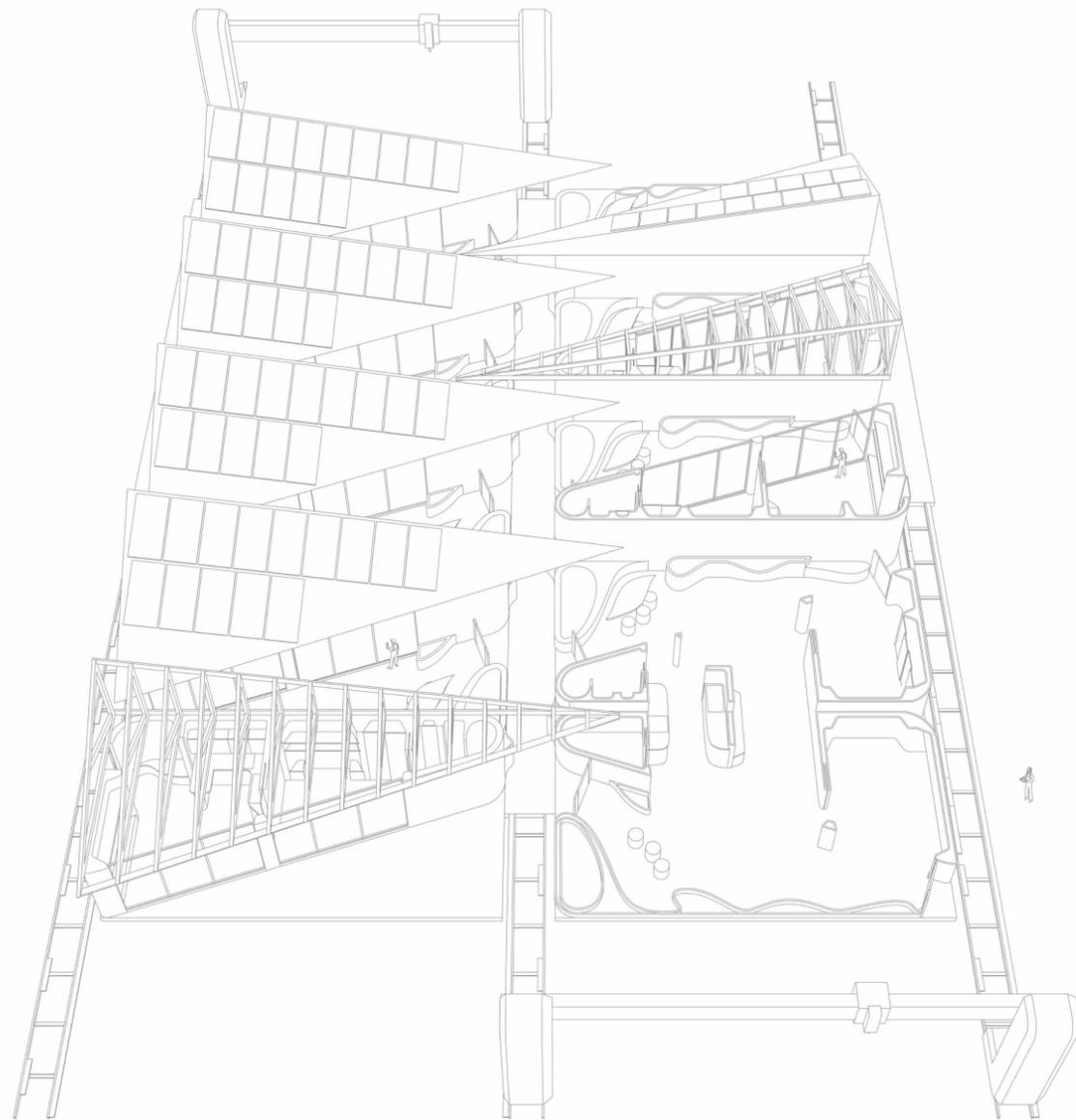




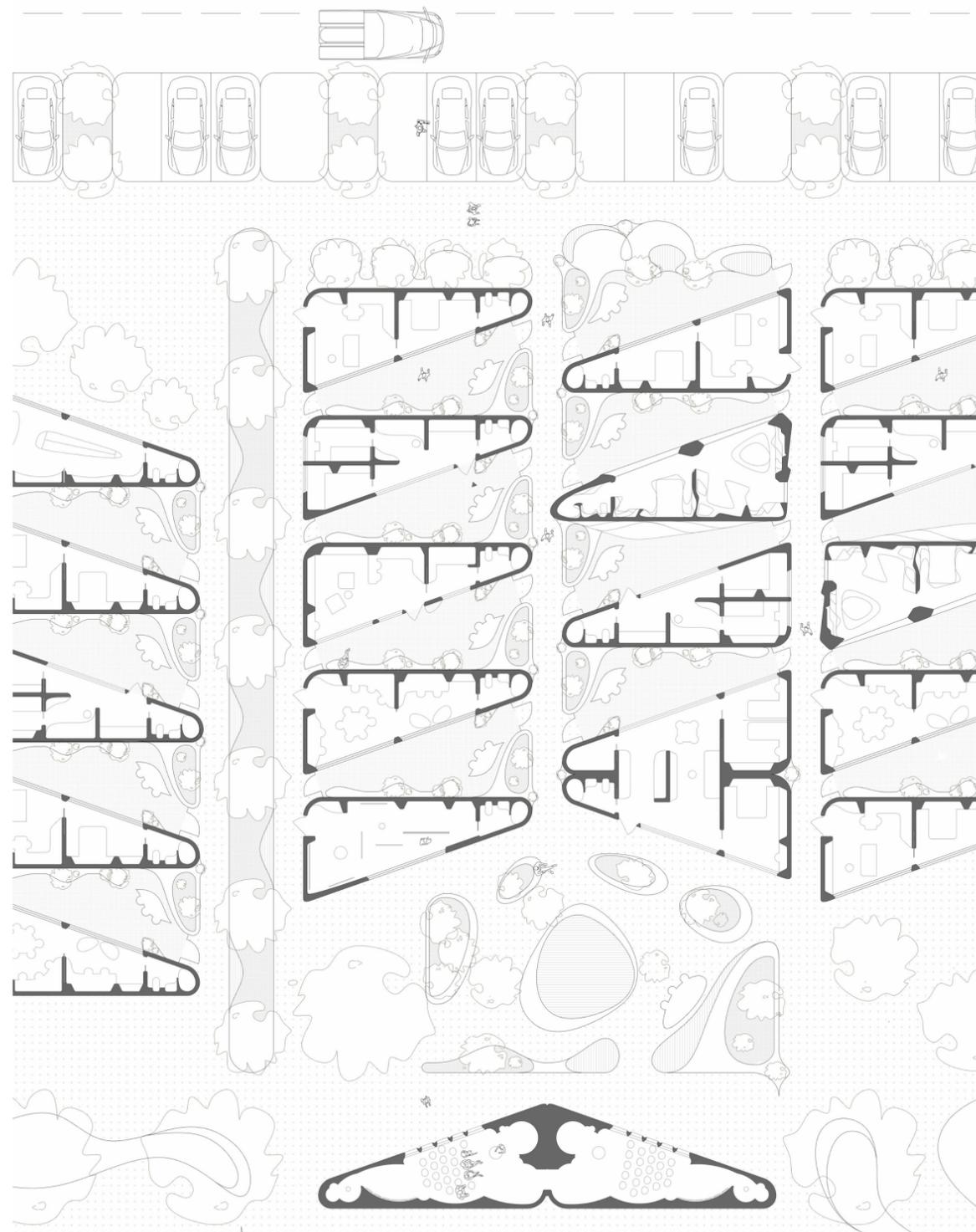
Trinity represents an innovative approach to housing design, rooted in the complex **balance between effective building volume and house price**. Our mission was to craft an equation that yields the optimal solution for a \$99,000 budget. Delving into this challenge, we sought not merely a formula but a guiding **principle that transcends conventional paradigms**.



Axonometry of process of construction on site

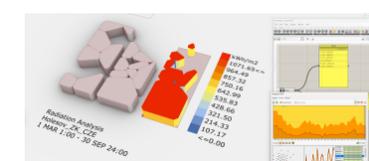
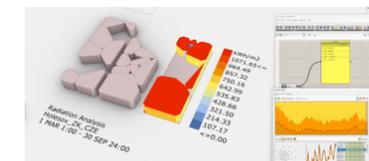
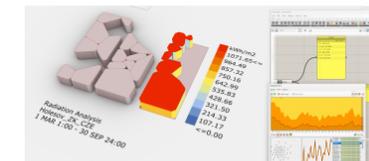
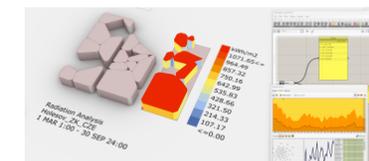
Revolutionizing Shelter: A 3D Printing Paradigm for Global Housing Solutions

In the face of escalating urbanization and the burgeoning global population, the **issue of homelessness has reached critical proportions**. A staggering **1.6 billion people worldwide endure substandard housing conditions**, underscoring the urgent demand for **affordable** and high-quality housing solutions on a world scale. Regrettably, conventional construction practices, limited land resources, and repetitive residential designs have imposed barriers to widespread homeownership. Compounding this challenge is the escalating number of individuals displaced from their homes due to **conflicts, climate change, and various social factors**, a trend that has been steadily rising since 2008, **affecting approximately 23 million people annually**, with projections indicating a further surge in the future. Amidst this disconcerting backdrop arises a promising solution through **innovative construction tools and techniques such as 3D printing, digital fabrication, and robotics**. Notably, 3D printing stands out as a transformative solution poised to alleviate the global housing crisis. This pioneering technology holds the potential to streamline the design and construction processes, expediting project timelines while upholding impeccable quality standards. In essence, **3D printing has the power to revolutionize the entire building industry**, providing a sustainable and scalable answer to the pressing need for adequate and affordable housing worldwide. Embracing these new-age methodologies is not just an architectural choice but a societal imperative that can **reshape the landscape of housing accessibility for generations to come**.



Example of the urban planning

The urban principle employs a syntax of alternating **houses (B) and yards (C)** in the sequence BCBCBCBCBCB, enabling the printing of 5 house-yard pairs (5BC) on a single print bed. These pairs are connected by elements like an **articulated park (G)** or a **garden with a root cistern and orchard (O)**. These green spaces can be linked to a **parking lot (P)** or a **public plaza (S)**. The resulting combinatorics generate a **diverse urban cluster** with public, semi-public, semi-private, and private spaces—P-O-5BC-S, S-G-5BC-P, and more. Various combinations, including G-G, OS, OO, SS, are possible, offering flexibility. Additionally, houses (B) can be replaced by public programs such as shops, classrooms, offices, gyms, galleries, introducing a **multitude of urban configurations**.

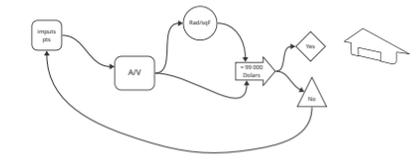


Trinity : A Harmonious Symphony of Architecture, Community, and Innovation

Our study led us to the comprehension : the key lies not solely in the shape of an individual building but in orchestrating a harmonious interplay within a larger, synergistic urban context. **Trinity acknowledges that a community is more than the sum of its architectural components**. It recognizes that innovation arises from understanding how buildings **seamlessly integrate into an urban tapestry, fostering a sense of unity and purpose**.

In our pursuit, we considered more than just efficiency and spatial layout; we prioritized a delicate equilibrium between private and public realms. Trinity aspires to be more than a mere structure; it's a testament to our commitment to create living spaces that **transcend functionality**. We aimed for a design that not only maximizes utility but also elevates the quality of life for its residents, blurring the lines between private retreats and communal spaces.

As we present Trinity for this competition, we would like to present you the convergence of affordability, thoughtful design, and a visionary approach to urban living. It is not just a project; it is a philosophy — a testimony to the belief that in the **trinity of effective design, economic viability, and communal harmony, we find the blueprint for the future of housing**.

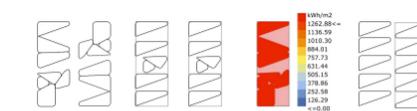


We embarked on the creation of an ingenious generative model harnessing basic **AI principles**, with a vision to rethink architectural design. Our model is dependent on input parameters of **area, volume, and glare** (measuring solar gain or maximum possible daylight). Pioneering a paradigm shift, we set out to examine the limitless potential within strict confines: a **print area** capped at 11.6 m x 30.5 m and a **financial ceiling of \$99k per structure**.

The heart of our innovation lies in an algorithm that orchestrates the random generation of point locations, each serving as a canvas for the creation of unique structures. Through successive iterations, the algorithm refines its output by scaling these points, gradually converging toward an **optimal solution**. Beyond the numerical precision, our emphasis was on **selecting a solution that not only met the specified criteria but also produced spaces of exceptional quality and contributed to a dynamic urban pattern**.

In the course of hundreds of iterations, our generative model transcends bare functionality. It becomes an artistic expression, a demonstration of the fusion of technology and creativity. We recognize the importance of not only adhering to predetermined constraints but also sculpting spaces that resonate with a **sense of identity and purpose**.

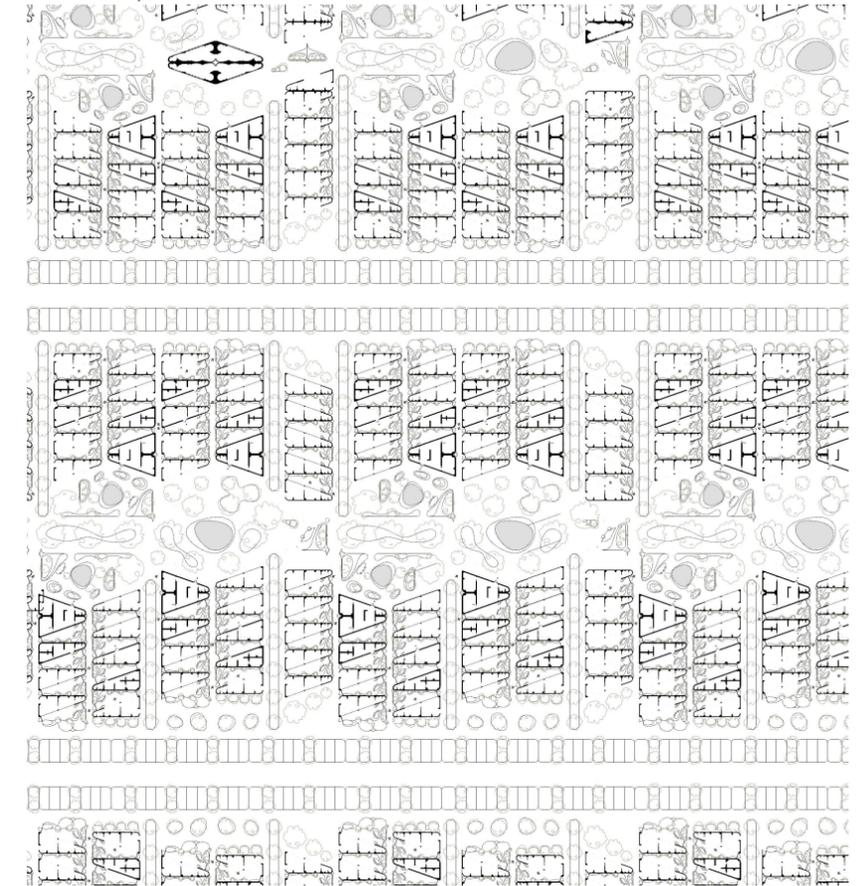
Our commitment extends beyond meeting standards; it's about crafting a legible urban narrative that evolves and adapts organically. As we present our generative model for this competition, we invite you to observe the convergence of computational prowess and architectural finesse. It is not just about arriving at a solution; it's about **redefining the very essence of urban living**, demonstrating that within the algorithmic dance of constraints, we unearth a symphony of innovation, variation, and enduring legibility.



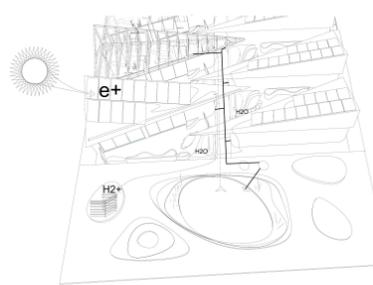
In summary, our competition entry represents a **fusion of innovation and adaptability in architectural design**. The chosen concept, marked by a distinctive pattern, **seamlessly transitions between single-unit and multi-room configurations, serving as a shop, office, workshop, or social space**. The thoughtful delineation of outdoor spaces skillfully **balances private and public realms**. Beyond mere structure, our design fosters **energetic and social synergy**, evident in features like roof overhangs that **facilitate neighborly interactions**. As we present this entry, we envision a future where architecture goes beyond static form, **becoming a dynamic force for community, adaptability, and thoughtful urban design**.



Clusters - siteplan

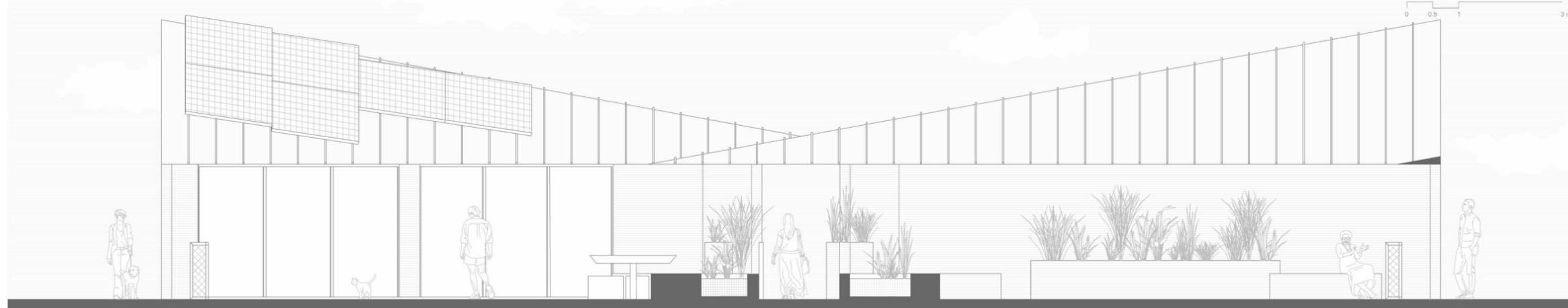


Energy - synergy

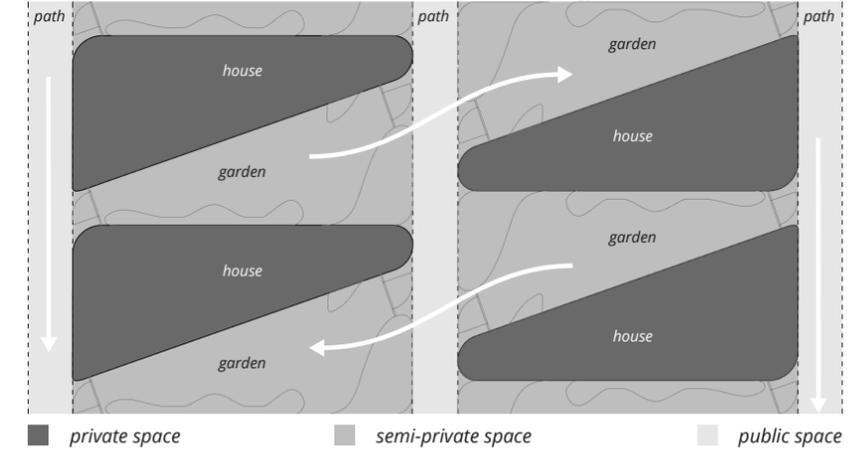


Rainwater harvested from the roof serves a dual purpose: irrigating the yards and accumulating in a pond. Greywater undergoes a filtration process, directed to a **root treatment plant for reuse** in flushing systems. Solar energy is harnessed by panels, converted into **hydrogen batteries**, and seamlessly retrieved as required. The cluster's guiding principle is cooperation, optimizing energy and water consumption and storage through a universal approach that enhances efficiency, **overstepping individual house-centric strategies**.

Units section view



Connectivity and privacy scheme





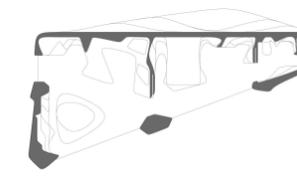
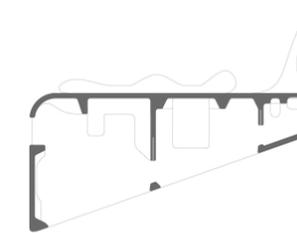
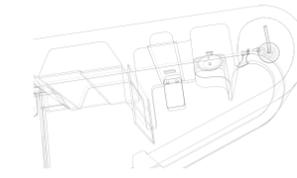
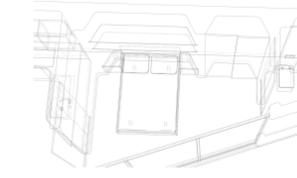
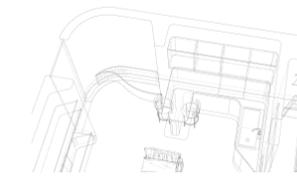
Integration and articulation

In the realm of 3DCP, we embrace a unique **opportunity to craft seamless integrations of various elements.**

This encompasses the harmonious incorporation of **furniture, kitchen setups, and essential bathroom amenities like showers, sinks, and toilets.**

Moreover, our scope extends to the meticulous inclusion of electrical wiring and elements, covering the foundational components of the building's technical infrastructure.

This **encompassing approach** not only ensures functional cohesion but also allows for a comprehensive and visionary design that goes beyond mere aesthetics, promising an elevated and **integrated living experience.**



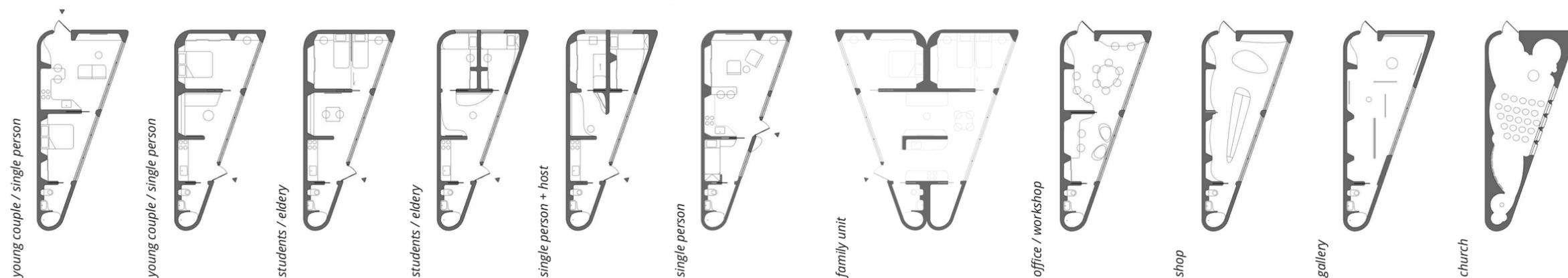
Articulation stands as a significant opportunity within 3DCP, offering the **potential to craft a distinctive architectural language** tailored to clients, communities, and **regional contexts.**

This innovative approach allows for adaptability, ensuring that our designs resonate with the specific needs and character of each project.

Through 3DCP, we transcend conventional boundaries, **fostering a dynamic interplay between form and function**, enabling architecture to become a bespoke expression that seamlessly integrates with its surroundings and serves as a testimony to thoughtful and **context-sensitive design.**

Programmatic Versatility

The Trinity structure boasts a remarkable flexibility in program distribution, drawing inspiration from the **synthesis of a classical megaron and a Socratic house.** This unique design allows for seamless transitions **from intimate to public spaces**, accommodating a diverse range of programs. From simple facilities for **stores, communities, offices, or workshops** to a spectrum of residential uses, our units cater to **individuals, housing-first initiatives, veterans, elderly couples, and families.** Tailoring to family needs, our design accommodates those with children, offering adaptability through easily configurable sleeping lofts. For larger requirements, Trinity cells/buildings can be ingeniously combined into **expansive units**, exemplified by the **double unit configuration.** This adaptability extends to programmatic articulation, reaching its zenith with the potential for a **church.** Here, interior walls become canvases for artistic interpretation, with the possibility of crafting an iconic roof, transforming the Trinity structure into a truly multi-functional and aesthetically expressive architectural creation.



Young couple / Single person unit
[36 m²]

Floor plan

1. Entrance
2. Living-room
3. Kitchen
4. Bedroom
5. Bathroom
6. Garden

Our design unfolds as a **continuous, adaptable space**, transitioning from a spacious communal kitchen and living area to more intimate private zones. The thoughtful layout leverages **natural light in the backyard**, offering flexibility with sliding doors for individual spaces. Integrated furniture elements maintain a sleek aesthetic, extending seamlessly into the backyard where built-in furniture and greenery enhance both form and function. In essence, our design prioritizes **fluidity and adaptability, creating a harmonious living experience.**

Materials used



3D printed concrete



ornamental plants



gravel



matte black metal



oak wood



wire mesh



terrazzo tiles



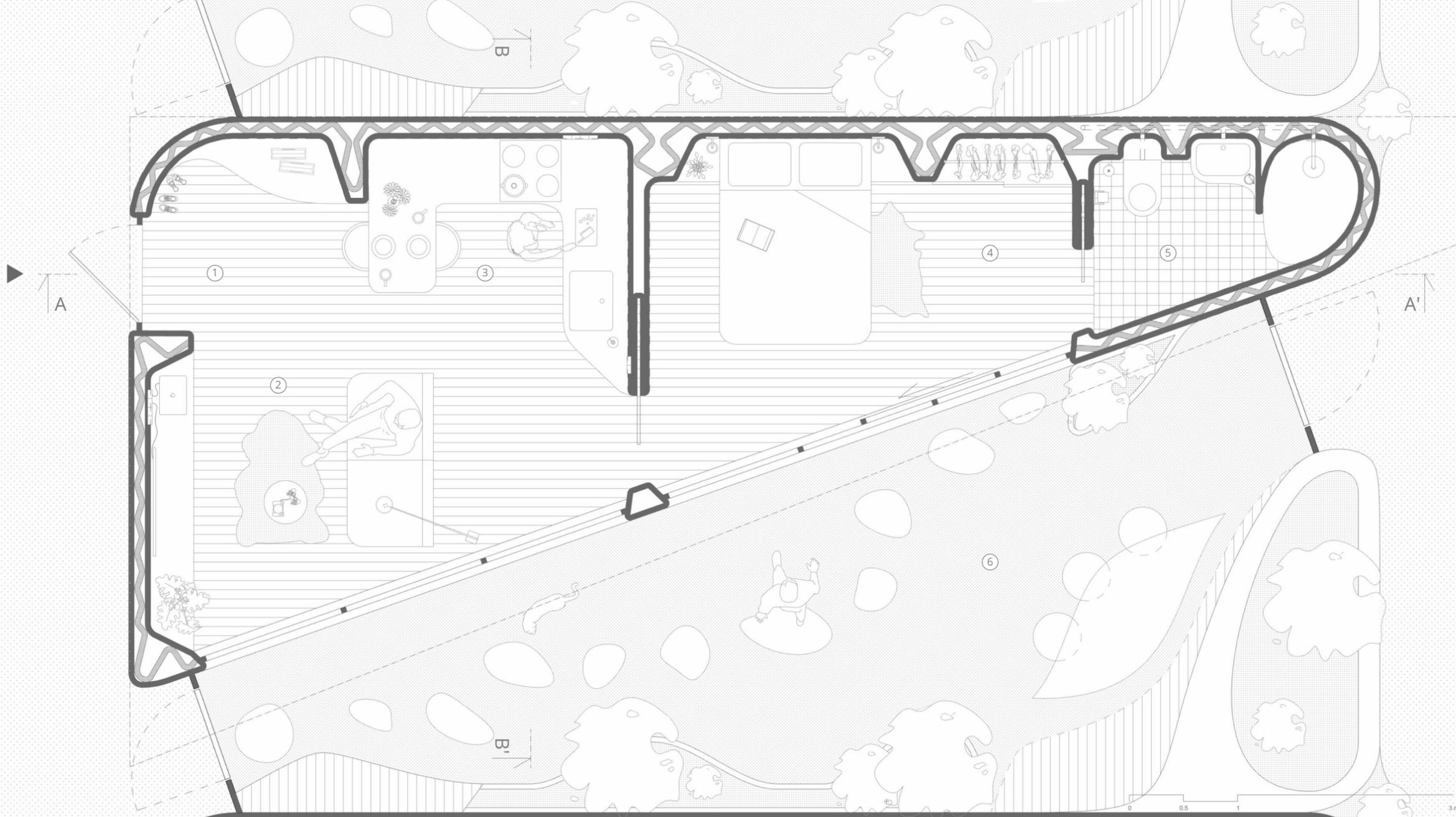
metal roofing



stepping stones



solar panels



Section A-A'



Section B-B'





In conclusion, **Trinity** represents a revolutionary approach to housing, balancing **effective design and affordability**. Our generative model, driven by an **innovative algorithm**, transcends functionality to become an artistic expression of technology and creativity, redefining the essence of urban living. Trinity's program versatility **caters to diverse needs**, from individuals to larger families, even accommodating a church. **The building's adaptability showcases the limitless potential within the Trinity concept.**

In the realm of 3DCP, **articulation is a crucial opportunity**. It enables the crafting of a distinctive architectural language tailored to clients, communities, and regional contexts. This adaptability ensures our designs resonate with specific project needs, fostering a dynamic interplay between form and function. Through 3DCP, we transcend conventional boundaries, creating bespoke expressions that seamlessly integrate with surroundings and reflect thoughtful, **context-sensitive design**.