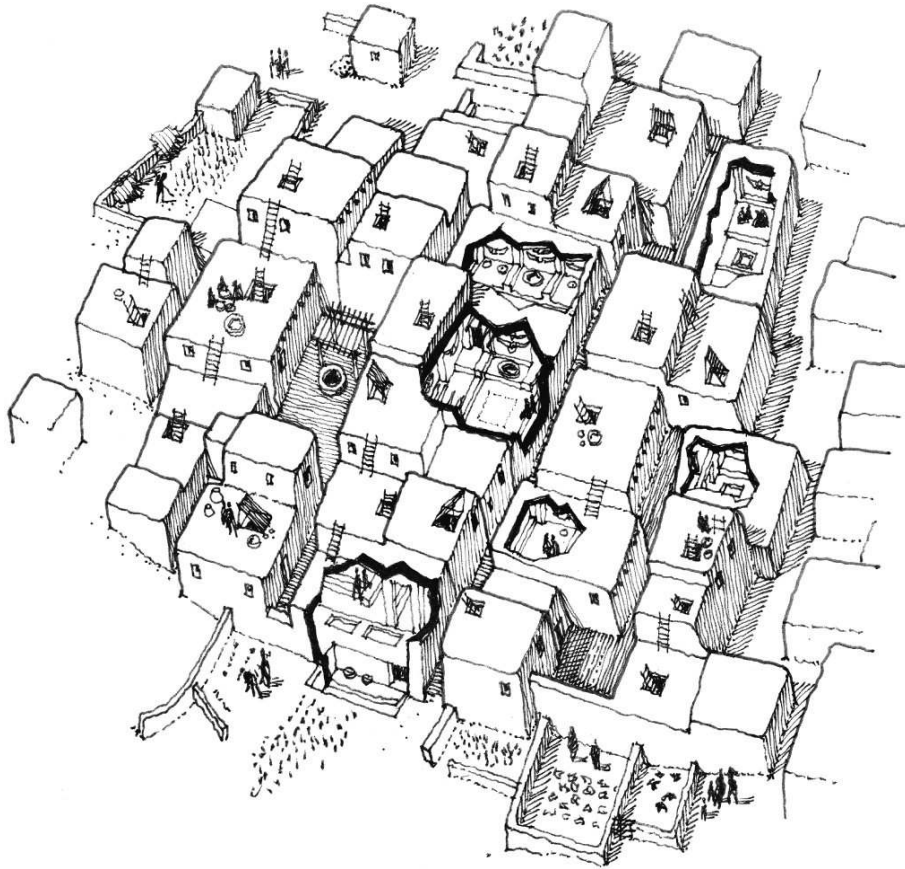
When Homes Touch

“On a cold November day in 1958, just before nightfall,” British archaeologist James Mellaart recalled, he finally “reached the double mound of Çatal Hüyük.”⁶⁵ He had first spotted the mound, “a third of a mile in length,” while exploring the Konya plain of the Anatolian plateau in 1952. But, as he admitted, “dysentery and lack of transport prevented its more formal discovery.”

Arriving with a team of archaeologists, he found: “Much . . . was covered by turf and ruin-weed (*Peganum harmala*) but where the prevailing south-westerly winds had scoured its surface bare there were unmistakable traces of mud-brick buildings, burned red in a conflagration contrasting with patches of grey ash, broken bones, potsherds and obsidian tools and weapons. To our surprise these were found not only at the bottom of the mound, but they continued right up to the top, some 15 metres above the level of the plain.”

Thus began the “discovery” of Çatalhöyük—though locals had long been aware of it. The settlement grew as an important supplier of obsidian, a volcanic rock prized for crafting blades. Occupied for over two millennia, it likely peaked at about 800 people in 6500 BC, far below earlier estimates of several thousands.⁶⁶ Nevertheless, it was one of the largest Neolithic villages of the time.

The village was essentially a massive honeycomb of cuboid houses pressed against each other without ground-level streets. Çatalhöyük was unlike anything seen since. Perhaps its closest modern parallel is found in dense informal settlements such as Rio de Janeiro's favelas, where houses are packed so closely that they seem a continuous mass.



Village of Çatalhöyük, Turkey, ca. 6700 BC.⁶⁷

The wheel had not yet been invented, so streets were not necessary for wheeled transport. Instead, residents descended into their homes not through front doors but through roof hatches using wooden ladders. This arrangement may have offered some advantages, such as defense. Large windows and doors would have made the interior too hot. And similar to Middle Eastern cities today, these rooftops were active living spaces. Some roofs even had ovens. However, entering homes by ladder would have made life challenging, especially for the elderly and pregnant women.

The sight of Çatalhöyük, with people living in adjacent boxes, would have likely stunned the hunter-gatherers of the time. They might have encountered more people in a single day than they would have seen in their entire lifetime. Their camps were open and transparent. But Çatalhöyük was a maze of enclosed spaces. Activities that had been public were now hidden behind walls.

The appeal of living in Çatalhöyük in terms of quality of life was not immediately obvious, aside from participation in the obsidian trade. Most houses had no windows and only had roof openings. These openings doubled as access into the dwelling and smokestacks for hearths located beneath them, filling interiors with smoke. The word “window” itself, derived from Old Norse *vindauga* (“wind eye”), speaks to this early form of ventilation. Yet this rudimentary arrangement brought health hazards. Skeletal remains showed the buildup of sooty black deposits on the inside of rib cages of older residents, probably a consequence of life in smoke-filled homes.⁶⁸

The village also struggled with hygiene. When a family vacated a home, it often became a dump for waste, including human and animal feces.⁶⁹ Infectious diseases spread easily in such unsanitary conditions, with up to a third of human bones showing signs of infected lesions.⁷⁰

But villagers did not just have to endure bad smells. ⁷¹ Çatalhöyük's homes required constant upkeep. Built largely from mud brick, the houses were vulnerable to rain. Mud brick deteriorates quickly when wet. Lacking proper drainage or strong foundations, homes demanded frequent repair or rebuilding.

Residents invested significant labor in maintenance. They replastered walls and sleeping platforms with white clay, gypsum, or lime to keep their interiors fresh and clean. ⁷² This maintenance process may have occurred up to three times a year. Some houses had been replastered about 450 times, ⁷³ lasting up to a hundred years. Builders then leveled entire homes and constructed new ones on top of the old foundations. Some structures had been rebuilt up to six times. Over generations, this practice caused the settlement to rise ever higher, eventually reaching sixty-six feet—roughly the height of a modern six-story building.

Villagers may have been willing to endure these challenges not only for economic reasons but also because they were deeply attached to their homes: Wall paintings were found in almost every house and often included elaborate symbols.

Residents divided their homes into two distinct zones. One was a small room centered around a hearth. It may have functioned as a kitchen area, judging by the ovens and clay bins for storing food found there.

But it was the main room that made Çatalhöyük famous. This room, typically cleaner than the other, had sleeping platforms. The walls and the platforms were covered with paintings, some bearing up to forty layers of plaster and paint. These murals offer windows into their worldview. Some images were morbid, showing vultures pecking at human corpses. Others featured abstract geometric designs, like a nine-foot mural possibly depicting a leopard skin. Many murals depicted wild animals and hunting scenes, even as the villagers increasingly domesticated animals, perhaps to evoke memories of the past.

Most dramatic were the protruding bull horn decorations, or *bucrania*, often set into the wall. Some were placed on small columns inside the room. They were often covered with plaster and painted with ochre red. In one example, three sets of bull horns were stacked one above the other on a wall, with a large human figurine above, its legs splayed wide. The walls also featured platforms with animal skulls, beaks, teeth, and tusks. The residents seemed to choose, above all, the pointier animal remains.

All of this may have been quite shocking to an outsider. Archaeologist Steven Mithen likened it to a “monstrous scene of bulls bursting from the wall. There are three of them at about waist-height—white heads striped with black and red, from which sprout enormous pointed horns. . . . Around the bulls the walls are painted with bold geometric designs—sharp, oppressive images above handprints in red and black.” ⁷⁴

Other symbolic components were found throughout the home and the village. Small figurines, often quickly made and discarded, were thought to be part of daily spiritual practices, akin to prayers. In other villages, archaeologists have also found decapitated animal figures that seem to have been ritualistically “killed.” ⁷⁵

Residents may have also been attached to their abodes because, unlike today, home was also a burial site. Ancestors were buried in fetal positions beneath the platforms. Some bodies were exhumed, their skulls possibly removed for use in ceremonies. These were placed in wall niches, almost as if they were watching over their descendants.

Anthropologist Ian Hodder, who spent decades excavating the site, identified a special category of dwellings. He called them “History Houses.” ⁷⁶ These featured more symbolism and more burials, one holding as many as sixty-two bodies. Though these houses likely held special religious significance, they showed no signs of greater wealth or storage capacity. This suggests a society where religious status did not bring material advantage. The archaeological evidence also hints at a

relative, if gruesome, gender equality: Both male and female skulls were used.⁷⁷ Men and women also had similar levels of darkened lungs, suggesting they spent equal time at home.

Importantly, these history houses had longer lifespans than other buildings. “Houses with many burials tend to be long lasting,”⁷⁸ observed Hodder. He argued that “making history” was essential in agricultural communities where labor had delayed payoffs. In contrast to the immediate return of foraging, farming required a “greater sense of temporal depth, history, and memory.”⁷⁹ Hodder notes, “The emergence of greater temporal depth was a necessary condition for dense settled life, the delayed returns of intensive subsistence systems.” The repeated rebuilding of homes, the burials, and the elaborate symbolism—all played out within the fabric of domestic life—maintained a shared sense of historical community.

Yet this ambitious experiment in communal living eventually faced significant challenges. Demand for wooden building materials led to extensive deforestation around Çatalhöyük. As trees vanished, residents had to travel farther for resources, adding new burdens to their daily work. The stresses of village life may have taken a toll as well. Evidence of interpersonal violence is found in the skulls of residents—of ninety-three skulls examined, twenty-five showed healed fractures, mostly among women, often from blows to the back of the head with round objects. Given that most of the head injuries occurred during the period of highest population density, some believe elevated stress and conflict may have been due to overcrowding.⁸⁰

By 6000 BC, Çatalhöyük was abandoned. It was part of a broader collapse of Neolithic settlements across the region. From Israel to Palestine, farming villages were deserted. People likely scattered into smaller hamlets. While changing climate patterns, including a drop in temperatures, played a role, the inhabitants themselves contributed significantly to the downfall of their villages. Deforestation, overcultivation, and overgrazing depleted the soil’s fertility. The pollution from human and animal waste further strained the ecosystems they were living in.⁸¹

At ‘Ain Ghazal in the Jordan Valley, the houses themselves contributed to the village’s decline. Villagers upgraded their homes by plastering floors with lime, which made them more water-resistant. Some builders spread the lime plaster as high as six inches up walls, posts, and hearths. But producing lime required burning limestone, heating it to between 750 and 850 degrees Celsius and accelerating deforestation. Trees vanished within a three-kilometer radius of ‘Ain Ghazal.⁸² Without the stabilizing tree roots, the soil eroded during periods of rainfall and became less fertile. With the soil already exhausted from overcultivation, crop yields shrank and the village was abandoned. Although other factors such as water pollution from human waste likely also played a role, the reliance on plaster technology influenced its downfall.⁸³

As archaeologists Nigel Goring-Morris and Anna Belfer-Cohen observed, permanent settlement during this time became increasingly unsustainable: “The whole fragile Neolithic network collapsed in upon itself.” By contrast, “the long duration of earlier mobile hunter-gatherer adaptations had enabled the ‘fine-tuning’ balance between people, the environment, and the resources necessary to avoid overexploitation.”⁸⁴

As our ancestors experimented with agriculture, housing, and construction techniques, they created larger and more permanent habitats. In the process, they faced new challenges. They lacked sewers and safe drinking water. They lacked reliable agriculture to support growing populations. Without workable solutions to these challenges of collective life—not realized until the Early Bronze Age—these villages hit a ceiling. Today, Çatalhöyük is a mound in the Turkish landscape, although one recognized by UNESCO as “a site of great importance for our understanding of the first steps toward ‘civilization.’”⁸⁵

When our ancestors transitioned from nomadic to settled life, they entered a new “indoor” phase of human existence. The walls they built reshaped not only their physical and mental world but also their relationship with nature. The problems they faced, from resource depletion to environmental degradation, echo those we struggle with today. As landscape architect Anne Whiston Spirn noted,

“Modern urban problems are no different, in essence, from those that plagued ancient cities, except in degree, in the toxicity and persistence of new contaminants, and the extent of the earth that is now urbanized.” ⁸⁶

The issue of home maintenance persists as well. As an owner of a mere hundred-year-old home, I find myself painting basement floors, clearing French drains, and repairing endless small failures. With a drill in hand to hang a family photo, I sense an odd parallel between those ancient residents who carved niches in their walls for ceremonial skulls. They worried about deteriorating mud brick. I worry about asbestos in insulation and lead in old paint. The tools and decorations have changed, but our desire to make our mark on these walls remains deeply human—even if there are hidden dangers in living a settled life.

Two

Cities of Mud

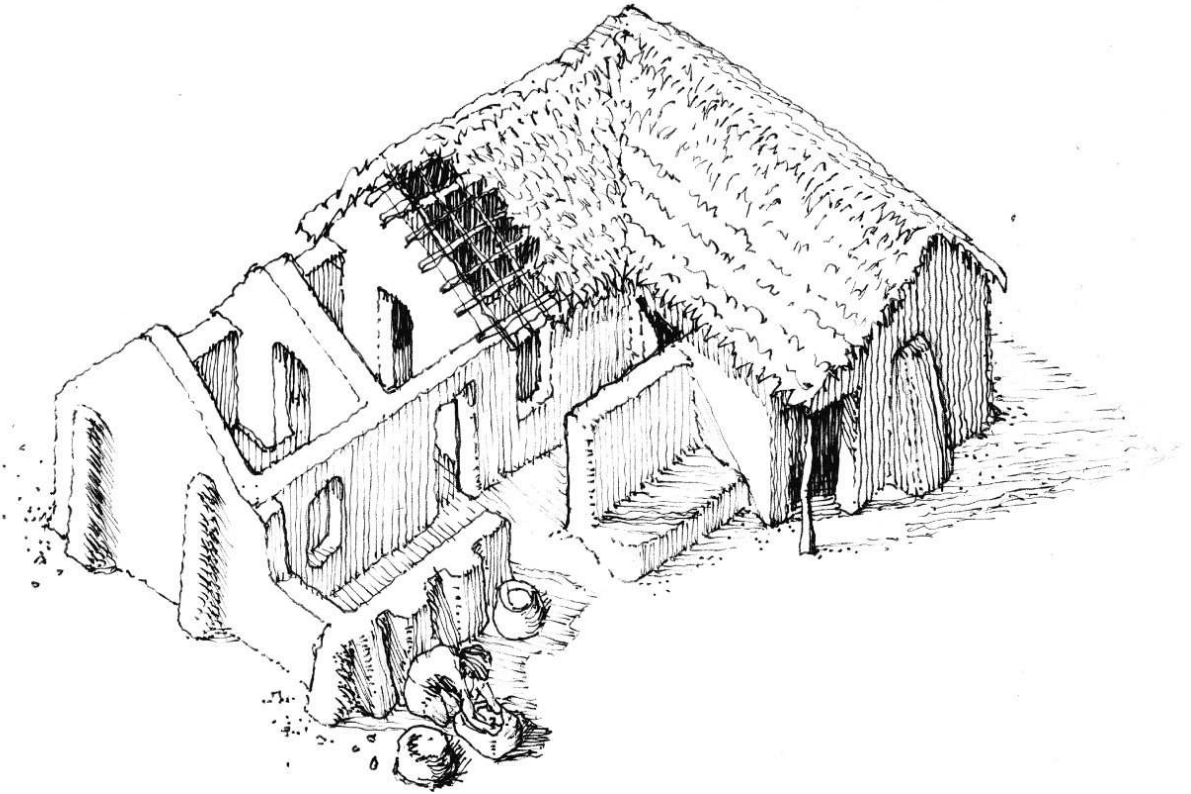
The Extended House

“In those ancient days . . . the lord of broad wisdom, Enki, the master of destinies . . . founded dwelling places; he took in his hand waters to encourage and create good seed; he laid out side by side the Tigris and the Euphrates, and caused them to bring water from the mountains; he scoured out the smaller streams, and positioned the other watercourses. . . . Enki made spacious sheepfolds and cattle-pens, and provided shepherds and herdsmen; he founded cities and settlements throughout the earth, and made the black-headed [Sumerians] multiply.”¹

In “Debate Between Bird and Fish,” a Sumerian essay dating back to the third millennium BC, it was Enki, the god of water, who created the world by laying out the great rivers. This belief reflects the reality of life in Mesopotamia. For it was in this “land between rivers”—for that is what *Mesopotamia* means in ancient Greek—that a new chapter in human history began.

Around 6000 BC, as farming villages in present-day Jordan, Israel, and Palestine were being abandoned, a new wave of settlement emerged in the foothills of Northern Mesopotamia. The twin waterways of the Euphrates and Tigris, born in the highlands of eastern Turkey and stretching to the Persian Gulf, provided the water, reeds, and clay that would build their world. These rivers—one fast flowing and unpredictable, the other broad and steady—would become both a lifeline and a challenge to the people who settled their banks.

The settlement of Tell Hassuna stood along the Tigris River. It was part of the Hassuna culture—one of the earliest farming societies in Northern Mesopotamia, centered in what is now northern Iraq. Villagers built small homes for nuclear families, consisting of just a few rooms. Excavators in 1943 found “the walls were built of lumps of mud of various sizes in a manner approximating the local modern practice. Smaller lumps were used to fill the gaps, and the faces were smoothed.”² These rudimentary buildings were likely topped with low-pitched roofs made of branches and covered in mud.



[Follow for extended description](#)

Packed-mud house, Tell Hassuna, Northern Iraq, ca. 5500 BC. ³

However, as agriculture intensified over the centuries, the villagers added rooms to their homes, seemingly at random. Their homes grew into sprawling complexes of fifteen to twenty rooms. Drawing on broader patterns, archaeologist Kent Flannery observed that this was the “next stage of village development, the replacement of nuclear households by extended family households.” ⁴ This likely resulted from the demands of early farming: “The combination of two tasks—cereal agriculture and the grazing of herd animals—requires a division of labor beyond the capacity of a nuclear family.” Success required an extended family of fifteen to twenty people to manage fields, tend herds, and diversify into activities such as craft making.

Over time, the villagers expanded their houses into complexes of grouped homes arranged around large open courtyards. This enabled them to enclose flocks at night. These homes, according to the excavators, “show the first clear signs of planning.” ⁵

Eventually, the fifteen- to twenty-room complexes began to appear in regularized forms. Previously, houses had a larger main room with one or more smaller side rooms. But the internal organization of the new complexes now introduced three distinct types of rooms. The larger rooms of 150 square feet or more were likely used as central gathering areas for communal activities. Elongated rooms of around 100 square feet served as sleeping or working areas. And square-shaped rooms of approximately 20 square feet were probably used for storage. ⁶ Residents were now intentionally building structures with specialized rooms for the extended family from the start.

This transformation from improvised to planned construction has been described as the “florescence of architecture.” ⁷ With their larger homes incorporating various room types, the inhabitants of Tell Hassuna contributed to a broader trend toward increased social and economic

complexity. The new houses were also more efficient, allowing for population densities of up to an estimated 160 people per acre—a figure that rivals some of the most densely populated areas in the world today. Archaeologist Kent Flannery noted, “It is clear that planned, extended family households can produce much higher densities.”⁸

But as the residents built up their village, they had to contend with the tensions of their growing settlement. The people of the Hassuna culture used stamped seals to impress clay, probably to mark ownership and safeguard property. The 1943 discovery of 2,400 clay balls hints at a darker side of this new societal development. They were quite likely used as sling missiles, either for hunting or defending what had been built.

Slightly later in time and a few hundred miles downstream toward the south, the people of Tell es-Sawwan faced a different challenge. They belonged to the Samarra culture, an early farming society in what is now north-central Iraq, about seventy miles north of modern-day Baghdad. Located below the 200-millimeter rainfall line, where annual rainfall drops below eight inches, Tell es-Sawwan lacked sufficient water for stable agriculture.

The farmers dug small ditches to channel the Tigris floods to their fields, allowing them to cultivate barley, wheat, and linseed. This mastery over water would come to define Mesopotamian civilization. It increased food security and population density in otherwise marginal lands, while the labor-intensive demands of water management spurred greater social complexity and stratification.⁹

The residents also had to innovate in construction. Unlike in the north, they did not have access to stone and wood. Without forests or quarries, they had no choice but to exploit the abundant clay in the region’s alluvial plains. They built their homes with mud bricks—the primary building material of Southern Mesopotamia.

Mud bricks improved upon earlier packed-earth techniques, which demanded skilled workers and precise attention to make sure the foundations and walls were consistently wide enough. The bricks, in contrast, allowed for simplified, more standardized construction. And they could be more easily transported, whereas packed mud relied on the material being available closer to the site.

However, the river clay was often too sandy. So the residents needed to refine the river clay’s consistency. They mixed it with chopped straw, creating a composite material, much like how rebar reinforces modern concrete. Straw and mud together create a substance stronger than either by itself. Dried mud is good at withstanding squeezing. Straw is good at preventing tearing. Combined, they balance each other’s weaknesses. Straw alone crumbles when you squeeze it, and dried mud pulverizes when you tear it apart. To further reduce brittleness, they also added dung, which, like straw, helped bind the mud particles together, making it less prone to cracking.¹⁰

They then pressed this mixture into molds that were open at both ends. After letting them bake for a few weeks, they had long cigar-shaped bricks, roughly the size of a loaf of bread. Builders arranged them in precise patterns, like the header-and-stretcher fashion—alternating layers of bricks laid with their short ends (headers) and long sides (stretchers) parallel to the wall’s surface. Finally, they sealed them with clay plaster, creating thick, strong walls that better resisted cracking and crumbling.

As simple as it sounds, it was a labor-intensive process. Producing the straw alone demanded a significant amount of land. A mere hundred bricks would have required at least 130 pounds of straw, the yield of roughly a third of an acre.¹¹ A single house would have required several acres of cultivated land.

The Samarrans carefully planned their homes as well. The buildings were uniquely recognizable by an enfilade: a sequence of aligned doorways along a central axis. This arrangement created a direct line of sight through the building. It offered an imposing view as well as a more efficient means of movement within the home. It was, in effect, a precursor to the modern corridor.

Villagers arranged their houses in clusters, with courtyards between the buildings. These accommodated ovens and granaries, suggesting a collective approach to resource management and irrigation.¹² By around 5900 BC, Tell es-Sawwan was surrounded by a deep ditch and a buttressed

wall. Throughout Samarran villages, clay jars were found with gypsum lids and seal impressions, marking ownership. These developments, along with the presence of clay balls possibly used as sling missiles, indicate a growing anxiety over property protection—and possibly a fear of outsiders pillaging the toils of their irrigated fields.

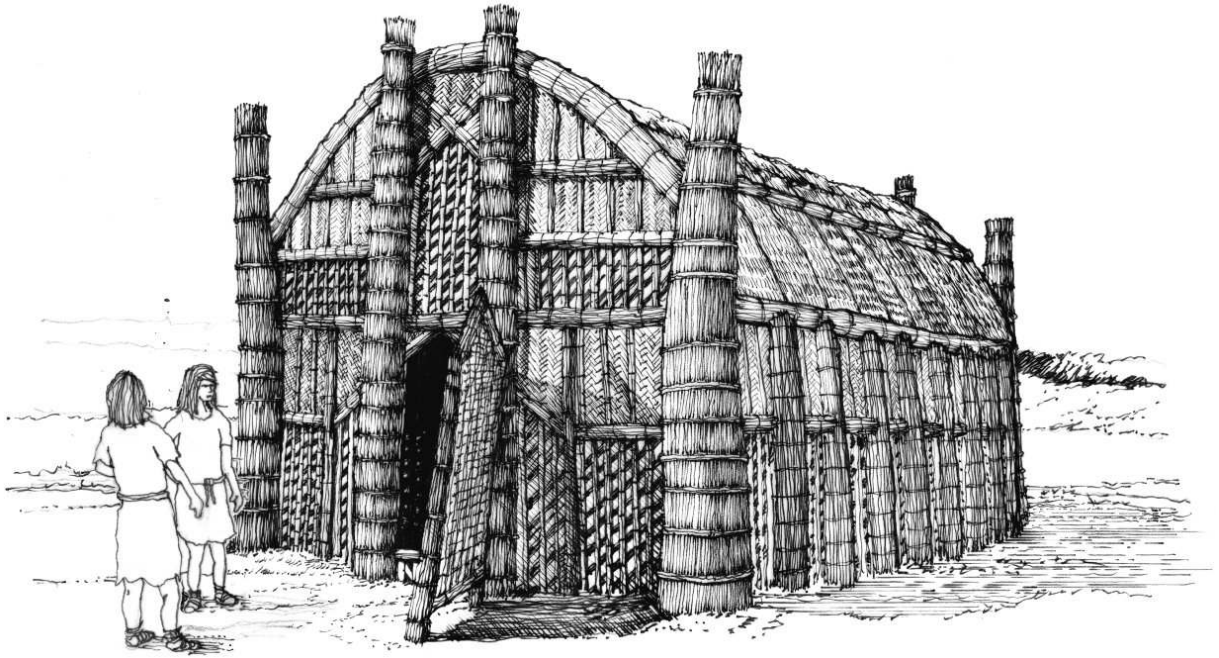
Farther south near the head of the Persian Gulf, the Ubaid people took their architecture one step further. Their beginnings overlap with the Samarra culture around the sixth millennium BC but endured much longer—until about 3800 BC. At the time, the gulf’s shoreline extended far inland, deep into what is now southern Iraq. As archaeologist Leonard Woolley vividly describes it, the Ubaid came to a land of marshes, “dense with reeds and opening out here and there into lagoons or clear channels. . . . It was a country rich enough in promise to make a certain amount of hardship well worthwhile.” ¹³

In these marshy southern reaches of Mesopotamia, reeds became an abundant and adaptable building material. Lacking access to timber or stone, the Ubaid built simple reed huts. They even built larger structures entirely from reed. These consisted of reed bundles, some up to three feet thick, bent into arches. Reed mats covered these arches to create long tunnel-shaped buildings.

These structures left little trace in the archaeological record, apart from depictions on Mesopotamian cylinder seals. Yet similar vernacular forms exist in Iraqi wetlands today. One such example is the *mudhif*—a long, arched guesthouse used by the Marsh Arabs. ¹⁴ Their contemporary reed canoes also look surprisingly like a model canoe found in a later Mesopotamian royal cemetery. ¹⁵

“Now a Mudhif you can’t picture until you have seen it,” wrote the English traveler Gertrude Bell in 1920. “It is constructed of reeds, reed mats spread over reed bundles, arching over and meeting at the top, so that the whole is a perfectly regular and exquisitely constructed yellow tunnel, 50 yards long. . . . the whole lighted by fire and a couple of small lamps, and the end of the Mudhif fading away into a golden gloom. Glorious.” ¹⁶

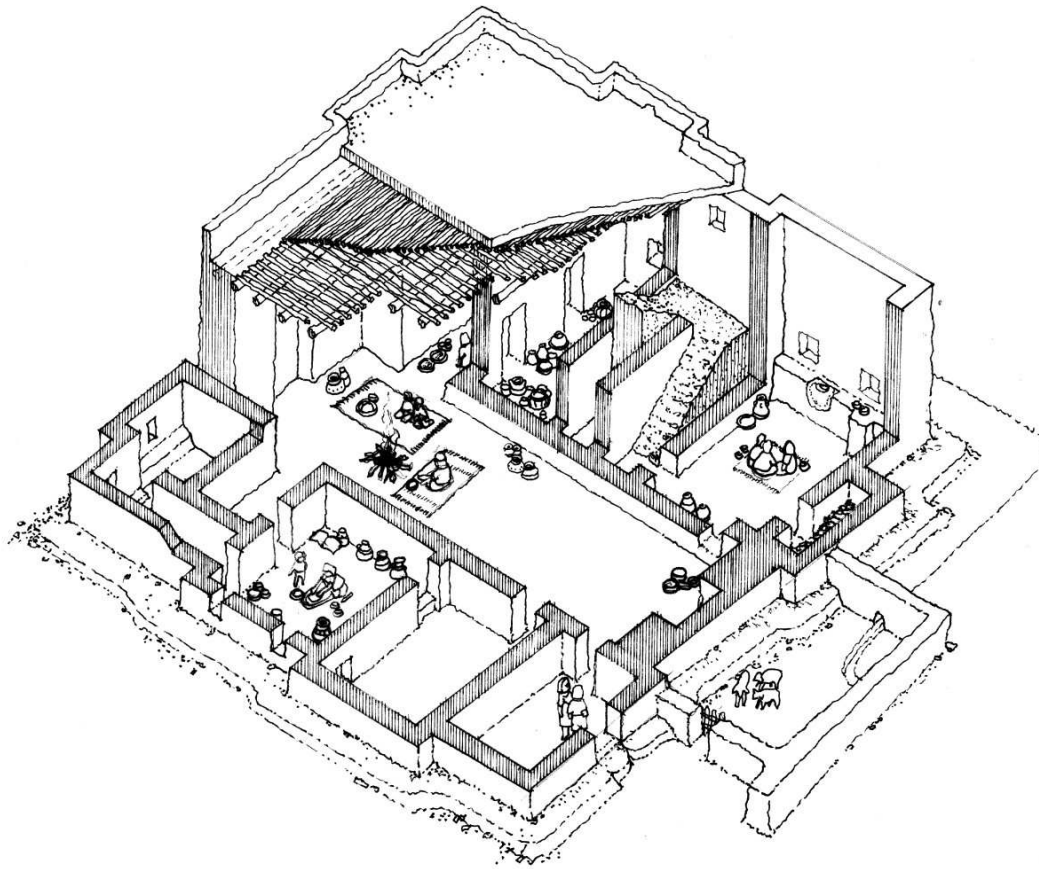
While poorer inhabitants likely dwelled in marshland reed huts, the Ubaid people also built more substantial permanent dwellings than the cultures before them. Some were as large as two thousand square feet and were built from molded mud bricks. These were organized around a central hall flanked by smaller rooms on each side, known as the tripartite design. Ubaid builders may have inherited the house plan from the Samarrans and possibly expanded the enfilade into a broad central hall, though this remains uncertain.



Traditional reed house (*mudhif*), Southern Iraq.

The tripartite design created a hierarchy of spaces. The deeper one moved through successive rooms, the more intimate they became. Private areas like storage spaces and bedrooms required passage through multiple chambers. Meanwhile, the central hall served as a versatile space, lending the building a monumental quality.

As Ubaid settlements grew in scale, social hierarchy became visible in the built environment. At Tell Gawra around 4400 BC, a few larger houses dominated access to communal granaries.¹⁷ They were often visible from afar, serving as focal points.¹⁸ These “prestige houses,” typical of larger Ubaid villages, may have distributed food to other houses, or they could have had a spiritual or political purpose. Across ancient societies, leaders often operated from their homes, and their homes were typically larger to accommodate social gatherings.²⁰ This tripartite design, with its central communal area, was ideal for these domestic and civic purposes.



Tripartite house, Tell Madhur, Iraq, ca. 4500 BC. ¹⁹

The tripartite house design also influenced religious architecture. In fact, it appears more frequently in what are believed to be public or ceremonial buildings than in domestic ones. Early temples adopted this layout of a central hall lined by smaller side rooms. Builders further distinguished these buildings with features such as niche-and-buttress facades that created striped visual effects and dynamic shadows. As archaeologist Pascal Butterlin observed, the house became “a symbolic unit that could be domestic, prestigious, or religious.” ²¹ It offered a versatile spatial form, adaptable to shifting social, spiritual, and political roles.

Some Ubaid temples may have even adhered to standardized measurements. One scholar proposed the existence of an “Ubaid cubit,” a standard unit measuring approximately twenty-eight inches. He concluded that this was used at the Temple VI in Eridu (around 4000 BC), suggesting an advanced level of abstract planning. ²² However, there is no evidence of a standardized system across the broader Ubaid world.

Still, the Ubaid cultural footprint stretched from the Persian Gulf to northern Syria, bringing cultural norms with them. One of their most important legacies was the tripartite house. “The formula proved remarkably durable,” noted Butterlin. ²³ He argued it became an important element of social organization. “The intensive use of tripartite buildings probably permitted the emergence of chiefdoms and states in a proto-urban context.” It was, he concluded, “a true archetype . . . frequently related to the birth of the first cities.” After thousands of years of building homes in Mesopotamia, in these Ubaid tripartite houses of mud brick, we may finally see the early outlines of future urban civilization.

The Ubaid builders' tripartite design accomplished something architects still strive for today: a thoughtful balance between communal and private space. Modern homes continue to follow this logic. They have larger shared living areas and smaller private rooms—and an intuitive flow connecting them. It almost certainly did not spring from a single source of invention. The Ubaid solution, like many others across time and place, reflects a universal logic of habitation—born from the practical realities of how people live together. In the end, there are only so many ways to shape space around the patterns of daily life.

The Ubaid homes also offer lessons in sustainable architecture. While today's energy-efficient buildings rely on composites, laminates, and synthetic insulators, Ubaid builders created relatively durable homes from only earth and sun. Their thick mud brick walls, typically eighteen to twenty-four inches wide, helped regulate indoor temperatures by absorbing heat throughout the warm day and releasing it during the cooler night. And where most of our construction material ends up in landfills, these ancient homes returned, in time, to the soil they rose from. They gradually accumulated into layered mounds—known as tells—that today form the archaeological signature of the region.

In our era of increasing environmental concerns, these elegant, low-tech solutions deserve renewed attention. Nevertheless, the Mesopotamians had environmental problems of their own. The irrigation channels that gave life to their fields slowly filled with silt, demanding constant maintenance. Inhabitants were caught in a perpetual struggle with the very force that had allowed their civilization to flourish: the water flowing from the rivers. It was a constant reminder of the delicate balance they had struck with nature.

Proto-cities

In 1937, mystery writer Agatha Christie accompanied her archaeologist husband Max Mallowan on various digs in Syria. She had first met him seven years earlier at an excavation site. Over the following decades, she joined him on numerous expeditions across the region, cleaning and cataloging artifacts, and even developing film. As she described later in a poem, “A-Sitting on a Tell,” she met an archaeologist amid the trenches of a dig. While he passionately extolled the nuances of measuring prehistoric pots, her mind wandered to plotting murders—imagining ways to “kill a millionaire,” and stash the body in a “Frigidaire.”²⁴

Little did Christie know that she was witnessing the discovery of an intriguing mystery—one that would change the origin story of urbanism. During this time, Mallowan made what would prove to be one of his most fortunate discoveries. In Syria, he was the first to excavate a site known as Tell Brak. There, he found an ancient temple filled with enigmatic figurines with distinctive eye motifs. Tell Brak, along with Khirbat al-Fakhar, would fundamentally challenge our understanding of how early cities began.

For millennia, the pattern of village life in Mesopotamia had followed a predictable cycle: When a settlement grew too large, when tensions arose between families or resources grew scarce, it would split like a cell dividing. One group would move away to establish a new settlement. But around 4000 BC, Tell Brak and Khirbat al-Fakhar departed from this pattern. Instead of splitting apart, they grew. Households clustered together in several neighborhood groups separated by open spaces. Each cluster functioned almost like a traditional village, but now these village-like units were part of something larger. Their scale was immense. Khirbat al-Fakhar sprawled across 750 acres, equal to five hundred football fields. Tell Brak was about 130 acres, still larger than other settlements.

These settlements were remarkable for their structure as well. Instead of a dense, cohesive urban core, they resembled a patchwork of household clusters interspersed with open spaces.²⁵ All of this defied conventional ideas of urbanism. They were too expansive to be called a village. At the same time, they could not be called cities, since they showed no signs of central authority. They had no

grand palaces, no soaring temples rising above the skyline. Scholars would come to refer to them as “proto-cities.”

This discovery upended the story of urbanization, as traditionally told. Scholars long believed that cities began from the minds of powerful rulers or the necessities of complex irrigation systems. But the evidence from Tell Brak and Khirbat al-Fakhar offers a fascinating alternative: Some cities could have emerged organically, shaped by the collective actions of countless households rather than the decrees of a central authority.²⁶ Complexity here was not imposed from above but grew from below.

This was no isolated phenomenon. Around the same time, ancient Trypillia settlements in present-day Ukraine exhibited similar traits. These settlements spanned up to 300 hectares, yet they lacked monumental buildings and evidence of centralized power structures. The parallel emergence of such settlements suggests a shared pattern of urban development across different regions, pointing to a broader decentralized model of early urbanization.²⁷

What drove people to create these unprecedented communities in Mesopotamia? One clue lies in a piece of volcanic glass. Obsidian, prized for its ability to be made into sharp tools, was likely the economic engine. Imported from hundreds of miles away, this precious resource attracted people from far and wide. Each household became a workshop, which contributed to a network of decentralized production and trade. Organizing such exchanges required communication, coordination, and trust—which put these communities on a path toward growing complexity, a path toward urbanism.

Yet with this growth came entirely new social challenges. Without centralized institutions to enforce order, residents needed to develop novel ways to manage conflict.

Archaeological evidence reveals that these communities were not quite egalitarian. At Tell Brak, the distribution of animal remains tells a story of social stratification. Pig remains—a cheaper source of meat—were found at the periphery, suggesting that poorer migrants lived in the outer clusters, much like the informal settlements that ring many megacities in the developing world today.²⁸

One peculiar aspect of the Mesopotamian proto-cities was the open spaces between clusters of households. These areas may have served as garden plots, like those in ancient Mesoamerican cities. Or they could have been buffers between groups to reduce conflict.²⁹ By maintaining physical separation, rather than living together in a single dense urban core, the inhabitants of Khirbat al-Fakhar and Tell Brak may have found a way to mitigate the social tensions associated with growing population density.

This evidence points to a new tentative conclusion. Some cities may have formed from a self-organizing process, emerging from the interactions of many independent agents rather than being directed by political elites. The pattern bears a resemblance to what biologists call “emergence”—as with termite mounds. These structures form without a leader directing the process, driven instead by individuals following simple rules—like following trails laid down by others, exchanging information, and building according to instinct.

Households likely didn’t set out to form large settlements from the beginning.³⁰ Instead, the settlement was the organic result of their collective motivations—which may have included feeding dependents, expanding households, and preserving autonomy. As archaeologist Jason Ur, who has studied these proto-cities in Mesopotamia, noted: “Urbanism does not appear to have originated with a single, powerful ruler or political entity. Instead, it was the organic outgrowth of many groups coming together.”³¹

The stories of Tell Brak and Khirbat al-Fakhar reveal two possible trajectories for these proto-cities. Between 4000 and 3800 BC, Tell Brak rapidly expanded, possibly housing up to 20,000 people within 300 acres.^{32, 33} Since nearby settlements were abandoned, it may be that migration drove this expansion. As the population increased, the settlement transformed its structure. Unlike traditional cities that expanded outward from a center, its suburbs grew inward, merging with the central core.

The outskirts became specialized zones for various functions. There was an industrial area equipped with bread ovens and pottery kilns. Another area was essentially a massive two- to three-hectare trash mound. This suggested that the inhabitants pushed such less-desirable activities to the periphery, as happens in modern cities.³⁴

But Tell Brak's growth reached natural constraints. Northern Mesopotamian settlements relied on cultivating a growing hinterland, leaving traces that persist to this day—over six thousand kilometers of “hollow ways,” the sunken paths formed by humans and livestock walking through agricultural fields.³⁵ Yet dry farming in Northern Mesopotamia had its limits, bounded by the land's productive capacity and the practical distance over which food could be transported. The more the settlement grew, the longer the farmers' commutes. These challenges capped the population at around 20,000 inhabitants.³⁶ Once a settlement reached this ceiling, it became increasingly vulnerable to environmental pressures. Fluctuations in rainfall or periodic droughts could lead to food shortages and social unrest.

As Tell Brak grew, its society became increasingly complex and hierarchical. Archaeologists have uncovered over one thousand clay seals used to secure jars and baskets or mark ownership of goods and raw materials. These artifacts reveal deepening social divisions within the community—potential sources of social stress.³⁷ Indeed, the challenges we associate with modern urban life were present from humanity's first experiments with urban living: from industrial hazards to long commutes and social inequities.

These tensions probably erupted into violence. Archaeologists discovered mass graves on the edge of Tell Brak containing skeletal remains with clear signs of trauma, especially blunt-force fractures to several skulls, indicating deliberate killings. The demographic profile of the victims—including women and children—suggests these graves may have been the result of internal conflict, rather than attacks by foreign invaders. The presence of animal remains buried alongside the human victims suggests the killings may have been followed by a feast or ritual.³⁸

The response to these growing challenges represented a turning point. As Tell Brak expanded, it built two impressive monumental buildings. First came a structure known as the Red Building, with walls up to six feet thick of distinctive red mud bricks. It stood near the industrial area and likely served as an early administrative center, overseeing production. By now, Tell Brak had firmly adopted centralized institutions.

But it was the second structure—the Eye Temple that Max Mallowan first discovered—that revealed something new about early urban society. The temple's design followed the same tripartite layout as a typical house but on a much larger scale. The builders had taken the familiar form of domestic architecture and transformed it, expanding the central hall into a sacred space and elevating the building on an artificial platform. “Archaeologists call it a ‘temple,’” explains Jason Ur, “but to the people of Brak, it was another household—this time the household of a god.”³⁹

This architectural choice was not accidental. It reflected deeply held beliefs that the divine realm was organized in families, and human society—especially its most important institutions—was modeled on this divine template. So naturally, the gods would dwell in houses and require the same provisions as people. Palaces and temples across Mesopotamia retained house-like forms. In fact, the terms for temple or palace in later Sumerian literally translated to “big house.” This shows that the house played a major role in shaping larger collectives and providing the structure for the first institutions. It became a template for organizing society at every scale, from family dwellings to divine spaces.

The temple's most distinctive feature—the thousands of “eye idols” found within—offers a window into the soul of early urban society. Made from clay or stone, they were simple enough that anyone could make them. There were so many of them that they appear to be a form of religious expression available to everyone, regardless of status. The ritual associated with the eye idols may have helped bind together an increasingly complex urban community.⁴⁰ While their purpose remains

a mystery, with no clear parallels except at Khirbat al-Fakhar, they speak to the role of shared symbols in urban life.

Their allure endures. At the Metropolitan Museum of Art, I stood before a display case of eye idols, each about the size of my palm. These idols felt quite intimate. A pair of oversized eyes tops their trapezoid-shaped bodies, making a profile similar to Mickey Mouse ears. Some larger idols featured smaller child figures carved onto their bodies, evoking parent-child relationships. Other idols had multiple sets of eyes. These wide owl-like eyes may have symbolized attentiveness to the gods, which was a recurring theme in later Mesopotamian art.

The remarkable resilience of these early urban settlements appears to have rested on more than just economics. Religion and shared belief systems likely anchored these communities as well.

With their oversized eyes and single unbroken eyebrow—a feature considered attractive in later Mesopotamia—the eye idols may have offered their users a common purpose. While most idols were found within the Eye Temple, many appeared in domestic spaces—perhaps as protective symbols, extending the divine presence into the intimate sphere of home.

We may never understand their true meaning. Yet the role of shared symbols endures. At the museum, I watched many visitors drifting to the gift shop to investigate designer pottery and fridge magnets depicting ancient art. These souvenirs may represent a similar desire for belonging—to carry home pieces of something greater than ourselves.

In time, this marvel of bottom-up urbanism gave way to a new order. By 3800 BC, Khirbat al-Fakhar was abandoned, its inhabitants relocating to Tell Hamoukar, a new site about a mile to the north. Archaeological evidence of over 1,200 clay projectiles suggests the city's fall. Around 3500 BC, Hamoukar's mud brick walls likely crumbled under assault, as attackers unleashed thousands of these sling "bullets." Perhaps it was the southern Uruk civilization, which was beginning to extend its influence into the region.⁴¹ After breaching the walls, the invaders set the city ablaze.

Tell Brak's fate was different. The city survived, but only as a colony of Uruk. Its distinctive culture faded away, and the production of eye idols ceased. A new urban age had begun. As the center of civilization shifted toward the south, the decentralized household-driven model that had defined Tell Brak gave way to a new urban form—one that would face challenges of its own.

The Courtyard House

In one of the earliest myths told by the Sumerians, "Inana and Enki," the goddess Inana challenges the god Enki to a drinking contest. She emerged victorious with the *mes*, divine decrees symbolizing the core elements of Sumerian civilization. "Holy Inana received the craft of the carpenter, the craft of the coppersmith, the craft of the scribe, the craft of the smith, the craft of the leather-worker, the craft of the fuller, the craft of the builder, the craft of the reed-worker,"⁴² the ancient myth recounts. However, these divine gifts, which enabled the functioning of their cities, were not all purely beneficial. Alongside civilization's advances, Inana also received "deceit" and "the plundering of cities" and "making lamentations." Bearing these powerful gifts, Inana returns triumphant to Uruk, the city under her protection, where she is greeted with a grand feast.

This myth captures the essential duality that would define early urban life, when humans first gathered in large numbers. On one hand, extraordinary innovations. On the other, formidable challenges. It was in Uruk where this new urban form of human dwelling would first take shape: the city, forever transforming humanity's relationship with the environment and with each other.

Uruk emerged around the fifth millennium BC on the fertile banks of the Euphrates River in Southern Mesopotamia, about 250 kilometers south of modern-day Baghdad. Natural barriers like the Zagros Mountains to the east and the Arabian Desert to the west provided the Sumerians with relative isolation, at least until horses were increasingly used in warfare. But they had to contend with an unforgiving environment. The scorching summers and arid climate spurred them to innovate. By

harnessing the annual floods of the Euphrates and Tigris Rivers through a vast network of canals, they transformed barren salt flats and marshes into fertile fields of barley, dates, figs, and chickpeas.

The irrigation system catalyzed a transformation in society. Building and maintaining canals required coordinated labor, technical planning, and centralized oversight. Dams were constructed to regulate water flow. Whether bureaucracy emerged to manage irrigation or irrigation expanded under a rising elite remains debated. Regardless, by the fourth millennium BC, state-level governance had formed—likely driven by the demands of infrastructure and the growing trade in vital and luxury goods.

Uruk benefited from significant technological advances. The wheel enabled oxen to pull three times their usual load. Plows boosted agricultural productivity. Boats waterproofed with natural tar, or bitumen, could move heavier cargo. By 3600 BC, Uruk had grown to 250 hectares. It had become the largest and most influential settlement of the region. With monumental temples and a centralized administration, it merited the title of “city.” Around 3000 BC, at its peak, it housed as many as 50,000 people—enough to fill a modern-day arena. With this large population, Uruk benefited from economies of scale, reducing labor costs and amassing larger military forces to defend its granaries, often relying on slave labor.⁴³

Much of Uruk’s domestic life remains elusive. Archaeological excavations often favored temples and palaces, leaving limited evidence of what ordinary homes looked like. The city’s earliest layers lie buried under more than eighty feet of later occupation, with only 0.1 percent of the lowest levels excavated.⁴⁴ Yet Uruk’s colonies, particularly Habuba Kabira, reveal how the earliest city dwellers adapted to urban life.

Habuba Kabira was established around 3500 BC about 800 miles upstream from the mother city. Many of the houses centered on open courtyards, departing from earlier Ubaid dwellings, which were organized around enclosed halls. Several elite residences featured both courtyards and halls. These halls likely served as reception areas and reflected a growing emphasis on privacy within domestic spaces.⁴⁵ This made them similar to the later *liwan*—a long room traditionally used for greeting guests in certain Middle Eastern homes. Some believed that this was a natural progression from the Ubaid house. As archaeologist Michael Roaf noted, “The tripartite house of the Ubaid period became a courtyard house, with a reception room along one side of the courtyard.”⁴⁶

The courtyard, meanwhile, helped bring light and fresh air into the building’s interior without compromising security, avoiding the need for windows in the building’s exterior walls. Though buildings had courtyards before, the courtyard house became increasingly prevalent, shaping Middle Eastern architecture for millennia.

These homes tell a story of increasing sophistication. The use of sun-dried bricks of standardized sizes suggests a degree of mass production. The roofs were likely flat, made from reed mats laid over beams and coated with mud. Pivot stones at wall openings point to early door mechanisms, allowing doors to swing, long before modern hinges. Terra-cotta pipes beneath mud floors point to early forms of drainage.

Habuba Kabira’s layout represented a departure from earlier Neolithic villages, which lacked planned streets, like Çatalhöyük, where houses abutted each other in one continuous mass. Instead, Habuba Kabira had a hierarchy of streets. Straight main roads likely went the full length of the settlement, while narrower lanes led to residential areas. It even featured an early attempt to manage stormwater. A few streets had drains lined with stone slabs and terra-cotta pipes that connected the town’s drainage to the surrounding countryside.⁴⁷ Other Sumerian cities may have had similar systems.⁴⁸ And although these systems did not extend into homes, Uruk itself may have housed one of the world’s earliest toilets—a deep cylinder-shaped pit inside a small room in a religious building dating back to around 3200 BC.⁴⁹

The skyline of Uruk embodied a new urban order. In the Eanna District, the brick temple complex of Inanna featured thousands of clay cones whose painted, flattened ends—set into wet plaster in

zigzag and diamond-shaped patterns, imitating textiles and mats—formed one of the world’s first mosaics. Another district featured the White Temple, dedicated to the sky god Anu, rising forty feet above the city on its massive platform. They were a constant reminder of divine power.

But perhaps Uruk’s greatest legacy came from the humble materials of everyday life: clay and reeds.⁵⁰ Before writing emerged, people used clay tokens to calculate and account for goods in increasingly complex economies. These tokens eventually gave rise to simple pictographs as the volume and variety of goods outstripped the capacity of the token system. These then evolved into the more abstract *cuneiform*, after the Latin term for “wedge,” named for the distinctive wedge-shaped marks made by pressing reeds into soft clay.

This invention revolutionized human civilization. Writing enabled not only complex urban administration but also the preservation of knowledge, stories, and ideas across generations. While some tablets were intentionally fired to make them permanent, most remained unbaked and were even reused, meaning vast amounts of early writing have vanished. Yet some remarkable examples endure. One of the earliest surviving tablets, dating to around 3100 BC, offers administrative records for brewing beer, complete with pictographs of a building, a chimney, and an ear of barley in a jar.⁵¹ Urbanization had ushered in a new era of human progress—beer included.

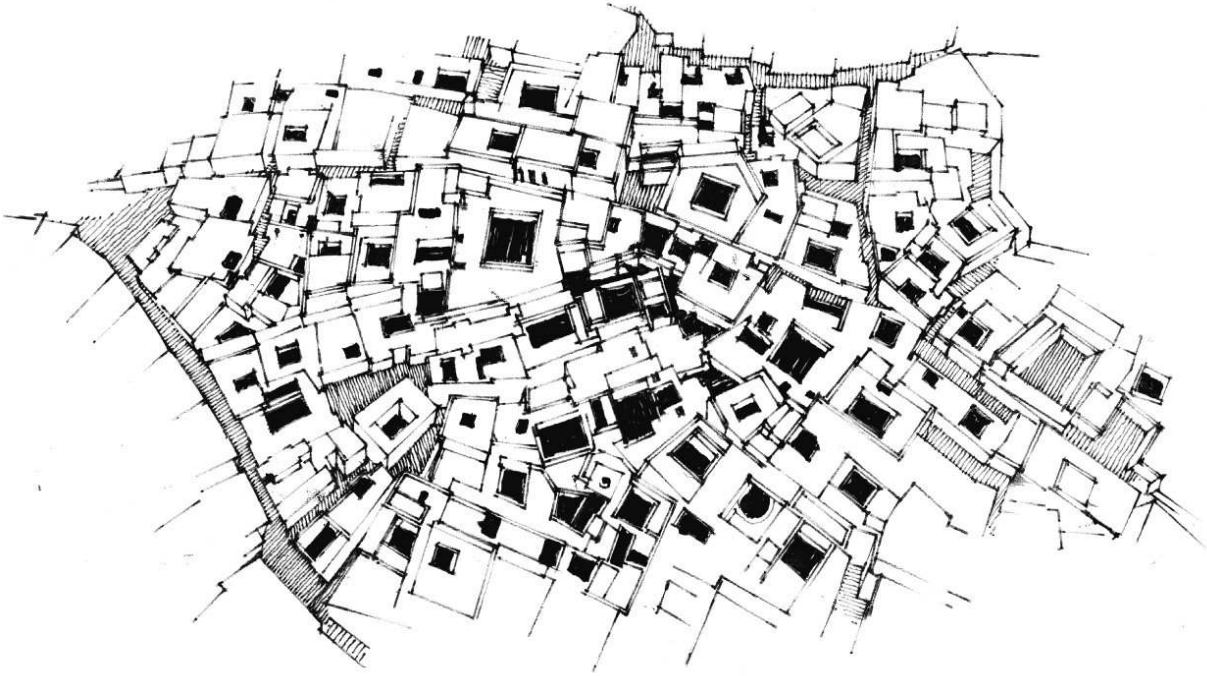
Writing, monumental architecture, specialized labor, political organizations, dense populations—all these were part of a dramatic transformation in human societies that Gordon Childe termed as the “Urban Revolution.” He saw this occurring independently across the ancient world, from the Indus Valley to Egypt and China. With urbanization came a fundamental shift in human relationships. Historian Lewis Mumford likened cities to pressure cookers: “As with a gas, the very pressure of the molecules within that limited space produced more social collisions and interactions within a generation than would have occurred in many centuries if still isolated in their native habitats, without boundaries.”⁵² Architectural historian Spiro Kostof described this as “energized crowding”⁵³—the essence of cities, where proximity to others led to greater opportunities, connections, and innovations.

The concentration of thousands of people in cities also created unprecedented environmental challenges, straining water and agricultural systems and sometimes contributing to their decline. During the late Uruk period, around 3200 to 3100 BC, the region likely experienced increased aridity. The marshes gradually receded. Subsistence agriculture became increasingly difficult. Initially, this crisis may have driven people toward urban centers, where large-scale reserves acted as a buffer against unpredictable crop yields.

However, these people then found themselves subject to political regimes. Uruk seemingly experienced escalating internal and external violence during this period. Seals depict prisoners, with their hands tied behind their backs, kneeling before spear-wielding soldiers. Artifacts such as maceheads, slingshot balls, and arrowheads point to violent confrontations. Meanwhile, urban existence in Uruk may have teetered precariously on the edge.⁵⁴

By 3000 BC, Uruk’s influence ended. Colonies such as Habuba Kabira were abandoned. Artifacts from the Uruk culture, once found as far away as central Iran and Egypt’s Nile Delta, stopped appearing, suggesting the city’s trade networks collapsed. The causes of this decline remain a mystery. They could be internal tension resulting from environmental stress, intrusions by people from Eastern Anatolia and Transcaucasia, or an influx of Semitic-speaking people from the west.⁵⁵

Uruk’s influence declined, but many of the architectural solutions found in its settlements lived on. One of the most enduring strategies was the courtyard house, which would go on to define urban form across North Africa to the Indus Valley. It offered a practical solution: thick mud-brick walls that moderated temperature swings through thermal mass. The courtyards brought light and air into the home while preserving privacy. Even the narrow streets, hardly wide enough for a single donkey cart, had their role. They cast shade and channeled cooling breezes, creating favorable microclimates throughout the city.⁵⁶



Traditional courtyard houses, Marrakech, Morocco.

These were not unique inventions of Uruk but shared adaptive responses to life in warm environments. They emerged independently across regions facing similar conditions. The courtyard house still offers comfort in hot weather today, from the *siheyuan* of Beijing to the *riads* of Fez. In these early settlements, we find not only the building blocks of urban life but also an architecture in dialogue with the earth and the sun.

Clay into Rock

A text from 2152 BC describes Gudea, a Sumerian ruler, in a temple's brick-laying ceremony: "Gudea put the blessed water in the frame of the brick mould. . . . He set up the appropriate brick stamp so that (the inscribed side) was upwards. . . . He raised the impeccable carrying-basket and set it before the mould. Gudea put the clay in the mould, he acted precisely as prescribed, and behold he succeeded in making a most beautiful brick for the house. . . . He struck the brick mould: the brick emerged into the daylight. He looked with complete satisfaction at the stamp (impression) on the clay. . . . raised the brick out of the frame of the mould: he carried the brick—a lovely tiara . . . which reached up to heaven—and went among his people." ⁵⁷

Nearly four millennia later, we still mark the beginning of construction projects with ceremony, although with golden shovels and photo opportunities. Yet these modern rituals pale in comparison to the profound significance that brickmaking held for the ancient Mesopotamians. Rulers like Gudea often depicted themselves carrying a basket of clay on their head, containing the first brick. They inscribed bricks with their names. They boasted about the number of bricks used in their works. So important were bricks that there was a brick god, Kulla, who was invoked during the laying of the first brick. In a society unable to use stone for building, creating bricks was nothing less than manufacturing artificial rock—a godlike act of transforming mud into the building blocks of civilization.

The story of the brick is, in many ways, the story of human dwelling itself. They are part of humanity's journey from temporary shelters of straw and wood to more permanent structures of brick and stone. In Mesopotamia, this evolution of bricks would reshape not only houses but also the fabric of human society—though it came at a cost.

By the middle of the third millennium BC, an unprecedented urban revolution was sweeping across Southern Mesopotamia. The once-sparse landscape had blossomed into a network of thriving cities, each spanning hundreds of hectares. The promise of opportunity drew villagers by the thousands, until an astounding 80 percent of the population lived in urban centers larger than forty hectares.⁵⁸ More than simple cities, these were city-states, complete with suburbs, satellite villages, and agricultural hinterlands, all governed by dynastic kings and temple elites.

But this urban explosion created an urgent challenge: how to house such dense populations safely and permanently. Houses were often not built safely, sometimes leading to collapse. So serious was this risk that the world's first building code, the Code of Hammurabi (circa 1750 BC), addressed it with chilling clarity. "If a builder constructs a house for a man but does not make it conform to specifications so that a wall then buckles, that builder shall make that wall sound using his silver."⁵⁹

But cases could be far more severe. "If a builder constructs a house for a man, but does not make his work sound, and the house that he constructs collapses and causes the death of the householder, that builder shall be killed. If it should cause the death of a son of the householder, they shall kill a son of that builder."

One problem lay with sun-dried brick. The traditional sun-dried mud bricks that had served village builders for generations proved dangerously inadequate for urban life. When exposed to moisture, these bricks could deteriorate and disintegrate⁶⁰—sometimes catastrophically. This is why builders frequently plastered sun-dried brick walls with fresh mud or gypsum to shield them from moisture and erosion, often reapplying it several times a year. Over time, they knocked down entire structures and rebuilt new ones atop earlier foundations. Life in early Mesopotamian settlements was defined by constant upkeep.

Several Mesopotamian cities show evidence of devastating floods, which would have destroyed most homes. Around 3500 BC, the city of Ur experienced a flood leaving up to eight feet of silt, leading excavator Leonard Woolley to believe it was evidence of the "Great Flood." While this is debated since it was more likely a local event, ancient Mesopotamians understood the limitations of their sun-dried brick homes. So they found a new solution. They began baking bricks. The Bible later echoes a similar turning point in Genesis, when humanity, after the Great Flood, resolves to rebuild: "They said to each other, 'Come, let's make bricks and bake them thoroughly.' They used brick instead of stone."⁶¹

Fired brick offered a more durable solution to the problem of moisture. By heating bricks to around 900°C to 1,000°C, a process called vitrification begins, where some of the silica and alumina in the clay fuse together, making the brick harder and more like a ceramic material. This firing removes chemically bound water and significantly reduces the porosity found in sun-dried bricks. However, Mesopotamian kilns rarely reached full vitrification. Nevertheless, the resulting bricks were still much more durable than sun-dried ones.

But fired bricks were a luxury, requiring both fuel and skilled labor. Economic records show that transporting 370 burnt bricks to a construction site cost one silver shekel—roughly 8.4 grams of silver.⁶² These expenses restricted their use to urban centers with the resources and artisans to produce them.

The impact of this innovation was clearly visible in Ur. While ceramics and bricks had been fired since the fourth millennium BC, it was in this port city—where the Euphrates once met the sea—that fired bricks became increasingly common. During the Third Dynasty of Ur (2112–2004 BC), a period later called the Sumerian Renaissance, the city became the capital of an empire known for its major building projects. Appropriately, one of the most iconic depictions of King Ur-Nammu, an early ruler

who founded the Third Dynasty, shows him carrying a basket of mud on his head, symbolizing the laying of the first brick.⁶³

By the height of Ur's power, fired bricks had become symbols of urban prosperity. They were increasingly used in private buildings—especially in courtyards, bathrooms, and wall footings prone to water damage. Baked bricks were laid at the base of walls as damp courses, to protect against moisture from rain and groundwater. This seemingly modest innovation greatly enhanced durability. While the sun-dried bricks above have mostly eroded, the fired bricks remain.

There were other techniques for managing moisture as well. A typical house featured an entry vestibule, “sometimes provided with a water-jar and a drain for the washing of the feet of those entering,”⁶⁴ imagined the excavator Leonard Woolley. It led into a courtyard paved with brick, with a carefully constructed drain at its center. Not yet able to make long pipes, builders stacked interlocking baked clay rings—an early plumbing method also used in their first toilets. These rings had holes along the sides to let water escape. Builders surrounded them with broken pottery to act like a filter, preventing clogging. This made it conceptually similar to a modern perforated drainpipe surrounded by gravel, like a French drain. As Woolley described, “a round pipe, 20 or 30 feet long, made of terra-cotta rings set one above the other; there were holes in the sides of the rings and round them there was a packing of broken pottery which kept the earth from blocking the holes.”

This central placement of the drain was used to move water away from the building's walls. Such was the importance of proper drainage that an ancient text warned: “If the water in the court runs to the back, expense will be continual; if the water in the court runs to the middle of the court, that man will have wealth.”⁶⁵

Mesopotamians also used bitumen, a sticky, waterproof material that was a naturally occurring tar found along the Tigris and Euphrates Rivers. They used it to waterproof their boats and their homes as well. Bitumen helped seal floors and also served as a mortar to bind bricks. Since it was stronger than mud mortar, it was especially useful for lower courses. Bitumen was likely also applied to coat roofs—similar to the use of asphalt roofs today.

To create flat waterproof roofs, Sumerian builders layered beams, reed mats, mud, and bitumen plaster. Even the *Epic of Gilgamesh*, the world's oldest known work of fiction, nods to the eternal challenge of roof maintenance, cursing a sacred prostitute with a leaky roof: “The roof of your house, no builder shall plaster!”⁶⁶

The widespread use of bricks, however, did put its limitations on domestic architecture. Mud bricks are strong under compression—like handling downward pressure from gravity. That makes them appropriate for walls. However, they are weak in tension and can crack or fail under the tensile forces that develop when spanning an opening, such as a window or doorway. Brick lintels had to be short, limiting window sizes. Therefore, homes faced the challenge of dark interiors.

Mesopotamian builders eventually got around this by using bricks to build arches, which primarily work under compression. This allowed them to span larger spaces with bricks alone, but this is not something they did for dwellings. Builders likely used timber beams to span window openings or support roofs.⁶⁷ However, wood was scarce in ancient Mesopotamia.

And it was their lack of wood that likely prevented multistory buildings. Several houses at Ur show remnants of staircases, and the brick walls were often quite thick. This led some to suggest they had a second story, while others propose they simply provided access to the roof. Roof space was almost certainly used—especially in dense cities where street-level space was limited. However, full multistory construction would have been prohibitively expensive. A second floor in a courtyard house would require additional timber not only for stairs but also for balconies to support upper-level access.

Archaeologist William Hafford proposed that many homes may have featured a “hybrid second story”:⁶⁸ partially enclosed rooms or shelters on the roof, perhaps made of reeds or brick, which expanded living space without the cost of full vertical construction. Most Sumerian houses likely had

For Natalie

By means of our hands we struggle to create, as it were, a second world
within the world of nature.

—MARCUS TULLIUS CICERO, *ON THE NATURE OF THE GODS* 2.61,
TRANSLATION ADAPTED FROM H. RACKHAM

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DWELLING ON EARTH

Introduction

Dwelling on Earth

One of the oldest known traces of early human habitation lies deep in Olduvai Gorge in Eastern Africa and dates back nearly two million years—marked by little more than scattered stone tools and fossilized animal bones. Though the first gestures of dwelling likely began even earlier and are lost to time, their significance was profound. When our ancestors began returning to familiar ground and reshaping their surroundings, they did more than rewrite human destiny—they began to rewrite the story of the Earth itself.

From these humble beginnings, our dwellings rose ever higher. Temporary shelters of mammoth bones gave way to Mesopotamian mud brick homes. In time, Roman multistory apartment buildings rose over ancient cities, housing thousands in the early concrete structures called *insulae*, meaning “islands,” rising from streets like stone archipelagos. Today, skyscrapers of glass and steel pierce the clouds in Shanghai and Dubai. And now, in our quest for survival and adaptation, we dare to imagine homes on distant planets—carrying the ancient idea of dwelling beyond our world.

As we shaped our dwellings to suit our needs, they in turn shaped us. In an era when survival meant grappling with the elements and nomadic wandering in search of resources, permanent dwellings emerged as sanctuaries. They sheltered us from storms, provided comfort and security, and became the seedbeds of civilization.

Dwellings allowed us to store possessions and accumulate wealth, luxuries that had eluded hunter-gatherers. They offered new degrees of privacy without the risk of venturing far from the community. As populations concentrated, these clusters of dwellings functioned as social catalysts. Larger settlements accelerated the rapid exchange of ideas and spurred cultural development. In a single day, a villager might encounter more people than a forager met in months—sometimes years.

Homes also became places to make sense of the world and express shared values. We filled them with symbols of belief, setting aside spaces for ritual and ceremony. About nine thousand years ago in the Stone Age town of Çatalhöyük on the Southern Anatolian Plateau, residents built walls incorporating vulture beaks and human skulls—precursors, perhaps, to the souvenirs and portraits we display on mantelpieces today.

Behind these walls and under these roofs, an extraordinary transformation took place, altering our habits, relationships, and the course of civilization. With shelter securing our fundamental requirements—anchored at the base of Maslow’s hierarchy of human needs—people could turn their energy to higher pursuits: building villages, founding cities, and raising monumental temples and pyramids.

Between our first basic huts and today’s towering structures lies an extraordinary and hard-won journey of innovation—from Roman concrete to modern steel frames, from wood-burning fireplaces to smart thermostats, from candlelight to LEDs. Many advancements arrived through trial and error, and sometimes at great human cost. The densely packed houses of Çatalhöyük, for instance, used flat roofs as streets, with roof openings doubling as chimneys and entrances accessed by ladders—a design that likely bred respiratory illnesses, frequent falls, and fractured bones. As much as human dwellings showcase our genius for adaptation, they also reveal our knack for creating the very risks they were meant to prevent.

The walls we built to keep nature out also created boundaries between people—inevitably fueling envy, suspicion, and inequality. In the earliest settlements, there was little differentiation among dwellings. But as settlements grew into cities, wealth inequality became visible. In Ur, one of the first cities in Mesopotamia, wealthy residents lived in durable homes made of courses of fired brick, while commoners occupied sun-dried mud brick structures prone to decay. Some had no secure shelter at all. Permanent settlement may have safeguarded the weak from the wild, yet its benefits were unevenly distributed.

Millennia later, the pattern persists. Luxury towers rise while people without shelter sleep in their shadows, as the gap between wages and housing costs widens. Even in wealthy nations, housing insecurity undermines health and well-being, particularly for vulnerable groups like children, who suffer developmental setbacks. Studies consistently show that stable housing improves quality of life, reduces healthcare costs, and lowers rates of intimate-partner violence.¹

And yet, even when architects set out to improve how we live, well-meaning efforts sometimes perpetuate social problems. In the 1920s, the modernist Frankfurt Kitchen introduced a streamlined workspace based on principles of scientific management and time-and-motion efficiency. Though intended to liberate women from domestic drudgery, its compact design—optimized for a single user—often left them working in isolation, with little space for conversation or supervising children. Rather than challenging traditional gender roles, it may have quietly entrenched them.

Our homes and neighborhoods also impact our health—influencing how we move, breathe, and sleep. Even seemingly comfortable homes can harbor hidden hazards. In car-centric suburbs, daily walks give way to long commutes behind the wheel, contributing to rising rates of diabetes, heart disease, and obesity. While our hunter-gatherer ancestors often walked on the order of 16,000 to 17,000 steps per day, the average American today takes about 4,000 to 5,000 steps. Studies indicate that people living in car-dependent areas face a significantly higher risk of developing type 2 diabetes and obesity.² Obesity, in turn, can reduce life expectancy by years, in severe cases comparable to the effects of lifelong smoking.³

Dense apartment living can present its own challenges, such as limited natural light, which can negatively affect mental health⁴—though apartment living can also foster social connection between neighbors.⁵ And those who live in a house with stairs may live longer and healthier lives, benefiting from the daily cardiovascular exercise of climbing them.⁶ Indoor air quality poses another challenge, especially with nearly airtight modern construction. Common building materials release volatile organic compounds, while poor ventilation allows pollutants to build up. Outside, those picture-perfect lawns surrounding suburban homes often rely on pesticides and herbicides such as 2,4-Dichlorophenoxyacetic acid that not only can contaminate groundwater but are so toxic that they pose serious risks to children and pets.⁷

Most people now spend the majority of their lives inside their residences. Americans devote about 90 percent of their time to interior spaces, two-thirds of that at home. Inside, design choices impact well-being. Natural light influences mood and sleep patterns,⁸ while clutter can elevate anxiety and dull focus.⁹ Views of nature or even simple natural elements have been shown to reduce stress and enhance cognitive function.¹⁰ Yet homes may also shape our inner lives in subtler, more poetic ways. “Thanks to the house, a great many of our memories are housed,” philosopher Gaston Bachelard observed, “and if the house is a bit elaborate, if it has a cellar and a garret, nooks and corridors, our memories have refuges that are all the more clearly delineated.”¹¹

“We shape our buildings; thereafter they shape us,” Winston Churchill once famously said when advocating to rebuild the bomb-damaged House of Commons to its original design. He believed its layout—two opposing banks of benches—was responsible for the two-party system and the very nature of British parliamentary democracy.

What holds for the House of Commons holds for the home as well. Dwelling is not merely a physical structure but a way of being—both noun and verb—woven into the fabric of human culture. Our homes are not just where we live. They are how we live.

Crafting Our Niche

It was our capacity to dwell that gave us a unique evolutionary advantage. While Darwin focused primarily on how species adapt to fit their environment, modern researchers emphasize that some animals form significant two-way relationships with their surroundings. Humans belong to this group—we engage in what researchers call “niche construction.” Like beavers building dams, we create environments that often afford us advantages. These “ecosystem engineers” pass down construction behaviors through generations.

Some animal-made niches rival even the ingenuity of our own creations. Mound-building termites in Australia are renowned for their monumental towers, sometimes reaching about 800 times their body length—the equivalent of skyscrapers taller than any built by humans.¹² They have even developed temperature control systems. Inside, these insects maintain constant temperatures through intricate systems of vents and flues, even as desert temperatures swing dramatically between day and night.¹³ Similarly, bees create precise hexagonal honeycomb patterns. This shape makes efficient use of space, eliminating gaps that would occur with circular cells. It uses less wax than triangles or squares would require to enclose the same area while still providing structural strength—a design so efficient that humans now use it in engineering applications. These remarkable structures, however, emerged over millennia as insects whose genes produced more efficient structures had greater reproductive success, passing their genetic traits to subsequent generations.

Humans, by contrast, accelerate architectural innovation through our ability to make tools, think abstractly, and cooperate intentionally. We leverage geometry, mathematics, and engineering to solve new problems within single lifetimes. We create scalable social networks that allow us to transmit new ideas and coordinate construction projects through planned collaboration rather than genetic instinct. Our earliest homes used simple round forms, as circles and ovals distribute the weight of the roof more evenly and round pits were straightforward to excavate. But we soon developed rectangular structures as our needs evolved, because right angles simplify expansion and partitioning into multiple rooms. We later clustered homes into blocks and orthogonal grids, creating ever-larger cities. We mastered arches and vaults, forged steel, and engineered vertical structures that scrape the sky. No species has ever reshaped its environment so swiftly or completely.

Yet this power comes at a cost. Species that construct niches inevitably alter the ecosystems around them. Just as beavers build dams that transform entire watersheds into lakes of their own making, our ability to modify our environment has fundamentally altered Earth’s ecosystems. In our relentless expansion and pursuit of ever-greater comfort, we invented machines that moved

mountains and paved vast road networks, and built climate control systems that burn through enormous amounts of energy.

Today, the built environment accounts for almost 40 percent of global carbon emissions, much of it from constructing, heating, and cooling residential buildings.¹⁴ And the problem is growing. By 2050, urban populations will increase by 2.5 billion, with cities housing over two-thirds of humanity. To meet this demand, we will need to build roughly the equivalent of a new New York City every month for the next three decades.¹⁵ Meanwhile, as the middle class in emerging economies is expected to double over the next decade, we may see a rise in consumerism mirroring Western patterns, further stoking demand for more floor space. In the US, even as household size halved, floor space per capita doubled from 400 to 800 square feet between 1891 and 2010¹⁶—contributing to a tenfold increase in total housing volume.

Our homes make up much of our built environment, driving economic activity and demand for land, infrastructure, and resources. This bond is etched into language itself: both “economy” and “ecology” spring from the Greek *oikos*, which means “house” or “household.” The ancient Greeks coined the term *oikonomia* (economy) as the management of the household, reflecting the house as society’s basic economic unit. Centuries later, German biologist Ernst Haeckel introduced *Ökologie* (ecology), to refer to the study of organisms in their habitats, their “houses.”

Perhaps even cities arose from the house. Archaeologists once believed the first cities, such as Uruk in Mesopotamia, sprang from the centralized power of temples and palaces. But archaeological finds at the earlier site of Tell Brak suggest another path: incremental growth, household by household, forming neighborhoods that collectively housed tens of thousands before any dominant civic structure emerged. This is what archaeologists call a “proto-city,” a large, densely occupied settlement with urban traits but with little or no early evidence of centralized authority. Like the “swarm intelligence” behind the complex structures built by termites, these larger settlements may have scaled up through the cumulative interactions of many independent households rather than through the top-down direction of political elites. Even when monumental buildings appeared later, they often mimicked domestic architecture. In Mesopotamia, many temples were essentially enlarged houses.

Today, the way we build shapes the planet more than ever before. From the clearing of forests for materials to the carbon footprint of buildings, our housing choices are transforming the environment. In our continuing pursuit to build ever more comfortable homes, we now face climate change and related challenges that threaten the very comfort we sought to create.

From Huts to High-Rises

How did our homes evolve from simple huts made of animal skins and bones to “smart” sensor-equipped buildings? What technological breakthroughs, societal shifts, and cultural currents sparked new ways of dwelling? And how has the evolution of our homes shaped humanity in return—reconfiguring our cities and neighborhoods, raising standards of comfort, and establishing social norms around privacy and domesticity? This book probes these questions, ultimately asking: How did the remarkable story of dwellings redefine our lives and the planet—and how might we build more sustainably in the future?

Dwelling on Earth traces the long, captivating evolution of human habitation and its entangled relationship with the environment. The story of the home is inseparable from the story of humanity itself, unfolding alongside our societal evolution. From brush huts to high-tech habitats, our dwellings have not only shaped how we live but also transformed our world.

For much of history, residential architecture was largely overlooked by architectural historians and archaeologists, who favored monumental temples and palaces. When ancient homes did enter the scholarly spotlight, conclusions were sometimes distorted by outdated science or cultural presumptions. Take the case of the Peking Man discovered in a cave at Dragon Bone Hill near

Beijing, dated to about 400,000 years ago. Early excavators proclaimed the site the home of the first caveman—and supposedly a cannibal, based on bite marks found on bones. Decades later, high-resolution microscopes and modern forensic techniques overturned the tale. The marks match those of gigantic hyenas, suggesting the cave was their den, where they dragged in and gnawed human remains.¹⁷

These interpretive problems had deep roots. One example is the eighteenth-century “primitive hut” theory of architecture, proposed by French priest Marc-Antoine Laugier, who imagined the first homes as sloped roofs supported by wooden columns—a form that conveniently mirrored classical Greek architecture.¹⁸ Until recently, the oval-shaped huts at Terra Amata in Nice, France, were considered the earliest purpose-built homes based on rings of stones found in a beach alcove—a conclusion perhaps skewed by the desire to declare a definitive “first” home. However, new archaeological evidence using micromorphology, which studies soil slices under polarized light, now indicates these rings were not human-built foundations, but likely resulted from naturally occurring stream flows.¹⁹ Nevertheless, the oval hut reconstructions live on, lingering in textbooks and museum displays.

Today, a range of cutting-edge tools enriches our understanding of early homes. DNA analysis reveals familial relationships and migration patterns among ancient residents. Satellite imagery detects settlements where none were expected. Pollen analysis reconstructs ancient climatic conditions. These and other methods provide new insights into early dwellings and settlements.

Yet even with such tools at our disposal, this book does not attempt to provide a complete global history of every dwelling type. Instead, it traces four major transformations: the Agricultural Revolution, the Urban Revolution, the Industrial Revolution, and the ongoing Sustainability Transition. The first three marked transformations from which there was almost no turning back, establishing new levels of complexity, enabling unprecedented forms of settlement, and fundamentally altering how humans could live. The fourth, however, is different—it compels us to choose how we dwell without destroying what sustains us. We’ll explore key innovations and how homes evolved through these turning points, from the first vertical apartment blocks of ancient Rome built by unscrupulous speculators to the early terraced row houses in Liverpool created by forward-thinking industrialists.

Before agriculture, dwellings were temporary—grassy beds, huts made of reeds and animal hides—and most vanished without a trace. But around 12,000 years ago, the Agricultural Revolution allowed us to invest more deeply in permanent settlements. Communities like the Natufians in modern-day Israel and Palestine built circular dwellings of stone and mud as they domesticated plants and animals. Similar round pit houses emerged independently around the globe—solutions to the same problems, arrived at separately.

However, with permanence came peril. Settled communities placed themselves in the path of natural disasters. Floods, droughts, and hurricanes posed considerable risks to their well-being. Communities also significantly modified their natural environments—clearing forests for farms, fuel, and building materials, which exposed topsoil to wind and rain, washing away fertile earth needed for crops. In doing so, they inadvertently contributed to the very “natural” disasters they feared. In many cases, these environmental missteps set the stage for collapse—a harsh reminder of the responsibilities that came with settled living.

The Urban Revolution, roughly six thousand years ago, gave birth to the city and new living spaces. As the demands of irrigation and agriculture favored extended family households, homes began to expand. Circular huts gave way to rectangular forms, far easier to expand and cluster in growing settlements.

With increased settlement size came greater social, economic, and political complexity—and homes evolved in tandem. A growing division of labor gave rise to professional builders. Growing populations and social specialization spurred innovative dwelling types, including row houses and even multistory apartment buildings.

Remarkably, several of these urban forms—such as the atrium house and the organized street grid—emerged independently in different parts of the world, in cultures with no direct contact. In ancient Rome, breakthroughs in materials like concrete made it possible to construct vertical apartment buildings, housing large numbers of urban residents. These unprecedented housing forms enabled more people to live in closer proximity, fostering new kinds of interaction.

Did settled life make us happier? While agricultural settlement is often viewed as inevitable progress, some anthropologists highlight the advantages of nomadic lifestyles. They cite the example of the nomadic !Kung people of the Kalahari, who spend only roughly 40 percent of their time securing food, dedicating the remainder to socializing, dancing, and other pursuits.²⁰ By contrast, settled life often brought increased labor demands—from dawn-to-dusk farming to endless home maintenance.

Even as the cities of the classical world grew, nomadic people persisted, offering a different model entirely. In the fifth century BC, the ancient Greek historian Herodotus described the nomadic peoples on the Eurasian steppe: “Having neither cities nor forts, and carrying their dwellings with them wherever they go: accustomed, moreover, one and all of them, to shoot from horseback; and living not by husbandry but on their cattle, their wagons the only houses that they possess, how can they fail of being unconquerable, and unassailable even?”²¹ These societies had mastered animal domestication but chose not to cultivate crops. As historian Spiro Kostof noted, “They had no use for settled permanence except as their last resting place.”²²

And yet the agglomeration of urban populations brought undeniable advantages. Larger scales of social organization fueled economic productivity and wealth creation—a pattern that continues from ancient cities to modern metropolises.²³ While early productivity manifested in temples and elite housing, today we measure it in GDP. Urban concentration consistently drives innovation.²⁴ In the United States, large cities produce about twice as many patents per person as smaller ones.²⁵ Cities became the engines of civilization.

But even these had limits. Preindustrial cities faced hard constraints to growth. Inadequate sanitation and insufficient agricultural output restricted their population. These barriers would not be broken until the Industrial Revolution, which introduced new energy sources and more efficient means of production—enabling urban growth on an unprecedented scale.

The Industrial Revolution reshaped residential architecture and cities as a whole. Steam trains enabled suburban expansion, while breakthroughs in steel production, construction equipment, and elevators revolutionized building height in cities like Chicago and New York. Meanwhile, a growing bourgeoisie redefined domestic life around the nuclear family—evident in seventeenth-century Dutch row houses, where, to the shock of foreign guests, visitors were expected to remove their shoes.

But industrialization came with a darker side. In many cities, the working class lived in overcrowded, unsanitary tenements. Polluted air, contaminated water, and squalid housing conditions made cities deadly environments, where mortality rates outpaced births. In response to these grim realities, reformers pioneered early planning reforms and regulations that led to better housing initiatives, exemplified by the terraced rows in Liverpool. The construction of modern sewage systems and clean water infrastructure eventually vastly improved urban life.

The twentieth century witnessed a bold modernist movement of urban living that reimagined the home as an efficient machine. This approach manifested in neatly organized rows of apartment blocks and tall towers set in parks. While some cities like Singapore and Hong Kong embraced vertical urbanism, elsewhere, particularly in the United States, domestic life increasingly migrated to automobile-oriented suburban developments.

As we prepare to build many more homes in the twenty-first century, we face new challenges. Today, our homes confront growing environmental threats, from rising temperatures to floods and wildfires. In response, architects are being called on to design more resilient and sustainable

dwellings. These range from entire floating neighborhoods to structures made from bio-based materials like mass timber—large engineered-wood panels strong enough to stand in for concrete.

Simultaneously, emerging technologies are transforming how we build and live. Where Mesopotamians once painstakingly molded clay bricks by hand, robotic arms now extrude concrete with precision. Digital design and automated manufacturing such as 3D printing are revolutionizing how we build, even enabling the design of prototypes for Martian habitats. Artificial intelligence is already beginning to generate home designs and manage domestic systems.

Yet amid this wave of innovation, we're also rediscovering the wisdom of time-tested preindustrial traditions. Passive heating and cooling, natural ventilation, and bio-based materials are making a return—not as nostalgic gestures, but as proven solutions. In many respects, our ancestors may have built more sustainably. Mesopotamian cities largely disappeared into the earth. Ours, by contrast, may be remembered by future archaeologists for their concrete debris.

As we confront the intertwined challenges of climate change and rapid urbanization, the long history of dwelling becomes more than a source of insight. It offers a foundation for reimagining how we live. This book traces that history to understand how we arrived at this moment, and to explore what it will take to build more sustainably.

Homes for Tomorrow

As a professor of architecture and urban planning, I've been fortunate to witness an extraordinary diversity of global housing solutions. My journey has taken me from the informal settlements of southern China to Manhattan's supertall skyscrapers, from Hong Kong's meticulously planned public housing estates to the Netherlands' experimental floating homes. Along the way, I've seen how seemingly technical policies—from zoning resolutions to building codes, even landscaping requirements—significantly shape the way we live. In the United States, for instance, regulations meant to keep neighborhoods orderly have inadvertently nudged out “missing middle” housing—such as row houses, duplexes, and apartment buildings that bridge the gap between single-family homes and large apartment blocks. They have also limited mixed-use blocks where apartments sit above corner cafés or neighborhood shops. The result? Fewer affordable, walkable choices in many communities. In Singapore, by contrast, urban planning policies have deliberately cultivated tall buildings that weave greenery into the skyline, proving how intentional policy design can achieve both density and livability.

As a practicing architect, I've watched the profession transform from hand-drawn blueprints to algorithm-driven modeling and AI-assisted renderings. Construction methods, too, have evolved. Brick walls once laid by hand can now arrive as factory-made panels or be installed by robotic arms. Drones monitor progress from above while robotic dogs patrol sites from the ground. Alongside these technical advances, our profession has championed more sustainable buildings, from advocating for stricter energy codes to embracing renewable materials like cross-laminated timber and bio-based finishes.

As a resident, my own experience of home began in a Dutch town. I grew up in a narrow row house, almost identical to its neighbors, each with its own modest backyard. No one had air-conditioning—we didn't need it. Thick brick walls, external shading, and cross ventilation kept interiors cool. The wide sidewalks fostered a sense of community. Most neighbors knew each other. As a child, I could bike safely to school and play in the street.

When I began my studies in Delft, I moved into student housing that was part of a bold experiment in 1970s architecture. Architects had reimagined the conventional layout, centering each floor around a communal kitchen. Most roommates took turns cooking for one another. There were no formal rules requiring this arrangement. The layout encouraged it. It nurtured collaboration and community. To our surprise, one roommate became the town's youngest mayor.

In Barcelona, I lived in a compact apartment in the old town. Despite the limited space, I was steps from shops, cafes, and public transit. Paris offered a similar lifestyle, with its Haussmann-era walk-up courtyard buildings. In New York, I lived in elevator buildings. Hong Kong immersed me in its vertical labyrinth of skyscrapers and “pencil towers.” Apartments were small but utilized every square inch through sliding walls, foldout furniture, and built-in storage tucked into every nook.

These cities share an important quality. Most daily activities are within a fifteen-minute walk or bike ride. They are examples of what planners now call the “15-minute city.” This experience taught me that quality of life isn’t necessarily tied to the size of one’s home but to the richness of the walkable surroundings.

My path later led me back to suburban life—to a midcentury modern villa in California, a townhouse in Virginia, and a century-old Colonial Revival house in a New Jersey railroad town. Each move brought new daily routines. In Manhattan, movement was built into everyday life, from walking to stores to catching the subway. In the New Jersey suburbs, staying active often requires a gym membership.

In the chapters ahead, we will explore the larger story of human habitation—from the first fired bricks of Mesopotamia to the modular 3D-printed homes of tomorrow. We’ll examine engineering feats that made cities possible, and social experiments that redefined domestic life. We’ll uncover innovations we now take for granted—like how the humble corridor reconfigured privacy. We will explore movements shaped by cultural and economic shifts, from Bauhaus to Brutalism.

While we will examine the physical structure of buildings, we will also consider the social structures they create. Each housing type has the ability to shape urban landscapes, daily experiences, and interactions across different walks of life. Even seemingly innocuous design choices can influence social dynamics. As Amos Rapoport observed in *House Form and Culture*, the placement of American dining counters—like the arrangement of chairs in psychotherapy sessions or courtroom layouts—is “remarkably indicative of the roles of the people involved.”²⁶

Throughout history, the concept and form of home have continually evolved. Unlike the Darwinian evolution of species shaped by natural selection, architecture evolves through artificial selection—driven by human intention. It is up to us to actively shape our built environment. We didn’t accept rock shelters as our final dwelling place. We built our way from mud huts to towers of steel and glass—not by chance, but by choice, and through the same cooperative intelligence that first forged our settlements to meet shared challenges. If we could once raise Gothic cathedrals stone by stone, we can certainly reimagine the homes we build today.

Today, we can create homes that do less harm to the planet. Addressing carbon emissions in the built environment is inherently complicated, involving trade-offs across materials, operations, infrastructure, and transportation. But due to advances in digital design, performance simulation, and life-cycle modeling, we now have the tools to understand and optimize these interactions with unprecedented precision. The technology exists. What remains is the collective will to act.

In our quest to build better homes, it’s tempting to focus on the newest technologies—solar panels, smart thermostats, superinsulation. But progress won’t come from buildings alone. It depends equally on what happens beyond the property line: the design of streets and the shape of neighborhoods. These decisions often lie outside the architect’s control, shaped instead by planners and policymakers. And yet, they have an enormous influence. Architects can design exceptional houses. However, they cannot overcome zoning laws that mandate excessive parking or the absence of safe sidewalks and crossings.

Growing up in the Netherlands quickly teaches you that landscapes are made, not given. Hardly a square inch remains untouched. One-fifth of the country is polder—land wrested from sea and river. You realize that the ground beneath your feet is engineered. If we can conjure land from water, surely we can reshape the land we have with equal ingenuity.

As a phrase attributed to Buckminster Fuller puts it, “We are called to be architects of the future, not its victims.” We are not prisoners to our surroundings, because we are their authors. The path

forward begins with reimagining how we dwell. For dwelling is more than walls and roofs. It's about who we are, how we relate to one another, and how we care for the Earth that remains our only home.

One

A Permanent Place

Fire and Shelter

In 1753, the Jesuit priest Marc-Antoine Laugier described the origin of dwelling by imagining a lone “savage” troubled by nature’s extremes. This “primitive man,” seeking refuge from scorching heat and torrential rain, initially fled to a cave but found it too dark and filled with “foul air.” Upon leaving the cave, he embarks on a mission. “Resolved to make good by his ingenuity the careless neglect of nature,” Laugier writes, “he wants to make himself a dwelling.”¹

As Laugier’s story continues, the man wanders through a forest, stumbles upon fallen branches, and has an epiphany. “He chooses four of the strongest, raises them upright and arranges them in a square.” With surprising engineering intuition, he lays four more branches across their tops to create a frame. He then crowns it with a pitched triangle, making a roof truss, and covers it “with leaves so closely packed that neither sun nor rain can penetrate. Thus man is housed.”

This tale of instant architecture became the foundation of Laugier’s influential theory, championing the simplicity of a “primitive hut,” a pitched roof supported by columns, over the theatrical flourishes of High Baroque architecture. While the story shaped architectural thinking for generations, it is far from the historical reality. Rather than a single stroke of genius, the story of human habitation is one of gradual evolution, unfolding over millions of years through the collaborative acts of countless generations. And this story begins not with *Homo sapiens* but with our distant ancestors.

This history begins in the trees, roughly 14 to 18 million years ago, according to evolutionary biologists, when our great ape ancestors likely developed sleeping platforms.² They would bend and weave together branches, twigs, and leaves, creating what we might call the first beds. Building these rudimentary and temporary platforms—something modern gorillas, orangutans, and chimpanzees still do—would have offered protection from predators and blood-sucking insects. Perhaps they offered escape from ground-level humidity as well.³

But the real transformation came when our hominin predecessors, the forebears of Neanderthals and *Homo sapiens*, broke from this pattern. While apes continued to build fresh nests each night, abandoning them in the morning, our hominin ancestors began experimenting with something surprisingly revolutionary: permanence.⁴

One of the earliest traces of this practice was found in Olduvai Gorge, Tanzania, dating back to around two million years ago. Archaeologists discovered stone artifacts associated with early hominin species. Most importantly, these were clustered in specific locations. This suggests our ancestors were creating the first “places,” sites they would return to again and again.

Why bother establishing a favored place at all? Unlike most primates, who consume what they find on the spot, early hominins began carrying food back to a central place to share. Such behavior would have improved the odds of reproduction. “The extraordinarily long period of juvenile dependency necessitates high levels of cooperation and resource sharing by both parents, by other children, and sometimes by other members of the society,” evolutionary anthropologists Steven Kuhn and Mary Stiner observe.⁵ “It takes a village to raise a child, but it also takes a long time.”

Regardless of intent, this seemingly simple change—the creation of places to return to—marked one of the most significant transformations in human evolution. Unlike the solitary nests of apes, these early campsites became the first community spaces in human history.

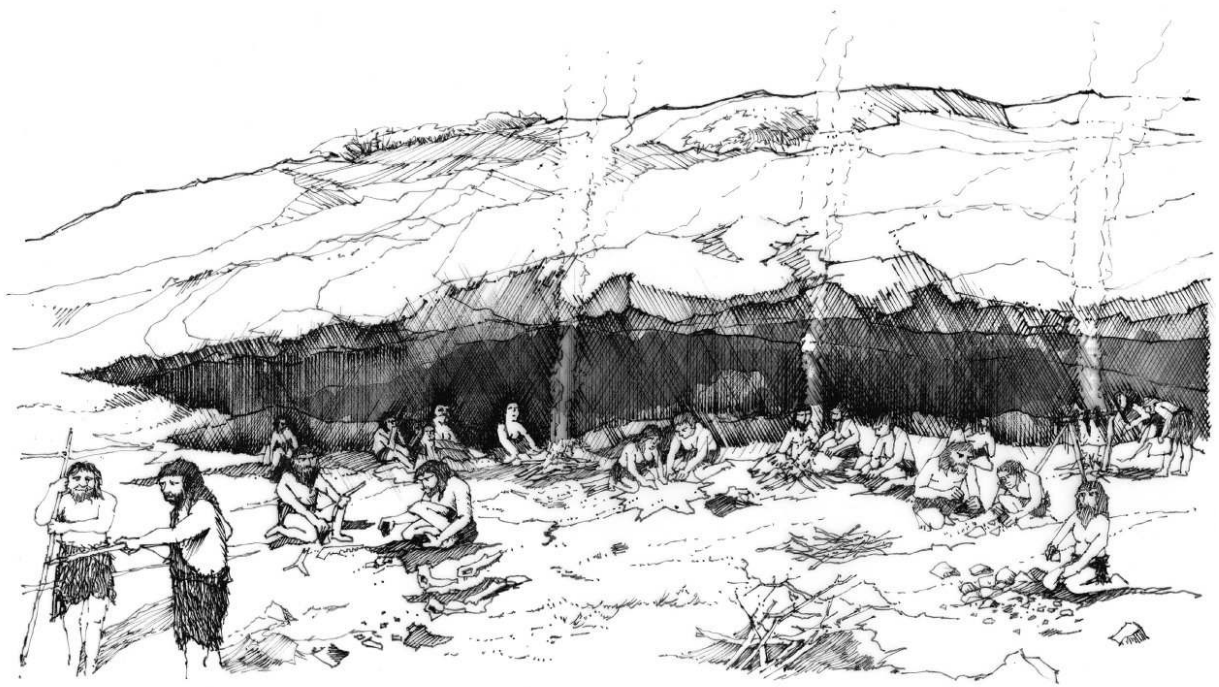
Here, our ancestors did more than rest—they slept, shared food, crafted tools, and passed down knowledge. As several anthropologists have noted, these sites became “arenas for social learning that had not existed previously.”⁶ This new social environment may have even helped shape our brains, particularly the neocortex—the region responsible for advanced cognitive functions such as emotional control and planning.⁷ This new lifestyle not only set human habitation apart from that of apes, it may have redefined who we were.

This would also have accelerated one of our signature strengths: our ability to make tools, positioning us, as several archaeologists describe, as “ultrasocial engineers.”⁸ The earliest known trace of this engineering impulse surfaces at Kalambo Falls, Zambia. There, excavators discovered two interlocking timbers dated to roughly 476,000 years ago—evidence that, as the researchers describe it, offers “a glimpse of a capacity to create a built environment” long before *Homo sapiens*.⁹

The next major revolution came with the habitual use of fire, beginning around 400,000 years ago. Fire changed human habitation in ways our ancestors could hardly have imagined. It kept predators at bay, illuminated the darkness, provided warmth, and unlocked new food sources, making previously inedible items like grains digestible. This transformed our relationship with time, cutting the time spent chewing raw foods and extending our days beyond sunset.

Around the same period, our ancestors began to more frequently occupy rock shelters and caves. Fire made the inhospitable conditions of caves more bearable, as caverns were often cold, dark, damp, and home to other residents like lions, bears, and hyenas, which had to be displaced. With fire, these places stayed occupied longer.¹⁰ But fire did more than make campsites and caves more comfortable.

“Home is where the hearth is” goes the saying, and in prehistoric times, the hearth was truly the center of the home. Our ancestors gathered around fires to share food, tell stories, and strengthen social ties. As archaeologists Desmond Clark and Jack Harris observed, fire “helped to weld early hominid groups into the coherent family units that are characteristic of human society.”¹¹



Rock-shelter, Abrigo de Navalmaíllo, Spain, ca. 73,000 BC. ¹²

These more permanent places likely changed our trajectory. They provided safe havens, helping to protect the young and vulnerable and extending the lifespan of the physically compromised. ¹³ Previously, a bone fracture would have meant certain death. Now, there was hope for recovery.

In some ways, a permanent place made survival easier. But it also required more advanced social skills. This could have affected our evolution. Natural selection could have increasingly favored those better at cooperation, communication, and conflict resolution. The use of fire for cooking reduced the size of our teeth, leaving them smaller than those of other animals. Some archaeologists have proposed that dwelling may have changed our brains. It established a feedback loop: Humans were creating homes, and homes were shaping humans. This process may have influenced the development of future generations in a nonlinear way. As Kuhn and Stiner observed, “More and more, hominins were coevolving with the world that they modified.”

These early settlements proved attractive to other hominins, drawing them in with the promise of food, resources, and companionship. Yet this closeness came at a cost. Exposure to smoke from open fires harmed lungs. Meanwhile, the close proximity of people hastened the transmission of mycobacterial diseases through coughing. ¹⁴ Tuberculosis, for instance, is estimated to have caused about a billion deaths across history, more than all famines and wars combined. ¹⁵

Managing fire brought other challenges as well. Early humans had to master the delicate balance between warmth and smoke inhalation. Recent studies of sites like Lazaret Cave, occupied approximately 170,000 years ago, reveal advanced spatial thinking. Hearths were strategically placed in “sweet spots” that maximized heat and light while allowing smoke to escape. ¹⁶ Too deep in the cave meant safety from predators but poor ventilation. Too near the entrance meant better air but exposure to cold and danger. This spatial problem-solving reflects not only an awareness of these practical challenges but also an ability to overcome them.

Meanwhile, the control of fire enabled our ancestors to venture into regions like northern Europe during periods when nearly 30 percent of the continent lay under ice, dramatically expanding our territory. It also marked humanity's first major impact on the Earth. Long before industrial emissions, our ancestors wielded flames as environmental engineering tools. They managed burn zones that promoted fruit- and nut-bearing plants in the postfire regrowth vegetation.¹⁷ Fire became a powerful hunting aid, exposing the nests of small game and driving larger prey into traps. It effectively shrank the "radius of a meal"¹⁸—the distance humans needed to travel to find enough food. Our ancient use of fire has influenced many ecosystems and spurred the rise of fire-adapted plant species (pyrophytes).

As our ancestors' mastery of fire grew, so did their ingenuity in creating comfort. More than 200,000 years ago, evidence of the first intentionally created bedding appeared in southern African rock shelters.¹⁹ Early *Homo sapiens* carefully constructed beds of broad-leaved grasses to enhance their comfort. They placed them close to the hearth—and, judging from the scorched ends of the grasses, sometimes too close. This arrangement mirrors modern hunter-gatherer camps, where people still gather to sleep around the fire.²⁰

Neanderthals displayed architectural capabilities of their own. Around 176,000 years ago, deep within Bruniquel Cave in France, they ventured more than a thousand feet from the entrance. Working by torchlight, they deliberately stacked hundreds of stalagmite pieces into two broad rings, some bearing traces of fire.²¹ This wasn't shelter but one of humanity's earliest monuments. The sheer effort required speaks to sophisticated planning and cooperation.

By 100,000 years ago, hominin settlements show evidence of complex spatial organization. The popular image of Neanderthals living deep in caves turns out to be wrong. Archaeologists found they preferred more accessible spaces near cave entrances and under rock shelters. There, they created distinct zones for different activities, including hearths for cooking and areas dedicated to toolmaking and butchering.²² They even buried their dead beneath the cave floors and engaged in symbol making, adorning stalagmites with abstract designs using red ochre pigments.

When Neanderthals tracked game, they constructed temporary windbreaks from wood and mammoth bones. One striking example comes from La Folie, a 60,000-year-old site in west-central France. In this harsh, cold environment of Ice Age Europe, Neanderthals created what archaeologists believe was a base camp. Preserved post holes suggest a circular wooden structure, likely supporting brush or hides, serving as a windbreak. Within this 30-foot diameter space, they carried out several activities. They rested, shaped stone tools, and prepared meals. They may have even laid mats to soften the floor.²⁴



Temporary Neanderthal camp “La Folie,” near present-day Poitiers, France, ca. 60,000 BC. ²³

As the Neanderthals gradually disappeared around 40,000 years ago—partly due to competition with our own species—*Homo sapiens* began taking shelter-building in new directions. In the Dordogne region of France, they occupied rock shelters and decorated them. They made engravings and stained them with red, yellow, and brown ochre, sometimes starting with a preparatory charcoal sketch. Among these earliest artistic expressions were hand stencils, geometric patterns, and animal figures. One of the oldest symbols was probably a representation of the vulva. ²⁵ These endeavors revealed not only the unique symbolic capacity of our species but also an emerging desire to make living spaces distinctly our own.

The limitation of caves, of course, is that they have a predetermined location. However, modern humans also built more impressive temporary shelters in open locations. One example comes from Mezhirich, Ukraine, dating back around 15,000 years ago. Here, a group of Ice Age hunter-gatherers constructed oval and circular huts from 120 to 240 square feet in size. They were built mostly from mammoth bones and are among the earliest examples of architecture. The largest of these structures, weighing approximately 50,000 pounds, would have required ten people over five days to erect. ²⁶ Given the extraordinary effort required to build them, these structures may have held ceremonial or symbolic meaning beyond simple shelter.

The mammoth-bone huts represent a level of architectural skill that sets them apart from the instinctive nest building of our ape ancestors. The builders demonstrated a rudimentary understanding of engineering, deliberately placing each bone to exploit its natural geometry. They created a precise oval or circular foundation and arranged leg bones and jaw bones at regular intervals. They positioned the jaws chin down. The leg bones probably upheld a roof, although it is likely that wooden elements would have helped support it as well. The entrance was marked by large upright mammoth tusks. The wall displayed a careful repetition and symmetry using pieces of the vertebral column. Remnants of hearths inside the dwellings indicate the use of bones as fuel. The final effect must have been striking—like igloos made of bone rather than blocks of ice.



Bone hut, Mezhirich, Ukraine, ca. 15,000 BC.

Several of these mammoth-bone dwellings have been found across Eastern Europe and Russia. They helped the builders cope with the frigid temperatures near the end of the last Ice Age when ice sheets stretched far into Europe. Archaeologist Steven Mithen describes what these homes might have been like inside: “The floor is soft, carpeted with hides and furs that surround a central ash-filled hearth. Mammoth skulls and leg bones provide furniture; an assortment of leather bags, bone and wooden bowls, antler and stone tools are scattered by the walls and hung from the rafters—a scene of Stone Age domestic clutter.”²⁷



[Follow for extended description](#)

Traditional Inuit igloo, Nunavut, Canada.

In a twist of prehistoric irony, our ancestors' hunting skills proved too effective, leading to the extinction of mammoths around 10,000 years ago—and mammoth-bone dwellings with them. However, humans also used other building materials, particularly wood. Yet these more perishable materials present a challenge for modern archaeologists. Wooden structures rarely survive. Even when promising sites are discovered, researchers struggle to interpret them, due to their decay. As archaeologist John Yellen noted, “Paleolithic Pompeiis are unknown.”²⁸ Most of these ancient homes have long since returned to the soil, leaving archaeologists to piece together their stories from fragmentary evidence.

However, on rare occasions nature preserves a snapshot of prehistoric domestic life. One such example was a fisher-hunter-gatherer base camp of six huts on the shore of Israel's Sea of Galilee dating back 23,000 years. These Paleolithic homes survived thanks to a curiously helpful sequence of events: a fire followed by submergence under lake water, which protected them from decay. They might have remained hidden forever, until a recent drought when water was pumped from the lake. Archaeologists found that the site's foragers had crafted small huts from brushwood, weaving them into dome-like structures enclosing a central hearth. Near the perimeter, they covered the floor with thick bunches of grass laid out in a tile-like pattern on top of a solid layer of clay.²⁹

Yet even these well-crafted dwellings were not meant to last forever. This pattern of temporary settlement continues among modern hunter-gatherers today, like the !Kung people in the Kalahari Desert. They rarely stay in one place for more than a few months due to the intrusion of insects that inevitably follows human habitation.³⁰ Nevertheless, in these fleeting shelters we find humanity's first steps toward permanent places in the landscape. What began as simple returns to favored spots evolved into increasingly sophisticated and enduring manipulations of space that would ultimately distinguish us from every other species on Earth.



Brush hut at Ohalo II, Sea of Galilee, Israel, ca. 21,000 BC.³¹

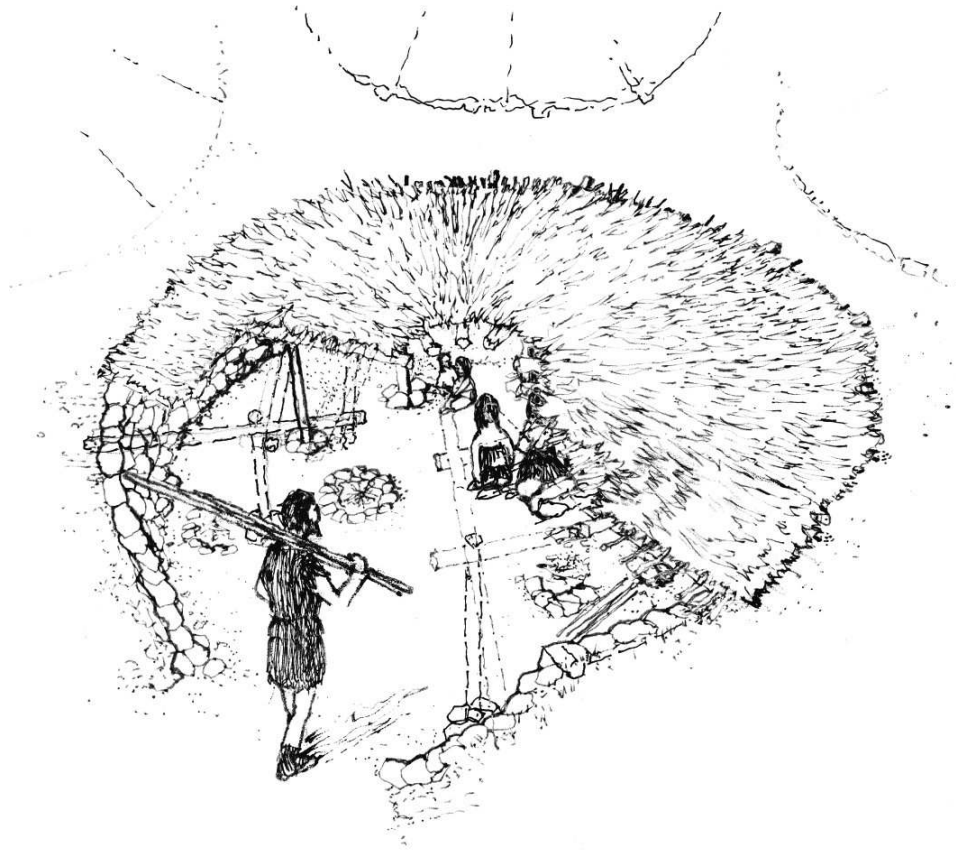
Digging In

Roughly 20,000 years ago, the last great Ice Age drew to a close. As the world began to warm, the ice sheets, which once cloaked nearly a quarter of the Earth's land, started to recede. Their retreat did more than reshape the terrain. In the Eastern Mediterranean, they created the perfect laboratory for human innovation. Once-barren steppes flourished into lush woodlands teeming with olive, pistachio, and oak trees, alongside fields of wild wheat and barley. Here, humanity would take major strides toward permanent settlement.

The Natufians, a hunter-gatherer culture inhabiting what would become modern-day Israel and Palestine, were the first to seize this opportunity. Around 14,500 years ago, surrounded by abundant almond and pistachio trees and calorie-rich plants, they chose a different path. They stopped following the seasonal migrations of animals and plants. Instead, they decided to make the land work for them. They settled down.

Their solution to permanent housing, the pit house, was both simple and ingenious. By excavating circular or oval depressions in the earth and roofing them over, they created dwellings that were easy to construct and durable. Without the masonry skill to erect freestanding walls, the Natufians used the earth itself to provide natural walls. Better still, these semisubterranean structures offered superior insulation, remaining warm in winter and cool in summer.

The pit house proved so effective that it emerged in other cultures as well. In Eastern Europe, hunter-gatherers first constructed mammoth-bone huts partially buried in circular pits to ward off the cold. The Yellow River Valley of China saw pit houses emerge around 6,500 years ago as shelter from harsh weather. Native Americans in the Sonoran Desert, about 4,000 years ago, also dug oval pits several feet deep for their dwellings to escape the summer heat. While these cultures developed their solutions independently, they all discovered the same solution. The pit house was nearly ideal, requiring minimal resources while being adaptable to almost any climate.



Natufian pit dwellings, 'Ain Mallaha ('Eynan), Israel, ca. 12,500 BC. ³²

Most archaeologists would agree that the round and oval houses of the Natufians represented the earliest structures to echo our modern notion of a home, marking a key step toward permanent settlement. ³³ The Natufians did not just dig a hole and cover it with branches. Instead, they used rocks to stabilize the pit's sides, creating a rudimentary retaining wall. Inside, they built a ring of evenly spaced posts that supported the roof, and anchored the posts with rocks. They likely created a roof from branches or reeds. These homes were modest in size, spanning 10 to 20 feet in diameter. They featured one or several stone hearths. ³⁴

The circular design of Natufian houses offered several other advantages as well. Round pits were easier to dig than rectangular ones. Round shapes also distributed structural forces more evenly, increasing resistance to wind forces. Unlike their rectangular equivalents, round buildings avoided collapsing corners. Without corners, construction became simpler. The circular design also proved highly efficient, as round shapes enclose maximum space using minimal materials. The presence of a central hearth could warm the interior evenly, ensuring optimal warmth throughout the dwelling. These benefits help explain why round forms dominated early architecture across widely separated cultures from Africa to the Americas. ³⁵

Perhaps most impressive was the geometric precision of some of the dwellings. One of the excavated remains featured perfectly circular foundations. Elsewhere, researchers found a circular limestone disk tool about eight inches in diameter. Both artifacts exhibit a surprisingly high level of symmetry. This likely reflected the Natufians' deliberate intent to build circular forms. ³⁶ These homes suggest they had planned their buildings in advance, challenging our assumptions about when such deliberate architecture emerged.

Their settlements featured both large and small single-room houses. However, their specific purpose remains uncertain. Curiously, house size showed no correlation with family size or social status—a finding consistent with the absence of evidence of social stratification among the Natufians. As a result, archaeologists suggest the variation in size was tied to function rather than social hierarchy.³⁷ The larger structures might have functioned as communal spaces or workshops.

For the first time in history, people began living together in such large numbers. Natufians clustered their homes into small hamlets, which supported estimated populations of around 150 individuals. This was a major increase from the typical hunter-gatherer groups of about 15 to 50 people.³⁸ The Natufians were not full-fledged farmers yet, as they cultivated wild cereals while preserving their hunting practices. Nevertheless, their dwellings represent a major step toward a sedentary existence.

These early villages were likely quite vibrant. Much of life occurred beyond individual dwellings in shared outdoor spaces, such as communal cooking and food preparation. François Valla, one of 'Ain Mallaha's original excavators, argued that life in these communities differed sharply from scattered bands.³⁹ They likely hosted feasts, ceremonies, and social events. These activities may have been similar to the periodic gatherings of later hunter-gatherer societies, like the seminomadic Inuit in the Arctic, who lived in tents in summer and igloos in winter.

But humanity's first experiment with permanent settlement also attracted unexpected visitors. As the settler populations expanded, so did house mice populations, drawn by the concentrated food waste in villages. House mice emerged around the same time as the first Natufian settlements and quickly outcompeted native wild mice.⁴⁰ The ripple effects of this ecological change extended further up the food chain. The abundance of food waste and the mice, in turn, drew wolves closer to human communities. Some scholars suggest that this influx of wolves may have triggered the domestication of dogs—a relationship immortalized in the burial of an elderly Natufian woman, her hand resting gently on a puppy.⁴¹

In response, the Natufians adapted their structures, modifying the smaller circular buildings between their dwellings—likely granaries—with suspended, sloped floors that deterred rodents and enhanced air circulation to prevent food spoilage.⁴² Thus, the Natufians had to adjust to environmental challenges they themselves unintentionally created.

The price of permanence grew steeper with each generation. Fixed settlements introduced water pollution, as accumulated garbage and human waste began to taint their water sources. The constant harvesting of local plants and the overhunting of animals led to gradually diminishing resources. In some cases, it led to local extinctions.

Yet this human-environment dynamic was more nuanced than just exploitation. The Natufians, like other early settlers, pioneered land management practices that reshaped landscapes in both costly and fruitful ways. Through selective harvesting, they unintentionally dispersed seeds. This created new vegetation patterns across their lands. Controlled burning promoted secondary forest growth, drew game animals, and fostered the growth of new plant species. The resulting ash boosted soil nutrients, often increasing local biodiversity and ecological productivity in ways that benefited both human communities and local ecosystems.

Remarkably, evidence reveals that as far back as 12,000 years ago, three-quarters of Earth's land bore subtle marks of human activity.⁴³ This finding upends our notion of “untouched” and “pristine” nature. The wilderness we now idealize was likely shaped by millennia of interaction between humans and their environment.

However, permanent settlement exposed humans to new vulnerabilities. With fixed dwellings and stored food supplies, communities lost the option to simply pack up and leave. Settlements in river valleys faced flooding, while those in drier areas were vulnerable to drought. Villages in woodlands risked wildfires. Resource depletion added pressure as intensive hunting and gathering began to outstrip natural regeneration. The Natufians found themselves in an increasingly adversarial

relationship with nature, both subject to its forces and unintentionally worsening the frequency and severity of disruptive environmental events. These challenges occasionally delivered stark reminders about the increased vulnerability and responsibility tied to their fixed abodes.

These risks intensified with growing populations. Permanent settlement allowed for larger families. With a stable home base, parents could more easily care for multiple children without the strain of continuous movement. This reduced the need to space births widely. The growing economic value of children in early farming and foraging activities likely spurred population growth as well.⁴⁴ But larger families strained food supplies. Archaeological evidence from gazelle bones indicates that the Natufians mostly hunted larger males.⁴⁵ This would have likely shrunk gazelle populations and meat yields over time. They also overharvested wild plants, reducing their capacity to regenerate.

Around 10,500 BC, the climate suddenly plunged back toward Ice-Age conditions—a brief cold spell known as the Younger Dryas. It likely struck a fatal blow to the Natufians’ sedentary life. They abandoned their villages and reverted to nomadism. Nevertheless, they still established smaller, semipermanent camps to exploit seasonal resources.

While their 2,000-year experiment in settled life ended, it was far from a failure. The Natufians pioneered innovations from durable pit houses to sophisticated granaries. Their hard-earned lessons helped pave the way for their descendants to transition from foragers to farmers and continue the trajectory toward permanent human habitation.

Breaking the Circle

One of the few places to witness the evolution from hunter-gatherer encampments to agricultural settlements is Beidha in southern Jordan. Unlike its famous neighbor Petra, whose striking tomb facades carved into red rocks draw crowds and feature in movies like *Indiana Jones and the Last Crusade*, Beidha offers little spectacle. It appears unremarkable—just ancient stone foundations. But what Beidha lacks in grandeur, it makes up for in historical significance. The site provides a key to understanding how so many of us came to inhabit rectangular buildings today.

Beidha was a seasonal encampment around 11,000 BC established by the Natufians, who used the site as a base for hunting activities. It was then abandoned, perhaps due to depleting resources and a cooling climate. Around 9600 BC, after enduring a thousand-year drought, temperatures rose. This dramatic change to warmer and wetter weather likely prompted a new society, descended from the Natufians, to try their luck at permanent settlements.

Perhaps realizing that wild crops would eventually be depleted with continued harvesting, these people began cultivating them. They grew rye, wheat, and barley in the fertile alluvial valley soils. Knowing that solely hunting wild gazelles was no longer sustainable due to overhunting, they started to domesticate sheep and goats. They became farmers.

This was the beginning of the Neolithic period, or the New Stone Age (from the ancient Greek *neos* meaning “new” and *lithos* meaning “stone”). The shift to agriculture enabled these early settlers to produce surplus food and invest more heavily in their dwellings. But by settling in permanent locations to manage their crops, they also had to safeguard them from others who might, quite literally, pick the fruits of their labor. As the architectural historian Spiro Kostof noted, “A fixed place under the sky—that is the Neolithic legacy.”⁴⁶

This culture is known to archaeologists as the Pre-Pottery Neolithic people. This name highlights their lack of pottery-making technology, such as the ability to fire clay. Yet what they lacked in ceramic skills, they made up for in their buildings. Returning to villages the Natufians had previously abandoned, these people began using more durable materials like stone and experimenting with innovative construction methods. One of these was the invention of mud bricks.

Mud bricks were one of humanity’s first widely used building materials. Mud was available in many parts of the world, but brick making was labor-intensive. It required that villagers laboriously dig clay from the valley floor. They then often kneaded it with straw for greater resilience. They

molded this mixture into oblong forms, leaving them to sun-dry for a few weeks. Once hardened, the villagers stacked them and bonded them with mud mortar to raise walls. These mud walls also offered some welcome insulation from both heat and cold. All these efforts demonstrate their dedication to permanent settlement.

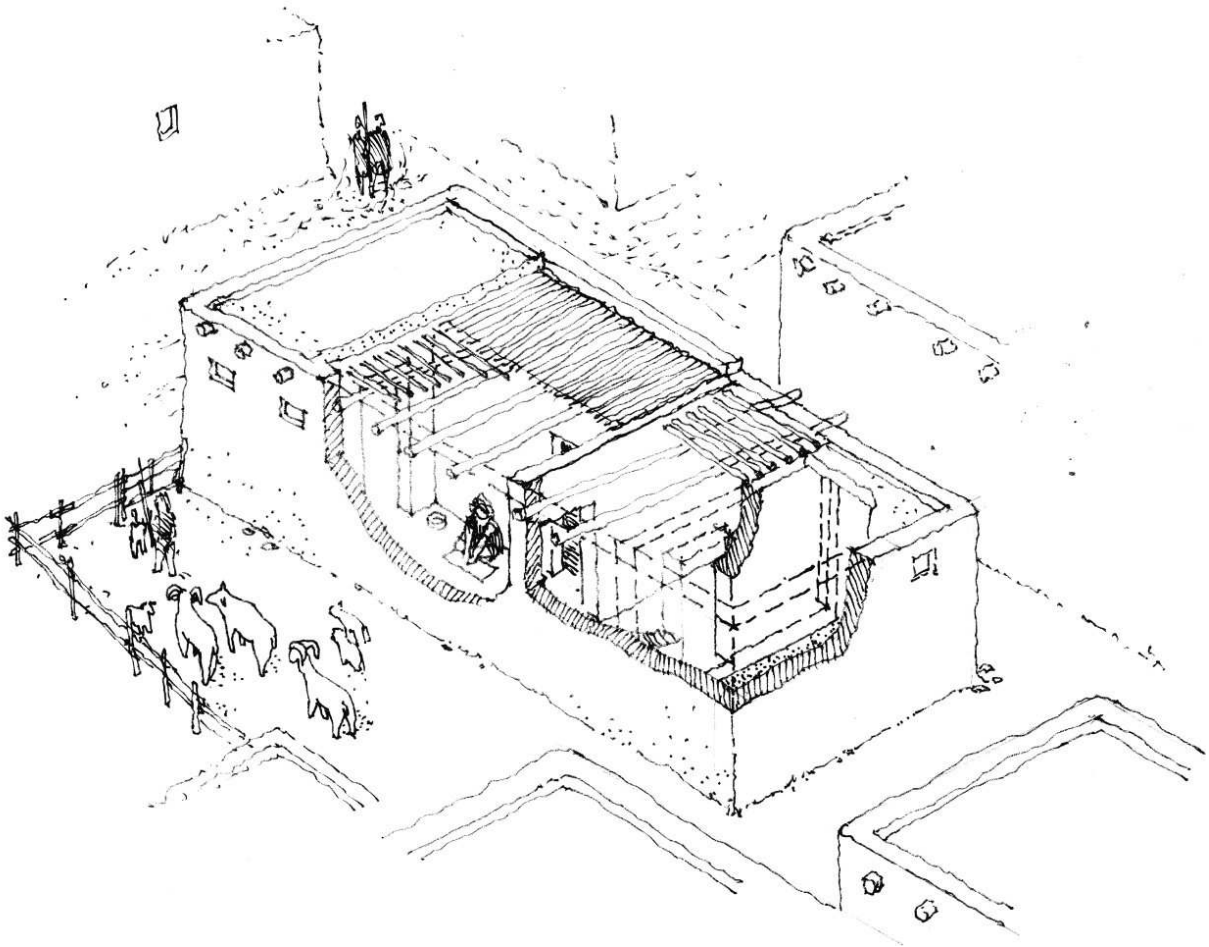
Their methods proved successful. The Pre-Pottery Neolithic people expanded across the Middle East. By 8000 BC, agropastoral villages thrived throughout the Levant in the eastern Mediterranean, from the highland regions above the Euphrates River in Syria northward into Anatolia. Some of these villages boasted hundreds of well-constructed houses.⁴⁷ One of the smaller settlements was Beidha.

At Beidha, the villagers herded goats, sowed barley and wheat, and also hunted game and foraged nuts.⁴⁸ In the beginning, they built pit houses with sunken floors, stone foundations, and wooden posts supporting roofs. But around 6650 BC, their homes were destroyed by fire.

From those ashes rose a new beginning. Departing from the old semisubterranean pit dwellings, they built aboveground designs. They erected walls of mud bricks and sandstone slabs and topped them with flat roofs. They covered floors in plaster and even decorated some with black paint or burnished black-and-red patterns.⁴⁹

Most importantly, their buildings were no longer round but rectangular.

Erecting rectangular houses demanded advanced building techniques, such as joining perpendicular walls at ninety-degree angles. But it gave them significant benefits. These homes could be more easily divided into multiple rooms, each space tailored to a specific purpose. They could more easily be expanded, with additional rooms built adjacent to existing ones. Flat roofs also provided new opportunities, such as the potential for upward expansion and rooftop private outdoor space. The shift to rectangular buildings fostered denser communities by allowing for more tightly knit, organized settlements.



Five-room mud brick house, Abu Hureyra, Syria, ca. 6500 BC.

Over time, Beidha's population doubled to a few hundred people. Residents built larger houses with up to five rooms, replacing the single-room homes of their earlier pit dwellings. Where circular homes could house one or two individuals, the rectangular multiroom structures could accommodate entire extended families. As agriculture led to an increase in village populations and social complexity, the rectangular plan offered a more practical dwelling arrangement.

This wasn't unique to Beidha. Across the Levant, a pattern emerged. As communities developed their farming and herding skills, they would shift from building circular dwellings to rectangular ones. For instance, Jericho, located in today's West Bank, began as a settlement of circular pit dwellings established by the Natufians. The Pre-Pottery Neolithic people initially continued this tradition of circular pit homes. By 9600 BC, the inhabitants had constructed a wall partially enclosing their village, perhaps to protect from floods, making it the first known fortified town.⁵⁰ Their crowning achievement was the Tower of Jericho, a 28-foot-tall round stone structure considered humanity's first work of monumental architecture. It may have had a ceremonial purpose, maybe as a landmark to draw outsiders into their communal way of life.⁵¹

Around 7000 BC, Jericho became one of the largest villages of its time, housing possibly up to 3,000 individuals. The village architecture of rectangular homes built from mud bricks reflected this. Even the bricks evolved. Where initially bricks had flat bottoms and rounded tops, they became perfectly cuboid, allowing better stacking and creating more stable construction.⁵²

This transition from round to rectangular dwellings happened not only in the Near East, but in agricultural societies worldwide, from Mesoamerica to Asia.⁵³ People arrived at rectangular building independently, suggesting it was a widely favored solution as communities became better farmers. Archaeologist Kent Flannery⁵⁴ noted how food storage played an important role in this transition. He found that in early villages with circular or oval-shaped huts, storage facilities typically stood out in the open. This pointed to food being shared communally. This practice resembles the egalitarian culture still observed by hunter-gatherers today, which reduces individual risk as environmental conditions change.⁵⁵ But the rise of rectangular homes with multiple rooms brought a major change. Increasingly, one room within the dwelling itself was specifically dedicated to storage. As agricultural societies advanced, the rectilinear house gave households a greater autonomy in managing surplus resources.

This architectural shift came along with a change in social dynamics. As Flannery emphasized, it changed the risk and reward equation for households. When storage was communal, individual households had little incentive to maximize resources for themselves, since everything was likely shared. Private storage changed this. Suddenly, houses within the village had an incentive to compete, each family striving to maximize resources for their own household. At the same time, as early farming villages expanded, it was likely that fewer families were closely related by blood. This could have made them increasingly less inclined to share resources with their neighbors.

One researcher noted that communities with privatized storage had a more “closed” site layout. They featured “either widely spaced household units or closed-in eating and storage areas, in order to avoid the jealousy and conflict which might arise from one household visibly having more than another.”⁵⁶

Yet paradoxically, the very walls hiding indoor activities may have intensified jealousy as well. As anthropologist Peter Wilson argued, the presence of walls fundamentally altered our ancestors’ visual attention, reshaping their drives and emotions. Hunter-gatherers could carry only what they could move, but once people settled in dwellings, they could accumulate, conceal, and display food, wealth, and status. This shift toward village life, Wilson suggests, was as transformational as when our distant ancestors descended from living in trees to living on the ground, which freed our hands from grasping. Villagers, he argued, became “domesticated people,” psychologically and socially distinct from those in roaming bands.⁵⁷

Meanwhile, the number of farmers was growing, outperforming hunter-gatherer societies. By cultivating crops and domesticating animals, agricultural communities could produce food more reliably and efficiently than through foraging alone. This sustained growing populations and more complex societies. Archaeologist Gordon Childe, who coined the term “Neolithic Revolution,” or Agricultural Revolution, estimated that in aboriginal America, unimproved land could sustain a population ranging from about .05 to .1 person per square mile. In contrast, Neolithic societies on the Pacific Islands today can sustain populations of approximately thirty or more people per square mile.⁵⁸ The transition from a hunter-gatherer lifestyle to an agricultural one dramatically expanded the Earth’s “human carrying capacity,” the maximum number of people that could be supported.

Given these advantages, it should be no surprise that the agricultural transition ultimately unfolded independently in at least eleven different regions worldwide.⁵⁹ This revolutionary shift began about 10,000 to 12,000 years ago, spanning from the cultivation of rice in East Asia to the domestication of squash in the Americas. As agricultural knowledge spread, in regions like the Mediterranean, humans selected and cultivated hundreds of varieties of crops, from olives to grapes.⁶⁰ Farming produced the surplus food that enabled more populous, specialized, and socially complex societies—though some might argue it was a double-edged sword.

Farming led to intensified resource exploitation and fierce competition for scarce resources within defined territories.⁶¹ Close contact with domesticated animals and wild pests, such as rodents, increased the incidence of zoonotic diseases like influenza. Dense, sedentary populations, with their

higher rates of contact, created perfect conditions for the spread of diseases like measles and smallpox. Farmers and their settlements contributed to deforestation, soil erosion, and water pollution. At times, the very practices that enabled growth also sowed the seeds of their own destruction. Even Beidha was eventually abandoned, perhaps due to the depletion of grazing lands, firewood, and fertile soil.⁶²

When I visited Beidha, it was difficult to imagine it was once a much greener place, with grasslands and trees. Today it is an arid desert. As the climate grew more arid over time, the once fertile land became less capable of supporting agriculture. People abandoned village life.

My stay at a Bedouin camp in Wadi Rum a few hours away provided a stark contrast. This otherworldly red desert—immortalized as alien terrain in films like *Star Wars* and *Dune*—at first seems a barren wasteland. Yet the Bedouins, with their goat- and camel-wool tents, seem well adapted to desert life. Their nomadic life in tents, radically different from agricultural communities in houses, shows that settled life is not the only way.

While the transition to rectangular buildings may have been an important step in human development, it wasn't the only path—or an irreversible one. Some societies, after embracing rectangular structures with private storage, returned to circular dwellings and shared storage, perhaps to share the burden of risk in changing economic conditions. And though permanent settlements are the norm for most of us, nomadic and seminomadic traditions persist today.

Many Bedouins clearly prefer it that way. Life in tents immerses them in the sweeping desert landscape and the unpolluted night sky. An archaeologist once observed how Bedouins have a fierce disdain for city life, citing a “mystical hatred of the roof” and a “religious revulsion to the house.”⁶³ Their rejection of rigid walls echoes the ancient Rechabites who, as Jeremiah chronicled, swore, “We do not drink wine.” And commanded: “You must never build houses, sow seed or plant vineyards; . . . [you] must always live in tents. Then you will live a long time.”⁶⁴ And so, not all succumbed to the comforts—and constraints—of rectilinear life.

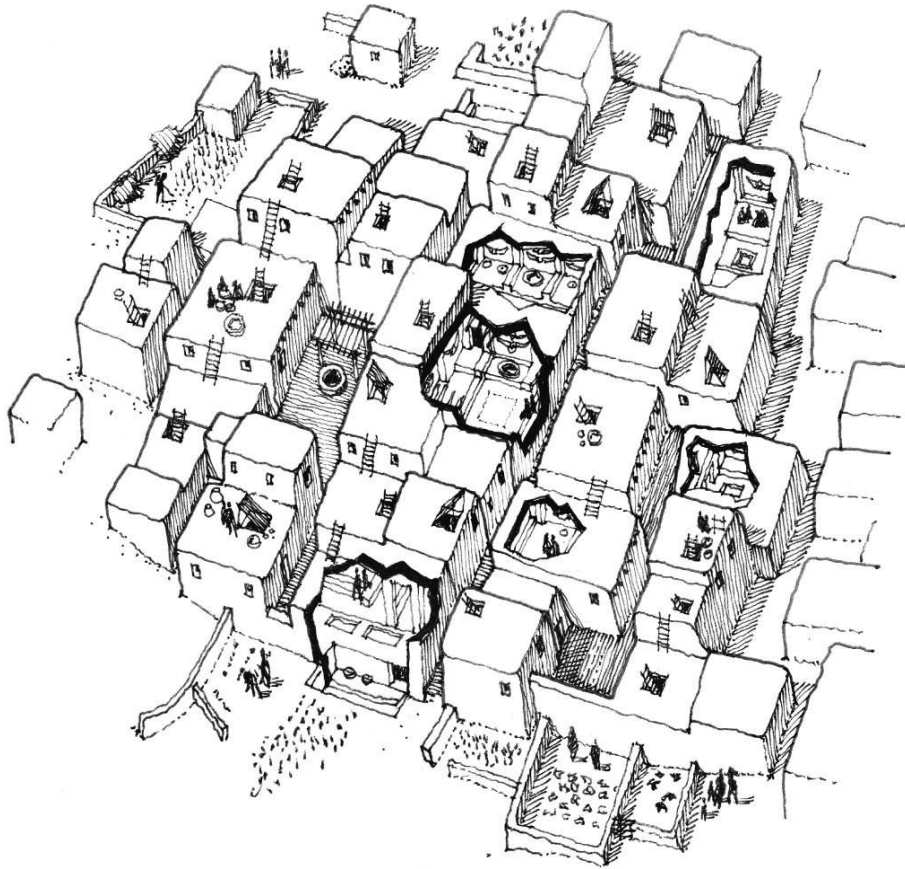
When Homes Touch

“On a cold November day in 1958, just before nightfall,” British archaeologist James Mellaart recalled, he finally “reached the double mound of Çatal Hüyük.”⁶⁵ He had first spotted the mound, “a third of a mile in length,” while exploring the Konya plain of the Anatolian plateau in 1952. But, as he admitted, “dysentery and lack of transport prevented its more formal discovery.”

Arriving with a team of archaeologists, he found: “Much . . . was covered by turf and ruin-weed (*Peganum harmala*) but where the prevailing south-westerly winds had scoured its surface bare there were unmistakable traces of mud-brick buildings, burned red in a conflagration contrasting with patches of grey ash, broken bones, potsherds and obsidian tools and weapons. To our surprise these were found not only at the bottom of the mound, but they continued right up to the top, some 15 metres above the level of the plain.”

Thus began the “discovery” of Çatalhöyük—though locals had long been aware of it. The settlement grew as an important supplier of obsidian, a volcanic rock prized for crafting blades. Occupied for over two millennia, it likely peaked at about 800 people in 6500 BC, far below earlier estimates of several thousands.⁶⁶ Nevertheless, it was one of the largest Neolithic villages of the time.

The village was essentially a massive honeycomb of cuboid houses pressed against each other without ground-level streets. Çatalhöyük was unlike anything seen since. Perhaps its closest modern parallel is found in dense informal settlements such as Rio de Janeiro's favelas, where houses are packed so closely that they seem a continuous mass.



Village of Çatalhöyük, Turkey, ca. 6700 BC. ⁶⁷

The wheel had not yet been invented, so streets were not necessary for wheeled transport. Instead, residents descended into their homes not through front doors but through roof hatches using wooden ladders. This arrangement may have offered some advantages, such as defense. Large windows and doors would have made the interior too hot. And similar to Middle Eastern cities today, these rooftops were active living spaces. Some roofs even had ovens. However, entering homes by ladder would have made life challenging, especially for the elderly and pregnant women.

The sight of Çatalhöyük, with people living in adjacent boxes, would have likely stunned the hunter-gatherers of the time. They might have encountered more people in a single day than they would have seen in their entire lifetime. Their camps were open and transparent. But Çatalhöyük was a maze of enclosed spaces. Activities that had been public were now hidden behind walls.

The appeal of living in Çatalhöyük in terms of quality of life was not immediately obvious, aside from participation in the obsidian trade. Most houses had no windows and only had roof openings. These openings doubled as access into the dwelling and smokestacks for hearths located beneath them, filling interiors with smoke. The word “window” itself, derived from Old Norse *vindauga* (“wind eye”), speaks to this early form of ventilation. Yet this rudimentary arrangement brought health hazards. Skeletal remains showed the buildup of sooty black deposits on the inside of rib cages of older residents, probably a consequence of life in smoke-filled homes. ⁶⁸

The village also struggled with hygiene. When a family vacated a home, it often became a dump for waste, including human and animal feces. ⁶⁹ Infectious diseases spread easily in such unsanitary conditions, with up to a third of human bones showing signs of infected lesions. ⁷⁰

But villagers did not just have to endure bad smells. ⁷¹ Çatalhöyük's homes required constant upkeep. Built largely from mud brick, the houses were vulnerable to rain. Mud brick deteriorates quickly when wet. Lacking proper drainage or strong foundations, homes demanded frequent repair or rebuilding.

Residents invested significant labor in maintenance. They replastered walls and sleeping platforms with white clay, gypsum, or lime to keep their interiors fresh and clean. ⁷² This maintenance process may have occurred up to three times a year. Some houses had been replastered about 450 times, ⁷³ lasting up to a hundred years. Builders then leveled entire homes and constructed new ones on top of the old foundations. Some structures had been rebuilt up to six times. Over generations, this practice caused the settlement to rise ever higher, eventually reaching sixty-six feet—roughly the height of a modern six-story building.

Villagers may have been willing to endure these challenges not only for economic reasons but also because they were deeply attached to their homes: Wall paintings were found in almost every house and often included elaborate symbols.

Residents divided their homes into two distinct zones. One was a small room centered around a hearth. It may have functioned as a kitchen area, judging by the ovens and clay bins for storing food found there.

But it was the main room that made Çatalhöyük famous. This room, typically cleaner than the other, had sleeping platforms. The walls and the platforms were covered with paintings, some bearing up to forty layers of plaster and paint. These murals offer windows into their worldview. Some images were morbid, showing vultures pecking at human corpses. Others featured abstract geometric designs, like a nine-foot mural possibly depicting a leopard skin. Many murals depicted wild animals and hunting scenes, even as the villagers increasingly domesticated animals, perhaps to evoke memories of the past.

Most dramatic were the protruding bull horn decorations, or *bucrania*, often set into the wall. Some were placed on small columns inside the room. They were often covered with plaster and painted with ochre red. In one example, three sets of bull horns were stacked one above the other on a wall, with a large human figurine above, its legs splayed wide. The walls also featured platforms with animal skulls, beaks, teeth, and tusks. The residents seemed to choose, above all, the pointier animal remains.

All of this may have been quite shocking to an outsider. Archaeologist Steven Mithen likened it to a “monstrous scene of bulls bursting from the wall. There are three of them at about waist-height—white heads striped with black and red, from which sprout enormous pointed horns. . . . Around the bulls the walls are painted with bold geometric designs—sharp, oppressive images above handprints in red and black.” ⁷⁴

Other symbolic components were found throughout the home and the village. Small figurines, often quickly made and discarded, were thought to be part of daily spiritual practices, akin to prayers. In other villages, archaeologists have also found decapitated animal figures that seem to have been ritualistically “killed.” ⁷⁵

Residents may have also been attached to their abodes because, unlike today, home was also a burial site. Ancestors were buried in fetal positions beneath the platforms. Some bodies were exhumed, their skulls possibly removed for use in ceremonies. These were placed in wall niches, almost as if they were watching over their descendants.

Anthropologist Ian Hodder, who spent decades excavating the site, identified a special category of dwellings. He called them “History Houses.” ⁷⁶ These featured more symbolism and more burials, one holding as many as sixty-two bodies. Though these houses likely held special religious significance, they showed no signs of greater wealth or storage capacity. This suggests a society where religious status did not bring material advantage. The archaeological evidence also hints at a

relative, if gruesome, gender equality: Both male and female skulls were used.⁷⁷ Men and women also had similar levels of darkened lungs, suggesting they spent equal time at home.

Importantly, these history houses had longer lifespans than other buildings. “Houses with many burials tend to be long lasting,”⁷⁸ observed Hodder. He argued that “making history” was essential in agricultural communities where labor had delayed payoffs. In contrast to the immediate return of foraging, farming required a “greater sense of temporal depth, history, and memory.”⁷⁹ Hodder notes, “The emergence of greater temporal depth was a necessary condition for dense settled life, the delayed returns of intensive subsistence systems.” The repeated rebuilding of homes, the burials, and the elaborate symbolism—all played out within the fabric of domestic life—maintained a shared sense of historical community.

Yet this ambitious experiment in communal living eventually faced significant challenges. Demand for wooden building materials led to extensive deforestation around Çatalhöyük. As trees vanished, residents had to travel farther for resources, adding new burdens to their daily work. The stresses of village life may have taken a toll as well. Evidence of interpersonal violence is found in the skulls of residents—of ninety-three skulls examined, twenty-five showed healed fractures, mostly among women, often from blows to the back of the head with round objects. Given that most of the head injuries occurred during the period of highest population density, some believe elevated stress and conflict may have been due to overcrowding.⁸⁰

By 6000 BC, Çatalhöyük was abandoned. It was part of a broader collapse of Neolithic settlements across the region. From Israel to Palestine, farming villages were deserted. People likely scattered into smaller hamlets. While changing climate patterns, including a drop in temperatures, played a role, the inhabitants themselves contributed significantly to the downfall of their villages. Deforestation, overcultivation, and overgrazing depleted the soil’s fertility. The pollution from human and animal waste further strained the ecosystems they were living in.⁸¹

At ‘Ain Ghazal in the Jordan Valley, the houses themselves contributed to the village’s decline. Villagers upgraded their homes by plastering floors with lime, which made them more water-resistant. Some builders spread the lime plaster as high as six inches up walls, posts, and hearths. But producing lime required burning limestone, heating it to between 750 and 850 degrees Celsius and accelerating deforestation. Trees vanished within a three-kilometer radius of ‘Ain Ghazal.⁸² Without the stabilizing tree roots, the soil eroded during periods of rainfall and became less fertile. With the soil already exhausted from overcultivation, crop yields shrank and the village was abandoned. Although other factors such as water pollution from human waste likely also played a role, the reliance on plaster technology influenced its downfall.⁸³

As archaeologists Nigel Goring-Morris and Anna Belfer-Cohen observed, permanent settlement during this time became increasingly unsustainable: “The whole fragile Neolithic network collapsed in upon itself.” By contrast, “the long duration of earlier mobile hunter-gatherer adaptations had enabled the ‘fine-tuning’ balance between people, the environment, and the resources necessary to avoid overexploitation.”⁸⁴

As our ancestors experimented with agriculture, housing, and construction techniques, they created larger and more permanent habitats. In the process, they faced new challenges. They lacked sewers and safe drinking water. They lacked reliable agriculture to support growing populations. Without workable solutions to these challenges of collective life—not realized until the Early Bronze Age—these villages hit a ceiling. Today, Çatalhöyük is a mound in the Turkish landscape, although one recognized by UNESCO as “a site of great importance for our understanding of the first steps toward ‘civilization.’”⁸⁵

When our ancestors transitioned from nomadic to settled life, they entered a new “indoor” phase of human existence. The walls they built reshaped not only their physical and mental world but also their relationship with nature. The problems they faced, from resource depletion to environmental degradation, echo those we struggle with today. As landscape architect Anne Whiston Spirn noted,

“Modern urban problems are no different, in essence, from those that plagued ancient cities, except in degree, in the toxicity and persistence of new contaminants, and the extent of the earth that is now urbanized.” ⁸⁶

The issue of home maintenance persists as well. As an owner of a mere hundred-year-old home, I find myself painting basement floors, clearing French drains, and repairing endless small failures. With a drill in hand to hang a family photo, I sense an odd parallel between those ancient residents who carved niches in their walls for ceremonial skulls. They worried about deteriorating mud brick. I worry about asbestos in insulation and lead in old paint. The tools and decorations have changed, but our desire to make our mark on these walls remains deeply human—even if there are hidden dangers in living a settled life.

Two

Cities of Mud

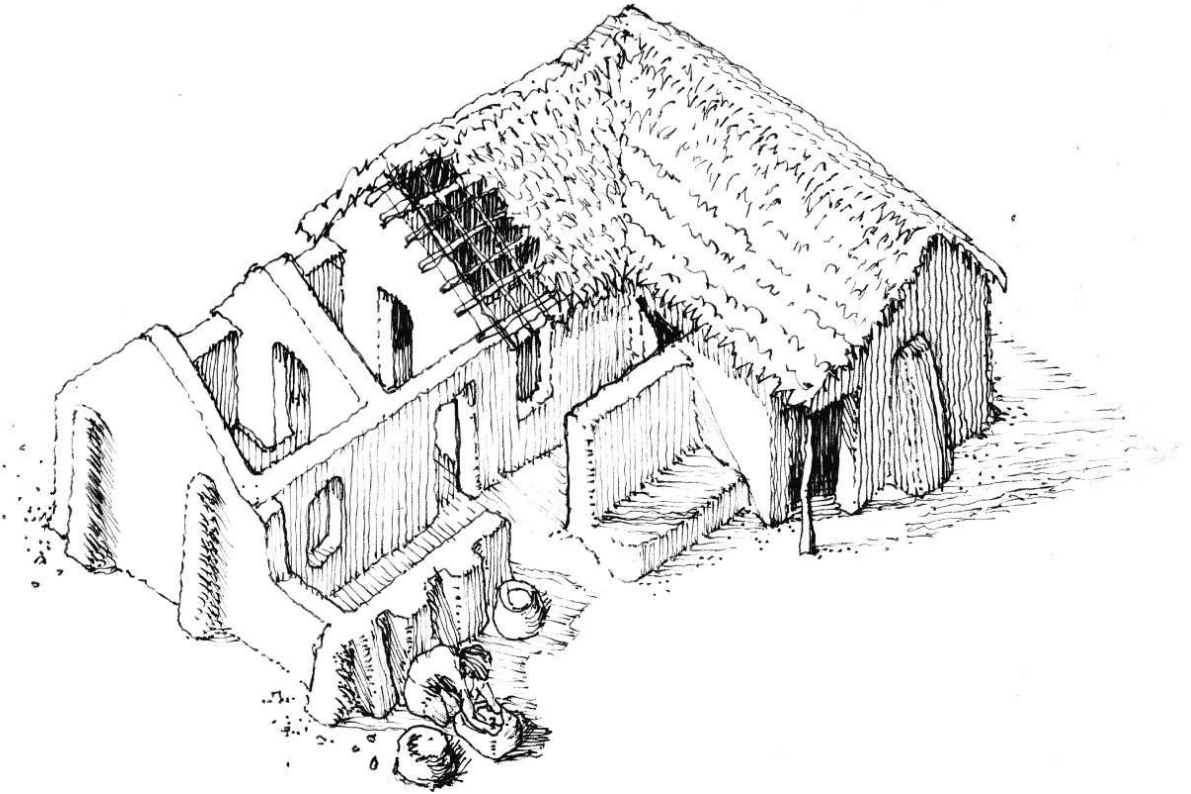
The Extended House

“In those ancient days . . . the lord of broad wisdom, Enki, the master of destinies . . . founded dwelling places; he took in his hand waters to encourage and create good seed; he laid out side by side the Tigris and the Euphrates, and caused them to bring water from the mountains; he scoured out the smaller streams, and positioned the other watercourses. . . . Enki made spacious sheepfolds and cattle-pens, and provided shepherds and herdsmen; he founded cities and settlements throughout the earth, and made the black-headed [Sumerians] multiply.”¹

In “Debate Between Bird and Fish,” a Sumerian essay dating back to the third millennium BC, it was Enki, the god of water, who created the world by laying out the great rivers. This belief reflects the reality of life in Mesopotamia. For it was in this “land between rivers”—for that is what *Mesopotamia* means in ancient Greek—that a new chapter in human history began.

Around 6000 BC, as farming villages in present-day Jordan, Israel, and Palestine were being abandoned, a new wave of settlement emerged in the foothills of Northern Mesopotamia. The twin waterways of the Euphrates and Tigris, born in the highlands of eastern Turkey and stretching to the Persian Gulf, provided the water, reeds, and clay that would build their world. These rivers—one fast flowing and unpredictable, the other broad and steady—would become both a lifeline and a challenge to the people who settled their banks.

The settlement of Tell Hassuna stood along the Tigris River. It was part of the Hassuna culture—one of the earliest farming societies in Northern Mesopotamia, centered in what is now northern Iraq. Villagers built small homes for nuclear families, consisting of just a few rooms. Excavators in 1943 found “the walls were built of lumps of mud of various sizes in a manner approximating the local modern practice. Smaller lumps were used to fill the gaps, and the faces were smoothed.”² These rudimentary buildings were likely topped with low-pitched roofs made of branches and covered in mud.



[Follow for extended description](#)

Packed-mud house, Tell Hassuna, Northern Iraq, ca. 5500 BC. ³

However, as agriculture intensified over the centuries, the villagers added rooms to their homes, seemingly at random. Their homes grew into sprawling complexes of fifteen to twenty rooms. Drawing on broader patterns, archaeologist Kent Flannery observed that this was the “next stage of village development, the replacement of nuclear households by extended family households.” ⁴ This likely resulted from the demands of early farming: “The combination of two tasks—cereal agriculture and the grazing of herd animals—requires a division of labor beyond the capacity of a nuclear family.” Success required an extended family of fifteen to twenty people to manage fields, tend herds, and diversify into activities such as craft making.

Over time, the villagers expanded their houses into complexes of grouped homes arranged around large open courtyards. This enabled them to enclose flocks at night. These homes, according to the excavators, “show the first clear signs of planning.” ⁵

Eventually, the fifteen- to twenty-room complexes began to appear in regularized forms. Previously, houses had a larger main room with one or more smaller side rooms. But the internal organization of the new complexes now introduced three distinct types of rooms. The larger rooms of 150 square feet or more were likely used as central gathering areas for communal activities. Elongated rooms of around 100 square feet served as sleeping or working areas. And square-shaped rooms of approximately 20 square feet were probably used for storage. ⁶ Residents were now intentionally building structures with specialized rooms for the extended family from the start.

This transformation from improvised to planned construction has been described as the “florescence of architecture.” ⁷ With their larger homes incorporating various room types, the inhabitants of Tell Hassuna contributed to a broader trend toward increased social and economic

complexity. The new houses were also more efficient, allowing for population densities of up to an estimated 160 people per acre—a figure that rivals some of the most densely populated areas in the world today. Archaeologist Kent Flannery noted, “It is clear that planned, extended family households can produce much higher densities.”⁸

But as the residents built up their village, they had to contend with the tensions of their growing settlement. The people of the Hassuna culture used stamped seals to impress clay, probably to mark ownership and safeguard property. The 1943 discovery of 2,400 clay balls hints at a darker side of this new societal development. They were quite likely used as sling missiles, either for hunting or defending what had been built.

Slightly later in time and a few hundred miles downstream toward the south, the people of Tell es-Sawwan faced a different challenge. They belonged to the Samarra culture, an early farming society in what is now north-central Iraq, about seventy miles north of modern-day Baghdad. Located below the 200-millimeter rainfall line, where annual rainfall drops below eight inches, Tell es-Sawwan lacked sufficient water for stable agriculture.

The farmers dug small ditches to channel the Tigris floods to their fields, allowing them to cultivate barley, wheat, and linseed. This mastery over water would come to define Mesopotamian civilization. It increased food security and population density in otherwise marginal lands, while the labor-intensive demands of water management spurred greater social complexity and stratification.⁹

The residents also had to innovate in construction. Unlike in the north, they did not have access to stone and wood. Without forests or quarries, they had no choice but to exploit the abundant clay in the region’s alluvial plains. They built their homes with mud bricks—the primary building material of Southern Mesopotamia.

Mud bricks improved upon earlier packed-earth techniques, which demanded skilled workers and precise attention to make sure the foundations and walls were consistently wide enough. The bricks, in contrast, allowed for simplified, more standardized construction. And they could be more easily transported, whereas packed mud relied on the material being available closer to the site.

However, the river clay was often too sandy. So the residents needed to refine the river clay’s consistency. They mixed it with chopped straw, creating a composite material, much like how rebar reinforces modern concrete. Straw and mud together create a substance stronger than either by itself. Dried mud is good at withstanding squeezing. Straw is good at preventing tearing. Combined, they balance each other’s weaknesses. Straw alone crumbles when you squeeze it, and dried mud pulverizes when you tear it apart. To further reduce brittleness, they also added dung, which, like straw, helped bind the mud particles together, making it less prone to cracking.¹⁰

They then pressed this mixture into molds that were open at both ends. After letting them bake for a few weeks, they had long cigar-shaped bricks, roughly the size of a loaf of bread. Builders arranged them in precise patterns, like the header-and-stretcher fashion—alternating layers of bricks laid with their short ends (headers) and long sides (stretchers) parallel to the wall’s surface. Finally, they sealed them with clay plaster, creating thick, strong walls that better resisted cracking and crumbling.

As simple as it sounds, it was a labor-intensive process. Producing the straw alone demanded a significant amount of land. A mere hundred bricks would have required at least 130 pounds of straw, the yield of roughly a third of an acre.¹¹ A single house would have required several acres of cultivated land.

The Samarrans carefully planned their homes as well. The buildings were uniquely recognizable by an enfilade: a sequence of aligned doorways along a central axis. This arrangement created a direct line of sight through the building. It offered an imposing view as well as a more efficient means of movement within the home. It was, in effect, a precursor to the modern corridor.

Villagers arranged their houses in clusters, with courtyards between the buildings. These accommodated ovens and granaries, suggesting a collective approach to resource management and irrigation.¹² By around 5900 BC, Tell es-Sawwan was surrounded by a deep ditch and a buttressed

wall. Throughout Samarran villages, clay jars were found with gypsum lids and seal impressions, marking ownership. These developments, along with the presence of clay balls possibly used as sling missiles, indicate a growing anxiety over property protection—and possibly a fear of outsiders pillaging the toils of their irrigated fields.

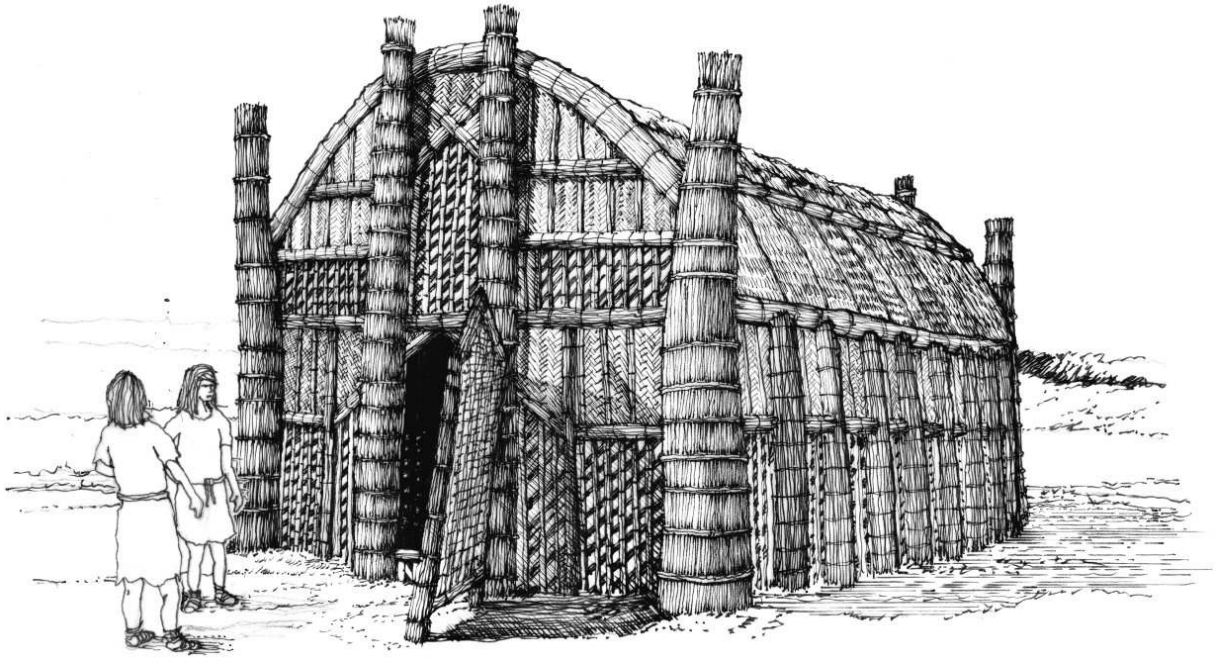
Farther south near the head of the Persian Gulf, the Ubaid people took their architecture one step further. Their beginnings overlap with the Samarra culture around the sixth millennium BC but endured much longer—until about 3800 BC. At the time, the gulf’s shoreline extended far inland, deep into what is now southern Iraq. As archaeologist Leonard Woolley vividly describes it, the Ubaid came to a land of marshes, “dense with reeds and opening out here and there into lagoons or clear channels. . . . It was a country rich enough in promise to make a certain amount of hardship well worthwhile.” ¹³

In these marshy southern reaches of Mesopotamia, reeds became an abundant and adaptable building material. Lacking access to timber or stone, the Ubaid built simple reed huts. They even built larger structures entirely from reed. These consisted of reed bundles, some up to three feet thick, bent into arches. Reed mats covered these arches to create long tunnel-shaped buildings.

These structures left little trace in the archaeological record, apart from depictions on Mesopotamian cylinder seals. Yet similar vernacular forms exist in Iraqi wetlands today. One such example is the *mudhif*—a long, arched guesthouse used by the Marsh Arabs. ¹⁴ Their contemporary reed canoes also look surprisingly like a model canoe found in a later Mesopotamian royal cemetery. ¹⁵

“Now a Mudhif you can’t picture until you have seen it,” wrote the English traveler Gertrude Bell in 1920. “It is constructed of reeds, reed mats spread over reed bundles, arching over and meeting at the top, so that the whole is a perfectly regular and exquisitely constructed yellow tunnel, 50 yards long. . . . the whole lighted by fire and a couple of small lamps, and the end of the Mudhif fading away into a golden gloom. Glorious.” ¹⁶

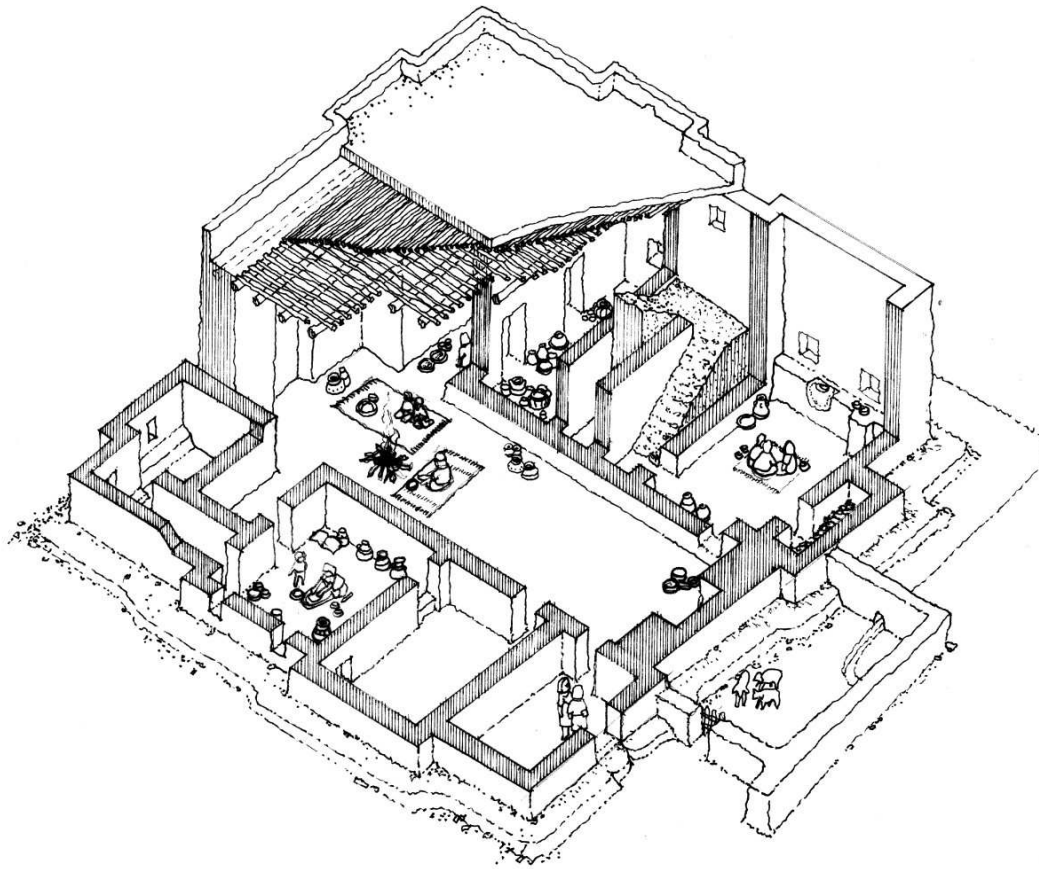
While poorer inhabitants likely dwelled in marshland reed huts, the Ubaid people also built more substantial permanent dwellings than the cultures before them. Some were as large as two thousand square feet and were built from molded mud bricks. These were organized around a central hall flanked by smaller rooms on each side, known as the tripartite design. Ubaid builders may have inherited the house plan from the Samarrans and possibly expanded the enfilade into a broad central hall, though this remains uncertain.



Traditional reed house (*mudhif*), Southern Iraq.

The tripartite design created a hierarchy of spaces. The deeper one moved through successive rooms, the more intimate they became. Private areas like storage spaces and bedrooms required passage through multiple chambers. Meanwhile, the central hall served as a versatile space, lending the building a monumental quality.

As Ubaid settlements grew in scale, social hierarchy became visible in the built environment. At Tell Gawra around 4400 BC, a few larger houses dominated access to communal granaries.¹⁷ They were often visible from afar, serving as focal points.¹⁸ These “prestige houses,” typical of larger Ubaid villages, may have distributed food to other houses, or they could have had a spiritual or political purpose. Across ancient societies, leaders often operated from their homes, and their homes were typically larger to accommodate social gatherings.²⁰ This tripartite design, with its central communal area, was ideal for these domestic and civic purposes.



Tripartite house, Tell Madhur, Iraq, ca. 4500 BC. ¹⁹

The tripartite house design also influenced religious architecture. In fact, it appears more frequently in what are believed to be public or ceremonial buildings than in domestic ones. Early temples adopted this layout of a central hall lined by smaller side rooms. Builders further distinguished these buildings with features such as niche-and-buttress facades that created striped visual effects and dynamic shadows. As archaeologist Pascal Butterlin observed, the house became “a symbolic unit that could be domestic, prestigious, or religious.” ²¹ It offered a versatile spatial form, adaptable to shifting social, spiritual, and political roles.

Some Ubaid temples may have even adhered to standardized measurements. One scholar proposed the existence of an “Ubaid cubit,” a standard unit measuring approximately twenty-eight inches. He concluded that this was used at the Temple VI in Eridu (around 4000 BC), suggesting an advanced level of abstract planning. ²² However, there is no evidence of a standardized system across the broader Ubaid world.

Still, the Ubaid cultural footprint stretched from the Persian Gulf to northern Syria, bringing cultural norms with them. One of their most important legacies was the tripartite house. “The formula proved remarkably durable,” noted Butterlin. ²³ He argued it became an important element of social organization. “The intensive use of tripartite buildings probably permitted the emergence of chiefdoms and states in a proto-urban context.” It was, he concluded, “a true archetype . . . frequently related to the birth of the first cities.” After thousands of years of building homes in Mesopotamia, in these Ubaid tripartite houses of mud brick, we may finally see the early outlines of future urban civilization.

The Ubaid builders' tripartite design accomplished something architects still strive for today: a thoughtful balance between communal and private space. Modern homes continue to follow this logic. They have larger shared living areas and smaller private rooms—and an intuitive flow connecting them. It almost certainly did not spring from a single source of invention. The Ubaid solution, like many others across time and place, reflects a universal logic of habitation—born from the practical realities of how people live together. In the end, there are only so many ways to shape space around the patterns of daily life.

The Ubaid homes also offer lessons in sustainable architecture. While today's energy-efficient buildings rely on composites, laminates, and synthetic insulators, Ubaid builders created relatively durable homes from only earth and sun. Their thick mud brick walls, typically eighteen to twenty-four inches wide, helped regulate indoor temperatures by absorbing heat throughout the warm day and releasing it during the cooler night. And where most of our construction material ends up in landfills, these ancient homes returned, in time, to the soil they rose from. They gradually accumulated into layered mounds—known as tells—that today form the archaeological signature of the region.

In our era of increasing environmental concerns, these elegant, low-tech solutions deserve renewed attention. Nevertheless, the Mesopotamians had environmental problems of their own. The irrigation channels that gave life to their fields slowly filled with silt, demanding constant maintenance. Inhabitants were caught in a perpetual struggle with the very force that had allowed their civilization to flourish: the water flowing from the rivers. It was a constant reminder of the delicate balance they had struck with nature.

Proto-cities

In 1937, mystery writer Agatha Christie accompanied her archaeologist husband Max Mallowan on various digs in Syria. She had first met him seven years earlier at an excavation site. Over the following decades, she joined him on numerous expeditions across the region, cleaning and cataloging artifacts, and even developing film. As she described later in a poem, "A-Sitting on a Tell," she met an archaeologist amid the trenches of a dig. While he passionately extolled the nuances of measuring prehistoric pots, her mind wandered to plotting murders—imagining ways to "kill a millionaire," and stash the body in a "Frigidaire."²⁴

Little did Christie know that she was witnessing the discovery of an intriguing mystery—one that would change the origin story of urbanism. During this time, Mallowan made what would prove to be one of his most fortunate discoveries. In Syria, he was the first to excavate a site known as Tell Brak. There, he found an ancient temple filled with enigmatic figurines with distinctive eye motifs. Tell Brak, along with Khirbat al-Fakhar, would fundamentally challenge our understanding of how early cities began.

For millennia, the pattern of village life in Mesopotamia had followed a predictable cycle: When a settlement grew too large, when tensions arose between families or resources grew scarce, it would split like a cell dividing. One group would move away to establish a new settlement. But around 4000 BC, Tell Brak and Khirbat al-Fakhar departed from this pattern. Instead of splitting apart, they grew. Households clustered together in several neighborhood groups separated by open spaces. Each cluster functioned almost like a traditional village, but now these village-like units were part of something larger. Their scale was immense. Khirbat al-Fakhar sprawled across 750 acres, equal to five hundred football fields. Tell Brak was about 130 acres, still larger than other settlements.

These settlements were remarkable for their structure as well. Instead of a dense, cohesive urban core, they resembled a patchwork of household clusters interspersed with open spaces.²⁵ All of this defied conventional ideas of urbanism. They were too expansive to be called a village. At the same time, they could not be called cities, since they showed no signs of central authority. They had no

grand palaces, no soaring temples rising above the skyline. Scholars would come to refer to them as “proto-cities.”

This discovery upended the story of urbanization, as traditionally told. Scholars long believed that cities began from the minds of powerful rulers or the necessities of complex irrigation systems. But the evidence from Tell Brak and Khirbat al-Fakhar offers a fascinating alternative: Some cities could have emerged organically, shaped by the collective actions of countless households rather than the decrees of a central authority.²⁶ Complexity here was not imposed from above but grew from below.

This was no isolated phenomenon. Around the same time, ancient Trypillia settlements in present-day Ukraine exhibited similar traits. These settlements spanned up to 300 hectares, yet they lacked monumental buildings and evidence of centralized power structures. The parallel emergence of such settlements suggests a shared pattern of urban development across different regions, pointing to a broader decentralized model of early urbanization.²⁷

What drove people to create these unprecedented communities in Mesopotamia? One clue lies in a piece of volcanic glass. Obsidian, prized for its ability to be made into sharp tools, was likely the economic engine. Imported from hundreds of miles away, this precious resource attracted people from far and wide. Each household became a workshop, which contributed to a network of decentralized production and trade. Organizing such exchanges required communication, coordination, and trust—which put these communities on a path toward growing complexity, a path toward urbanism.

Yet with this growth came entirely new social challenges. Without centralized institutions to enforce order, residents needed to develop novel ways to manage conflict.

Archaeological evidence reveals that these communities were not quite egalitarian. At Tell Brak, the distribution of animal remains tells a story of social stratification. Pig remains—a cheaper source of meat—were found at the periphery, suggesting that poorer migrants lived in the outer clusters, much like the informal settlements that ring many megacities in the developing world today.²⁸

One peculiar aspect of the Mesopotamian proto-cities was the open spaces between clusters of households. These areas may have served as garden plots, like those in ancient Mesoamerican cities. Or they could have been buffers between groups to reduce conflict.²⁹ By maintaining physical separation, rather than living together in a single dense urban core, the inhabitants of Khirbat al-Fakhar and Tell Brak may have found a way to mitigate the social tensions associated with growing population density.

This evidence points to a new tentative conclusion. Some cities may have formed from a self-organizing process, emerging from the interactions of many independent agents rather than being directed by political elites. The pattern bears a resemblance to what biologists call “emergence”—as with termite mounds. These structures form without a leader directing the process, driven instead by individuals following simple rules—like following trails laid down by others, exchanging information, and building according to instinct.

Households likely didn’t set out to form large settlements from the beginning.³⁰ Instead, the settlement was the organic result of their collective motivations—which may have included feeding dependents, expanding households, and preserving autonomy. As archaeologist Jason Ur, who has studied these proto-cities in Mesopotamia, noted: “Urbanism does not appear to have originated with a single, powerful ruler or political entity. Instead, it was the organic outgrowth of many groups coming together.”³¹

The stories of Tell Brak and Khirbat al-Fakhar reveal two possible trajectories for these proto-cities. Between 4000 and 3800 BC, Tell Brak rapidly expanded, possibly housing up to 20,000 people within 300 acres.^{32, 33} Since nearby settlements were abandoned, it may be that migration drove this expansion. As the population increased, the settlement transformed its structure. Unlike traditional cities that expanded outward from a center, its suburbs grew inward, merging with the central core.

The outskirts became specialized zones for various functions. There was an industrial area equipped with bread ovens and pottery kilns. Another area was essentially a massive two- to three-hectare trash mound. This suggested that the inhabitants pushed such less-desirable activities to the periphery, as happens in modern cities.³⁴

But Tell Brak's growth reached natural constraints. Northern Mesopotamian settlements relied on cultivating a growing hinterland, leaving traces that persist to this day—over six thousand kilometers of “hollow ways,” the sunken paths formed by humans and livestock walking through agricultural fields.³⁵ Yet dry farming in Northern Mesopotamia had its limits, bounded by the land's productive capacity and the practical distance over which food could be transported. The more the settlement grew, the longer the farmers' commutes. These challenges capped the population at around 20,000 inhabitants.³⁶ Once a settlement reached this ceiling, it became increasingly vulnerable to environmental pressures. Fluctuations in rainfall or periodic droughts could lead to food shortages and social unrest.

As Tell Brak grew, its society became increasingly complex and hierarchical. Archaeologists have uncovered over one thousand clay seals used to secure jars and baskets or mark ownership of goods and raw materials. These artifacts reveal deepening social divisions within the community—potential sources of social stress.³⁷ Indeed, the challenges we associate with modern urban life were present from humanity's first experiments with urban living: from industrial hazards to long commutes and social inequities.

These tensions probably erupted into violence. Archaeologists discovered mass graves on the edge of Tell Brak containing skeletal remains with clear signs of trauma, especially blunt-force fractures to several skulls, indicating deliberate killings. The demographic profile of the victims—including women and children—suggests these graves may have been the result of internal conflict, rather than attacks by foreign invaders. The presence of animal remains buried alongside the human victims suggests the killings may have been followed by a feast or ritual.³⁸

The response to these growing challenges represented a turning point. As Tell Brak expanded, it built two impressive monumental buildings. First came a structure known as the Red Building, with walls up to six feet thick of distinctive red mud bricks. It stood near the industrial area and likely served as an early administrative center, overseeing production. By now, Tell Brak had firmly adopted centralized institutions.

But it was the second structure—the Eye Temple that Max Mallowan first discovered—that revealed something new about early urban society. The temple's design followed the same tripartite layout as a typical house but on a much larger scale. The builders had taken the familiar form of domestic architecture and transformed it, expanding the central hall into a sacred space and elevating the building on an artificial platform. “Archaeologists call it a ‘temple,’” explains Jason Ur, “but to the people of Brak, it was another household—this time the household of a god.”³⁹

This architectural choice was not accidental. It reflected deeply held beliefs that the divine realm was organized in families, and human society—especially its most important institutions—was modeled on this divine template. So naturally, the gods would dwell in houses and require the same provisions as people. Palaces and temples across Mesopotamia retained house-like forms. In fact, the terms for temple or palace in later Sumerian literally translated to “big house.” This shows that the house played a major role in shaping larger collectives and providing the structure for the first institutions. It became a template for organizing society at every scale, from family dwellings to divine spaces.

The temple's most distinctive feature—the thousands of “eye idols” found within—offers a window into the soul of early urban society. Made from clay or stone, they were simple enough that anyone could make them. There were so many of them that they appear to be a form of religious expression available to everyone, regardless of status. The ritual associated with the eye idols may have helped bind together an increasingly complex urban community.⁴⁰ While their purpose remains

a mystery, with no clear parallels except at Khirbat al-Fakhar, they speak to the role of shared symbols in urban life.

Their allure endures. At the Metropolitan Museum of Art, I stood before a display case of eye idols, each about the size of my palm. These idols felt quite intimate. A pair of oversized eyes tops their trapezoid-shaped bodies, making a profile similar to Mickey Mouse ears. Some larger idols featured smaller child figures carved onto their bodies, evoking parent-child relationships. Other idols had multiple sets of eyes. These wide owl-like eyes may have symbolized attentiveness to the gods, which was a recurring theme in later Mesopotamian art.

The remarkable resilience of these early urban settlements appears to have rested on more than just economics. Religion and shared belief systems likely anchored these communities as well.

With their oversized eyes and single unbroken eyebrow—a feature considered attractive in later Mesopotamia—the eye idols may have offered their users a common purpose. While most idols were found within the Eye Temple, many appeared in domestic spaces—perhaps as protective symbols, extending the divine presence into the intimate sphere of home.

We may never understand their true meaning. Yet the role of shared symbols endures. At the museum, I watched many visitors drifting to the gift shop to investigate designer pottery and fridge magnets depicting ancient art. These souvenirs may represent a similar desire for belonging—to carry home pieces of something greater than ourselves.

In time, this marvel of bottom-up urbanism gave way to a new order. By 3800 BC, Khirbat al-Fakhar was abandoned, its inhabitants relocating to Tell Hamoukar, a new site about a mile to the north. Archaeological evidence of over 1,200 clay projectiles suggests the city's fall. Around 3500 BC, Hamoukar's mud brick walls likely crumbled under assault, as attackers unleashed thousands of these sling "bullets." Perhaps it was the southern Uruk civilization, which was beginning to extend its influence into the region.⁴¹ After breaching the walls, the invaders set the city ablaze.

Tell Brak's fate was different. The city survived, but only as a colony of Uruk. Its distinctive culture faded away, and the production of eye idols ceased. A new urban age had begun. As the center of civilization shifted toward the south, the decentralized household-driven model that had defined Tell Brak gave way to a new urban form—one that would face challenges of its own.

The Courtyard House

In one of the earliest myths told by the Sumerians, "Inana and Enki," the goddess Inana challenges the god Enki to a drinking contest. She emerged victorious with the *mes*, divine decrees symbolizing the core elements of Sumerian civilization. "Holy Inana received the craft of the carpenter, the craft of the coppersmith, the craft of the scribe, the craft of the smith, the craft of the leather-worker, the craft of the fuller, the craft of the builder, the craft of the reed-worker,"⁴² the ancient myth recounts. However, these divine gifts, which enabled the functioning of their cities, were not all purely beneficial. Alongside civilization's advances, Inana also received "deceit" and "the plundering of cities" and "making lamentations." Bearing these powerful gifts, Inana returns triumphant to Uruk, the city under her protection, where she is greeted with a grand feast.

This myth captures the essential duality that would define early urban life, when humans first gathered in large numbers. On one hand, extraordinary innovations. On the other, formidable challenges. It was in Uruk where this new urban form of human dwelling would first take shape: the city, forever transforming humanity's relationship with the environment and with each other.

Uruk emerged around the fifth millennium BC on the fertile banks of the Euphrates River in Southern Mesopotamia, about 250 kilometers south of modern-day Baghdad. Natural barriers like the Zagros Mountains to the east and the Arabian Desert to the west provided the Sumerians with relative isolation, at least until horses were increasingly used in warfare. But they had to contend with an unforgiving environment. The scorching summers and arid climate spurred them to innovate. By

harnessing the annual floods of the Euphrates and Tigris Rivers through a vast network of canals, they transformed barren salt flats and marshes into fertile fields of barley, dates, figs, and chickpeas.

The irrigation system catalyzed a transformation in society. Building and maintaining canals required coordinated labor, technical planning, and centralized oversight. Dams were constructed to regulate water flow. Whether bureaucracy emerged to manage irrigation or irrigation expanded under a rising elite remains debated. Regardless, by the fourth millennium BC, state-level governance had formed—likely driven by the demands of infrastructure and the growing trade in vital and luxury goods.

Uruk benefited from significant technological advances. The wheel enabled oxen to pull three times their usual load. Plows boosted agricultural productivity. Boats waterproofed with natural tar, or bitumen, could move heavier cargo. By 3600 BC, Uruk had grown to 250 hectares. It had become the largest and most influential settlement of the region. With monumental temples and a centralized administration, it merited the title of “city.” Around 3000 BC, at its peak, it housed as many as 50,000 people—enough to fill a modern-day arena. With this large population, Uruk benefited from economies of scale, reducing labor costs and amassing larger military forces to defend its granaries, often relying on slave labor.⁴³

Much of Uruk’s domestic life remains elusive. Archaeological excavations often favored temples and palaces, leaving limited evidence of what ordinary homes looked like. The city’s earliest layers lie buried under more than eighty feet of later occupation, with only 0.1 percent of the lowest levels excavated.⁴⁴ Yet Uruk’s colonies, particularly Habuba Kabira, reveal how the earliest city dwellers adapted to urban life.

Habuba Kabira was established around 3500 BC about 800 miles upstream from the mother city. Many of the houses centered on open courtyards, departing from earlier Ubaid dwellings, which were organized around enclosed halls. Several elite residences featured both courtyards and halls. These halls likely served as reception areas and reflected a growing emphasis on privacy within domestic spaces.⁴⁵ This made them similar to the later *liwan*—a long room traditionally used for greeting guests in certain Middle Eastern homes. Some believed that this was a natural progression from the Ubaid house. As archaeologist Michael Roaf noted, “The tripartite house of the Ubaid period became a courtyard house, with a reception room along one side of the courtyard.”⁴⁶

The courtyard, meanwhile, helped bring light and fresh air into the building’s interior without compromising security, avoiding the need for windows in the building’s exterior walls. Though buildings had courtyards before, the courtyard house became increasingly prevalent, shaping Middle Eastern architecture for millennia.

These homes tell a story of increasing sophistication. The use of sun-dried bricks of standardized sizes suggests a degree of mass production. The roofs were likely flat, made from reed mats laid over beams and coated with mud. Pivot stones at wall openings point to early door mechanisms, allowing doors to swing, long before modern hinges. Terra-cotta pipes beneath mud floors point to early forms of drainage.

Habuba Kabira’s layout represented a departure from earlier Neolithic villages, which lacked planned streets, like Çatalhöyük, where houses abutted each other in one continuous mass. Instead, Habuba Kabira had a hierarchy of streets. Straight main roads likely went the full length of the settlement, while narrower lanes led to residential areas. It even featured an early attempt to manage stormwater. A few streets had drains lined with stone slabs and terra-cotta pipes that connected the town’s drainage to the surrounding countryside.⁴⁷ Other Sumerian cities may have had similar systems.⁴⁸ And although these systems did not extend into homes, Uruk itself may have housed one of the world’s earliest toilets—a deep cylinder-shaped pit inside a small room in a religious building dating back to around 3200 BC.⁴⁹

The skyline of Uruk embodied a new urban order. In the Eanna District, the brick temple complex of Inanna featured thousands of clay cones whose painted, flattened ends—set into wet plaster in

zigzag and diamond-shaped patterns, imitating textiles and mats—formed one of the world’s first mosaics. Another district featured the White Temple, dedicated to the sky god Anu, rising forty feet above the city on its massive platform. They were a constant reminder of divine power.

But perhaps Uruk’s greatest legacy came from the humble materials of everyday life: clay and reeds.⁵⁰ Before writing emerged, people used clay tokens to calculate and account for goods in increasingly complex economies. These tokens eventually gave rise to simple pictographs as the volume and variety of goods outstripped the capacity of the token system. These then evolved into the more abstract *cuneiform*, after the Latin term for “wedge,” named for the distinctive wedge-shaped marks made by pressing reeds into soft clay.

This invention revolutionized human civilization. Writing enabled not only complex urban administration but also the preservation of knowledge, stories, and ideas across generations. While some tablets were intentionally fired to make them permanent, most remained unbaked and were even reused, meaning vast amounts of early writing have vanished. Yet some remarkable examples endure. One of the earliest surviving tablets, dating to around 3100 BC, offers administrative records for brewing beer, complete with pictographs of a building, a chimney, and an ear of barley in a jar.⁵¹ Urbanization had ushered in a new era of human progress—beer included.

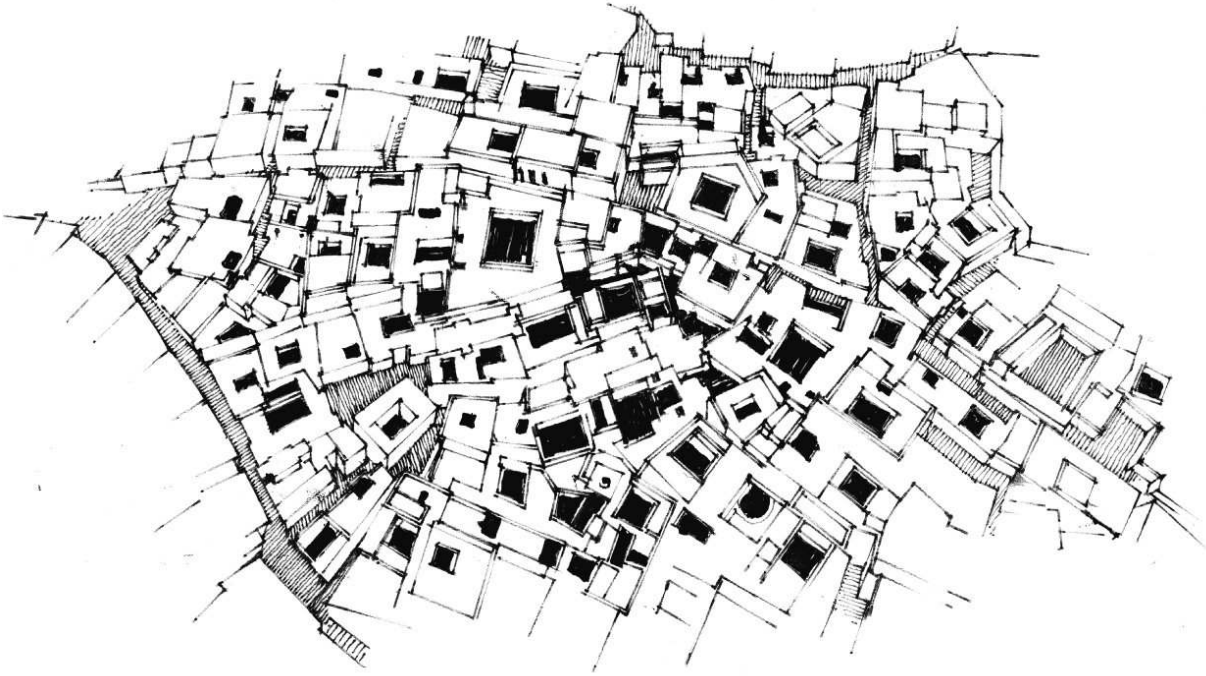
Writing, monumental architecture, specialized labor, political organizations, dense populations—all these were part of a dramatic transformation in human societies that Gordon Childe termed as the “Urban Revolution.” He saw this occurring independently across the ancient world, from the Indus Valley to Egypt and China. With urbanization came a fundamental shift in human relationships. Historian Lewis Mumford likened cities to pressure cookers: “As with a gas, the very pressure of the molecules within that limited space produced more social collisions and interactions within a generation than would have occurred in many centuries if still isolated in their native habitats, without boundaries.”⁵² Architectural historian Spiro Kostof described this as “energized crowding”⁵³—the essence of cities, where proximity to others led to greater opportunities, connections, and innovations.

The concentration of thousands of people in cities also created unprecedented environmental challenges, straining water and agricultural systems and sometimes contributing to their decline. During the late Uruk period, around 3200 to 3100 BC, the region likely experienced increased aridity. The marshes gradually receded. Subsistence agriculture became increasingly difficult. Initially, this crisis may have driven people toward urban centers, where large-scale reserves acted as a buffer against unpredictable crop yields.

However, these people then found themselves subject to political regimes. Uruk seemingly experienced escalating internal and external violence during this period. Seals depict prisoners, with their hands tied behind their backs, kneeling before spear-wielding soldiers. Artifacts such as maceheads, slingshot balls, and arrowheads point to violent confrontations. Meanwhile, urban existence in Uruk may have teetered precariously on the edge.⁵⁴

By 3000 BC, Uruk’s influence ended. Colonies such as Habuba Kabira were abandoned. Artifacts from the Uruk culture, once found as far away as central Iran and Egypt’s Nile Delta, stopped appearing, suggesting the city’s trade networks collapsed. The causes of this decline remain a mystery. They could be internal tension resulting from environmental stress, intrusions by people from Eastern Anatolia and Transcaucasia, or an influx of Semitic-speaking people from the west.⁵⁵

Uruk’s influence declined, but many of the architectural solutions found in its settlements lived on. One of the most enduring strategies was the courtyard house, which would go on to define urban form across North Africa to the Indus Valley. It offered a practical solution: thick mud-brick walls that moderated temperature swings through thermal mass. The courtyards brought light and air into the home while preserving privacy. Even the narrow streets, hardly wide enough for a single donkey cart, had their role. They cast shade and channeled cooling breezes, creating favorable microclimates throughout the city.⁵⁶



Traditional courtyard houses, Marrakech, Morocco.

These were not unique inventions of Uruk but shared adaptive responses to life in warm environments. They emerged independently across regions facing similar conditions. The courtyard house still offers comfort in hot weather today, from the *siheyuan* of Beijing to the *riads* of Fez. In these early settlements, we find not only the building blocks of urban life but also an architecture in dialogue with the earth and the sun.

Clay into Rock

A text from 2152 BC describes Gudea, a Sumerian ruler, in a temple's brick-laying ceremony: "Gudea put the blessed water in the frame of the brick mould. . . . He set up the appropriate brick stamp so that (the inscribed side) was upwards. . . . He raised the impeccable carrying-basket and set it before the mould. Gudea put the clay in the mould, he acted precisely as prescribed, and behold he succeeded in making a most beautiful brick for the house. . . . He struck the brick mould: the brick emerged into the daylight. He looked with complete satisfaction at the stamp (impression) on the clay. . . . raised the brick out of the frame of the mould: he carried the brick—a lovely tiara . . . which reached up to heaven—and went among his people." ⁵⁷

Nearly four millennia later, we still mark the beginning of construction projects with ceremony, although with golden shovels and photo opportunities. Yet these modern rituals pale in comparison to the profound significance that brickmaking held for the ancient Mesopotamians. Rulers like Gudea often depicted themselves carrying a basket of clay on their head, containing the first brick. They inscribed bricks with their names. They boasted about the number of bricks used in their works. So important were bricks that there was a brick god, Kulla, who was invoked during the laying of the first brick. In a society unable to use stone for building, creating bricks was nothing less than manufacturing artificial rock—a godlike act of transforming mud into the building blocks of civilization.

The story of the brick is, in many ways, the story of human dwelling itself. They are part of humanity's journey from temporary shelters of straw and wood to more permanent structures of brick and stone. In Mesopotamia, this evolution of bricks would reshape not only houses but also the fabric of human society—though it came at a cost.

By the middle of the third millennium BC, an unprecedented urban revolution was sweeping across Southern Mesopotamia. The once-sparse landscape had blossomed into a network of thriving cities, each spanning hundreds of hectares. The promise of opportunity drew villagers by the thousands, until an astounding 80 percent of the population lived in urban centers larger than forty hectares.⁵⁸ More than simple cities, these were city-states, complete with suburbs, satellite villages, and agricultural hinterlands, all governed by dynastic kings and temple elites.

But this urban explosion created an urgent challenge: how to house such dense populations safely and permanently. Houses were often not built safely, sometimes leading to collapse. So serious was this risk that the world's first building code, the Code of Hammurabi (circa 1750 BC), addressed it with chilling clarity. "If a builder constructs a house for a man but does not make it conform to specifications so that a wall then buckles, that builder shall make that wall sound using his silver."⁵⁹

But cases could be far more severe. "If a builder constructs a house for a man, but does not make his work sound, and the house that he constructs collapses and causes the death of the householder, that builder shall be killed. If it should cause the death of a son of the householder, they shall kill a son of that builder."

One problem lay with sun-dried brick. The traditional sun-dried mud bricks that had served village builders for generations proved dangerously inadequate for urban life. When exposed to moisture, these bricks could deteriorate and disintegrate⁶⁰—sometimes catastrophically. This is why builders frequently plastered sun-dried brick walls with fresh mud or gypsum to shield them from moisture and erosion, often reapplying it several times a year. Over time, they knocked down entire structures and rebuilt new ones atop earlier foundations. Life in early Mesopotamian settlements was defined by constant upkeep.

Several Mesopotamian cities show evidence of devastating floods, which would have destroyed most homes. Around 3500 BC, the city of Ur experienced a flood leaving up to eight feet of silt, leading excavator Leonard Woolley to believe it was evidence of the "Great Flood." While this is debated since it was more likely a local event, ancient Mesopotamians understood the limitations of their sun-dried brick homes. So they found a new solution. They began baking bricks. The Bible later echoes a similar turning point in Genesis, when humanity, after the Great Flood, resolves to rebuild: "They said to each other, 'Come, let's make bricks and bake them thoroughly.' They used brick instead of stone."⁶¹

Fired brick offered a more durable solution to the problem of moisture. By heating bricks to around 900°C to 1,000°C, a process called vitrification begins, where some of the silica and alumina in the clay fuse together, making the brick harder and more like a ceramic material. This firing removes chemically bound water and significantly reduces the porosity found in sun-dried bricks. However, Mesopotamian kilns rarely reached full vitrification. Nevertheless, the resulting bricks were still much more durable than sun-dried ones.

But fired bricks were a luxury, requiring both fuel and skilled labor. Economic records show that transporting 370 burnt bricks to a construction site cost one silver shekel—roughly 8.4 grams of silver.⁶² These expenses restricted their use to urban centers with the resources and artisans to produce them.

The impact of this innovation was clearly visible in Ur. While ceramics and bricks had been fired since the fourth millennium BC, it was in this port city—where the Euphrates once met the sea—that fired bricks became increasingly common. During the Third Dynasty of Ur (2112–2004 BC), a period later called the Sumerian Renaissance, the city became the capital of an empire known for its major building projects. Appropriately, one of the most iconic depictions of King Ur-Nammu, an early ruler

who founded the Third Dynasty, shows him carrying a basket of mud on his head, symbolizing the laying of the first brick.⁶³

By the height of Ur's power, fired bricks had become symbols of urban prosperity. They were increasingly used in private buildings—especially in courtyards, bathrooms, and wall footings prone to water damage. Baked bricks were laid at the base of walls as damp courses, to protect against moisture from rain and groundwater. This seemingly modest innovation greatly enhanced durability. While the sun-dried bricks above have mostly eroded, the fired bricks remain.

There were other techniques for managing moisture as well. A typical house featured an entry vestibule, “sometimes provided with a water-jar and a drain for the washing of the feet of those entering,”⁶⁴ imagined the excavator Leonard Woolley. It led into a courtyard paved with brick, with a carefully constructed drain at its center. Not yet able to make long pipes, builders stacked interlocking baked clay rings—an early plumbing method also used in their first toilets. These rings had holes along the sides to let water escape. Builders surrounded them with broken pottery to act like a filter, preventing clogging. This made it conceptually similar to a modern perforated drainpipe surrounded by gravel, like a French drain. As Woolley described, “a round pipe, 20 or 30 feet long, made of terra-cotta rings set one above the other; there were holes in the sides of the rings and round them there was a packing of broken pottery which kept the earth from blocking the holes.”

This central placement of the drain was used to move water away from the building's walls. Such was the importance of proper drainage that an ancient text warned: “If the water in the court runs to the back, expense will be continual; if the water in the court runs to the middle of the court, that man will have wealth.”⁶⁵

Mesopotamians also used bitumen, a sticky, waterproof material that was a naturally occurring tar found along the Tigris and Euphrates Rivers. They used it to waterproof their boats and their homes as well. Bitumen helped seal floors and also served as a mortar to bind bricks. Since it was stronger than mud mortar, it was especially useful for lower courses. Bitumen was likely also applied to coat roofs—similar to the use of asphalt roofs today.

To create flat waterproof roofs, Sumerian builders layered beams, reed mats, mud, and bitumen plaster. Even the *Epic of Gilgamesh*, the world's oldest known work of fiction, nods to the eternal challenge of roof maintenance, cursing a sacred prostitute with a leaky roof: “The roof of your house, no builder shall plaster!”⁶⁶

The widespread use of bricks, however, did put its limitations on domestic architecture. Mud bricks are strong under compression—like handling downward pressure from gravity. That makes them appropriate for walls. However, they are weak in tension and can crack or fail under the tensile forces that develop when spanning an opening, such as a window or doorway. Brick lintels had to be short, limiting window sizes. Therefore, homes faced the challenge of dark interiors.

Mesopotamian builders eventually got around this by using bricks to build arches, which primarily work under compression. This allowed them to span larger spaces with bricks alone, but this is not something they did for dwellings. Builders likely used timber beams to span window openings or support roofs.⁶⁷ However, wood was scarce in ancient Mesopotamia.

And it was their lack of wood that likely prevented multistory buildings. Several houses at Ur show remnants of staircases, and the brick walls were often quite thick. This led some to suggest they had a second story, while others propose they simply provided access to the roof. Roof space was almost certainly used—especially in dense cities where street-level space was limited. However, full multistory construction would have been prohibitively expensive. A second floor in a courtyard house would require additional timber not only for stairs but also for balconies to support upper-level access.

Archaeologist William Hafford proposed that many homes may have featured a “hybrid second story”:⁶⁸ partially enclosed rooms or shelters on the roof, perhaps made of reeds or brick, which expanded living space without the cost of full vertical construction. Most Sumerian houses likely had

For Natalie

By means of our hands we struggle to create, as it were, a second world
within the world of nature.

—MARCUS TULLIUS CICERO, *ON THE NATURE OF THE GODS* 2.61,
TRANSLATION ADAPTED FROM H. RACKHAM

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DWELLING ON EARTH

Introduction

Dwelling on Earth

One of the oldest known traces of early human habitation lies deep in Olduvai Gorge in Eastern Africa and dates back nearly two million years—marked by little more than scattered stone tools and fossilized animal bones. Though the first gestures of dwelling likely began even earlier and are lost to time, their significance was profound. When our ancestors began returning to familiar ground and reshaping their surroundings, they did more than rewrite human destiny—they began to rewrite the story of the Earth itself.

From these humble beginnings, our dwellings rose ever higher. Temporary shelters of mammoth bones gave way to Mesopotamian mud brick homes. In time, Roman multistory apartment buildings rose over ancient cities, housing thousands in the early concrete structures called *insulae*, meaning “islands,” rising from streets like stone archipelagos. Today, skyscrapers of glass and steel pierce the clouds in Shanghai and Dubai. And now, in our quest for survival and adaptation, we dare to imagine homes on distant planets—carrying the ancient idea of dwelling beyond our world.

As we shaped our dwellings to suit our needs, they in turn shaped us. In an era when survival meant grappling with the elements and nomadic wandering in search of resources, permanent dwellings emerged as sanctuaries. They sheltered us from storms, provided comfort and security, and became the seedbeds of civilization.

Dwellings allowed us to store possessions and accumulate wealth, luxuries that had eluded hunter-gatherers. They offered new degrees of privacy without the risk of venturing far from the community. As populations concentrated, these clusters of dwellings functioned as social catalysts. Larger settlements accelerated the rapid exchange of ideas and spurred cultural development. In a single day, a villager might encounter more people than a forager met in months—sometimes years.

Homes also became places to make sense of the world and express shared values. We filled them with symbols of belief, setting aside spaces for ritual and ceremony. About nine thousand years ago in the Stone Age town of Çatalhöyük on the Southern Anatolian Plateau, residents built walls incorporating vulture beaks and human skulls—precursors, perhaps, to the souvenirs and portraits we display on mantelpieces today.

Behind these walls and under these roofs, an extraordinary transformation took place, altering our habits, relationships, and the course of civilization. With shelter securing our fundamental requirements—anchored at the base of Maslow’s hierarchy of human needs—people could turn their energy to higher pursuits: building villages, founding cities, and raising monumental temples and pyramids.

Between our first basic huts and today’s towering structures lies an extraordinary and hard-won journey of innovation—from Roman concrete to modern steel frames, from wood-burning fireplaces to smart thermostats, from candlelight to LEDs. Many advancements arrived through trial and error, and sometimes at great human cost. The densely packed houses of Çatalhöyük, for instance, used flat roofs as streets, with roof openings doubling as chimneys and entrances accessed by ladders—a design that likely bred respiratory illnesses, frequent falls, and fractured bones. As much as human dwellings showcase our genius for adaptation, they also reveal our knack for creating the very risks they were meant to prevent.

The walls we built to keep nature out also created boundaries between people—inevitably fueling envy, suspicion, and inequality. In the earliest settlements, there was little differentiation among dwellings. But as settlements grew into cities, wealth inequality became visible. In Ur, one of the first cities in Mesopotamia, wealthy residents lived in durable homes made of courses of fired brick, while commoners occupied sun-dried mud brick structures prone to decay. Some had no secure shelter at all. Permanent settlement may have safeguarded the weak from the wild, yet its benefits were unevenly distributed.

Millennia later, the pattern persists. Luxury towers rise while people without shelter sleep in their shadows, as the gap between wages and housing costs widens. Even in wealthy nations, housing insecurity undermines health and well-being, particularly for vulnerable groups like children, who suffer developmental setbacks. Studies consistently show that stable housing improves quality of life, reduces healthcare costs, and lowers rates of intimate-partner violence.¹

And yet, even when architects set out to improve how we live, well-meaning efforts sometimes perpetuate social problems. In the 1920s, the modernist Frankfurt Kitchen introduced a streamlined workspace based on principles of scientific management and time-and-motion efficiency. Though intended to liberate women from domestic drudgery, its compact design—optimized for a single user—often left them working in isolation, with little space for conversation or supervising children. Rather than challenging traditional gender roles, it may have quietly entrenched them.

Our homes and neighborhoods also impact our health—influencing how we move, breathe, and sleep. Even seemingly comfortable homes can harbor hidden hazards. In car-centric suburbs, daily walks give way to long commutes behind the wheel, contributing to rising rates of diabetes, heart disease, and obesity. While our hunter-gatherer ancestors often walked on the order of 16,000 to 17,000 steps per day, the average American today takes about 4,000 to 5,000 steps. Studies indicate that people living in car-dependent areas face a significantly higher risk of developing type 2 diabetes and obesity.² Obesity, in turn, can reduce life expectancy by years, in severe cases comparable to the effects of lifelong smoking.³

Dense apartment living can present its own challenges, such as limited natural light, which can negatively affect mental health⁴—though apartment living can also foster social connection between neighbors.⁵ And those who live in a house with stairs may live longer and healthier lives, benefiting from the daily cardiovascular exercise of climbing them.⁶ Indoor air quality poses another challenge, especially with nearly airtight modern construction. Common building materials release volatile organic compounds, while poor ventilation allows pollutants to build up. Outside, those picture-perfect lawns surrounding suburban homes often rely on pesticides and herbicides such as 2,4-Dichlorophenoxyacetic acid that not only can contaminate groundwater but are so toxic that they pose serious risks to children and pets.⁷

Most people now spend the majority of their lives inside their residences. Americans devote about 90 percent of their time to interior spaces, two-thirds of that at home. Inside, design choices impact well-being. Natural light influences mood and sleep patterns,⁸ while clutter can elevate anxiety and dull focus.⁹ Views of nature or even simple natural elements have been shown to reduce stress and enhance cognitive function.¹⁰ Yet homes may also shape our inner lives in subtler, more poetic ways. “Thanks to the house, a great many of our memories are housed,” philosopher Gaston Bachelard observed, “and if the house is a bit elaborate, if it has a cellar and a garret, nooks and corridors, our memories have refuges that are all the more clearly delineated.”¹¹

“We shape our buildings; thereafter they shape us,” Winston Churchill once famously said when advocating to rebuild the bomb-damaged House of Commons to its original design. He believed its layout—two opposing banks of benches—was responsible for the two-party system and the very nature of British parliamentary democracy.

What holds for the House of Commons holds for the home as well. Dwelling is not merely a physical structure but a way of being—both noun and verb—woven into the fabric of human culture. Our homes are not just where we live. They are how we live.

Crafting Our Niche

It was our capacity to dwell that gave us a unique evolutionary advantage. While Darwin focused primarily on how species adapt to fit their environment, modern researchers emphasize that some animals form significant two-way relationships with their surroundings. Humans belong to this group—we engage in what researchers call “niche construction.” Like beavers building dams, we create environments that often afford us advantages. These “ecosystem engineers” pass down construction behaviors through generations.

Some animal-made niches rival even the ingenuity of our own creations. Mound-building termites in Australia are renowned for their monumental towers, sometimes reaching about 800 times their body length—the equivalent of skyscrapers taller than any built by humans.¹² They have even developed temperature control systems. Inside, these insects maintain constant temperatures through intricate systems of vents and flues, even as desert temperatures swing dramatically between day and night.¹³ Similarly, bees create precise hexagonal honeycomb patterns. This shape makes efficient use of space, eliminating gaps that would occur with circular cells. It uses less wax than triangles or squares would require to enclose the same area while still providing structural strength—a design so efficient that humans now use it in engineering applications. These remarkable structures, however, emerged over millennia as insects whose genes produced more efficient structures had greater reproductive success, passing their genetic traits to subsequent generations.

Humans, by contrast, accelerate architectural innovation through our ability to make tools, think abstractly, and cooperate intentionally. We leverage geometry, mathematics, and engineering to solve new problems within single lifetimes. We create scalable social networks that allow us to transmit new ideas and coordinate construction projects through planned collaboration rather than genetic instinct. Our earliest homes used simple round forms, as circles and ovals distribute the weight of the roof more evenly and round pits were straightforward to excavate. But we soon developed rectangular structures as our needs evolved, because right angles simplify expansion and partitioning into multiple rooms. We later clustered homes into blocks and orthogonal grids, creating ever-larger cities. We mastered arches and vaults, forged steel, and engineered vertical structures that scrape the sky. No species has ever reshaped its environment so swiftly or completely.

Yet this power comes at a cost. Species that construct niches inevitably alter the ecosystems around them. Just as beavers build dams that transform entire watersheds into lakes of their own making, our ability to modify our environment has fundamentally altered Earth’s ecosystems. In our relentless expansion and pursuit of ever-greater comfort, we invented machines that moved

mountains and paved vast road networks, and built climate control systems that burn through enormous amounts of energy.

Today, the built environment accounts for almost 40 percent of global carbon emissions, much of it from constructing, heating, and cooling residential buildings.¹⁴ And the problem is growing. By 2050, urban populations will increase by 2.5 billion, with cities housing over two-thirds of humanity. To meet this demand, we will need to build roughly the equivalent of a new New York City every month for the next three decades.¹⁵ Meanwhile, as the middle class in emerging economies is expected to double over the next decade, we may see a rise in consumerism mirroring Western patterns, further stoking demand for more floor space. In the US, even as household size halved, floor space per capita doubled from 400 to 800 square feet between 1891 and 2010¹⁶—contributing to a tenfold increase in total housing volume.

Our homes make up much of our built environment, driving economic activity and demand for land, infrastructure, and resources. This bond is etched into language itself: both “economy” and “ecology” spring from the Greek *oikos*, which means “house” or “household.” The ancient Greeks coined the term *oikonomia* (economy) as the management of the household, reflecting the house as society’s basic economic unit. Centuries later, German biologist Ernst Haeckel introduced *Ökologie* (ecology), to refer to the study of organisms in their habitats, their “houses.”

Perhaps even cities arose from the house. Archaeologists once believed the first cities, such as Uruk in Mesopotamia, sprang from the centralized power of temples and palaces. But archaeological finds at the earlier site of Tell Brak suggest another path: incremental growth, household by household, forming neighborhoods that collectively housed tens of thousands before any dominant civic structure emerged. This is what archaeologists call a “proto-city,” a large, densely occupied settlement with urban traits but with little or no early evidence of centralized authority. Like the “swarm intelligence” behind the complex structures built by termites, these larger settlements may have scaled up through the cumulative interactions of many independent households rather than through the top-down direction of political elites. Even when monumental buildings appeared later, they often mimicked domestic architecture. In Mesopotamia, many temples were essentially enlarged houses.

Today, the way we build shapes the planet more than ever before. From the clearing of forests for materials to the carbon footprint of buildings, our housing choices are transforming the environment. In our continuing pursuit to build ever more comfortable homes, we now face climate change and related challenges that threaten the very comfort we sought to create.

From Huts to High-Rises

How did our homes evolve from simple huts made of animal skins and bones to “smart” sensor-equipped buildings? What technological breakthroughs, societal shifts, and cultural currents sparked new ways of dwelling? And how has the evolution of our homes shaped humanity in return—reconfiguring our cities and neighborhoods, raising standards of comfort, and establishing social norms around privacy and domesticity? This book probes these questions, ultimately asking: How did the remarkable story of dwellings redefine our lives and the planet—and how might we build more sustainably in the future?

Dwelling on Earth traces the long, captivating evolution of human habitation and its entangled relationship with the environment. The story of the home is inseparable from the story of humanity itself, unfolding alongside our societal evolution. From brush huts to high-tech habitats, our dwellings have not only shaped how we live but also transformed our world.

For much of history, residential architecture was largely overlooked by architectural historians and archaeologists, who favored monumental temples and palaces. When ancient homes did enter the scholarly spotlight, conclusions were sometimes distorted by outdated science or cultural presumptions. Take the case of the Peking Man discovered in a cave at Dragon Bone Hill near

Beijing, dated to about 400,000 years ago. Early excavators proclaimed the site the home of the first caveman—and supposedly a cannibal, based on bite marks found on bones. Decades later, high-resolution microscopes and modern forensic techniques overturned the tale. The marks match those of gigantic hyenas, suggesting the cave was their den, where they dragged in and gnawed human remains.¹⁷

These interpretive problems had deep roots. One example is the eighteenth-century “primitive hut” theory of architecture, proposed by French priest Marc-Antoine Laugier, who imagined the first homes as sloped roofs supported by wooden columns—a form that conveniently mirrored classical Greek architecture.¹⁸ Until recently, the oval-shaped huts at Terra Amata in Nice, France, were considered the earliest purpose-built homes based on rings of stones found in a beach alcove—a conclusion perhaps skewed by the desire to declare a definitive “first” home. However, new archaeological evidence using micromorphology, which studies soil slices under polarized light, now indicates these rings were not human-built foundations, but likely resulted from naturally occurring stream flows.¹⁹ Nevertheless, the oval hut reconstructions live on, lingering in textbooks and museum displays.

Today, a range of cutting-edge tools enriches our understanding of early homes. DNA analysis reveals familial relationships and migration patterns among ancient residents. Satellite imagery detects settlements where none were expected. Pollen analysis reconstructs ancient climatic conditions. These and other methods provide new insights into early dwellings and settlements.

Yet even with such tools at our disposal, this book does not attempt to provide a complete global history of every dwelling type. Instead, it traces four major transformations: the Agricultural Revolution, the Urban Revolution, the Industrial Revolution, and the ongoing Sustainability Transition. The first three marked transformations from which there was almost no turning back, establishing new levels of complexity, enabling unprecedented forms of settlement, and fundamentally altering how humans could live. The fourth, however, is different—it compels us to choose how we dwell without destroying what sustains us. We’ll explore key innovations and how homes evolved through these turning points, from the first vertical apartment blocks of ancient Rome built by unscrupulous speculators to the early terraced row houses in Liverpool created by forward-thinking industrialists.

Before agriculture, dwellings were temporary—grassy beds, huts made of reeds and animal hides—and most vanished without a trace. But around 12,000 years ago, the Agricultural Revolution allowed us to invest more deeply in permanent settlements. Communities like the Natufians in modern-day Israel and Palestine built circular dwellings of stone and mud as they domesticated plants and animals. Similar round pit houses emerged independently around the globe—solutions to the same problems, arrived at separately.

However, with permanence came peril. Settled communities placed themselves in the path of natural disasters. Floods, droughts, and hurricanes posed considerable risks to their well-being. Communities also significantly modified their natural environments—clearing forests for farms, fuel, and building materials, which exposed topsoil to wind and rain, washing away fertile earth needed for crops. In doing so, they inadvertently contributed to the very “natural” disasters they feared. In many cases, these environmental missteps set the stage for collapse—a harsh reminder of the responsibilities that came with settled living.

The Urban Revolution, roughly six thousand years ago, gave birth to the city and new living spaces. As the demands of irrigation and agriculture favored extended family households, homes began to expand. Circular huts gave way to rectangular forms, far easier to expand and cluster in growing settlements.

With increased settlement size came greater social, economic, and political complexity—and homes evolved in tandem. A growing division of labor gave rise to professional builders. Growing populations and social specialization spurred innovative dwelling types, including row houses and even multistory apartment buildings.

Remarkably, several of these urban forms—such as the atrium house and the organized street grid—emerged independently in different parts of the world, in cultures with no direct contact. In ancient Rome, breakthroughs in materials like concrete made it possible to construct vertical apartment buildings, housing large numbers of urban residents. These unprecedented housing forms enabled more people to live in closer proximity, fostering new kinds of interaction.

Did settled life make us happier? While agricultural settlement is often viewed as inevitable progress, some anthropologists highlight the advantages of nomadic lifestyles. They cite the example of the nomadic !Kung people of the Kalahari, who spend only roughly 40 percent of their time securing food, dedicating the remainder to socializing, dancing, and other pursuits.²⁰ By contrast, settled life often brought increased labor demands—from dawn-to-dusk farming to endless home maintenance.

Even as the cities of the classical world grew, nomadic people persisted, offering a different model entirely. In the fifth century BC, the ancient Greek historian Herodotus described the nomadic peoples on the Eurasian steppe: “Having neither cities nor forts, and carrying their dwellings with them wherever they go: accustomed, moreover, one and all of them, to shoot from horseback; and living not by husbandry but on their cattle, their wagons the only houses that they possess, how can they fail of being unconquerable, and unassailable even?”²¹ These societies had mastered animal domestication but chose not to cultivate crops. As historian Spiro Kostof noted, “They had no use for settled permanence except as their last resting place.”²²

And yet the agglomeration of urban populations brought undeniable advantages. Larger scales of social organization fueled economic productivity and wealth creation—a pattern that continues from ancient cities to modern metropolises.²³ While early productivity manifested in temples and elite housing, today we measure it in GDP. Urban concentration consistently drives innovation.²⁴ In the United States, large cities produce about twice as many patents per person as smaller ones.²⁵ Cities became the engines of civilization.

But even these had limits. Preindustrial cities faced hard constraints to growth. Inadequate sanitation and insufficient agricultural output restricted their population. These barriers would not be broken until the Industrial Revolution, which introduced new energy sources and more efficient means of production—enabling urban growth on an unprecedented scale.

The Industrial Revolution reshaped residential architecture and cities as a whole. Steam trains enabled suburban expansion, while breakthroughs in steel production, construction equipment, and elevators revolutionized building height in cities like Chicago and New York. Meanwhile, a growing bourgeoisie redefined domestic life around the nuclear family—evident in seventeenth-century Dutch row houses, where, to the shock of foreign guests, visitors were expected to remove their shoes.

But industrialization came with a darker side. In many cities, the working class lived in overcrowded, unsanitary tenements. Polluted air, contaminated water, and squalid housing conditions made cities deadly environments, where mortality rates outpaced births. In response to these grim realities, reformers pioneered early planning reforms and regulations that led to better housing initiatives, exemplified by the terraced rows in Liverpool. The construction of modern sewage systems and clean water infrastructure eventually vastly improved urban life.

The twentieth century witnessed a bold modernist movement of urban living that reimagined the home as an efficient machine. This approach manifested in neatly organized rows of apartment blocks and tall towers set in parks. While some cities like Singapore and Hong Kong embraced vertical urbanism, elsewhere, particularly in the United States, domestic life increasingly migrated to automobile-oriented suburban developments.

As we prepare to build many more homes in the twenty-first century, we face new challenges. Today, our homes confront growing environmental threats, from rising temperatures to floods and wildfires. In response, architects are being called on to design more resilient and sustainable

dwellings. These range from entire floating neighborhoods to structures made from bio-based materials like mass timber—large engineered-wood panels strong enough to stand in for concrete.

Simultaneously, emerging technologies are transforming how we build and live. Where Mesopotamians once painstakingly molded clay bricks by hand, robotic arms now extrude concrete with precision. Digital design and automated manufacturing such as 3D printing are revolutionizing how we build, even enabling the design of prototypes for Martian habitats. Artificial intelligence is already beginning to generate home designs and manage domestic systems.

Yet amid this wave of innovation, we're also rediscovering the wisdom of time-tested preindustrial traditions. Passive heating and cooling, natural ventilation, and bio-based materials are making a return—not as nostalgic gestures, but as proven solutions. In many respects, our ancestors may have built more sustainably. Mesopotamian cities largely disappeared into the earth. Ours, by contrast, may be remembered by future archaeologists for their concrete debris.

As we confront the intertwined challenges of climate change and rapid urbanization, the long history of dwelling becomes more than a source of insight. It offers a foundation for reimagining how we live. This book traces that history to understand how we arrived at this moment, and to explore what it will take to build more sustainably.

Homes for Tomorrow

As a professor of architecture and urban planning, I've been fortunate to witness an extraordinary diversity of global housing solutions. My journey has taken me from the informal settlements of southern China to Manhattan's supertall skyscrapers, from Hong Kong's meticulously planned public housing estates to the Netherlands' experimental floating homes. Along the way, I've seen how seemingly technical policies—from zoning resolutions to building codes, even landscaping requirements—significantly shape the way we live. In the United States, for instance, regulations meant to keep neighborhoods orderly have inadvertently nudged out “missing middle” housing—such as row houses, duplexes, and apartment buildings that bridge the gap between single-family homes and large apartment blocks. They have also limited mixed-use blocks where apartments sit above corner cafés or neighborhood shops. The result? Fewer affordable, walkable choices in many communities. In Singapore, by contrast, urban planning policies have deliberately cultivated tall buildings that weave greenery into the skyline, proving how intentional policy design can achieve both density and livability.

As a practicing architect, I've watched the profession transform from hand-drawn blueprints to algorithm-driven modeling and AI-assisted renderings. Construction methods, too, have evolved. Brick walls once laid by hand can now arrive as factory-made panels or be installed by robotic arms. Drones monitor progress from above while robotic dogs patrol sites from the ground. Alongside these technical advances, our profession has championed more sustainable buildings, from advocating for stricter energy codes to embracing renewable materials like cross-laminated timber and bio-based finishes.

As a resident, my own experience of home began in a Dutch town. I grew up in a narrow row house, almost identical to its neighbors, each with its own modest backyard. No one had air-conditioning—we didn't need it. Thick brick walls, external shading, and cross ventilation kept interiors cool. The wide sidewalks fostered a sense of community. Most neighbors knew each other. As a child, I could bike safely to school and play in the street.

When I began my studies in Delft, I moved into student housing that was part of a bold experiment in 1970s architecture. Architects had reimagined the conventional layout, centering each floor around a communal kitchen. Most roommates took turns cooking for one another. There were no formal rules requiring this arrangement. The layout encouraged it. It nurtured collaboration and community. To our surprise, one roommate became the town's youngest mayor.

In Barcelona, I lived in a compact apartment in the old town. Despite the limited space, I was steps from shops, cafes, and public transit. Paris offered a similar lifestyle, with its Haussmann-era walk-up courtyard buildings. In New York, I lived in elevator buildings. Hong Kong immersed me in its vertical labyrinth of skyscrapers and “pencil towers.” Apartments were small but utilized every square inch through sliding walls, foldout furniture, and built-in storage tucked into every nook.

These cities share an important quality. Most daily activities are within a fifteen-minute walk or bike ride. They are examples of what planners now call the “15-minute city.” This experience taught me that quality of life isn’t necessarily tied to the size of one’s home but to the richness of the walkable surroundings.

My path later led me back to suburban life—to a midcentury modern villa in California, a townhouse in Virginia, and a century-old Colonial Revival house in a New Jersey railroad town. Each move brought new daily routines. In Manhattan, movement was built into everyday life, from walking to stores to catching the subway. In the New Jersey suburbs, staying active often requires a gym membership.

In the chapters ahead, we will explore the larger story of human habitation—from the first fired bricks of Mesopotamia to the modular 3D-printed homes of tomorrow. We’ll examine engineering feats that made cities possible, and social experiments that redefined domestic life. We’ll uncover innovations we now take for granted—like how the humble corridor reconfigured privacy. We will explore movements shaped by cultural and economic shifts, from Bauhaus to Brutalism.

While we will examine the physical structure of buildings, we will also consider the social structures they create. Each housing type has the ability to shape urban landscapes, daily experiences, and interactions across different walks of life. Even seemingly innocuous design choices can influence social dynamics. As Amos Rapoport observed in *House Form and Culture*, the placement of American dining counters—like the arrangement of chairs in psychotherapy sessions or courtroom layouts—is “remarkably indicative of the roles of the people involved.”²⁶

Throughout history, the concept and form of home have continually evolved. Unlike the Darwinian evolution of species shaped by natural selection, architecture evolves through artificial selection—driven by human intention. It is up to us to actively shape our built environment. We didn’t accept rock shelters as our final dwelling place. We built our way from mud huts to towers of steel and glass—not by chance, but by choice, and through the same cooperative intelligence that first forged our settlements to meet shared challenges. If we could once raise Gothic cathedrals stone by stone, we can certainly reimagine the homes we build today.

Today, we can create homes that do less harm to the planet. Addressing carbon emissions in the built environment is inherently complicated, involving trade-offs across materials, operations, infrastructure, and transportation. But due to advances in digital design, performance simulation, and life-cycle modeling, we now have the tools to understand and optimize these interactions with unprecedented precision. The technology exists. What remains is the collective will to act.

In our quest to build better homes, it’s tempting to focus on the newest technologies—solar panels, smart thermostats, superinsulation. But progress won’t come from buildings alone. It depends equally on what happens beyond the property line: the design of streets and the shape of neighborhoods. These decisions often lie outside the architect’s control, shaped instead by planners and policymakers. And yet, they have an enormous influence. Architects can design exceptional houses. However, they cannot overcome zoning laws that mandate excessive parking or the absence of safe sidewalks and crossings.

Growing up in the Netherlands quickly teaches you that landscapes are made, not given. Hardly a square inch remains untouched. One-fifth of the country is polder—land wrested from sea and river. You realize that the ground beneath your feet is engineered. If we can conjure land from water, surely we can reshape the land we have with equal ingenuity.

As a phrase attributed to Buckminster Fuller puts it, “We are called to be architects of the future, not its victims.” We are not prisoners to our surroundings, because we are their authors. The path

forward begins with reimagining how we dwell. For dwelling is more than walls and roofs. It's about who we are, how we relate to one another, and how we care for the Earth that remains our only home.

One

A Permanent Place

Fire and Shelter

In 1753, the Jesuit priest Marc-Antoine Laugier described the origin of dwelling by imagining a lone “savage” troubled by nature’s extremes. This “primitive man,” seeking refuge from scorching heat and torrential rain, initially fled to a cave but found it too dark and filled with “foul air.” Upon leaving the cave, he embarks on a mission. “Resolved to make good by his ingenuity the careless neglect of nature,” Laugier writes, “he wants to make himself a dwelling.”¹

As Laugier’s story continues, the man wanders through a forest, stumbles upon fallen branches, and has an epiphany. “He chooses four of the strongest, raises them upright and arranges them in a square.” With surprising engineering intuition, he lays four more branches across their tops to create a frame. He then crowns it with a pitched triangle, making a roof truss, and covers it “with leaves so closely packed that neither sun nor rain can penetrate. Thus man is housed.”

This tale of instant architecture became the foundation of Laugier’s influential theory, championing the simplicity of a “primitive hut,” a pitched roof supported by columns, over the theatrical flourishes of High Baroque architecture. While the story shaped architectural thinking for generations, it is far from the historical reality. Rather than a single stroke of genius, the story of human habitation is one of gradual evolution, unfolding over millions of years through the collaborative acts of countless generations. And this story begins not with *Homo sapiens* but with our distant ancestors.

This history begins in the trees, roughly 14 to 18 million years ago, according to evolutionary biologists, when our great ape ancestors likely developed sleeping platforms.² They would bend and weave together branches, twigs, and leaves, creating what we might call the first beds. Building these rudimentary and temporary platforms—something modern gorillas, orangutans, and chimpanzees still do—would have offered protection from predators and blood-sucking insects. Perhaps they offered escape from ground-level humidity as well.³

But the real transformation came when our hominin predecessors, the forebears of Neanderthals and *Homo sapiens*, broke from this pattern. While apes continued to build fresh nests each night, abandoning them in the morning, our hominin ancestors began experimenting with something surprisingly revolutionary: permanence.⁴

One of the earliest traces of this practice was found in Olduvai Gorge, Tanzania, dating back to around two million years ago. Archaeologists discovered stone artifacts associated with early hominin species. Most importantly, these were clustered in specific locations. This suggests our ancestors were creating the first “places,” sites they would return to again and again.

Why bother establishing a favored place at all? Unlike most primates, who consume what they find on the spot, early hominins began carrying food back to a central place to share. Such behavior would have improved the odds of reproduction. “The extraordinarily long period of juvenile dependency necessitates high levels of cooperation and resource sharing by both parents, by other children, and sometimes by other members of the society,” evolutionary anthropologists Steven Kuhn and Mary Stiner observe.⁵ “It takes a village to raise a child, but it also takes a long time.”

Regardless of intent, this seemingly simple change—the creation of places to return to—marked one of the most significant transformations in human evolution. Unlike the solitary nests of apes, these early campsites became the first community spaces in human history.

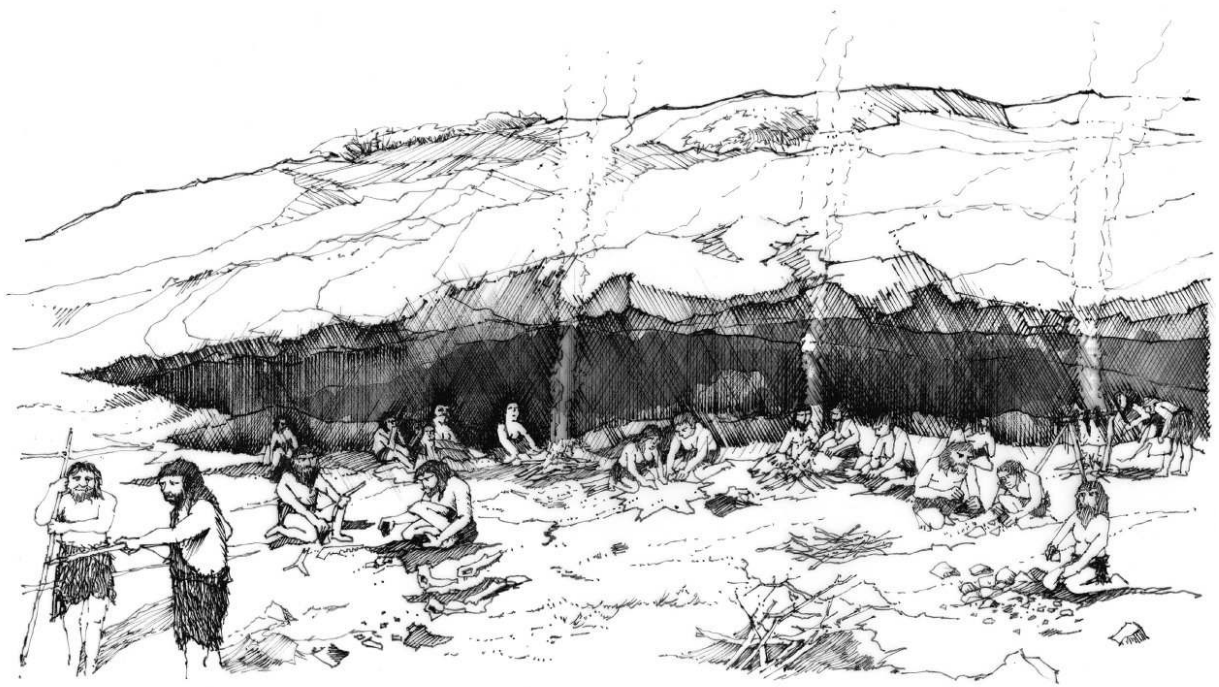
Here, our ancestors did more than rest—they slept, shared food, crafted tools, and passed down knowledge. As several anthropologists have noted, these sites became “arenas for social learning that had not existed previously.”⁶ This new social environment may have even helped shape our brains, particularly the neocortex—the region responsible for advanced cognitive functions such as emotional control and planning.⁷ This new lifestyle not only set human habitation apart from that of apes, it may have redefined who we were.

This would also have accelerated one of our signature strengths: our ability to make tools, positioning us, as several archaeologists describe, as “ultrasocial engineers.”⁸ The earliest known trace of this engineering impulse surfaces at Kalambo Falls, Zambia. There, excavators discovered two interlocking timbers dated to roughly 476,000 years ago—evidence that, as the researchers describe it, offers “a glimpse of a capacity to create a built environment” long before *Homo sapiens*.⁹

The next major revolution came with the habitual use of fire, beginning around 400,000 years ago. Fire changed human habitation in ways our ancestors could hardly have imagined. It kept predators at bay, illuminated the darkness, provided warmth, and unlocked new food sources, making previously inedible items like grains digestible. This transformed our relationship with time, cutting the time spent chewing raw foods and extending our days beyond sunset.

Around the same period, our ancestors began to more frequently occupy rock shelters and caves. Fire made the inhospitable conditions of caves more bearable, as caverns were often cold, dark, damp, and home to other residents like lions, bears, and hyenas, which had to be displaced. With fire, these places stayed occupied longer.¹⁰ But fire did more than make campsites and caves more comfortable.

“Home is where the hearth is” goes the saying, and in prehistoric times, the hearth was truly the center of the home. Our ancestors gathered around fires to share food, tell stories, and strengthen social ties. As archaeologists Desmond Clark and Jack Harris observed, fire “helped to weld early hominid groups into the coherent family units that are characteristic of human society.”¹¹



Rock-shelter, Abrigo de Navalmaíllo, Spain, ca. 73,000 BC. ¹²

These more permanent places likely changed our trajectory. They provided safe havens, helping to protect the young and vulnerable and extending the lifespan of the physically compromised. ¹³ Previously, a bone fracture would have meant certain death. Now, there was hope for recovery.

In some ways, a permanent place made survival easier. But it also required more advanced social skills. This could have affected our evolution. Natural selection could have increasingly favored those better at cooperation, communication, and conflict resolution. The use of fire for cooking reduced the size of our teeth, leaving them smaller than those of other animals. Some archaeologists have proposed that dwelling may have changed our brains. It established a feedback loop: Humans were creating homes, and homes were shaping humans. This process may have influenced the development of future generations in a nonlinear way. As Kuhn and Stiner observed, “More and more, hominins were coevolving with the world that they modified.”

These early settlements proved attractive to other hominins, drawing them in with the promise of food, resources, and companionship. Yet this closeness came at a cost. Exposure to smoke from open fires harmed lungs. Meanwhile, the close proximity of people hastened the transmission of mycobacterial diseases through coughing. ¹⁴ Tuberculosis, for instance, is estimated to have caused about a billion deaths across history, more than all famines and wars combined. ¹⁵

Managing fire brought other challenges as well. Early humans had to master the delicate balance between warmth and smoke inhalation. Recent studies of sites like Lazaret Cave, occupied approximately 170,000 years ago, reveal advanced spatial thinking. Hearths were strategically placed in “sweet spots” that maximized heat and light while allowing smoke to escape. ¹⁶ Too deep in the cave meant safety from predators but poor ventilation. Too near the entrance meant better air but exposure to cold and danger. This spatial problem-solving reflects not only an awareness of these practical challenges but also an ability to overcome them.

Meanwhile, the control of fire enabled our ancestors to venture into regions like northern Europe during periods when nearly 30 percent of the continent lay under ice, dramatically expanding our territory. It also marked humanity's first major impact on the Earth. Long before industrial emissions, our ancestors wielded flames as environmental engineering tools. They managed burn zones that promoted fruit- and nut-bearing plants in the postfire regrowth vegetation.¹⁷ Fire became a powerful hunting aid, exposing the nests of small game and driving larger prey into traps. It effectively shrank the "radius of a meal"¹⁸—the distance humans needed to travel to find enough food. Our ancient use of fire has influenced many ecosystems and spurred the rise of fire-adapted plant species (pyrophytes).

As our ancestors' mastery of fire grew, so did their ingenuity in creating comfort. More than 200,000 years ago, evidence of the first intentionally created bedding appeared in southern African rock shelters.¹⁹ Early *Homo sapiens* carefully constructed beds of broad-leaved grasses to enhance their comfort. They placed them close to the hearth—and, judging from the scorched ends of the grasses, sometimes too close. This arrangement mirrors modern hunter-gatherer camps, where people still gather to sleep around the fire.²⁰

Neanderthals displayed architectural capabilities of their own. Around 176,000 years ago, deep within Bruniquel Cave in France, they ventured more than a thousand feet from the entrance. Working by torchlight, they deliberately stacked hundreds of stalagmite pieces into two broad rings, some bearing traces of fire.²¹ This wasn't shelter but one of humanity's earliest monuments. The sheer effort required speaks to sophisticated planning and cooperation.

By 100,000 years ago, hominin settlements show evidence of complex spatial organization. The popular image of Neanderthals living deep in caves turns out to be wrong. Archaeologists found they preferred more accessible spaces near cave entrances and under rock shelters. There, they created distinct zones for different activities, including hearths for cooking and areas dedicated to toolmaking and butchering.²² They even buried their dead beneath the cave floors and engaged in symbol making, adorning stalagmites with abstract designs using red ochre pigments.

When Neanderthals tracked game, they constructed temporary windbreaks from wood and mammoth bones. One striking example comes from La Folie, a 60,000-year-old site in west-central France. In this harsh, cold environment of Ice Age Europe, Neanderthals created what archaeologists believe was a base camp. Preserved post holes suggest a circular wooden structure, likely supporting brush or hides, serving as a windbreak. Within this 30-foot diameter space, they carried out several activities. They rested, shaped stone tools, and prepared meals. They may have even laid mats to soften the floor.²⁴



Temporary Neanderthal camp “La Folie,” near present-day Poitiers, France, ca. 60,000 BC. ²³

As the Neanderthals gradually disappeared around 40,000 years ago—partly due to competition with our own species—*Homo sapiens* began taking shelter-building in new directions. In the Dordogne region of France, they occupied rock shelters and decorated them. They made engravings and stained them with red, yellow, and brown ochre, sometimes starting with a preparatory charcoal sketch. Among these earliest artistic expressions were hand stencils, geometric patterns, and animal figures. One of the oldest symbols was probably a representation of the vulva. ²⁵ These endeavors revealed not only the unique symbolic capacity of our species but also an emerging desire to make living spaces distinctly our own.

The limitation of caves, of course, is that they have a predetermined location. However, modern humans also built more impressive temporary shelters in open locations. One example comes from Mezhirich, Ukraine, dating back around 15,000 years ago. Here, a group of Ice Age hunter-gatherers constructed oval and circular huts from 120 to 240 square feet in size. They were built mostly from mammoth bones and are among the earliest examples of architecture. The largest of these structures, weighing approximately 50,000 pounds, would have required ten people over five days to erect. ²⁶ Given the extraordinary effort required to build them, these structures may have held ceremonial or symbolic meaning beyond simple shelter.

The mammoth-bone huts represent a level of architectural skill that sets them apart from the instinctive nest building of our ape ancestors. The builders demonstrated a rudimentary understanding of engineering, deliberately placing each bone to exploit its natural geometry. They created a precise oval or circular foundation and arranged leg bones and jaw bones at regular intervals. They positioned the jaws chin down. The leg bones probably upheld a roof, although it is likely that wooden elements would have helped support it as well. The entrance was marked by large upright mammoth tusks. The wall displayed a careful repetition and symmetry using pieces of the vertebral column. Remnants of hearths inside the dwellings indicate the use of bones as fuel. The final effect must have been striking—like igloos made of bone rather than blocks of ice.



Bone hut, Mezhirich, Ukraine, ca. 15,000 BC.

Several of these mammoth-bone dwellings have been found across Eastern Europe and Russia. They helped the builders cope with the frigid temperatures near the end of the last Ice Age when ice sheets stretched far into Europe. Archaeologist Steven Mithen describes what these homes might have been like inside: “The floor is soft, carpeted with hides and furs that surround a central ash-filled hearth. Mammoth skulls and leg bones provide furniture; an assortment of leather bags, bone and wooden bowls, antler and stone tools are scattered by the walls and hung from the rafters—a scene of Stone Age domestic clutter.”²⁷



[Follow for extended description](#)

Traditional Inuit igloo, Nunavut, Canada.

In a twist of prehistoric irony, our ancestors' hunting skills proved too effective, leading to the extinction of mammoths around 10,000 years ago—and mammoth-bone dwellings with them. However, humans also used other building materials, particularly wood. Yet these more perishable materials present a challenge for modern archaeologists. Wooden structures rarely survive. Even when promising sites are discovered, researchers struggle to interpret them, due to their decay. As archaeologist John Yellen noted, “Paleolithic Pompeiis are unknown.”²⁸ Most of these ancient homes have long since returned to the soil, leaving archaeologists to piece together their stories from fragmentary evidence.

However, on rare occasions nature preserves a snapshot of prehistoric domestic life. One such example was a fisher-hunter-gatherer base camp of six huts on the shore of Israel's Sea of Galilee dating back 23,000 years. These Paleolithic homes survived thanks to a curiously helpful sequence of events: a fire followed by submergence under lake water, which protected them from decay. They might have remained hidden forever, until a recent drought when water was pumped from the lake. Archaeologists found that the site's foragers had crafted small huts from brushwood, weaving them into dome-like structures enclosing a central hearth. Near the perimeter, they covered the floor with thick bunches of grass laid out in a tile-like pattern on top of a solid layer of clay.²⁹

Yet even these well-crafted dwellings were not meant to last forever. This pattern of temporary settlement continues among modern hunter-gatherers today, like the !Kung people in the Kalahari Desert. They rarely stay in one place for more than a few months due to the intrusion of insects that inevitably follows human habitation.³⁰ Nevertheless, in these fleeting shelters we find humanity's first steps toward permanent places in the landscape. What began as simple returns to favored spots evolved into increasingly sophisticated and enduring manipulations of space that would ultimately distinguish us from every other species on Earth.



Brush hut at Ohalo II, Sea of Galilee, Israel, ca. 21,000 BC.³¹

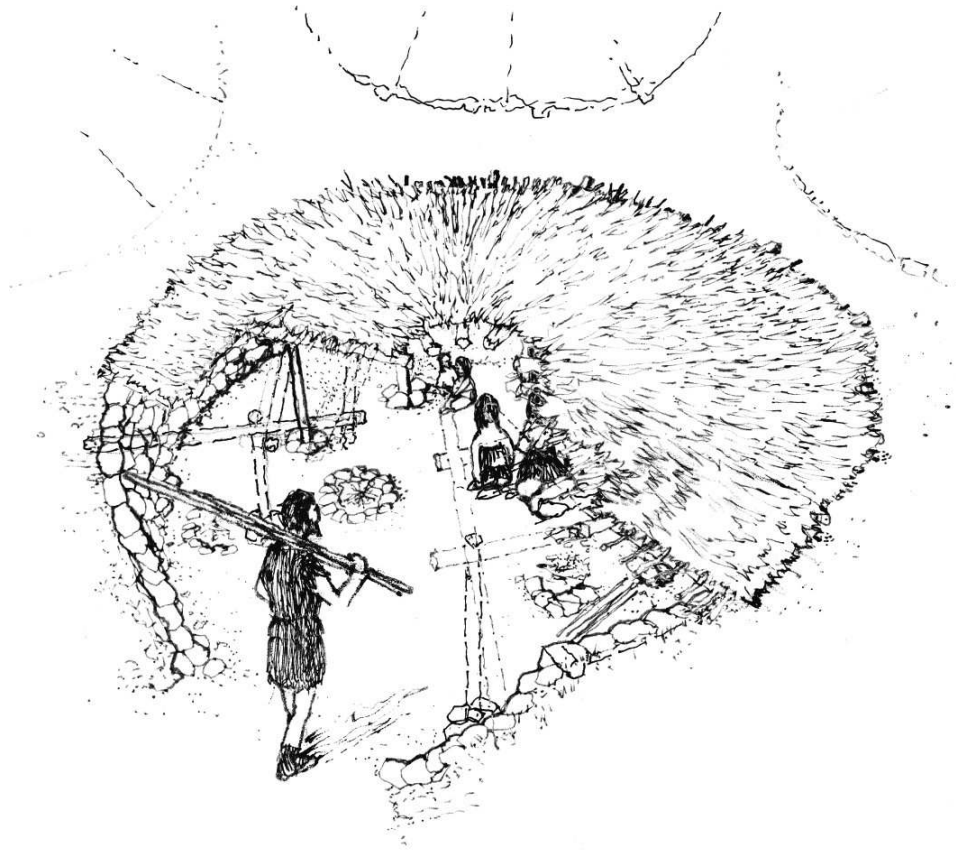
Digging In

Roughly 20,000 years ago, the last great Ice Age drew to a close. As the world began to warm, the ice sheets, which once cloaked nearly a quarter of the Earth's land, started to recede. Their retreat did more than reshape the terrain. In the Eastern Mediterranean, they created the perfect laboratory for human innovation. Once-barren steppes flourished into lush woodlands teeming with olive, pistachio, and oak trees, alongside fields of wild wheat and barley. Here, humanity would take major strides toward permanent settlement.

The Natufians, a hunter-gatherer culture inhabiting what would become modern-day Israel and Palestine, were the first to seize this opportunity. Around 14,500 years ago, surrounded by abundant almond and pistachio trees and calorie-rich plants, they chose a different path. They stopped following the seasonal migrations of animals and plants. Instead, they decided to make the land work for them. They settled down.

Their solution to permanent housing, the pit house, was both simple and ingenious. By excavating circular or oval depressions in the earth and roofing them over, they created dwellings that were easy to construct and durable. Without the masonry skill to erect freestanding walls, the Natufians used the earth itself to provide natural walls. Better still, these semisubterranean structures offered superior insulation, remaining warm in winter and cool in summer.

The pit house proved so effective that it emerged in other cultures as well. In Eastern Europe, hunter-gatherers first constructed mammoth-bone huts partially buried in circular pits to ward off the cold. The Yellow River Valley of China saw pit houses emerge around 6,500 years ago as shelter from harsh weather. Native Americans in the Sonoran Desert, about 4,000 years ago, also dug oval pits several feet deep for their dwellings to escape the summer heat. While these cultures developed their solutions independently, they all discovered the same solution. The pit house was nearly ideal, requiring minimal resources while being adaptable to almost any climate.



Natufian pit dwellings, 'Ain Mallaha ('Eynan), Israel, ca. 12,500 BC. ³²

Most archaeologists would agree that the round and oval houses of the Natufians represented the earliest structures to echo our modern notion of a home, marking a key step toward permanent settlement. ³³ The Natufians did not just dig a hole and cover it with branches. Instead, they used rocks to stabilize the pit's sides, creating a rudimentary retaining wall. Inside, they built a ring of evenly spaced posts that supported the roof, and anchored the posts with rocks. They likely created a roof from branches or reeds. These homes were modest in size, spanning 10 to 20 feet in diameter. They featured one or several stone hearths. ³⁴

The circular design of Natufian houses offered several other advantages as well. Round pits were easier to dig than rectangular ones. Round shapes also distributed structural forces more evenly, increasing resistance to wind forces. Unlike their rectangular equivalents, round buildings avoided collapsing corners. Without corners, construction became simpler. The circular design also proved highly efficient, as round shapes enclose maximum space using minimal materials. The presence of a central hearth could warm the interior evenly, ensuring optimal warmth throughout the dwelling. These benefits help explain why round forms dominated early architecture across widely separated cultures from Africa to the Americas. ³⁵

Perhaps most impressive was the geometric precision of some of the dwellings. One of the excavated remains featured perfectly circular foundations. Elsewhere, researchers found a circular limestone disk tool about eight inches in diameter. Both artifacts exhibit a surprisingly high level of symmetry. This likely reflected the Natufians' deliberate intent to build circular forms. ³⁶ These homes suggest they had planned their buildings in advance, challenging our assumptions about when such deliberate architecture emerged.

Their settlements featured both large and small single-room houses. However, their specific purpose remains uncertain. Curiously, house size showed no correlation with family size or social status—a finding consistent with the absence of evidence of social stratification among the Natufians. As a result, archaeologists suggest the variation in size was tied to function rather than social hierarchy.³⁷ The larger structures might have functioned as communal spaces or workshops.

For the first time in history, people began living together in such large numbers. Natufians clustered their homes into small hamlets, which supported estimated populations of around 150 individuals. This was a major increase from the typical hunter-gatherer groups of about 15 to 50 people.³⁸ The Natufians were not full-fledged farmers yet, as they cultivated wild cereals while preserving their hunting practices. Nevertheless, their dwellings represent a major step toward a sedentary existence.

These early villages were likely quite vibrant. Much of life occurred beyond individual dwellings in shared outdoor spaces, such as communal cooking and food preparation. François Valla, one of 'Ain Mallaha's original excavators, argued that life in these communities differed sharply from scattered bands.³⁹ They likely hosted feasts, ceremonies, and social events. These activities may have been similar to the periodic gatherings of later hunter-gatherer societies, like the seminomadic Inuit in the Arctic, who lived in tents in summer and igloos in winter.

But humanity's first experiment with permanent settlement also attracted unexpected visitors. As the settler populations expanded, so did house mice populations, drawn by the concentrated food waste in villages. House mice emerged around the same time as the first Natufian settlements and quickly outcompeted native wild mice.⁴⁰ The ripple effects of this ecological change extended further up the food chain. The abundance of food waste and the mice, in turn, drew wolves closer to human communities. Some scholars suggest that this influx of wolves may have triggered the domestication of dogs—a relationship immortalized in the burial of an elderly Natufian woman, her hand resting gently on a puppy.⁴¹

In response, the Natufians adapted their structures, modifying the smaller circular buildings between their dwellings—likely granaries—with suspended, sloped floors that deterred rodents and enhanced air circulation to prevent food spoilage.⁴² Thus, the Natufians had to adjust to environmental challenges they themselves unintentionally created.

The price of permanence grew steeper with each generation. Fixed settlements introduced water pollution, as accumulated garbage and human waste began to taint their water sources. The constant harvesting of local plants and the overhunting of animals led to gradually diminishing resources. In some cases, it led to local extinctions.

Yet this human-environment dynamic was more nuanced than just exploitation. The Natufians, like other early settlers, pioneered land management practices that reshaped landscapes in both costly and fruitful ways. Through selective harvesting, they unintentionally dispersed seeds. This created new vegetation patterns across their lands. Controlled burning promoted secondary forest growth, drew game animals, and fostered the growth of new plant species. The resulting ash boosted soil nutrients, often increasing local biodiversity and ecological productivity in ways that benefited both human communities and local ecosystems.

Remarkably, evidence reveals that as far back as 12,000 years ago, three-quarters of Earth's land bore subtle marks of human activity.⁴³ This finding upends our notion of “untouched” and “pristine” nature. The wilderness we now idealize was likely shaped by millennia of interaction between humans and their environment.

However, permanent settlement exposed humans to new vulnerabilities. With fixed dwellings and stored food supplies, communities lost the option to simply pack up and leave. Settlements in river valleys faced flooding, while those in drier areas were vulnerable to drought. Villages in woodlands risked wildfires. Resource depletion added pressure as intensive hunting and gathering began to outstrip natural regeneration. The Natufians found themselves in an increasingly adversarial

relationship with nature, both subject to its forces and unintentionally worsening the frequency and severity of disruptive environmental events. These challenges occasionally delivered stark reminders about the increased vulnerability and responsibility tied to their fixed abodes.

These risks intensified with growing populations. Permanent settlement allowed for larger families. With a stable home base, parents could more easily care for multiple children without the strain of continuous movement. This reduced the need to space births widely. The growing economic value of children in early farming and foraging activities likely spurred population growth as well.⁴⁴ But larger families strained food supplies. Archaeological evidence from gazelle bones indicates that the Natufians mostly hunted larger males.⁴⁵ This would have likely shrunk gazelle populations and meat yields over time. They also overharvested wild plants, reducing their capacity to regenerate.

Around 10,500 BC, the climate suddenly plunged back toward Ice-Age conditions—a brief cold spell known as the Younger Dryas. It likely struck a fatal blow to the Natufians’ sedentary life. They abandoned their villages and reverted to nomadism. Nevertheless, they still established smaller, semipermanent camps to exploit seasonal resources.

While their 2,000-year experiment in settled life ended, it was far from a failure. The Natufians pioneered innovations from durable pit houses to sophisticated granaries. Their hard-earned lessons helped pave the way for their descendants to transition from foragers to farmers and continue the trajectory toward permanent human habitation.

Breaking the Circle

One of the few places to witness the evolution from hunter-gatherer encampments to agricultural settlements is Beidha in southern Jordan. Unlike its famous neighbor Petra, whose striking tomb facades carved into red rocks draw crowds and feature in movies like *Indiana Jones and the Last Crusade*, Beidha offers little spectacle. It appears unremarkable—just ancient stone foundations. But what Beidha lacks in grandeur, it makes up for in historical significance. The site provides a key to understanding how so many of us came to inhabit rectangular buildings today.

Beidha was a seasonal encampment around 11,000 BC established by the Natufians, who used the site as a base for hunting activities. It was then abandoned, perhaps due to depleting resources and a cooling climate. Around 9600 BC, after enduring a thousand-year drought, temperatures rose. This dramatic change to warmer and wetter weather likely prompted a new society, descended from the Natufians, to try their luck at permanent settlements.

Perhaps realizing that wild crops would eventually be depleted with continued harvesting, these people began cultivating them. They grew rye, wheat, and barley in the fertile alluvial valley soils. Knowing that solely hunting wild gazelles was no longer sustainable due to overhunting, they started to domesticate sheep and goats. They became farmers.

This was the beginning of the Neolithic period, or the New Stone Age (from the ancient Greek *neos* meaning “new” and *lithos* meaning “stone”). The shift to agriculture enabled these early settlers to produce surplus food and invest more heavily in their dwellings. But by settling in permanent locations to manage their crops, they also had to safeguard them from others who might, quite literally, pick the fruits of their labor. As the architectural historian Spiro Kostof noted, “A fixed place under the sky—that is the Neolithic legacy.”⁴⁶

This culture is known to archaeologists as the Pre-Pottery Neolithic people. This name highlights their lack of pottery-making technology, such as the ability to fire clay. Yet what they lacked in ceramic skills, they made up for in their buildings. Returning to villages the Natufians had previously abandoned, these people began using more durable materials like stone and experimenting with innovative construction methods. One of these was the invention of mud bricks.

Mud bricks were one of humanity’s first widely used building materials. Mud was available in many parts of the world, but brick making was labor-intensive. It required that villagers laboriously dig clay from the valley floor. They then often kneaded it with straw for greater resilience. They

molded this mixture into oblong forms, leaving them to sun-dry for a few weeks. Once hardened, the villagers stacked them and bonded them with mud mortar to raise walls. These mud walls also offered some welcome insulation from both heat and cold. All these efforts demonstrate their dedication to permanent settlement.

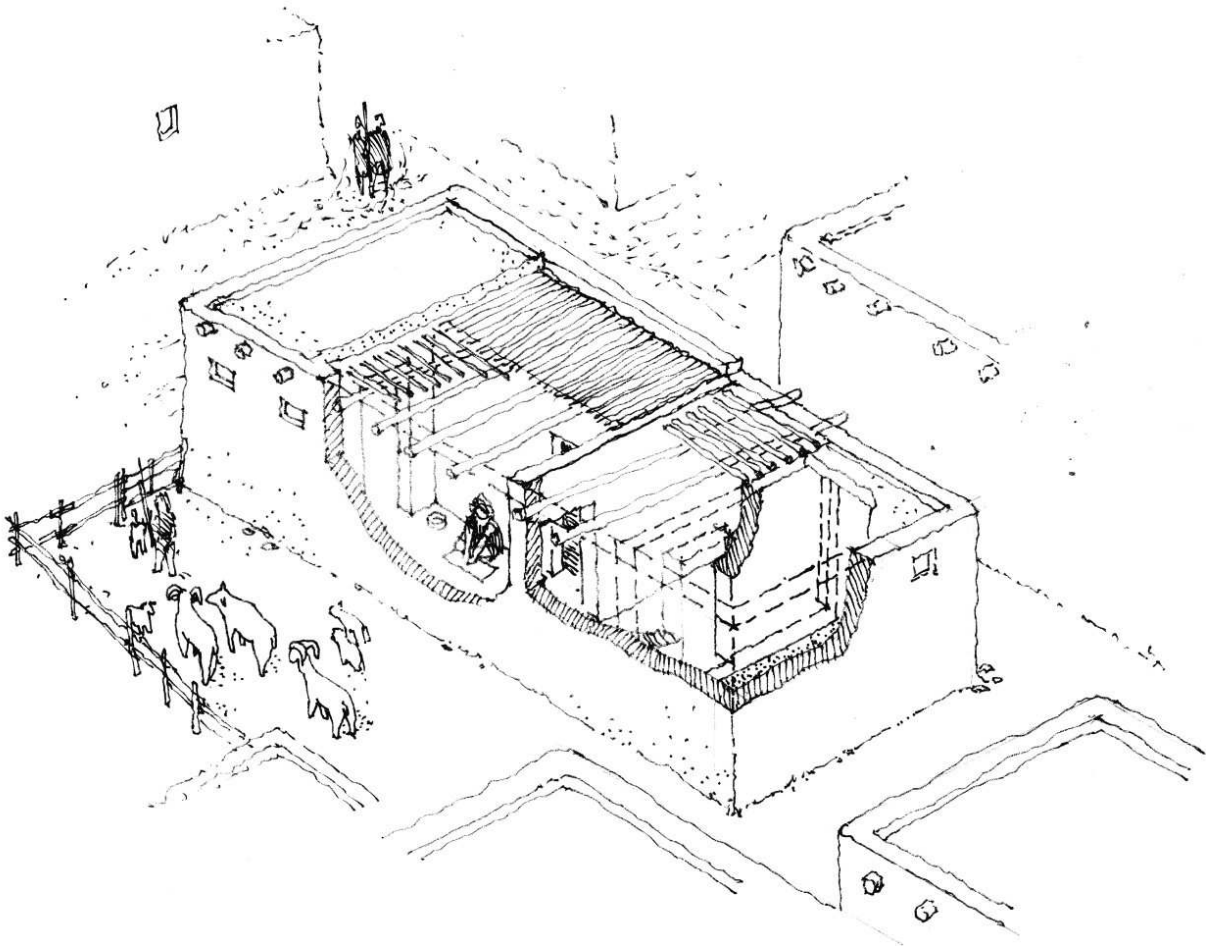
Their methods proved successful. The Pre-Pottery Neolithic people expanded across the Middle East. By 8000 BC, agropastoral villages thrived throughout the Levant in the eastern Mediterranean, from the highland regions above the Euphrates River in Syria northward into Anatolia. Some of these villages boasted hundreds of well-constructed houses.⁴⁷ One of the smaller settlements was Beidha.

At Beidha, the villagers herded goats, sowed barley and wheat, and also hunted game and foraged nuts.⁴⁸ In the beginning, they built pit houses with sunken floors, stone foundations, and wooden posts supporting roofs. But around 6650 BC, their homes were destroyed by fire.

From those ashes rose a new beginning. Departing from the old semisubterranean pit dwellings, they built aboveground designs. They erected walls of mud bricks and sandstone slabs and topped them with flat roofs. They covered floors in plaster and even decorated some with black paint or burnished black-and-red patterns.⁴⁹

Most importantly, their buildings were no longer round but rectangular.

Erecting rectangular houses demanded advanced building techniques, such as joining perpendicular walls at ninety-degree angles. But it gave them significant benefits. These homes could be more easily divided into multiple rooms, each space tailored to a specific purpose. They could more easily be expanded, with additional rooms built adjacent to existing ones. Flat roofs also provided new opportunities, such as the potential for upward expansion and rooftop private outdoor space. The shift to rectangular buildings fostered denser communities by allowing for more tightly knit, organized settlements.



Five-room mud brick house, Abu Hureyra, Syria, ca. 6500 BC.

Over time, Beidha's population doubled to a few hundred people. Residents built larger houses with up to five rooms, replacing the single-room homes of their earlier pit dwellings. Where circular homes could house one or two individuals, the rectangular multiroom structures could accommodate entire extended families. As agriculture led to an increase in village populations and social complexity, the rectangular plan offered a more practical dwelling arrangement.

This wasn't unique to Beidha. Across the Levant, a pattern emerged. As communities developed their farming and herding skills, they would shift from building circular dwellings to rectangular ones. For instance, Jericho, located in today's West Bank, began as a settlement of circular pit dwellings established by the Natufians. The Pre-Pottery Neolithic people initially continued this tradition of circular pit homes. By 9600 BC, the inhabitants had constructed a wall partially enclosing their village, perhaps to protect from floods, making it the first known fortified town.⁵⁰ Their crowning achievement was the Tower of Jericho, a 28-foot-tall round stone structure considered humanity's first work of monumental architecture. It may have had a ceremonial purpose, maybe as a landmark to draw outsiders into their communal way of life.⁵¹

Around 7000 BC, Jericho became one of the largest villages of its time, housing possibly up to 3,000 individuals. The village architecture of rectangular homes built from mud bricks reflected this. Even the bricks evolved. Where initially bricks had flat bottoms and rounded tops, they became perfectly cuboid, allowing better stacking and creating more stable construction.⁵²

This transition from round to rectangular dwellings happened not only in the Near East, but in agricultural societies worldwide, from Mesoamerica to Asia.⁵³ People arrived at rectangular building independently, suggesting it was a widely favored solution as communities became better farmers. Archaeologist Kent Flannery⁵⁴ noted how food storage played an important role in this transition. He found that in early villages with circular or oval-shaped huts, storage facilities typically stood out in the open. This pointed to food being shared communally. This practice resembles the egalitarian culture still observed by hunter-gatherers today, which reduces individual risk as environmental conditions change.⁵⁵ But the rise of rectangular homes with multiple rooms brought a major change. Increasingly, one room within the dwelling itself was specifically dedicated to storage. As agricultural societies advanced, the rectilinear house gave households a greater autonomy in managing surplus resources.

This architectural shift came along with a change in social dynamics. As Flannery emphasized, it changed the risk and reward equation for households. When storage was communal, individual households had little incentive to maximize resources for themselves, since everything was likely shared. Private storage changed this. Suddenly, houses within the village had an incentive to compete, each family striving to maximize resources for their own household. At the same time, as early farming villages expanded, it was likely that fewer families were closely related by blood. This could have made them increasingly less inclined to share resources with their neighbors.

One researcher noted that communities with privatized storage had a more “closed” site layout. They featured “either widely spaced household units or closed-in eating and storage areas, in order to avoid the jealousy and conflict which might arise from one household visibly having more than another.”⁵⁶

Yet paradoxically, the very walls hiding indoor activities may have intensified jealousy as well. As anthropologist Peter Wilson argued, the presence of walls fundamentally altered our ancestors’ visual attention, reshaping their drives and emotions. Hunter-gatherers could carry only what they could move, but once people settled in dwellings, they could accumulate, conceal, and display food, wealth, and status. This shift toward village life, Wilson suggests, was as transformational as when our distant ancestors descended from living in trees to living on the ground, which freed our hands from grasping. Villagers, he argued, became “domesticated people,” psychologically and socially distinct from those in roaming bands.⁵⁷

Meanwhile, the number of farmers was growing, outperforming hunter-gatherer societies. By cultivating crops and domesticating animals, agricultural communities could produce food more reliably and efficiently than through foraging alone. This sustained growing populations and more complex societies. Archaeologist Gordon Childe, who coined the term “Neolithic Revolution,” or Agricultural Revolution, estimated that in aboriginal America, unimproved land could sustain a population ranging from about .05 to .1 person per square mile. In contrast, Neolithic societies on the Pacific Islands today can sustain populations of approximately thirty or more people per square mile.⁵⁸ The transition from a hunter-gatherer lifestyle to an agricultural one dramatically expanded the Earth’s “human carrying capacity,” the maximum number of people that could be supported.

Given these advantages, it should be no surprise that the agricultural transition ultimately unfolded independently in at least eleven different regions worldwide.⁵⁹ This revolutionary shift began about 10,000 to 12,000 years ago, spanning from the cultivation of rice in East Asia to the domestication of squash in the Americas. As agricultural knowledge spread, in regions like the Mediterranean, humans selected and cultivated hundreds of varieties of crops, from olives to grapes.⁶⁰ Farming produced the surplus food that enabled more populous, specialized, and socially complex societies—though some might argue it was a double-edged sword.

Farming led to intensified resource exploitation and fierce competition for scarce resources within defined territories.⁶¹ Close contact with domesticated animals and wild pests, such as rodents, increased the incidence of zoonotic diseases like influenza. Dense, sedentary populations, with their

higher rates of contact, created perfect conditions for the spread of diseases like measles and smallpox. Farmers and their settlements contributed to deforestation, soil erosion, and water pollution. At times, the very practices that enabled growth also sowed the seeds of their own destruction. Even Beidha was eventually abandoned, perhaps due to the depletion of grazing lands, firewood, and fertile soil.⁶²

When I visited Beidha, it was difficult to imagine it was once a much greener place, with grasslands and trees. Today it is an arid desert. As the climate grew more arid over time, the once fertile land became less capable of supporting agriculture. People abandoned village life.

My stay at a Bedouin camp in Wadi Rum a few hours away provided a stark contrast. This otherworldly red desert—immortalized as alien terrain in films like *Star Wars* and *Dune*—at first seems a barren wasteland. Yet the Bedouins, with their goat- and camel-wool tents, seem well adapted to desert life. Their nomadic life in tents, radically different from agricultural communities in houses, shows that settled life is not the only way.

While the transition to rectangular buildings may have been an important step in human development, it wasn't the only path—or an irreversible one. Some societies, after embracing rectangular structures with private storage, returned to circular dwellings and shared storage, perhaps to share the burden of risk in changing economic conditions. And though permanent settlements are the norm for most of us, nomadic and seminomadic traditions persist today.

Many Bedouins clearly prefer it that way. Life in tents immerses them in the sweeping desert landscape and the unpolluted night sky. An archaeologist once observed how Bedouins have a fierce disdain for city life, citing a “mystical hatred of the roof” and a “religious revulsion to the house.”⁶³ Their rejection of rigid walls echoes the ancient Rechabites who, as Jeremiah chronicled, swore, “We do not drink wine.” And commanded: “You must never build houses, sow seed or plant vineyards; . . . [you] must always live in tents. Then you will live a long time.”⁶⁴ And so, not all succumbed to the comforts—and constraints—of rectilinear life.

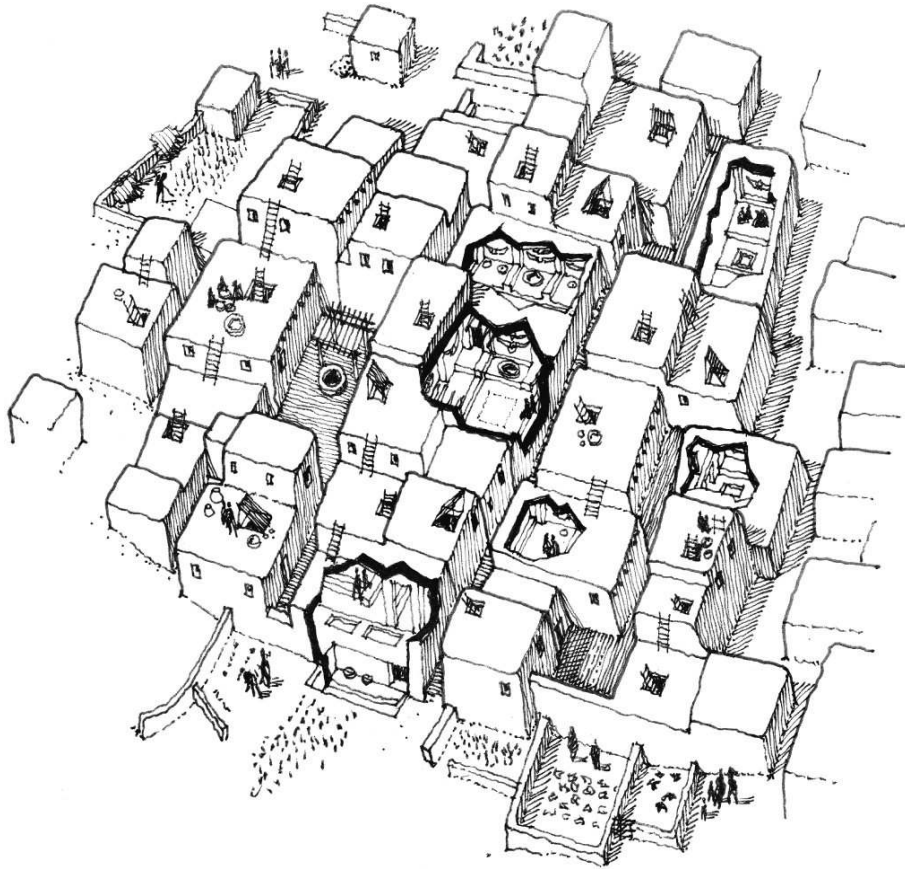
When Homes Touch

“On a cold November day in 1958, just before nightfall,” British archaeologist James Mellaart recalled, he finally “reached the double mound of Çatal Hüyük.”⁶⁵ He had first spotted the mound, “a third of a mile in length,” while exploring the Konya plain of the Anatolian plateau in 1952. But, as he admitted, “dysentery and lack of transport prevented its more formal discovery.”

Arriving with a team of archaeologists, he found: “Much . . . was covered by turf and ruin-weed (*Peganum harmala*) but where the prevailing south-westerly winds had scoured its surface bare there were unmistakable traces of mud-brick buildings, burned red in a conflagration contrasting with patches of grey ash, broken bones, potsherds and obsidian tools and weapons. To our surprise these were found not only at the bottom of the mound, but they continued right up to the top, some 15 metres above the level of the plain.”

Thus began the “discovery” of Çatalhöyük—though locals had long been aware of it. The settlement grew as an important supplier of obsidian, a volcanic rock prized for crafting blades. Occupied for over two millennia, it likely peaked at about 800 people in 6500 BC, far below earlier estimates of several thousands.⁶⁶ Nevertheless, it was one of the largest Neolithic villages of the time.

The village was essentially a massive honeycomb of cuboid houses pressed against each other without ground-level streets. Çatalhöyük was unlike anything seen since. Perhaps its closest modern parallel is found in dense informal settlements such as Rio de Janeiro's favelas, where houses are packed so closely that they seem a continuous mass.



Village of Çatalhöyük, Turkey, ca. 6700 BC. ⁶⁷

The wheel had not yet been invented, so streets were not necessary for wheeled transport. Instead, residents descended into their homes not through front doors but through roof hatches using wooden ladders. This arrangement may have offered some advantages, such as defense. Large windows and doors would have made the interior too hot. And similar to Middle Eastern cities today, these rooftops were active living spaces. Some roofs even had ovens. However, entering homes by ladder would have made life challenging, especially for the elderly and pregnant women.

The sight of Çatalhöyük, with people living in adjacent boxes, would have likely stunned the hunter-gatherers of the time. They might have encountered more people in a single day than they would have seen in their entire lifetime. Their camps were open and transparent. But Çatalhöyük was a maze of enclosed spaces. Activities that had been public were now hidden behind walls.

The appeal of living in Çatalhöyük in terms of quality of life was not immediately obvious, aside from participation in the obsidian trade. Most houses had no windows and only had roof openings. These openings doubled as access into the dwelling and smokestacks for hearths located beneath them, filling interiors with smoke. The word “window” itself, derived from Old Norse *vindauga* (“wind eye”), speaks to this early form of ventilation. Yet this rudimentary arrangement brought health hazards. Skeletal remains showed the buildup of sooty black deposits on the inside of rib cages of older residents, probably a consequence of life in smoke-filled homes. ⁶⁸

The village also struggled with hygiene. When a family vacated a home, it often became a dump for waste, including human and animal feces. ⁶⁹ Infectious diseases spread easily in such unsanitary conditions, with up to a third of human bones showing signs of infected lesions. ⁷⁰

But villagers did not just have to endure bad smells. ⁷¹ Çatalhöyük's homes required constant upkeep. Built largely from mud brick, the houses were vulnerable to rain. Mud brick deteriorates quickly when wet. Lacking proper drainage or strong foundations, homes demanded frequent repair or rebuilding.

Residents invested significant labor in maintenance. They replastered walls and sleeping platforms with white clay, gypsum, or lime to keep their interiors fresh and clean. ⁷² This maintenance process may have occurred up to three times a year. Some houses had been replastered about 450 times, ⁷³ lasting up to a hundred years. Builders then leveled entire homes and constructed new ones on top of the old foundations. Some structures had been rebuilt up to six times. Over generations, this practice caused the settlement to rise ever higher, eventually reaching sixty-six feet—roughly the height of a modern six-story building.

Villagers may have been willing to endure these challenges not only for economic reasons but also because they were deeply attached to their homes: Wall paintings were found in almost every house and often included elaborate symbols.

Residents divided their homes into two distinct zones. One was a small room centered around a hearth. It may have functioned as a kitchen area, judging by the ovens and clay bins for storing food found there.

But it was the main room that made Çatalhöyük famous. This room, typically cleaner than the other, had sleeping platforms. The walls and the platforms were covered with paintings, some bearing up to forty layers of plaster and paint. These murals offer windows into their worldview. Some images were morbid, showing vultures pecking at human corpses. Others featured abstract geometric designs, like a nine-foot mural possibly depicting a leopard skin. Many murals depicted wild animals and hunting scenes, even as the villagers increasingly domesticated animals, perhaps to evoke memories of the past.

Most dramatic were the protruding bull horn decorations, or *bucrania*, often set into the wall. Some were placed on small columns inside the room. They were often covered with plaster and painted with ochre red. In one example, three sets of bull horns were stacked one above the other on a wall, with a large human figurine above, its legs splayed wide. The walls also featured platforms with animal skulls, beaks, teeth, and tusks. The residents seemed to choose, above all, the pointier animal remains.

All of this may have been quite shocking to an outsider. Archaeologist Steven Mithen likened it to a “monstrous scene of bulls bursting from the wall. There are three of them at about waist-height—white heads striped with black and red, from which sprout enormous pointed horns. . . . Around the bulls the walls are painted with bold geometric designs—sharp, oppressive images above handprints in red and black.” ⁷⁴

Other symbolic components were found throughout the home and the village. Small figurines, often quickly made and discarded, were thought to be part of daily spiritual practices, akin to prayers. In other villages, archaeologists have also found decapitated animal figures that seem to have been ritualistically “killed.” ⁷⁵

Residents may have also been attached to their abodes because, unlike today, home was also a burial site. Ancestors were buried in fetal positions beneath the platforms. Some bodies were exhumed, their skulls possibly removed for use in ceremonies. These were placed in wall niches, almost as if they were watching over their descendants.

Anthropologist Ian Hodder, who spent decades excavating the site, identified a special category of dwellings. He called them “History Houses.” ⁷⁶ These featured more symbolism and more burials, one holding as many as sixty-two bodies. Though these houses likely held special religious significance, they showed no signs of greater wealth or storage capacity. This suggests a society where religious status did not bring material advantage. The archaeological evidence also hints at a

relative, if gruesome, gender equality: Both male and female skulls were used.⁷⁷ Men and women also had similar levels of darkened lungs, suggesting they spent equal time at home.

Importantly, these history houses had longer lifespans than other buildings. “Houses with many burials tend to be long lasting,”⁷⁸ observed Hodder. He argued that “making history” was essential in agricultural communities where labor had delayed payoffs. In contrast to the immediate return of foraging, farming required a “greater sense of temporal depth, history, and memory.”⁷⁹ Hodder notes, “The emergence of greater temporal depth was a necessary condition for dense settled life, the delayed returns of intensive subsistence systems.” The repeated rebuilding of homes, the burials, and the elaborate symbolism—all played out within the fabric of domestic life—maintained a shared sense of historical community.

Yet this ambitious experiment in communal living eventually faced significant challenges. Demand for wooden building materials led to extensive deforestation around Çatalhöyük. As trees vanished, residents had to travel farther for resources, adding new burdens to their daily work. The stresses of village life may have taken a toll as well. Evidence of interpersonal violence is found in the skulls of residents—of ninety-three skulls examined, twenty-five showed healed fractures, mostly among women, often from blows to the back of the head with round objects. Given that most of the head injuries occurred during the period of highest population density, some believe elevated stress and conflict may have been due to overcrowding.⁸⁰

By 6000 BC, Çatalhöyük was abandoned. It was part of a broader collapse of Neolithic settlements across the region. From Israel to Palestine, farming villages were deserted. People likely scattered into smaller hamlets. While changing climate patterns, including a drop in temperatures, played a role, the inhabitants themselves contributed significantly to the downfall of their villages. Deforestation, overcultivation, and overgrazing depleted the soil’s fertility. The pollution from human and animal waste further strained the ecosystems they were living in.⁸¹

At ‘Ain Ghazal in the Jordan Valley, the houses themselves contributed to the village’s decline. Villagers upgraded their homes by plastering floors with lime, which made them more water-resistant. Some builders spread the lime plaster as high as six inches up walls, posts, and hearths. But producing lime required burning limestone, heating it to between 750 and 850 degrees Celsius and accelerating deforestation. Trees vanished within a three-kilometer radius of ‘Ain Ghazal.⁸² Without the stabilizing tree roots, the soil eroded during periods of rainfall and became less fertile. With the soil already exhausted from overcultivation, crop yields shrank and the village was abandoned. Although other factors such as water pollution from human waste likely also played a role, the reliance on plaster technology influenced its downfall.⁸³

As archaeologists Nigel Goring-Morris and Anna Belfer-Cohen observed, permanent settlement during this time became increasingly unsustainable: “The whole fragile Neolithic network collapsed in upon itself.” By contrast, “the long duration of earlier mobile hunter-gatherer adaptations had enabled the ‘fine-tuning’ balance between people, the environment, and the resources necessary to avoid overexploitation.”⁸⁴

As our ancestors experimented with agriculture, housing, and construction techniques, they created larger and more permanent habitats. In the process, they faced new challenges. They lacked sewers and safe drinking water. They lacked reliable agriculture to support growing populations. Without workable solutions to these challenges of collective life—not realized until the Early Bronze Age—these villages hit a ceiling. Today, Çatalhöyük is a mound in the Turkish landscape, although one recognized by UNESCO as “a site of great importance for our understanding of the first steps toward ‘civilization.’”⁸⁵

When our ancestors transitioned from nomadic to settled life, they entered a new “indoor” phase of human existence. The walls they built reshaped not only their physical and mental world but also their relationship with nature. The problems they faced, from resource depletion to environmental degradation, echo those we struggle with today. As landscape architect Anne Whiston Spirn noted,

“Modern urban problems are no different, in essence, from those that plagued ancient cities, except in degree, in the toxicity and persistence of new contaminants, and the extent of the earth that is now urbanized.” ⁸⁶

The issue of home maintenance persists as well. As an owner of a mere hundred-year-old home, I find myself painting basement floors, clearing French drains, and repairing endless small failures. With a drill in hand to hang a family photo, I sense an odd parallel between those ancient residents who carved niches in their walls for ceremonial skulls. They worried about deteriorating mud brick. I worry about asbestos in insulation and lead in old paint. The tools and decorations have changed, but our desire to make our mark on these walls remains deeply human—even if there are hidden dangers in living a settled life.

Two

Cities of Mud

The Extended House

“In those ancient days . . . the lord of broad wisdom, Enki, the master of destinies . . . founded dwelling places; he took in his hand waters to encourage and create good seed; he laid out side by side the Tigris and the Euphrates, and caused them to bring water from the mountains; he scoured out the smaller streams, and positioned the other watercourses. . . . Enki made spacious sheepfolds and cattle-pens, and provided shepherds and herdsmen; he founded cities and settlements throughout the earth, and made the black-headed [Sumerians] multiply.”¹

In “Debate Between Bird and Fish,” a Sumerian essay dating back to the third millennium BC, it was Enki, the god of water, who created the world by laying out the great rivers. This belief reflects the reality of life in Mesopotamia. For it was in this “land between rivers”—for that is what *Mesopotamia* means in ancient Greek—that a new chapter in human history began.

Around 6000 BC, as farming villages in present-day Jordan, Israel, and Palestine were being abandoned, a new wave of settlement emerged in the foothills of Northern Mesopotamia. The twin waterways of the Euphrates and Tigris, born in the highlands of eastern Turkey and stretching to the Persian Gulf, provided the water, reeds, and clay that would build their world. These rivers—one fast flowing and unpredictable, the other broad and steady—would become both a lifeline and a challenge to the people who settled their banks.

The settlement of Tell Hassuna stood along the Tigris River. It was part of the Hassuna culture—one of the earliest farming societies in Northern Mesopotamia, centered in what is now northern Iraq. Villagers built small homes for nuclear families, consisting of just a few rooms. Excavators in 1943 found “the walls were built of lumps of mud of various sizes in a manner approximating the local modern practice. Smaller lumps were used to fill the gaps, and the faces were smoothed.”² These rudimentary buildings were likely topped with low-pitched roofs made of branches and covered in mud.