NEW TOOLS, OLD WALLS: INTEGRATING ARTIFICIAL INTELLIGENCE INTO ARCHITECTURAL DESIGN THROUGH ADAPTIVE REUSE

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New Tools, Old Walls

Integrating Artificial Intelligence Into Architectural Design Through Adaptive Reuse

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Murali Paranandi, Diane Fellows, and Sam Toland

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Abstract

This thesis explores the emerging role of Artificial Intelligence (AI) in the architectural design process by introducing experimental approaches involving algorithmic logic, conversational tools, and formal manipulation. AI is presented not as a trend but as an evolving design assistant to which Neil Leach refers to as “extended” intelligence. This concept suggests that architectural thinking can now extend beyond human cognition through technological systems increasing complexity and expanding possibilities of process and form.

This project applies AI through adaptive reuse of existing buildings in downtown Dayton, Ohio, proposing mixed use programs while focusing on the process. Architectural operations such as subtraction, layering, and void generation are guided by data-driven parameters including solar exposure, site-specific context, and AI-assisted feedback. In this context, AI is not a replacement for the architect, but a tool that broadens the capacity to explore, iterate, and respond to complex design challenges. It enables a shift in how we think and design, while remaining rooted in the foundational principles of architecture, evolving traditional methods through new tools rather than discarding them. Ultimately, this thesis positions AI as a catalyst for reimagining the design process and uncovering architectural possibilities that were previously inaccessible.

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01

Discovering Intelligence

We are entering a defining moment in architectural history, one shaped not by a single style or material, but by the rise of artificial intelligence as a creative partner. AI has quickly moved into the everyday workflows of designers, offering tools for visualization, simulation, and iteration that operate at unprecedented speed. It is no longer a question of whether AI should be used in design, but how it can be meaningfully integrated into the creative process.

This thesis begins from a place of curiosity: What does it mean to collaborate with AI? How can we move beyond using it simply for efficiency and instead develop a dialogue between human intention and machine-generated potential? Rather than positioning AI as a replacement for the architect or designer, this work explores it as a partner—capable of suggesting, interpreting, and expanding upon ideas when guided with care and intention.

This thesis proposes that AI should not be used blindly or passively. Instead, it should be treated as part of an evolving conversation where the designer remains the decision-maker. The process becomes less about automation and more about guided exploration. In doing so, architecture becomes a site of exchange, where human creativity and machine logic intersect to uncover new ways of designing architecture.



Image 1:
Generated form through ChatGPT

02

ARC 636: Exploring Relationships with Artificial Intelligence and Human Collaboration Through Architectural Design

ABSTRACT

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Artificial Intelligence (AI) is a technology of a new generation organizing and classifying information. Biologically inspired using the organization of neural networks programming computational algorithms supports the completion of tasks for humans. It works through algorithms attempting to mimic the human brain and produce data like the human brain. The use of AI in Architecture is best represented as a new tool for the architect, similarly as the addition of the computer. Learning the techniques of the computer architecture has had a major change through form and style. An example of AI in Architecture; a generative chair by Architect Philippe Starck using AI powered by the Autodesk research team. Through this project, exploration of AI in Architecture increases.

As a new technology, architecture firms are using different AI tools in their design process such as text to prompt image generation of concept design. Other methods include plan optimization, site analysis and conceptual form. As technology continues to advance, it opens the conversation of exploring new design methods through machine learning and algortihms. This transition is an uncanny style of Architecture. Methodologies of different architects in history are combined with contemporary technologies similarly the represented structure of AI and machine learning. Finally, this opens the conversation of a new architectural tool that will impact a new generation of architecture and students. Architecture continues to influence from the transition of drawing and sketches to 3D modeling and rendering. Architects continue to experience and learn new design methodologies exploring unfound opportunities of what future Architecture can be.

Introducing AI in Architecture

Technological innovation explores indifferent solutions for contemporary problems. As with the implementation of mass production or computer technology, innovations are introduced to help complete human tasks in a more efficient manner. Technological evolution is based and examined on history and experience allowing for the livelihood of a human to salvage time in a day.[1]

AI is a growing technological innovation based on a large collection of data and completing machine based decisions replicating the human brain. It is a fast-paced technology applied through computed algorithms and user input.[2] The use of AI in Architecture should work as a collaboration with human intelligence. Expressed simply as a tool with the production of Architecture exploring limitless boundaries of contemporary architecture design process. The efficiency of plan optimization or the use of text to image programs can be explored. Using AI has the possibility of opposing the normality of long hours in design production.[3] Exploring different methods to accompish tasks in an efficient manner of site anylsis, code research, and precedent research.

Human Consciousness and Artificial Consciousness

The neural anatomy of a human brain is important in correlation with AI, resembling the neural anatomy structure made up of neurons. The brain has 86 billion neurons which in similar reflect the amount of neural nodes in machine learning, but has a greater amount of data continues to grow and grow. A neural network (NN) is a module representing the human brain through AI. The cell body of a neuron controls the function of a neuron, in a neural network a node; controls network function and performs computation. Dendrites are branch-like structures responsible for neuron communication. The axon which carries an electric impulse from the cell body to the other end of a neuron is represented by a weight in a neural network; which connects single or multiple nodes for single transfers of information. The axon terminal passes impulses to other neurons while the synapse is the checmial junction between axon terminal and other dendrites.[4]

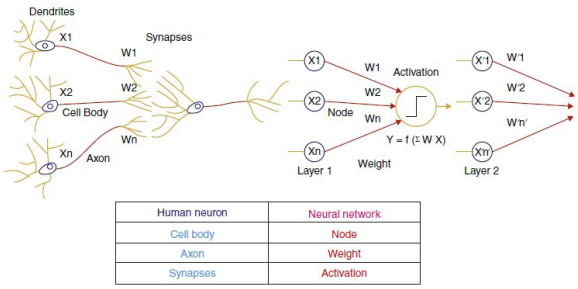


Figure 1:
Human Neuron and Neural Network Comparison

Artificial cognition and human cognition have similarities recognized to complete tasks. These neural networks are pre=programmed and biologically inspired. AI attempts to resemble human intelligence to solve problems, which can be used by humans to solve problems efficiently and effectively. The human brain continously grows and learns from experience and surrounding sources. Machine Learning (ML) is a subset of AI in which the computer learns to make decisions, another characteristic of the human brain. The human brain as it learns also creates information into memories using reception, it learns to observe certain characteristics from objects and classifies into categories, such as noticing the curvature and yellowness of a banana to classify it as a banana. Deep Learning (DL) is a subset of machine learning, which extracts object features through a large amount of data, then identifies and classifies the information.[5]

As AI is continuously fed data to learn and organization, it goes through training simultaneously. To make AI relatively understandable the consciousness of how human generate thoughts based on learning and experience. The feeling of anger or love is created through our human sensations travelling through our nervous system originating from the neurons in our brain. As humans, sensations and feelings created are difficult for AI to create. Regardless of data input or algorithms the human brain constitutes impulsive decisions with or without the need of analyzing data. Psychology then is now combined with computer science as a collaborative

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This opens the conversation of unexplored boundaries of AI and its learning capabilities. The mind of a human brain versus the mind of computational artificial intelligence continues to experience and learn of past experiences generating better data. Therefore, this tool becomes uncanny as it resembles the human mind. It is a different tool we are currently applying to eventually becoming normal. [7]

AI and Human Intelligence is a Partnership

Through architecture we have the experience of organizing different fields together to create a designed object reflecting conceptual design. Through collaboration of these different disciplines of engineers, owners, specialists, and other parties we aim for the positive outcome of creating a successful architectural design. This suggestion of cooperative collaboration can be resembled through the collaboration of AI and human cognition. There are many disciplines feeding data and information. It gets analyzed by different AI programs to classify and organize correct information. Through this classification of different disciplines, data is organized and retrieved in a quicker manner. This allows for parties not in specific disciplines to learn about other disciplines whether it is detailed information or a vague generalization of the field simply to understand other parties.[8]

As data is gathered throughout different fields it is organized in such a manner of accessible information. Communication is the building block combining everything together. Communication is a concept needed not only through AI and human intelligence but also in between human collaboration. The common platform of communication in architecture is an important aspect such as the client to architect initial interaction. The client must describe a general concept of the proposed design for the architect to gather ideas. Once applied, the owner and architect communicate with different fields, banks, general contractors, engineers, and other responsible parties. The responsibilities grow within each field to create a successful architectural project. The building block of communication of AI and human collaboration is an important concept still required as the communication between different fields. Introducing AI into the traditional collaboration of different fields speeds up the process of shared data. Repetitive tasks are done in an efficient manner and communication of ideas is explored better.

BIM as a Catalyst to Foster Creativity Through Collaboration

Building Information Modeling (BIM) enables a collaborative process using a 3D model and analyzing it through its building life cycle. A mix of BIM and non-BIM such as hand sketching and physical models is part of the architectural process staying relevant through architectural design. Through an architectural project introduced by Murali Paranandi ai Miami University in Oxford explores the collaboration of students to create a temporary modular screen system through BIM. The communication of students allows for the exploration of different ideas creating advantages and disadvantages of breaking down ideas. Using technology creates different designs inspired from different uses and introduces different methods.

Successful collaboration can be greatly influenced through encouraging experimentation and rewarding risk taking. Innovation is learned from stepping outside the comfort zone and being open to different architectural technologies. Using AI as a tool in architectural design exceeds the limitless barriers changing our comfortable way of thinking. With the use of AI in architecture we are elevating the human brain to produce potential for creativity into solving complex problems. It speeds up the process of evolution in technology collaborating the pool of ideas and organizing which solution is best.[9]

Using AI as a Tool in Architectural Design

In the beginning phases of architecture careers, we are embedded in architectural history and design methods, and trained repeatedly to understand and categorize architectural data such as building recognition, architectural styles, site relationships, and form production. With this information learned we have the capabilities to create architectural projects. We are taught about the five pillars of Modernism by Le Corbusier or learn how to draw a floor plan. We are trained repeatedly to understand and categorize certain data of architecture to help us process our design initiatives and process.[10] AI is continuing the process of recognizing and understanding characteristics through a quicker pace of machine learning. The process of identifying architectural styles to classify certain processes to Brutalism or Modernism.[11]

For an AI to understand what architecture is and transfer data to the human, it must be trained to understand architectural data. As a simple understanding, AI must be trained through data generation through a training set. This is where the AI will learn patterns of architecture whether history, images, or design methods through machine learning code. Data gathered from the training set is then layered through a validation set, where parameters are set in place to evaluate the training set of data, generalization, and organization to minimize error and detect potential issues. Once an AI has the gathered data it continues the process of machine learning by attempting to computing loss and a gradient. There is no specific algorithm telling us what a brutalist building is. The AI must learn to decipher and organize what are the characteristics are, therefore computing a gradient means it tries to replicate the parameters with minimal error. The parameters are then updated to specify and organize at a deeper level. Once the AI finishes the process it is called an epoch. An epoch is a form of understanding what the AI is computing, learning from the process, and restarting the process over again to correctly organize data learning from each iteration again.

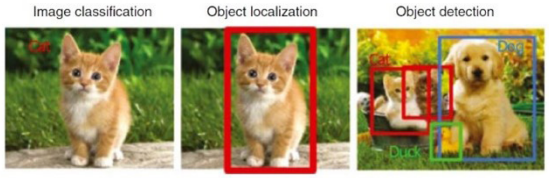


Figure 2:
Object Recognition

AI in Conceptual Design of Architecture

Chaos, a visualization technology company and Architezer, the world's largest community of architects completed a survey ranging from different size firms across the world. From freelancers up to companies with 100+ employees. Among 1,227 respondents, 46% are currently using AI tools in architectural projects while 23% plan to use AI in future architectural projects.[12]

The possibilities are endless of the many features using AI in architectural design, and technology will continue to transform into a better technology than before. Inspiration for conceptual design process is a major method AI is being used currently. Sketching on a napkin while at dinner for a client is nothing unheard of and is usually the beginning stage of architectural design. Yifan Zhou from the University of Hawaii explores integrating initial sketches into an AI application program assisting architects using different textual inputs by generating architectural variations.[13] This can expedite the architectural process into gathering inspirational data to form an architectural design in less time than it takes from traveling back to the office to create a design.

Exploring the Availability of AI in Architectural Design

In the compelling world of architecture, personnel are required to perform exciting or tedious tasks. Whether the excitement comes from conceptual design and placing ideas into drawings or researching attractive building codes reviewing conceptual design after office hours. AI in architecture is widely available to users willing to explore and learn the capabilities of it. Many different varieties with many different capabilities through architectural design. Popular use of AI currently is the idea of image generation based on text prompt. The level of detail in a text prompt correlates to the level of detail in images generated. This tool is then used for conceptual inspiration and pushing

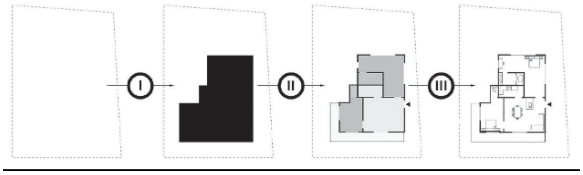
the boundaries of what architecture can be created into, whether mixing architectural styles of parametric and brutalism creating the illusion of bringing it to real life.[14]



Figure 3:
Brutalist and Parametric Design Combined

Veras is a visualization program creating renderings from your built geometry in your 3D modeling software. Finch 3D is an AI program generating floorplans based off precedent parameters for best plan optimization. Digital Blue Foam is another AI program which is set for the early design stage of forming geometries of parameters to explore creativity or inspiration for conceptual design.[15]
Elevar Design Group is an architecture firm headquartered in Cincinnati, OH. A firm dedicated to smart design solutions and increased performance and outcomes. After a conversation with Jonny Hofmann senior architect and John Tsuchiya senior designer, AI is being used in architectural design creating progressional steps in revolutionary technological design. Using Testfit, an AI software generating concept design from data input producing cost, building efficiency, parcel data, massing models, road layout, and using built-in topography data. This AI tool is used for site specifics and rapid studies exported into 3D modeling software's such as Revit. It speeds up the process of practical conceptual design layering out the number of units and square footage for a possible design. This method speeds up the early design process for clients at Elevar. In final comments, Elevar has agreed to use other AI software's provided and integrate into their design process while providing resulting data of how it is effectively changing architectural design processes.

Figure 4:
Generative Timeline of Parcel to Building Footprint to Room Split to Furnishing



Collection of Architectural Data Through AI and Human Cognition

Architectural research becomes an easier task becoming more efficient in the amount of data available retrieved in less time. As machine learning progresses and classifies correlated data correctly, specific questions and data can be organized to a detailed extent. This opens the possibility of answering specific questions to specific related architectural problems. Thus, becomes another use of AI in architectural design. The gathering of data must be recognized as it combines the cognitive mind of thousands of architects with different experiences from across the world. This becomes an important and efficient way of not only solving problems but learning about different situations encountered in their daily lives.[16]

Data gathering comes from different locations from different cognitive minds. As cities continue to grow more data will become available. Every city is designed and defined differently based on location and population. With the use of AI and data collection, cities and urbanization can be planned in a more sustainable and efficient manner. As city planning is based more on algorithms and calculations versus architectural design, AI becomes an important tool to apply different varieties of city design. This can help in the hypothesis of different designs and how the residents of the city will react to it and understand living in those design conditions. Achieving the best design through repetition of training and solving solutions.[17]

Human Reaction of AI in Architectural Design

Using AI in architectural design we now progress in the futuristic realm of production and design. This opens another conversation about the ethical guidelines of using AI in architectural design or how the human reacts to use of AI in the architectural process. As with the computer,

AutoCAD, and Revit this becomes a technological shift of efficient tools in designing architecture creates uncertainty. Returning to the survey by Chaos and Architizer 70% of the respondents are comfortable with using AI in architectural projects. The embedded structure of architecture uses the tools at hand to create. Sketching and drawing is not being replaced by lines of programming code, but simply influencing the next generation of sketching and drawing.

Through time and experience, we begin to learn the different motives and solutions to architectural problems. Architecture transforms to different eras and into different architectural styles. In the beginning, one of the first problems was protecting ourselves from nature itself, but now we must decide whether a certain bathroom tile looks best with our vanity. It is important to realize AI becomes another transitional tool to create architectural design. It is our tool to explore past the boundaries of architecture and create a new type of architecture never seen before. The architectural pencil now becomes a detailed text prompt or sliders and buttons on parameters to modify a generative concept. Therefore, we are not changing an architectural design process, but transitioning into a different design process.[18]

Exploring Architectural Design and Methodologies in Computational Architecture

Architectural design and methodologies correlate to each other as we find different perspectives and reasonings to perform certain movements in design. Whether we are trying to relate our design to our site context or combining past architectural concepts, it becomes a starting point to create something original. The methodology of creating something original becomes an intense pressure on the architectural designer, yet we take information and data from other projects and combine them together to create a conceptual design. Artificial intelligence then becomes a tool to lighten the pressure of becoming original, yet the designer or AI is not copying from someone. The relationship yet is being analyzed by the characteristics of style and architectural transitions of eras.[19]



Figure 5:
Combination of Materials to Generate a Design

Post Human Occupancy Through Architectural Design

AI in architectural design is new therefore the amount of real-life architectural designs using AI isn't available yet. The transition of using AI into conceptual design will slowly transition as designers become comfortable using AI as a tool to appreciate design. As of now, AI is only being seen as a 2D to 3D image being generated by text prompt or creating a 3D Model based off the image mapping of a 2D image. Theoretically, the interior spaces of computational architectural designs will have more varieties of interior design explored and classified based off parameters, but also exploration of interior ideas not encountered. Through time and experience we will be able to explore the inside of an AI generated building through the use of virtual reality, just as VR is currently being used in architectural firms to explore in first person of conceptual designs.[20]

Philippe Stark is using generative design to explore technology allowing designers to produce new architectural artifacts. This merges the ideas of creative thinking, chairs, and AI where we are exploring a different attitude towards design. He asks the generative AI "How can you support our body with the least amount of material and

energy possible?" creating a revolutionary chair and design by AI. This opens the conversation of human use through AI. Humans now have a tool to design an object with parameters for the best design in seconds. As the beginning steps of AI in architecture are being explored, the concept of humans is being understood through collaboration. A tool creating design through efficient management while providing solutions.

Exploring the Future of AI in Architectural Design

These algorithms of computed AI can be based off specific architectural context such as site slope, elevation, site orientation, or site limitations. As data continuously gets uploaded and updated, information will be updated for the user. Figuratively using AI as a tool will help complete tasks in an efficient manner. This is used to retrieve data; our cognitive mind takes in this information but even with calculations and data we can make decisions opposite of algorithms or data.[21] It is important to understand the technological innovation of our time. As we are in the beginning stages of AI in architecture, it is best to understand and explore the tool in the early beginning stages. History will continue to repeat itself as we learn from industrial revolutions of machines being inserted into task making and the efficiency of human quality in production. As we continue to grow our expertise in AI, the use will become a normality such as the cell phone or computer. It will be introduced in the education of architecture and used in architectural practices, but understanding the capabilities now is what is most important. History repeats itself as technology continues to advance. The first industrial revolution introduces the first technological innovation in human history in production. Humans have become introduced to machines performing tasks in a quicker and efficient manner.

Applying AI as a technological evolution creates variety as there are different programs for different problems. Discussing the variety of programs to distinguish between plan optimization, structural optimization, precedent studies, conceptual design, and rendering varieties can be accomplished by different programs. It is being used as a tool for efficiency in data, but our architectural expertise decides the overall outcome.

The main objective of AI in architectural design is the gathering of data and information. Without the organization and classification of data, it isn't helpful. Once data is organized, precise questions can be answered to direct situations. Combined expertise at a quick search becomes easier to understand our outcomes and how they can be applied to our problems. This becomes a technological innovation of having access to different possibilities from different resources. Allowing the human cognitive of decision making based on architectural style or preference. Creating the illusion of originality but observing precedent of other projects. A tool to explore the boundaries of architecture never seen before thus creating a new generational innovation of the future.

Endnotes

Figure 1. Human Neuron and Neural Network Comparison

Figure 2. Object Recognition Through AI

Figure 3. Brutalist and Parametric Design Through AI

Figure 4. Generative Timeline of AI Through Architectural Design

Figure 5. Combination of Materials in Original Input to Create Architecture Design

Endnotes Cont.

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03

ARC 701: Applying Artificial Intelligence to Architectural Design: Part 1

ABSTRACT

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Vacant architecture, prevalent across post industrial cities across the United States and anywhere across the world pose numerous social, economic and aesthetic challenges. There is a surplus supply of vacant buildings in places like Dayton, Ohio, where there is little market demand for reuse. Given this lack of market demand to repurpose these buildings, the goal of this project is to provide community benefit through the preservation and enhancement of building facades, using novel methods in AI design technology.

Artificial intelligence (AI), is an emerging topic and design methodology in contemporary architecture AI is modeled on the neuron structure of the human brain, creating uncertainty about cognition and decision-making, while at the same time, opening new opportunities of architectural exploration.

With the use of artificial intelligence, Rhino + Grasshopper components including Wallacei and LunchBoxML uses connection nodes, parametric design, and data to create different variations of façade designs through user input and machine learning. Through this process providing new facades to vacant buildings will be based on two parameters: 1.) Data – gathered through research of existing case studies of program, materials, life cycle, and impact on community. 2.) Variation – based on the gathered research of data, predicting outcomes of façade design from machine learning. The algorithm used in the machine learning components is NSGA-2, starting with random solutions and classifying outcomes by the balancing of objectives through non-dominated sorting, combining features creating new solutions lowering the variation curve. Once variations are created, solutions will be organized through K-means, a machine learning algorithm for clustering data.

Through this process, varied for instant design results allowing the architect to make decisions with help from digital technology. This allows the study of different materials for adaptive reuse of the vacant buildings and creating a new life for vacant buildings. Architectural capacity becomes greater using AI, different variations of design newly explored by breaking constraints of creative thinking.

Evolution and Innovation

Innovation and advancement in technology is a lengthy process to which experimentation and risk are the greatest factors in achieving successful results. As humans we are faced with problems and experiences that shape who we've become based on our reaction. Constantly learning and preparing for the next circumstance and this process of learning is uncomfortable. Being comfortable with the uncomfortable strengthens learning through our everyday lives into which innovation is a lengthy process. Everything cannot be solved at the snap of a finger or click of a button, but the risk and initiative for continuous learning and being uncomfortable creates the risk at attempting contemporary methods of problem solving.

Artificial Intelligence (AI) is an uprising technology mimicking the neural process of design including pattern recognition and learning. It dates back to the 1950's, mimicking human intelligence to solve a problem. The computer produced a generational shift of production similarly to the Industrial revolution. Innovation continues and humans are the ones in the driver seat. Whether against AI or for it, it is currently being used in everyday life. Examples include social media algorithms, Alexa, Siri, Google Gemini, and Apple Intelligence. Amazon uses it during Thursday Night Football tracking the movement and statistics of players, creating algorithms confirming pass and fail percentage of certain plays. Algorithms are now becoming the contemporary mines, and data is crude oil. Yet as oil, it isn't useful until we turn this into a useable resource resembling gasoline for automotive vehicles. Data similarly isn't useful until classified and organized, factual data without the emotion or bias of humans. If it helps, think of an algorithm as a pet parrot, the more said around it and as expected eventually your pet parrot will repeat after you even if it doesn't understand what you are saying. These algorithms are classifying data based on recognition, learning, repetition and other factors.

AI in Architecture

The architecture of a building is more than style or physical boundaries. These spaces represent sensory experiences through an interplay of forms. Schools and Universities educate, hospitals heal, and homes represent a safe space separated from the outside world. Through design, architects have the power to create different experiences for everyone else, whether the classroom has enough daylight to help students, or the ambient lighting inside a restaurant celebrating an anniversary. We learn from current and past architecture to best fit the circumstances of creating experiences.

Through the eyes of architecture it introduces uncanny methods of design including generative modeling of form, site analysis, and the exploration between traditional architecture and AI assisted architecture.Technology is revolutionizing and through AEC AI HUB, there are over 1,400 products using AI for Architecture, Engineering and Construction. With the help of Autodesk, Architect Phillip Starck through generative design and parameters designed a chair. Although not a building it explores analyzing alternative solutions through the use of AI.

AI in the field of Architecture again is an innovative tool that will require a lengthy process to fully understand the capabilities. Leaders and board members of the National Council of Architectural Registration Boards (NCARB) are understanding more about the influence of AI in architecture, opinions divided but understood that the field of Architecture should not limit the use of AI as long as it supports the ability to improve the health, safety, and welfare of the public. Architect and AI practitioner Neil Leich describes AI as "extended intelligence" as another form of human innovation, an invisible tool that extends our mental capacity. Leich compares it to a prosthetic, eventually becoming a part of us that we can no longer live without. A technology that is supposed to help and at the early stages of an AI revolution.

Through Architecture as mentioned earlier we express the process of design, gather precedent information and analysis research. Research helps designers accomplish a design usually through an extensive process categorizing information that corresponds to certain programs of buildings. Providing a waiting room is applicable for a doctor's office but isn't as helpful for a grocery store as it seems unnecessary. Using AI through this

journey puts the minds of many different architects together. In chatGPT, specifying the question and the choice of words can produce feedback at an instance, exploring more and more the unreachable.

"Some people scorn violently the idea that lifeless machines could be of any advantage to inventive thinning... I believe that by this attitude the baby is cast away with the wash" - Walter Gropius, 1984 Boston Architectural Center

The Ethical Relationship between AI and Architecture

Ethics and integrity although not legally obligated are guidelines that architects should adhere to while producing designs. AI doesn't raise the question of ethics as something new, because we face ethical decisions and problems every day before AI became popular. However, AI because AI is supposedly used as a tool it raises the ethical behavior of how it is being used. Architects and designers must challenge AI as it misses the emotional and human interaction of Architecture. As it is trained, you should be aware of the data it is being fed and output. This information is important to understand why AI cannot replace the architect because of the bias and ethical behavior that should overcome factual information. Not only does the future of Architecture and education rely on learning contemporary tools, but understand the ethical needs of people to choose a material that is sustainable and harmless over low cost. Bias will influence the process of design and it is the role of the designer to understand the differences between morality and legality.

The similarities between precedents that resemble the program analyzing what was done correctly and what was done wrong is part of the process in design. Architects use information from past projects and apply it to their own project in their own way. Inspiration, but not plagiarism. A lot of conversation is around the rights of products that AI produces, officially there is no owner of the produced products from AI. It must be understood that the output of AI isn't the final product. It should be used as inspiration or a starting point. Technology works as an architect simply missing the emotional bias and standard of care.

AI as a Partnership in Architecture

AI should be seen as a compatible partnership, a tool, but yet AI cannot do everything. There is no magic button for AI to press and outputs a building. We have to use and understand the program such as learning Autocad and Rhino. AI also does not make the decisions for you, when it is simply suggesting possible responses. The question about AI in architecture is not what it can do but how and why it impacts the design process. Through trial and error, AI will only get better and it will make the architect's job easier being able to complete tasks. The traditional architect is trained to recognize, understand, and process important information to design a project, and analyze precedents. Dependent on architectural principles of historical styles, emphasizing proportion and symmetry. The similarities between past projects that resemble the program analyzing what was done correctly and what was done wrong.

An element of creativity is dependent on the influences and inspirations of others, suggesting building design is not entirely original, but dependent on precedent designs to create inspiration. The exploration of using AI as an aid to create architecture sets new experiences for the traditional architect, the boundaries can now be broken in design. The interesting proposition about AI in architecture is data collection and using it for design of human behavior and human needs. Through data analysis, we can understand what works best for the human user.

Ai is useful in the process of design, but I did have to lower my expectations because I thought I could press a button and output a building and that is not the case. I believe it is a technology that will not go away similar to the computer. I believe at one point, one should explore the ai programs, dip your toes and learn what is valuable to you. In education at Miami University in Oxford, OH Murali Paranadi will teach Ai and Architecture: Implications for the Built Environment of Tomorrow and in the professional life, Foster & Partners are using AI as a design assistant, creating simulations answering analytical answers. My goal? Creating architecture through AI seeming humanistic while answering an architectural solution of employing a mixed use program to embrace the site.

Understanding Dayton's Story

Over the past 200 years Dayton, OH is enriched with cultural and innovative history including being the birthplace of aviation. First established in 1803 and with the first major population of only 765 in 1819. At that time the small town of Dayton connected with Cincinnati through the Miami-Erie Canal expanding transportations of goods, services, and people. With this innovation the population continued to grow at 2,350 people in 1829, 14,000 in 1848, and 35,000 1876. Dayton began to thrive during the late 1800's with rapid industrialization, neighborhoods continued to grow, and due to its location is the regional center between two major cities of Columbus and Cincinnati. The flood of 1913 impacted Dayton and the Miami Valley in a devastating manner, leaving the people to remain positive and refix their hometown. Nevertheless, the population began to grow to 152,559 as the growth of development and innovation continued in 1929, becoming known as the City of a Thousand Factories. Major peak population grows to 262,332 and in Montgomery County a total of 527,080. After the Great Depression and wartime, major highway systems including I-75 and U.S. 35 are implemented, having a major impact on travel patterns, creating shopping centers and moving residents around Dayton.

In the early 1960's through 1970's, Dayton had the largest drop in population in the entire country. This can be due to society and political problems happening throughout the U.S. due to the Vietnam War, the Cold War, the recession of 1969, and the War on Drugs. Manufacturing jobs are lost and thousands of people lose their jobs with the population lowering to 193,536 and Montgomery County slowly rises to 571,697 people in 1980. However, Dayton never really recovered from the decrease in population and according to the U.S. Census, the total population in Dayton was 135,512 as of July 1, 2023. The decline in population and loss of manufacturing jobs impacted Dayton as the other industrial cities across the U.S. Through this economic downturn, the rise of abandoned factories, businesses, homes, and other buildings changes the scenery. It isn't getting any better as well, through the Ohio Department of Development Office of Research by the year 2050, Dayton and Montgomery County will experience a 5% decline in population. This becomes a bigger issue than Architecture and the implementation of AI, but a challenge to keep people in Dayton and help it continue to grow.

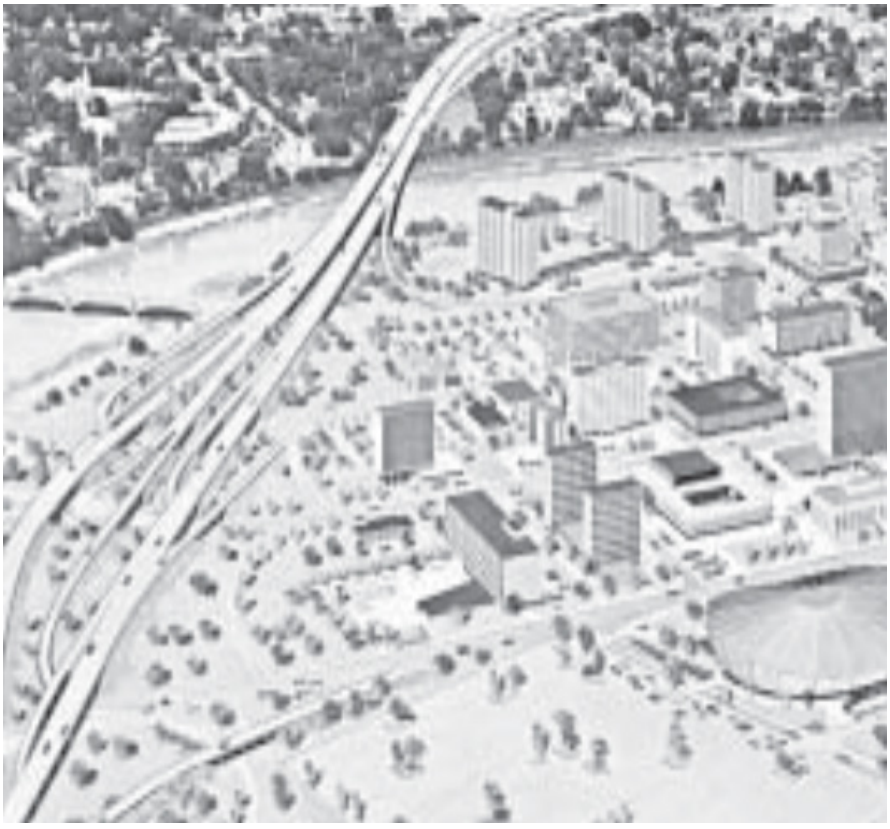


Image 1:
This image shows the initial developments of 1960's highway I-75

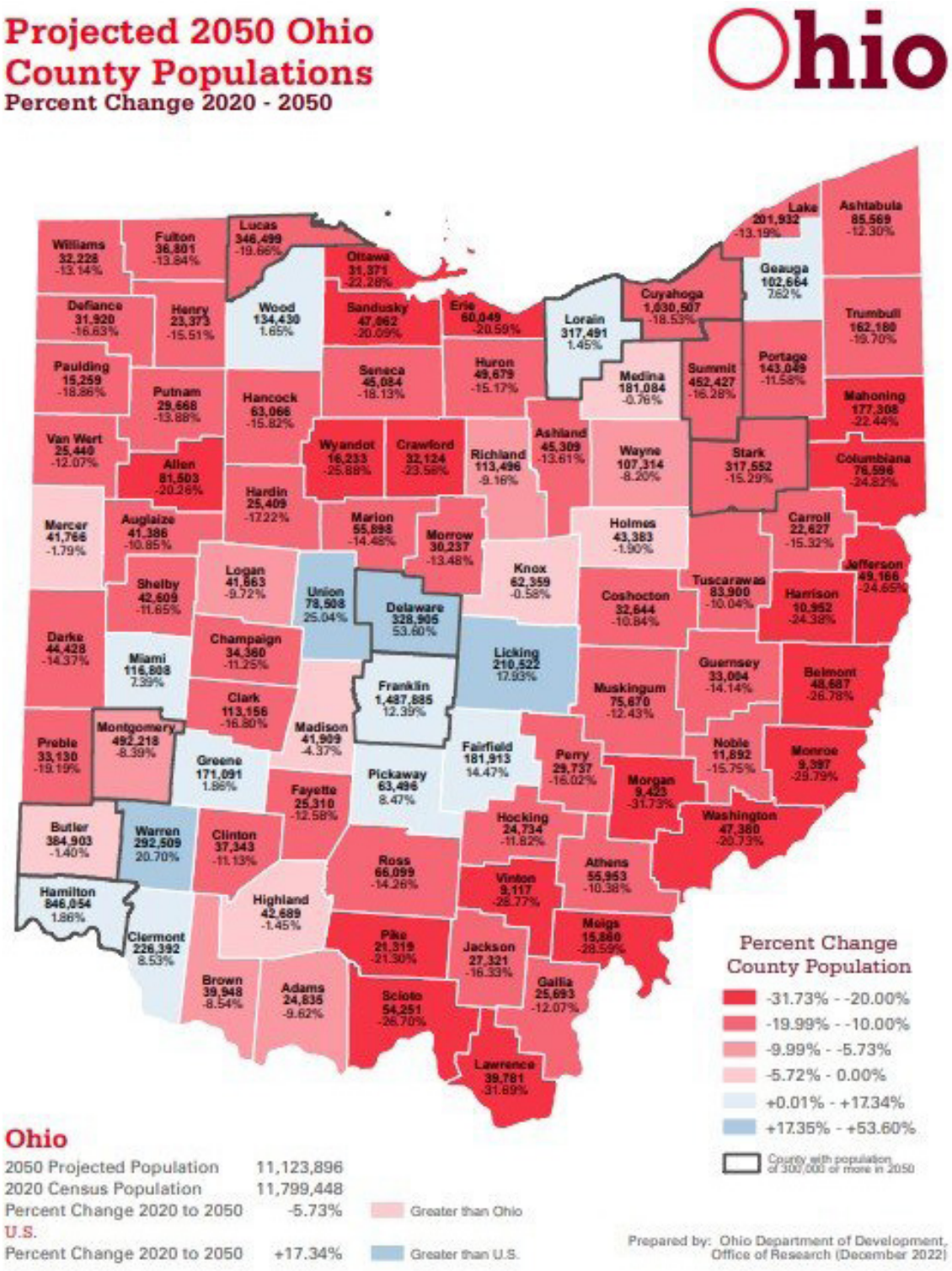


Image 2:
This graphic shows the population expectencies across the state of Ohio

Vacant Architecture

Vacant buildings and houses are a normal sight growing up in my neighborhood. It exists as fragile shells without purpose, ignoring human activity it was originally designed for. Emerging vacant buildings are a product of the decline of the economy, gentrification, restructuring of the urban landscape, or natural disasters. This creates psychological effects of economic decline and social decay in the community layout. To which, it becomes a new architectural objective of refurbishing and repurpose continuing the life cycle of architecture. It imposes challenges of architectural design combining vacant architecture with new architecture, carrying origins of decay and loss, and factors of transformation, renewal, and reinterpretation. Vacant architecture is no longer a group of unused spaces, but an architectural shell of parameters combining echoes of history



Image 3:
Collage of abandoned buildings throughout Dayton, OH

and the future possibility of promising architecture.

As mentioned earlier, architecture solely isn't represented as a style or boundary of spaces. Architecture creates and represents experiences for people, and the memories created remain as long as the architecture stands. Through adaptive reuse, the memories remain with the building itself. Through adaptive reuse it creates a strong bridge between historical and contemporary architecture changing different views of existing buildings. It promotes environmental sustainability, saving embodied energy by not demolishing the existing building. A successful project of adaptive reuse includes the High Line in New York City involving the surrounding communities.

The positive outcome of adaptive reuse of vacant architecture is the strengthening the cultural identity of a community. There is strength in rehabilitation, focusing on improving versus quitting and not solely on the subject of Architecture. It has the ability to lower crime rate, safety, and connect the community together. Not only does it promote sustainability as well, reducing the carbon footprint but also preserves gentrification allowing residents to stay local. Adaptive reuse allows for the exploration of new ideas in Architecture, however the constraint is working with the existing buildings retaining the locality of a project.

Precedent Research

The process of adaptive reuse begins with intense preliminary research about the existing buildings. It should include information about historical relevance, structural stability, site analysis, surrounding buildings and programs, existing materials, safety, and examining the possibilities of programs that can engage the local community and attract outside visitors. A challenge through this process is updating the existing structure to local building codes. Issues arise building code and zoning verification wasn't established before most buildings were created throughout the U.S. including implementing areas of required program: HVAC, plumbing, electrical systems, fire exits to a modern technology. The surrounding community plays a major role

in the projected design, gaining support and funding allows for a successful execution of a project. Proposing an ideal project that is practical and efficient while also entertaining. As architects, it is important to understand the cause and effect of a projected project. To not only think about the Architecture in present time, but how it can affect the lives of future generations who don't exist yet. How will the future generations react and will it create a sustainable solution to learn from and solve future problems.



Image 4:
Interior common space of updated building

The Battersea Power Station

An Art Deco structure in London, United Kingdom, the Battersea Power Station was originally built between 1930 and 1955. It provided one-fight of London's electricity supplying other important landmarks including Buckingham Palace and the House of Parliament. Decommissioned and vacant in 1983 became a structure of emptied voidness. Architects WilkinsonEyre revived the structure in 2022 as a mixed use complex retaining detailed features including its four chimneys, but also throughout the structure are the Art Deco aesthetics in all of the residential spaces interrelated with the turbine halls. Differentiation of scale remains as it uses the original features of full-height voids and the remaining central atrium. Adaptively reusing the existing structure respects the historical integrity of the existing structure while providing event spaces, an art gallery, and residential units. Today, it is one of London's existing shopping and leisure destinations and has brought the surrounding community together and back to life. An extraordinary place to eat, shop, drink, live, work and play.

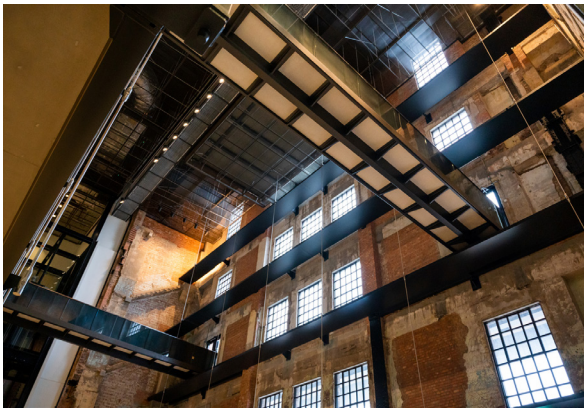


Image 5:
Interior image showing retained materials in updated structure



Image 6:
Detailed artificats of pulley wheel retained from original structure



Image 7:
Exterior image of the Battersea Power Station

Antwerp Port House

Antwerp Port House in Antwerp, Belgium was redesigned by Zaha Hadid Architects gathering over 500 port employees that used to work separately around the city. Antwerp is Europe's second largest shipping port with over 12 kilometers of docks. The port serves over 15,000 sea trade ships and 60,000 inland barges each year. Through this adaptive reuse project, it blends in the original Hanseatic-style building while combining touches of modern architecture, a "floating" crystal addition, this glass expansion in the shape of a ship's bow represents Antwerp's fleet. Through research, ZHA's team found the site's history and heritage play a major role and is the base layer of this adaptive reuse design. The north-south site axis is parallel with the Kattendijkdok linking the city centre to the port. ZHA's team also founded, due to the water surrounding the location, each facade of the proposed design is equally important as views from each direction are accessbile. Due to the surrounding water, extensions in the horizontal direction were least favorable to which the decision was to continue vertically, respecting the original facades of the fire station. Through this project, the transition is clearly visible between traditional aspects of architecture and historical architecture. While the original structure is relevant, the old fire station courtyard is transformed into the new reception area including a central atrium, able to see the contemporary addition from below. Through this project, ZHA was able to adaptively reuse an existing building and incorporate the surrounding site context in the influence of the design, gathering people in one central location for maximum efficiency. The form design interplays with the historical context of ships and ports, exploring different opportunities of interplaying original and contemporary materials.



Image 11:
Exterior image of Antwerp Port House



Image 8:
Exterior view of addition and original structure

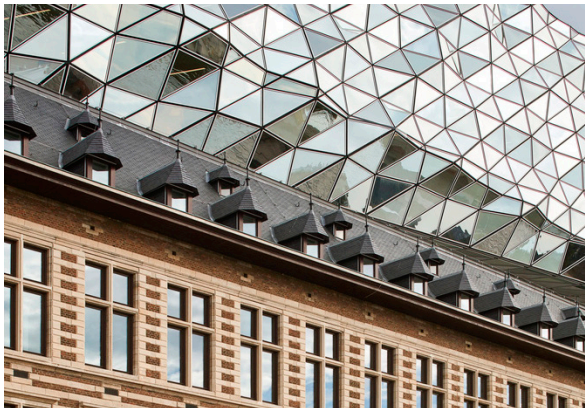


Image 9:
Exterior view of facade blending



Image 10:
Interior view of historical and contemporary architecture



Image 12:
This graphic shows the site selected buildings and experiences in rememberance by the people of Dayton



Image 13:
This image shows the selected site before the contruction of the retro style diner

Design Framework

Dayton is currently facing the issue of economic decline and population deficit, and architecture can play a major role for its economic uproot. In downtown Dayton, at the corner of E 4th St. and S St. Clair St. are two existing buildings; a vacant retro style diner and a vacant factory. The retro style diner formerly known as "The Diner On St. Clair", "Roxies", or "The Vex" has had continuous problems of vacancy since the early 90's. The building was once a retro style diner with neon colors and rotating bar stools, now filled with emptiness and signs of debris and trash. Currently there is no business at the location and sits as a void next to the grand scale parking garage. The location continues to fail and due to social and political issues a new form of revival is required. On the same parcel, is an abandoned factory building. Originally, DP&L generator station now sits empty with fading brick covering the exterior. The roof caving in, broken windows, and the interior filled with debris. The factory is an open floor layout with the exterior structured as the load bearing walls. Through adaptive reuse and including tools of AI, the possibilities are endless of what the end goal can be. The challenge is obtaining the attention of the people surrounding Dayton, having a purpose for people to visit Downtown Dayton. Due to remote work, the need for office space is lowering, lowering the need for people to visit downtown.

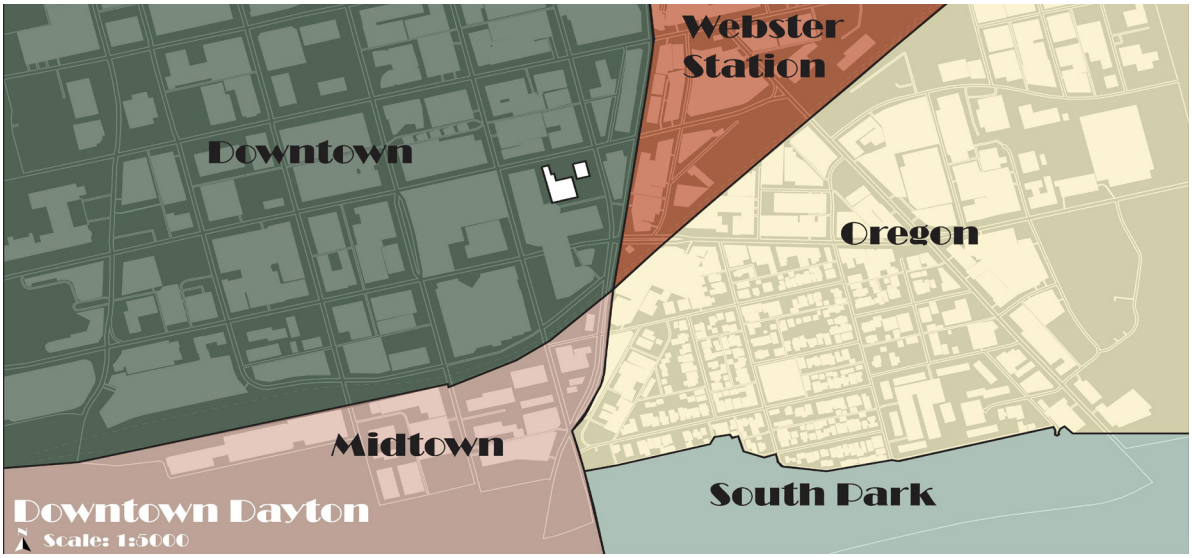


Image 14:
This image shows the location of selected site in relation to Dayton



Image 15:
This image shows the location of vacant buildings surrounding the selected site context

Aino AI

Aino AI is an advanced data analysis program designed for site analysis, with illustrative features to create site analysis diagrams. It is a subscription based program at $25.00 a month with a discount for students. The layout of Aino AI is similar to the format and layout of ChatGPT, asking users to ask detailed questions to access real life data from OpenStreetMap. Through the rapid filtration and accessibility of data, this can be a powerful tool for architects, urban planners, and researchers.

Through this program, a half-mile radius around the central point of my selected site is established. This setting allows Aino AI to gather data relevant to Dayton, OH. In image XX, the selected site is highlighted while the vacant buildings are also highlighted around the selected site, emphasizing the contextual relationship with the existing buildings. It then selects and filters roads, buildings, points of interest including restaurants and entertainment, water features, and land use classifications. This automates the process of site analysis and research and allows the access to quick diagrams through clarity.

Although a useful tool, it would be interesting to see the integration capabilities including Rhino and Grasshopper to directly apply the site analysis in the 3D modeling field. This can open up the possibilities of evidence-based decision making, and find continuous patterns of zoning and programming. Nevertheless, this analyzes data without having to be a programmer or using spreadsheets, a tool with the ability to be useful.

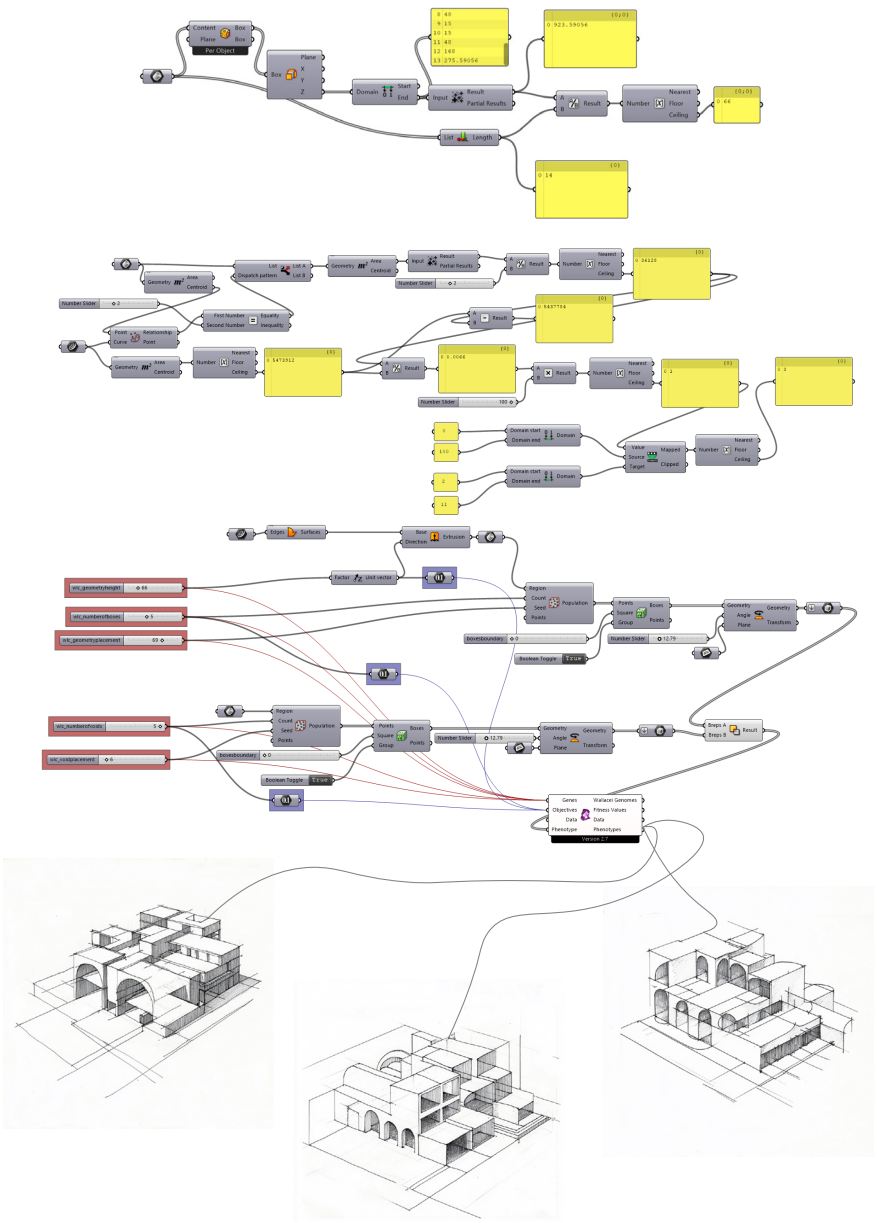


Image 16:
This graphic shows the Grasshopper script components being used. At the bottom are examples of final production

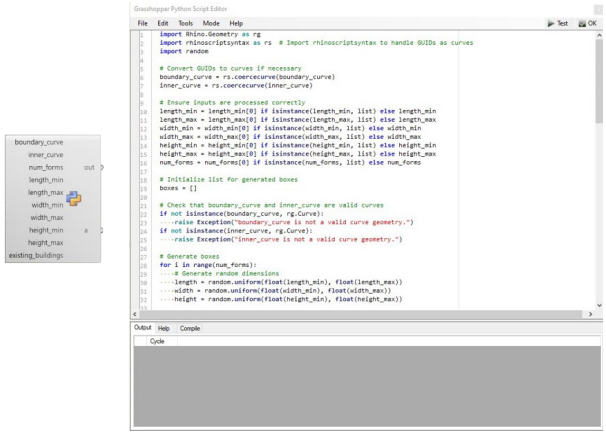


Image 17:
This graphic shows the python code used to create geometries in the selected boundary produced by ChatGPT

Combing Rhino 7, Grasshopper and ChatGPT

Rhino 7 is a 3-D modeling software that serves as the primary tool in this design process. It has the capability of freeform modeling without constraints. Integrated in Rhino 7 is Grasshopper, a visual programming language and scripting tool to handle complex workflows. This combination of tools explores enhanced design through design commands. The final product reflects continuous learning of Rhino implying the journey of learning design is as significant as the final product. Bruce Mau in his 1938 Incomplete Manifesto for Growth states “process more important than outcome. When the outcome drives the process we will only ever go to where we’ve already been. If the process drives the outcome we may not know where we’re going, but we will know what we want to be there.”

Rhino’s capabilities are particularly important in generative design and parametric processes. Through Grasshopper, parameters are set through the use of components. The components can automate repetitive tasks and create complex geometries through nodes and scripts. The manipulation of scripting can modify geometries dependent on proximity of parameters, using number scales, boolean toggles, or gene pools. In combination with ChatGPT, techniques of solving problems or assisting with scripts. Adding another layer of efficiency and creativity. It accelerates the workflow partnering with an AI assistant retrieving data, and in this process ChatGPT was used to help with Python programming by using the Python component for a design move. Another method, describing and explaining your form idea and asking ChatGPT how to apply that in a scripting format language.

The existing buildings on site are constant variables and are a set parameter. Other parameters can vary depending on location and zoning regulation. For this process, the max building height is 120’ - 0”, a setback of 15’ - 0” from the parcel boundary, buildable area which is set inside the setback line.

For initial experimentation, the addition of geometries was implemented based on a ratio calculation. Inside the half mile boundary from the selected site, the base surface of each building is added together to create a total square footage and then

divided by the set boundary area. It will create a percentage of geometries that should be added to the proposed design. These geometries are then placed at random by a random seed generator.

The next parameter is the max height these geometries are being placed. This parameter is determined by dividing the total height of surrounding buildings by the number of buildings to calculate the average height. This ensures the new structure height blends seamlessly with the existing urban fabric.

The next parameter is determined by the non-building square footage area. This is the opposite percentage of adding geometries, but instead summing the total number of voids. This prioritizes areas that require additional sunlight to enhance indoor environmental quality. This area is predetermined based on the existing structure's height. The direct sun analysis was performed by Ladybug, an additive Grasshopper component that has the capability for environmental analysis. These voided geometries are placed at random inside the selected boundary requiring extra sunlight.

These initial parameters help explore the initial process using tools to enhance the design. These parameters are inputted into the Wallacei X component, another additive for Grasshopper.

Wallacei X

Wallacei X is an advanced Grasshopper AI design component programmed to generate design variations using algorithms. Providing designers with data driven tools to run simulations generating iterations. It begins the process with defining an idea and in this process adding geometry variations continues to reuse the existing buildings as part of the design. Next, setting parameters to adjust different outcomes for Wallacei X to generate. These parameters are defined by number slider components and gene pool components that represent data through a numerical value. Finally, establishing fitness objectives using number values to evaluate and rank solutions. Through this process, Wallacei X uses the NSGA-2 Algorithm, a method to balance fitness objectives. The algorithm starts with a random set of solutions and employs K-means clustering. Grouping unlabeled data into clusters based on similarity while

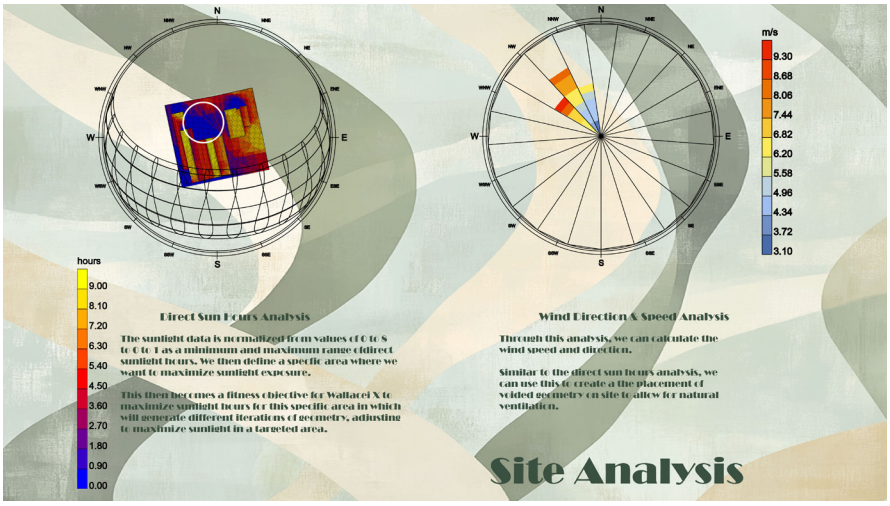


Image 18:
This graphic shows the site analysis of direct sunlight hours and wind patterns, performed by Grasshopper component Ladybug

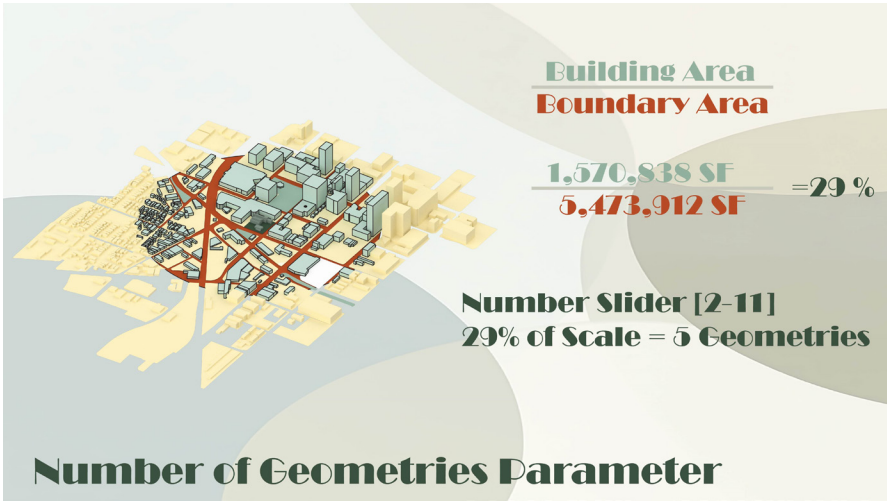


Image 19:
This graphic shows the number of geomreties based on the building area and boundary area ratio

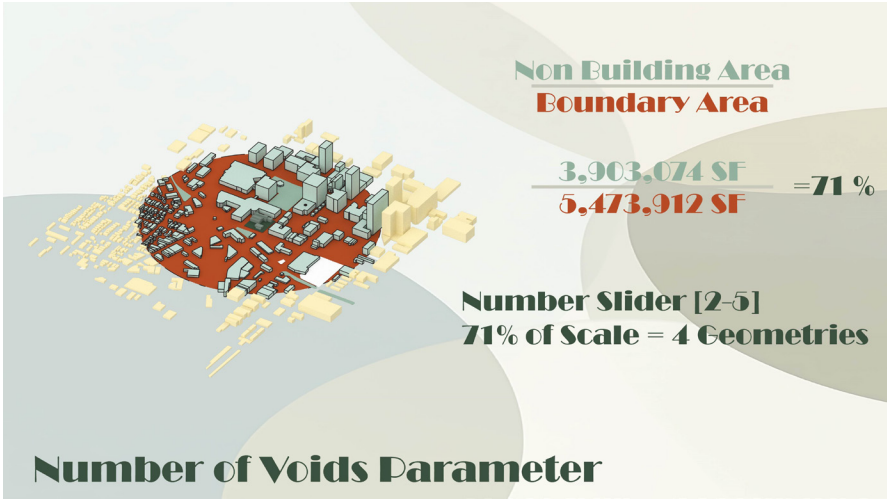


Image 20:
This graphic shows the number of voided geometries based on the non building area and boundary area ratio

accounting for randomness, including diversity in the solutions. This iterative process continues for multiple generations, each aiming to refine and improve upon the last.

In the most recent test using Wallacei X, 100 generations each generation constructed of 100 iterations were created in 17 minutes and 24 seconds. 10,000 different geometries produced at the rate of 10 geometries each second. The rapid computation results in an array of abstract geometries, each shaped to the different settings of the parameters. With the integration of ChatGPT, it accelerates problem solving and troubleshooting technical issues. Through this combination of tools it ensures that complex projects remain manageable.

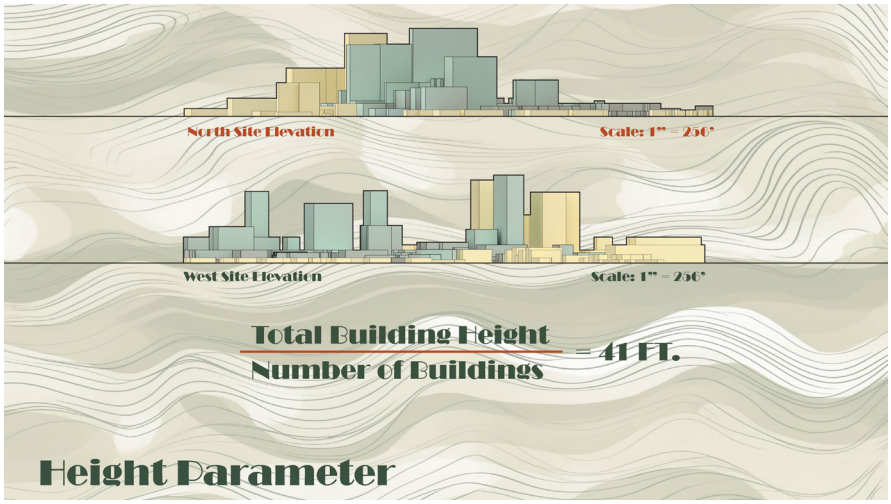


Image 21:
This graphic shows the average building height determined by total building and number of buildings

Analyzing AI Driven Results

In the most recent test using Wallacei X, 100 generations each generation constructed of 100 iterations were created in 17 minutes and 24 seconds. 10,000 different geometries produced at the rate of 10 geometries each second. The rapid computation results in an array of abstract geometries, each shaped to the different settings of the parameters. With the integration of ChatGPT, it accelerates problem solving and troubleshooting technical issues. Through this combination of tools it ensures that complex projects remain manageable.

In this experiment, the fitness objectives measured the number of additive geometries, the number of voids, and the total building height. Through Wallacei X, the AI driven component created these generations of different variations, clustering together the different results that seemed similar. The random placement parameter changes the location of each of these specified parameters allowing for the analysis of form finding through the scripting process.

These variations are placed graphically on a parallel coordinate plot. In this graph, the different variations generated show the closeness of the difference of fitness objectives. The closer to the lower part of the graph, the closer the variation will reach all fitness objectives, and vice versa the farther away from the graph certain fitness objectives weigh heavier than other fitness objectives.

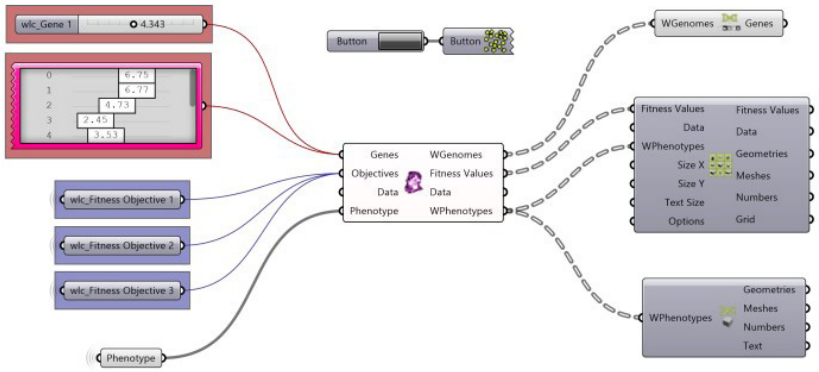


Image 22:
This graphic shows how Wallacei X is constructed

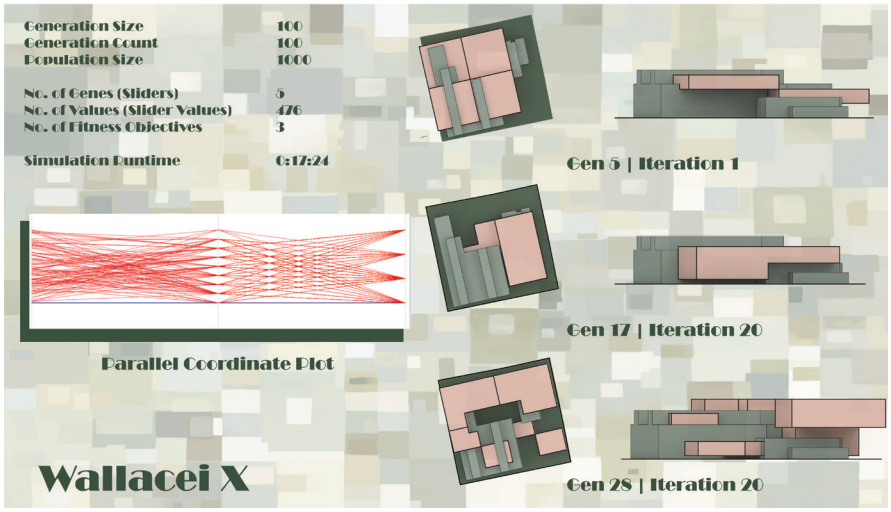


Image 23:
This graphic shows the end result of using Wallacei X



Image 24:
This graphic shows the tools being used in relation of adaptive reuse

What's Next?

Design parameters offer opportunities to create designs that are responsive, efficient, and innovative. Quantifying parameters and translating to measurable data can develop adaptive workflows that allows Wallacei X to manipulate these evidence based parameters. This process aims to investigate other measurable parameters not included in the initial study.

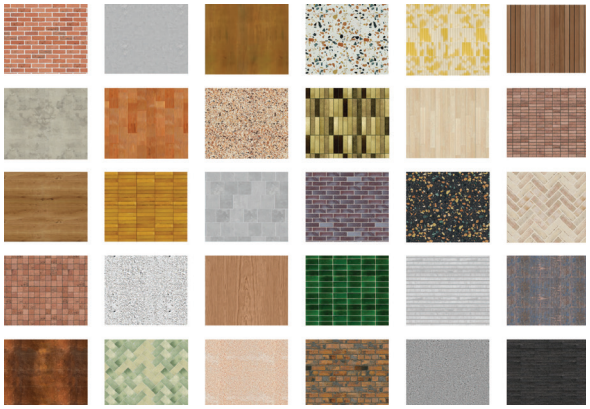


Image 25:
This graphic shows a variety of materials being used

Building Form Parameters

Floor Plate Area defines usable space and can help determine the functional layout possibilities. This parameter would be inputted as a set range between a minimum 500 square feet (sqft.) to 10,000 sqft.

Number of stories influences building density and vertical circulation. While usually dependent on zoning regulations, a number scale where each number represents the number of stories with the minimum set at 1 for single story and a maximum of 10 stories.

Roof type influences drainage and architectural style and can be determined by the type of either flat or sloped. This parameter will be inputted as a number scale where each number defines the slope in pitch where 1 would be flat, 2-10 would define the pitch.

Shading devices such as overhangs control the solar gain and can reduce cooling loads. This parameter will be tracked through a number scale where the input will be the top edge of openings. The number scale determines the overhang depth ranging from a minimum of 2 feet to 8 feet.

Facade panel size and type affects the daylight accessibility factor and the visual appearance of the building facades. This parameter will be determined by a number scale representing sizes from 1'x1' to 8'x8'.

Material selection affects the use of materials whether original or contemporary in which the use of the existing building challenges how it can apply updated styles while also blending in with the site. This parameter will be tracked through a percentage ratio of existing materials to new and then diversified by a gene pool of different and new materials that correspond to the surrounding context.

Demographic data can drive the architectural design offering insights for social, cultural, and economic characteristics of the site and its surrounding context. Understanding the demographic data can help to cater the specific needs and behaviors of the community. Tracking demographics involve the use of statistical data and normalized into measurable number scales. The integration ensures that design not only responds to the physical boundaries, but it involves community engagement and applying ethics to the gathering of data. The tracking of demographics is challenging, and applying changes can cause problems without involving ethics. Data will provide that a percentage of low income classes will live in smaller homes or trailer parks. Ethics will drive the design in responding to data representing the need of ethics to drive an ethical design.

LunchboxML

LunchBox ML is a Grasshopper plugin that integrates machine learning capabilities for architectural design workflows. Through its ability by training models directly within the Grasshopper environment. It attempts to identify patterns, make predictions, and automate complex processes. A key influence is processing large data sets gathered from the result analysation of Wallacei X. It will be able to analyze direct sunlight hours, wind direction and patterns, and suggest building orientation or facade design. Its use will be in the classification and organization of facade panel sizes based on predefined data of glazing to wall ratio, and sunlight penetration. This process allows the architect to refine design concepts based on real-time feedback from machine learning.

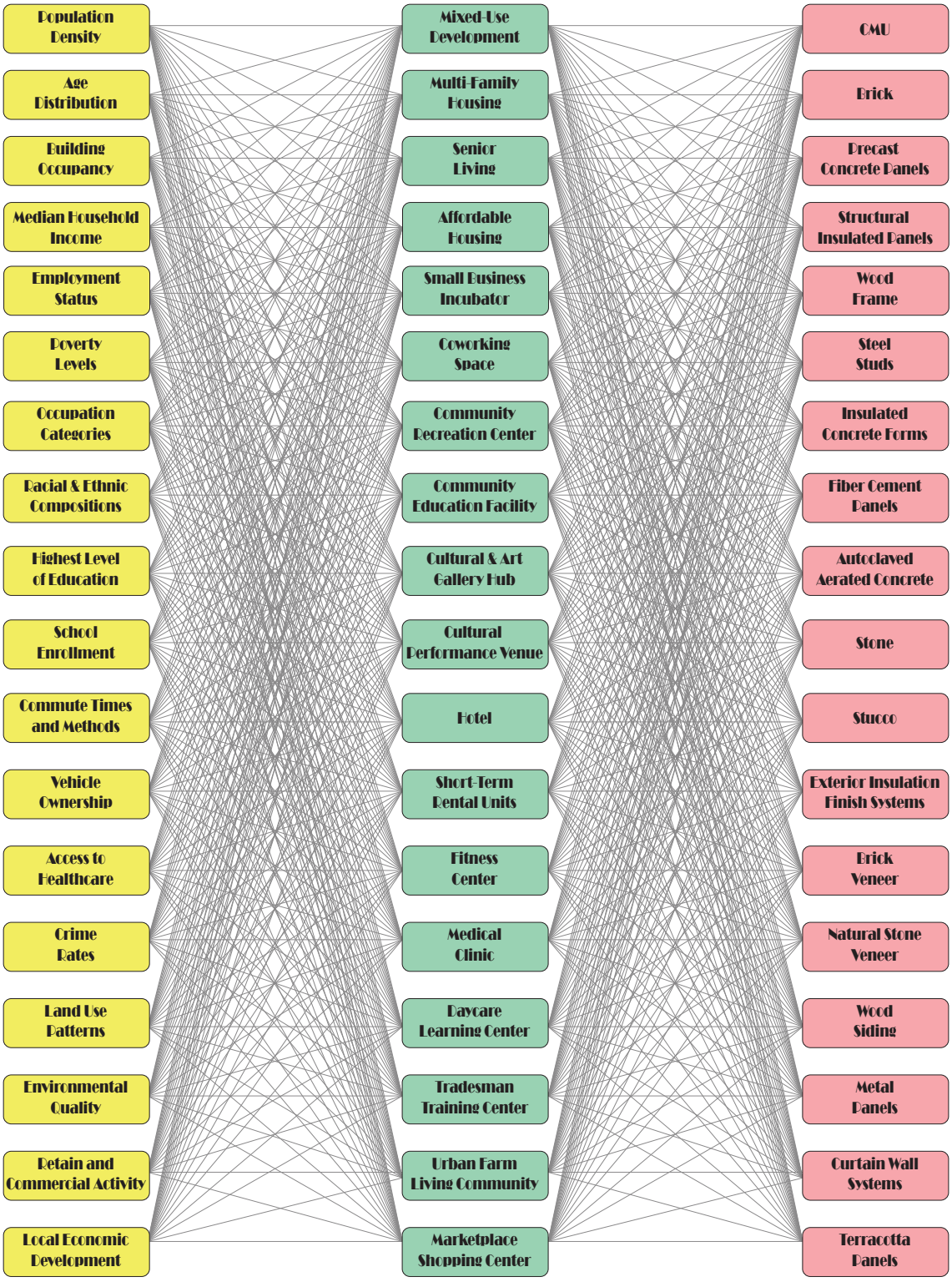


Image 26:
This graphic shows the amount of parameters that can be analyzed by location, influencing the design of AI in Architecture

Another method to include is the optimization of building layout by predicting user movement patterns and circulation efficiency. Data will be collected through different methods including direct observations and questionnaires. Other methods will include spatial analysis tools as in DepthMapx, a multi-platform software that performs a set of spatial network analyses to understand social processes within the built environment. This potential bridges the gap between using AI in Architecture, redefining the process of design using AI tools, and exploring the limitless boundaries of design.

AI and Interior Design

Interior design goes hand in hand with the field of Architecture, not simply about the aesthetics of design but shaping an important factor of people interacting and experiencing spaces. It can influence emotions, and boost productivity. For example, in a hospital setting adding vegetation, and color can improve the emotion of anxiety and fear. In an office setting allowing daylighting, adjusting colors of the office, and adding vegetation can boost productivity. Continuously as technology advances in the field of Architecture, embracing innovation in interior design can open the possibilities of different designs. AI offers designers data driven methods to enhance the demands of modern spaces. This approach of AI in interior design gathers data for personalized, adaptable, and sustainable designs that can connect with people at a deeper spiritual level. It will be able to craft spaces meeting functional requirements and experiences.

AI in interior design has the ability to create special moments in a space. These special moments are represented as spaces with hierarchy and can be represented as a dramatic entryway gathering the attention of walking bystanders, or in the case of this thesis process, an art gallery space connecting the local community to Dayton Ohio and its history. AI algorithms will be able to create variations of different interior spaces through analysis of user preferences, spatial proportions, and lighting conditions. These parameters will adjust the different variation of building forms, adjusting rapidly without time consuming constraints.

Rayon is an AI software similar to CAD software that allows designers to experiment with designed building layouts. It can turn technical wireframes to enriched drawing sets, and allows you to work with the files you already have. It also offers libraries of blocks, the ability to create schedules, annotate existing drawings, and collaborative editions. It will be used to create mood boards and material libraries by gathering pictures, textures, materials and drawings in one place.

Material selection is a critical area where AI is an interactive role with the designer. Analyzing the material properties of durability, sustainability, and emotional effect. This comparison of materials is affected by the use of the existing materials from the existing building and creating a transition effect of transforming new architecture with the existing architecture, and In consideration of aesthetics including factors of texture and color. Material selection can also be based on climate conditions, thermal performance, and acoustical comfort, helping designers align different alternatives.

Mood boards, color palettes, and material palettes can help distinguish a designer's vision of a final design. Coolors is a website that provides a color palette based on the color choice. Planner 5D integrates AI algorithms to visualize different materials working together in real life context. The color and material psychology analyzes human behavior and preferences influencing the change of desired emotions or productivity. Through the use of these tools and techniques can enhance the creativity for designers, by crafting special moments of hierarchy. It pushes designers to explore limitless possibilities and create spaces that are visually compelling and functional. Technology will continue to evolve, the importance of AI in interior design will continue to grow based on data. Following the path of innovation, AI has the potential to inspire and connect with space.

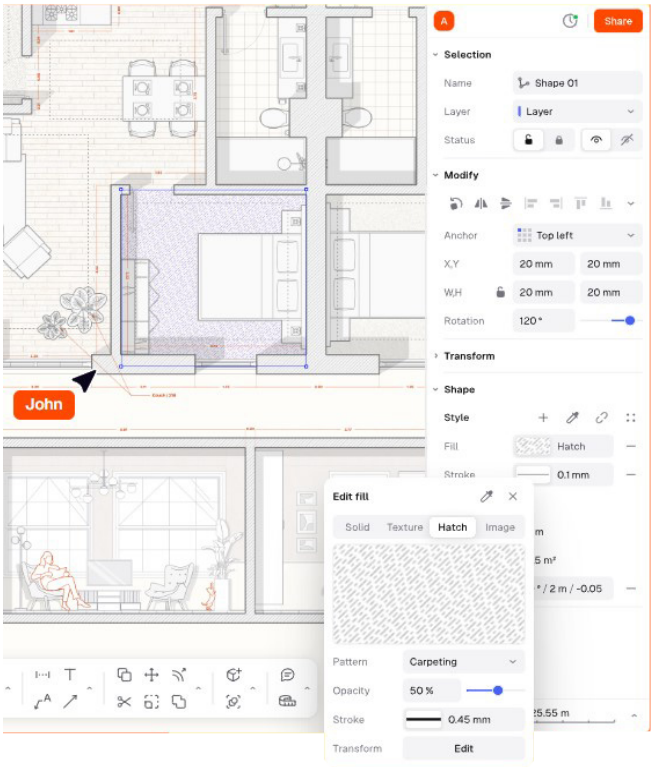


Image 27:
This graphic shows the layout of Rayon

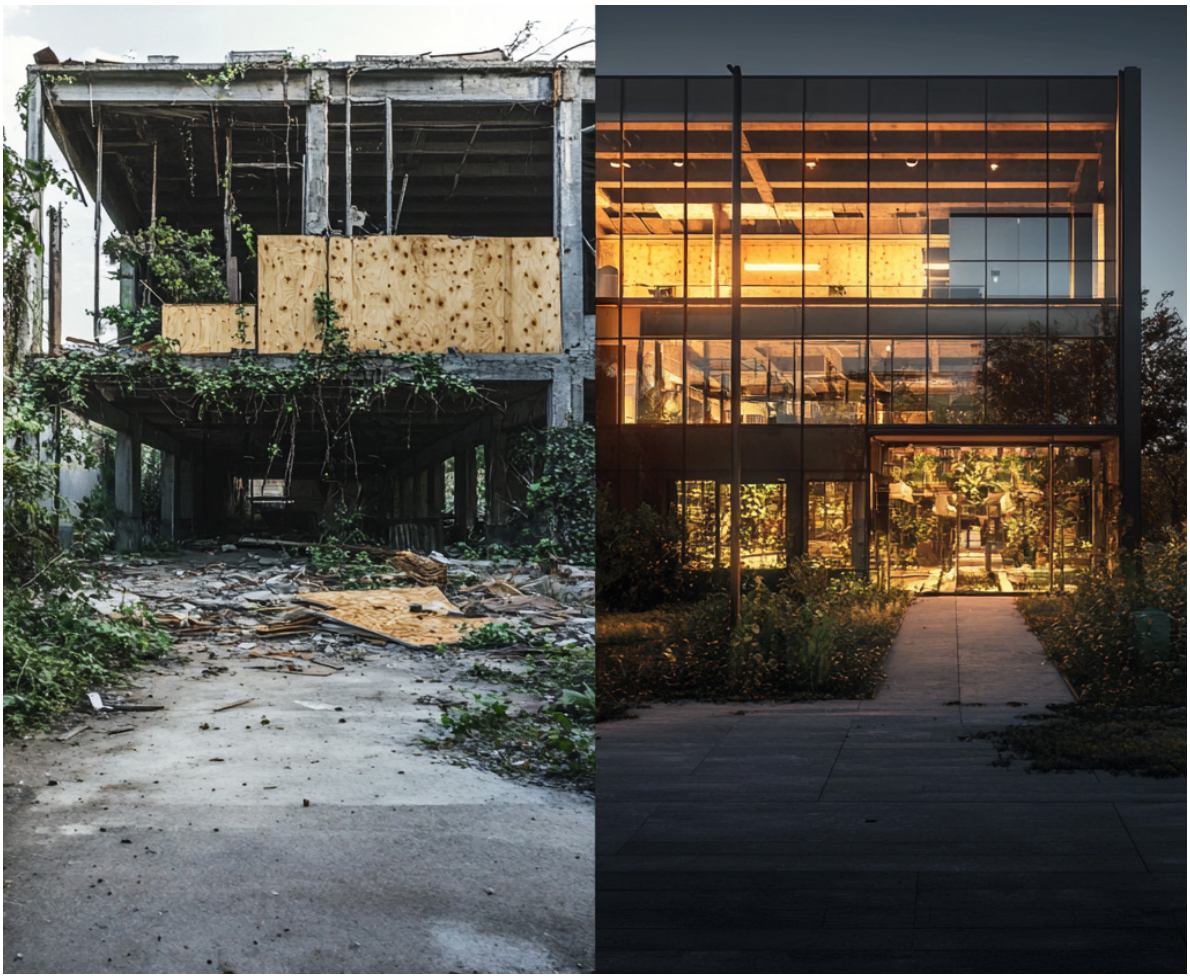


Image 29:
This image shows the transition of adaptive reuse

04

ARC 702: Applying Artificial Intelligence to Architectural Design: Part 2

Through various design iterations, the complexity of AI started to intersect directly with the development of the project. At one stage, I experimented with creating a machine learning algorithm intended to simulate multiple formal iterations. Using LunchboxML, a Grasshopper plugin, I attempted to generate a wide range of data sets and linked these to geometrical transformations within the design process. However, I found myself grappling with the terminology and underlying mechanics of machine learning; I didn't quite understand what was going on.

The challenge was not in grasping the general concept of neural networks, or the actual language process of how AI works but in understanding the deeper layers of how to retrieve data, transform data into a readable format, and programming it to the specific design needs. This raised a larger question: is it necessary to know how to build an algorithm to use one meaningfully in architectural design?

After these initial attempts, conversations with my professors helped clarify where I stood in the development of the thesis. I came to understand that the power of AI in design may not lie solely in visual, but rather its capacity for conversation. Tools like ChatGPT, a large language model trained on billions of data points, offers a unique interaction that mimics human conversation, but through the interface of technology. This led to a shift in approach: instead of building a purely generative model, I began constructing a design process guided through machine-aided dialogue. Comparing this use of ChatGPT to more generative forms of AI, it became clear that such tools do not replace human creativity or judgment. As Neil Leach has noted, they serve to enhance and expand our intelligence.

The system still relies on human expertise to frame questions, interpret answers, and make decisions. At a basic level, ChatGPT works by recognizing word patterns and, through training, generating the most probable next word based on context. For example, it doesn't understand the difference between "there's a yellow banana on the floor" and "there's a yellow sky on the floor," but based on learning from humans the probability that banana is higher than the probability of the word sky. In this way, ChatGPT becomes less a replacement and more a collaborator capable of helping the designer retrieve information, resolve and propose design challenges, and open new conversations within the design process.

Creating Design

Building upon the work established in Part 1, the form manipulation process remained consistent, but my decision making as a human designer became more informed and intentional. I continued to use Rhino with Grasshopper to generate site and building geometries. Wallacei X, a Grasshopper plugin that implements the NSGA-2 algorithm to evaluate and layer design iterations based on defined fitness parameters and fitness objectives. Imagine designing a shed; shed 4 might inherit features from sheds 1, 2, and 3, such as spatial dimensions, roof pitch, or window to wall ratios to create shed 4.

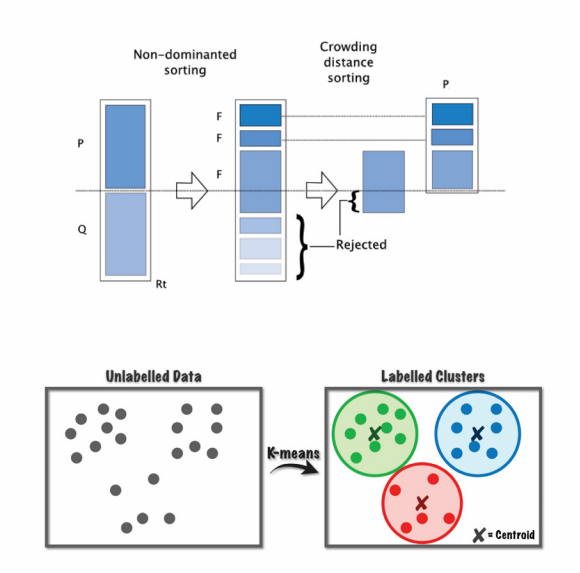


Image 1:
Diagrams representing the NSGA-2 algorithm and K-means clustering

Wallacei X then organizes the resulting design options using K-means clustering, which groups similar outcomes based on shared characteristics much like organizing tools within a shed by function, such as hammers, nails, or cleaning supplies. Using this premade AI plug-in, I was able to generate over 625 design options, each of which would have taken far longer than 30 seconds to draw and model manually.

Each iteration represented an attempt at balancing parameters, ultimately seeking an optimized solution through layered evaluation. Within this framework, the method of subtraction through carving, hollowing, and voiding portions of our host geometry was most successful. This subtractive approach generated meaningful spatial qualities that were simple to understand the actions of AI. By removing mass rather than adding form, it provided clearer iterations of the different moves completed in pattern. From one parameter to the next, the process is trained through rules and steps.

Host Geometry Height Parameter

The first parameter established in the form manipulation process was the height of the host geometry. This was calculated by averaging the total height of 34 selected buildings within the context, with individual heights ranging from 12 to 200 feet. The combined height of these buildings totaled 1,509 feet, resulting in an average of approximately 45 feet as determined by the fitness objective. While the algorithm allows for variation in height across different iterations, it consistently seeks to maintain a balance with other parameters around this 45-foot average. This height parameter is the only one that directly modifies the host geometry itself, which remains within the boundaries of the property line. All remaining parameters are associated with the action of subtraction carving voids and spaces from within the host form to influence spatial, and experiential outcomes.

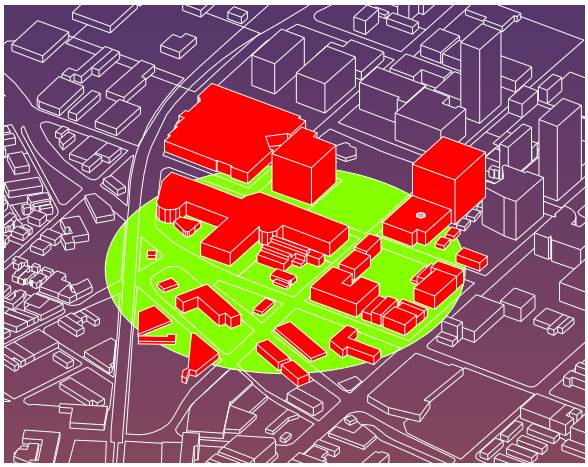


Image 2:
This image shows the selected buildings for the host geometry parameter

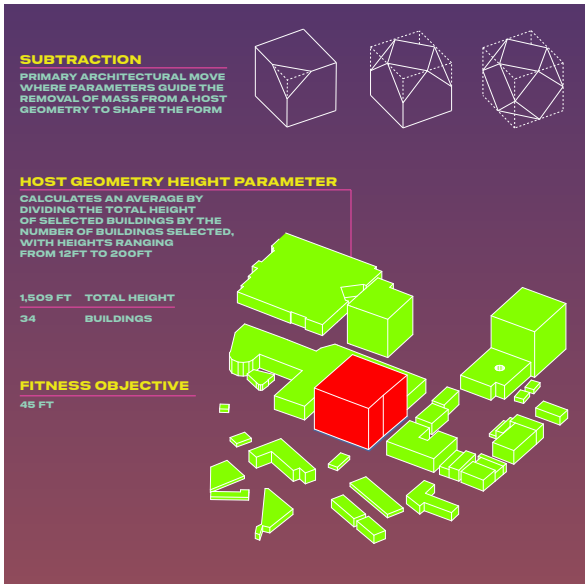


Image 3:
This image shows the action of subtraction and host geometry height parameter

Number of Voids Parameter

The next parameter is the number of voids, which is derived from an analysis of open space within a defined quarter-mile radius. The total area within this radius is 1,368,478 square feet. Subtracting the total ground floor area of existing buildings at 400,228 square feet gives us a total 968,250 square feet of unbuilt or open space. This results in a void ratio of 71%, indicating that most of the area remains unoccupied by built structures. To translate this percentage into a usable design parameter, a range of one to thirty buildings was selected as potential voids. Applying the 71% void ratio to this range yields 22 geometries, which were then used as subtractive volumes. These 22 voids serve as the fitness objective for this parameter, shaping the host geometry through spatial subtraction and contributing to the architectural form's porosity and articulation.

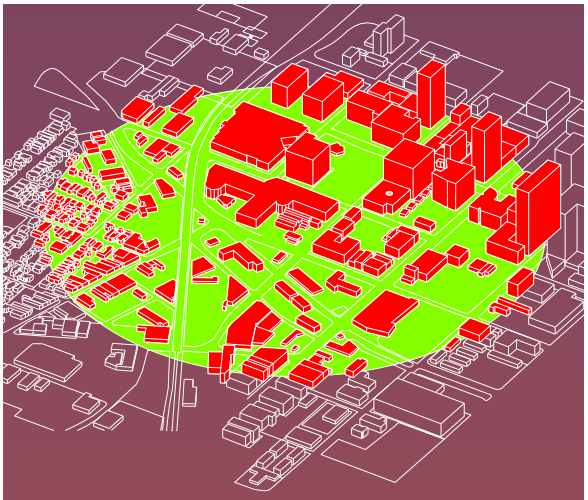


Image 4:
This image shows the number of voids parameter

Placement of Voids Parameter

The next parameter addresses the spatial placement of void geometries, which is by direct sunlight exposure analysis using the Ladybug plugin in Grasshopper. Ladybug draws on real-world weather data from EnergyPlus to simulate and visualize solar exposure across the site. Through this analysis, areas receiving less than four hours of direct sunlight per day are shown in blue, while red and yellow areas indicate zones with four to eight hours of sun exposure. To optimize environmental performance and natural lighting, voids are strategically placed in the blue zones. Subtracting from the host geometry in these areas improves solar access and daylight penetration. As a result, the fitness objective for this parameter is tied to targeting zones with less than four hours of daily sunlight exposure.

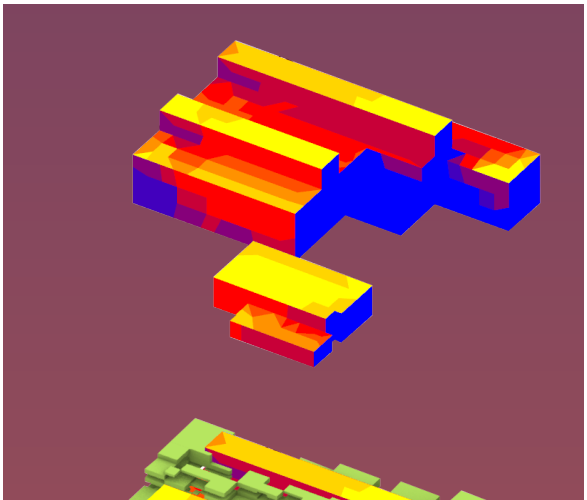


Image 5:
This image shows the void placement parameter

Boundary Parameter

The boundary parameter governs the spatial limits within which voids can be generated and placed. This parameter considers the site's setbacks and property lines, ensuring that the placement of void geometries responds to context. During the design process, variations were tested both within and beyond these boundaries to explore the spatial and formal iterations of extending past boundary limits. The fitness objective for this parameter prioritizes configurations that remain entirely within the defined boundary. This constraint reinforces a grounded relationship between the host geometry and its site, ensuring compliance while still allowing for meaningful spatial manipulation through subtraction.

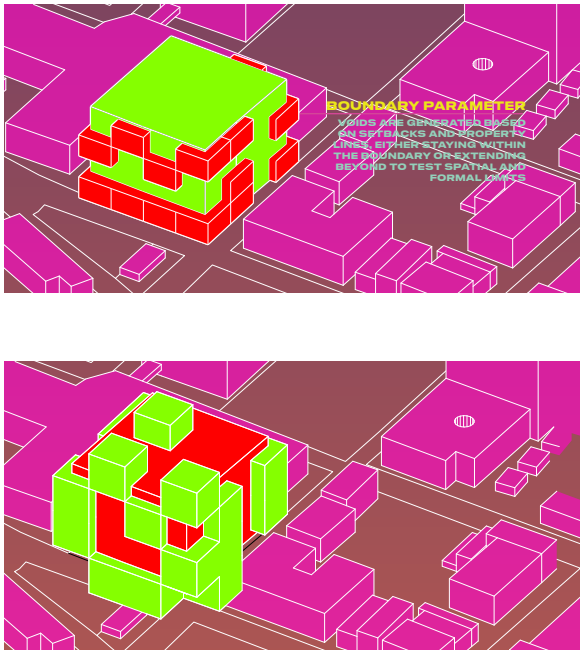


Image 6:
This image shows the boundary parameter between staying inside and outside the boundary

Scale Parameter

The final parameter in the form manipulation process is the scale parameter, which controls the relative size of the void geometries. This parameter functions in a straightforward manner, adjusting the scale of each void. The fitness objective for this parameter is set to a scale factor of 1.2, providing a balanced range that avoids extremes preventing the voids from becoming extremely large or insignificant in size. This subtle yet important adjustment helps maintain visual coherence and spatial legibility throughout the design iterations.

After compiling all parameters and defining their respective fitness objectives, the inputs were fed into the Wallacei X component, creating a series of form manipulation iterations. This process created a wide array of geometries, each responding differently to the interplay of parameters and fitness objectives. The results revealed unexpected spatial moments of formal curiosity that discovered new design possibilities. In other cases, certain outcomes appeared less productive. For instance, Generation 1, Iteration 6 produced fragmented, floating forms that lacked clear spatial or structural coherence, rendering them seemingly intangible. Even these less viable outputs contributed to a broader understanding of the design space and the range of potential architectural expressions.

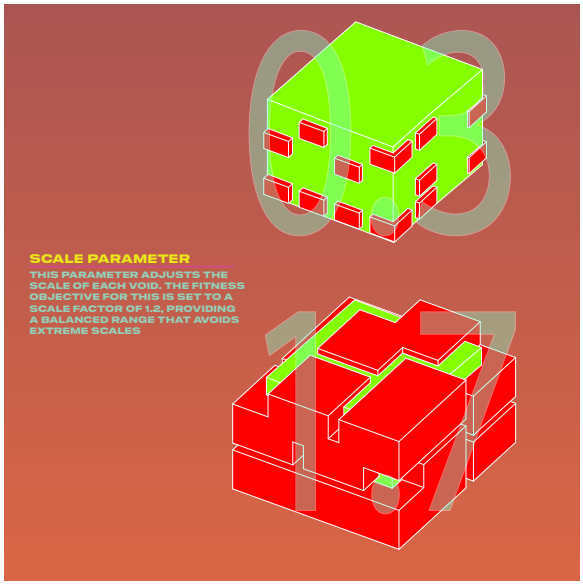


Image 7:
This image shows the scale of voids parameter

By Generation 25, Iteration 25, the process had evolved to a point where newly generated forms were strategically placed above the existing buildings. This marked a turning point in my curiosity, as the placement of these contemporary additions above preserved historical structures suggested a compelling architectural dialogue honoring the past while projecting into the future. These elevated forms became ideal for housing the vertical farming program, while a connection point at the farthest corner introduced a new experiential layer allowing users to circulate throughout the building while simultaneously engaging with the surrounding site from above.

Despite the algorithm's generative power, I remained the author of the final design. The machine provided a starting point, a rich field of possibilities, but it was my creativity, historical awareness, and architectural judgment that shaped the outcome. This process revealed a productive balance between AI assisted exploration and human dialogue, reinforcing a foundational truth: architecture, at its core, is governed by a set of rules and orders. Even as the algorithm operates, it does so within the framework of parameters I have defined, parameters that reflect my intentions, constraints, and responsibilities as a designer.



Image 8:
Generation 1
Iteration 6

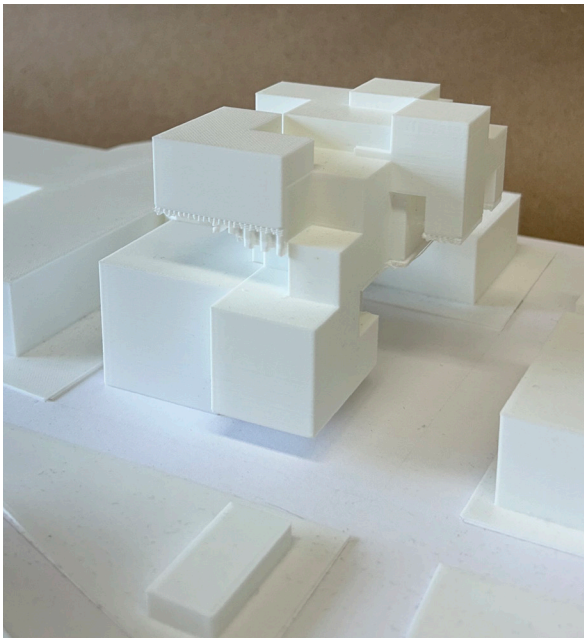


Image 9:
Generation 13
Iteration 20

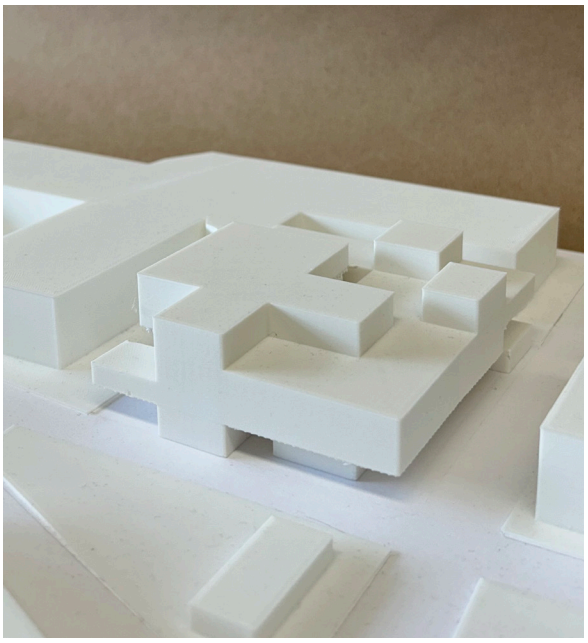


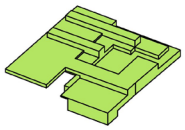
Image 10:
Left: Generation 1
Iteration 1



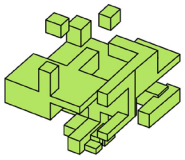
Image 11:
Right: Generation 25
Iteration 25



Generation 1: Iteration 1
Boundary Parameter: 0
Host Geometry Height: 40'-0"
Number of Buildings: 107
Scale: 1.5
Number of Voids: 19



Generation 1: Iteration 6
Boundary Parameter: 0
Host Geometry Height: 163'-0"
Number of Buildings: 71
Scale: 1.6
Number of Voids: 26



Generation 1: Iteration 24
Boundary Parameter: 0
Host Geometry Height: 197'-0"
Number of Buildings: 149
Scale: 1.7
Number of Voids: 21

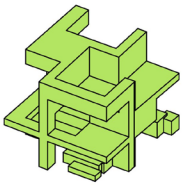


Image 12:
This image shows a variation of the generations

Generation 25: Iteration 25
Boundary Parameter: 0
Host Geometry Height: 181'-0"
Number of Buildings: 16
Scale: 1.5
Number of Voids: 12

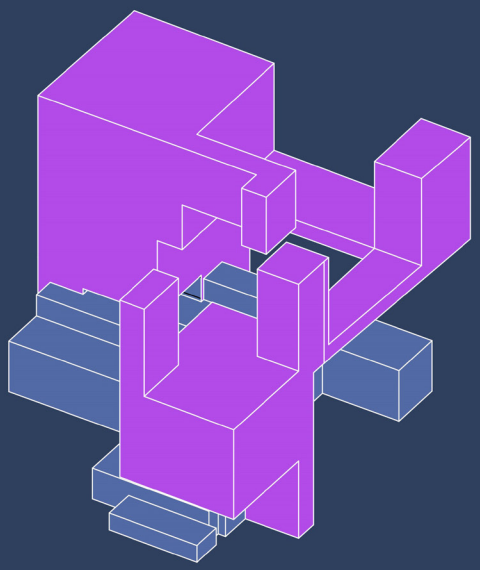


Image 13:
This image shows Generation 25 Iteration 25

Organizing Programs

With a selected form in place, the design process progressed toward spatial organization and programmatic layout. Responding to the site context, the intention was to establish a central node, one that could engage with pedestrian activity throughout Dayton while also functioning as a experiential destination. With a mixed-use program guiding the design, I began mapping out the spatial distribution of functions within the new structure. The elevated volumes naturally housed the vertical farming components: mass seed storage, grow rooms, and plant laboratories taking advantage of their spatial separation and scale. Meanwhile, the existing DP&L building, with its open floor plates, was ideally suited to accommodate the event space, and the retro-futuristic character of the adjacent diner made it an ideal location for the art gallery. This resulted a circulation loop that connected all programmatic elements, enabling visitors to begin their journey at any point and experience a continuous, narrative-driven architectural sequence. The images following to the right expresses different program layouts that were discussed with my studio professor to which it creates a central idea of how to fit function into form.

With this framework in mind, I developed a structured prompt for ChatGPT to assist in generating a program analysis for the building. The prompt was divided into multiple parts to optimize the clarity of the responses. Its objective was to explore different iterations of program layouts, with a specific emphasis on circulation patterns and the experiential flow of space. Key instructions were mentioned to ensure that human experience remained central to the design, avoiding purely formal or arbitrary spatial arrangements. Additionally, the prompt provided clear context regarding the programmatic requirements, including vertical farming, event space, and an art gallery, as well as the directive that the only shared area between these programs would be the outdoor courtyards and marketplace.

The final prompt input was:

I need you to act as an expert in architecture with years of experience in design. I want different iterations of a program layout for a building that includes vertical farming,

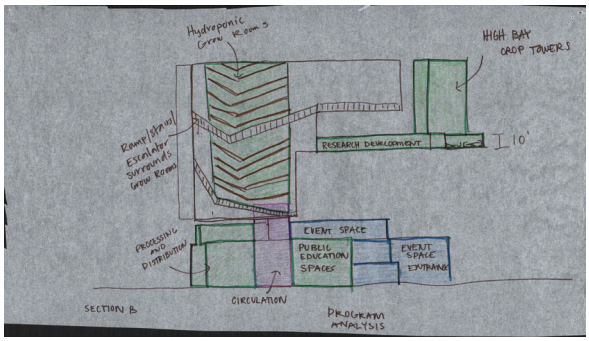


Image 14:
Hand drawing of program section

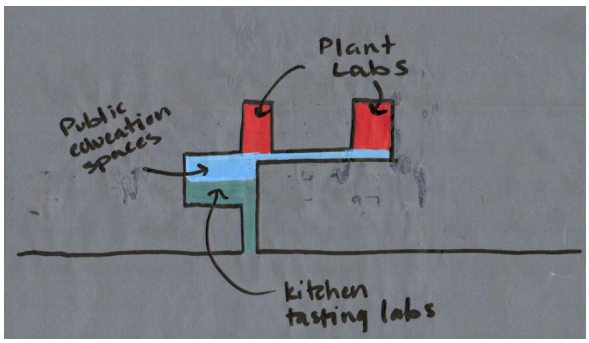


Image 15:
Hand drawing program analysis

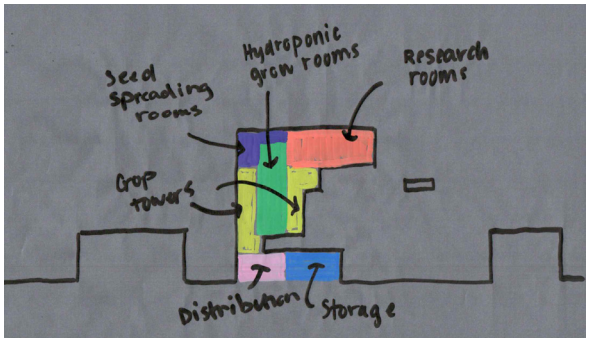


Image 16:
Hand drawing program analysis

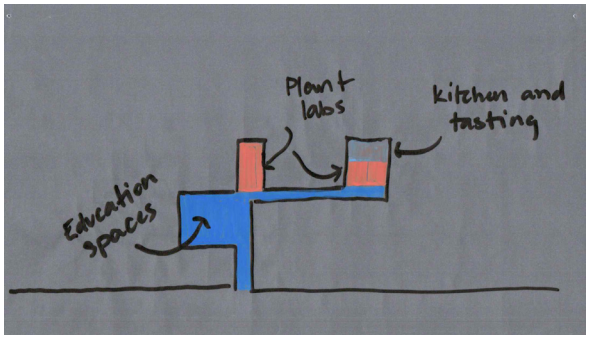


Image 17:
Hand drawing program analysis

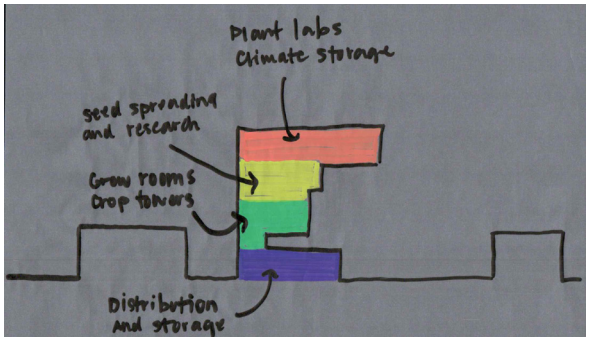


Image 18:
Hand drawing program analysis

an event space, and an art gallery, think in section and in plan views. The components: this includes are crop towers, hydroponic grow rooms, bioengineer plant labs, public education spaces, research development spaces, seed spreading rooms, climate controlled storage, distribution and docks, and a kitchen. The event space includes a stage area, an open floor plan, bar area, loading docks that is shared with vertical farming, and a gallery exhibition hall. The art gallery includes the main gallery, fabrication and workshop areas, collection and storage, office and research, and an outdoor sculptural yard that is shared between all programs outside.

For each iteration, provide a specified layout and flow of circulation; creating a story. Be careful of not having not taking consideration of human experience and placing rooms just for the fun of it. For context: I am designing a building using existing buildings including new programs of vertical farming, event space, and an art gallery to which an outside market is shared between every program, and I already have a mass form geometry. The existing mass geometries are on floor level while new geometries are being generated above the existing buildings connected through cantilevers. Although these three programs are different, the only space they should share is the outside courtyards including the market. Please create flow diagrams with colors explaining your reasoning.

AI Response

This moment marked a shift in how I perceived the role of AI in design not simply as a task completer, but as a conversational collaborator. In response to my prompt, ChatGPT posed thoughtful questions that required my input, effectively prompting reflection and decision making. This exchange of bouncing ideas proved to be a productive workflow for uncovering design opportunities. To further contextualize the discussion, I provided an image of the selected architectural form, aiming to refine the scope and relevance of the AI's output. The response included a programmatic diagram based on a form entirely unrelated to the one I submitted. However, this divergence offered unexpected value: it proposed spatial relationships and architectural elements that, while not aligned with the existing form, introduced alternative possibilities. These suggestions were not final solutions but early iterations, an invitation to rethink the design from another angle. Although imperfect, the AI-generated content served as a solid foundation for further exploration. Ultimately, the true strength of AI lies not in producing resolved answers, but in exploration, offering multiple iterations and revealing how adjustments in parameters can meaningfully influence architectural outcomes.

1. **Can you confirm which masses are part of the existing buildings and which are newly cantilevered?**
2. **Where do you envision the main access points?**
3. **Do different masses correspond to specific floors, or are they open to flexible programming?**
4. **Are there any strong relationships you want to prioritize?**

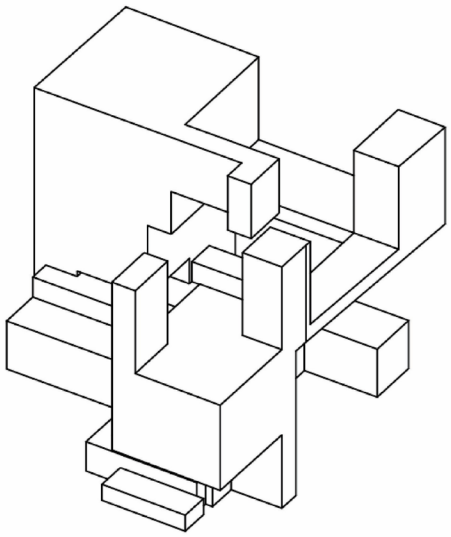


Image 19:
This image shows the response of ChatGPT of defining parameters

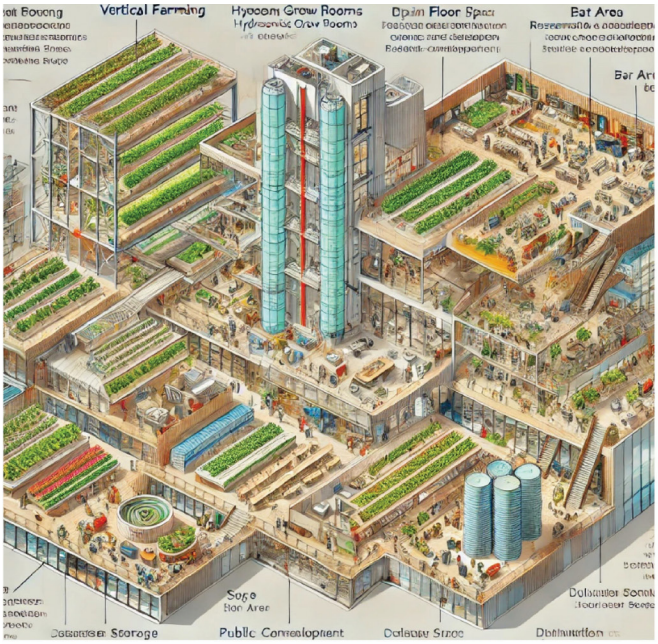


Image 20:
This image the generated image from ChatGPT describing program layouts

Vertical Farming
Positioned in upper levels to maximize sunlight with organized zones of crop towers and hydroponic grow rooms; placing storage and distribution on lower levels

Event Space
Stage and open floor plan centrally located with the bar area adjacent to circulation routes encouraging visitor engagement, while the exhibition hall provides a transition between event and art spaces

Art Gallery
Main gallery for public access while the fabrication and workshop areas are in proximity while the marketplace and sculptural yard connects all programs as a common space for interactions

Narrowing Design Moves

As the design process progressed and the architectural form became more defined through modeling and detailing, one of the key design challenges I encountered was resolving the structural logic of a cantilevered intersection where two elevated walkways connect at a corner condition. This junction not only carried visual significance but also presented a structural complexity that required careful consideration. I began exploring various structural systems that could support the cantilevered mass while minimizing visible supports to preserve the spatial and aesthetic qualities of the form. My initial concept involved anchoring the structure at two strategic points, enabling the weight and tension from the cantilevered corner to be effectively transferred back to vertical posts positioned away from the edge.

During this phase, I found myself toggling between two types of collaborators: my professor, who offered grounded technical insights, and AI, which offered speculative design options and conceptual variations. The dialogue between these two sources created a dynamic space for experimentation. This dual-source feedback loop became a valuable design tool, allowing me to test and refine ideas through both technical critique and imaginative prompts.

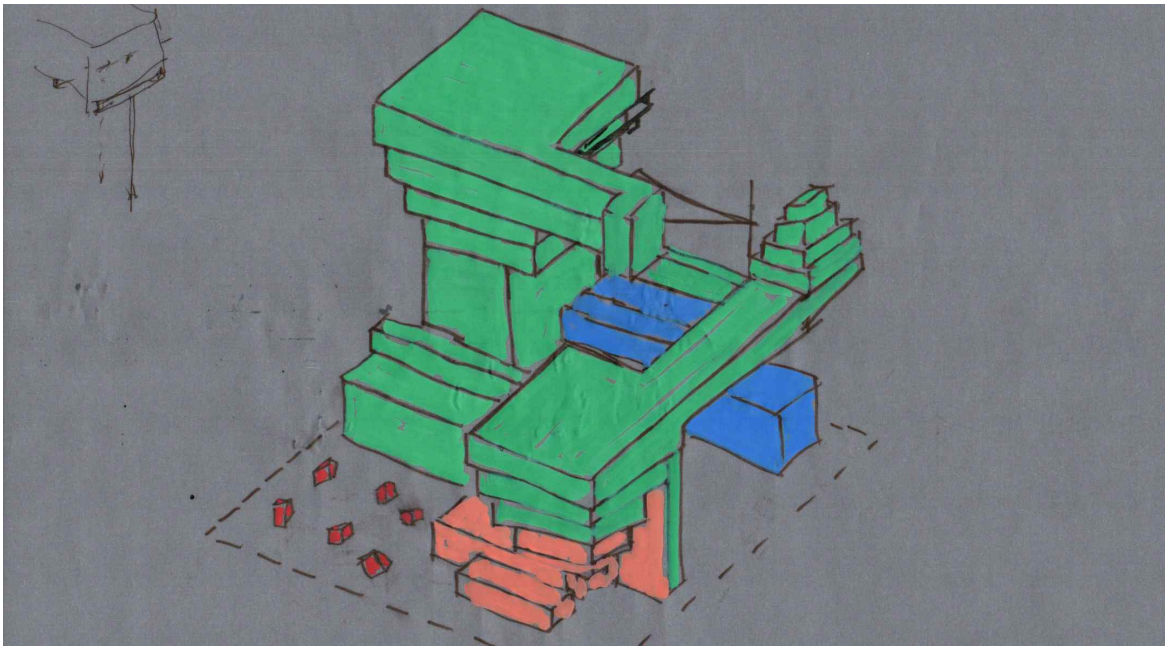


Image 21:
Hand drawing of form manipulating

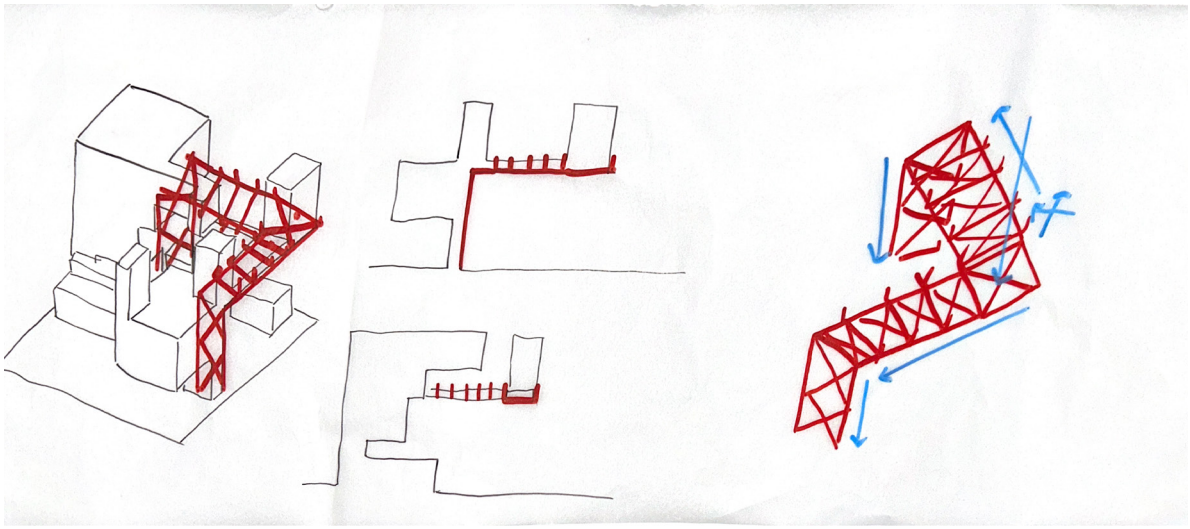


Image 22:
Hand drawing of structure iterations

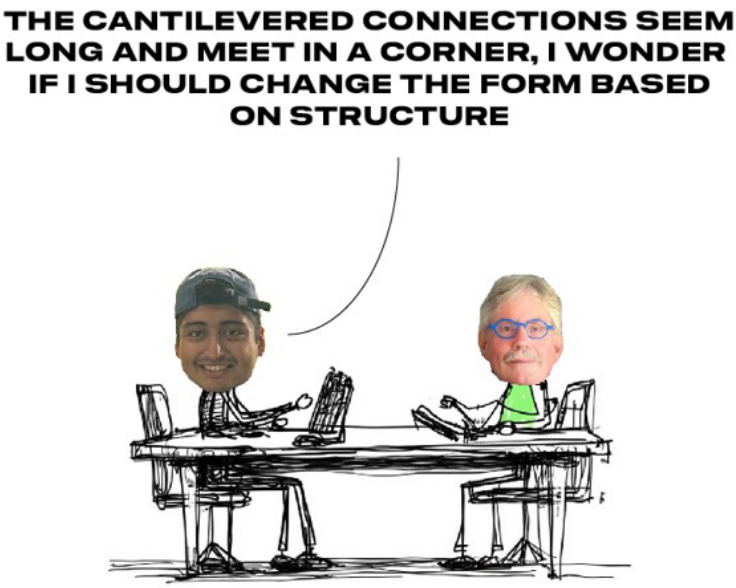


Image 23:
Conversation with professor Terry Welker

Image 24:
Conversation with professor Terry Welker

I'M REDESIGNING MY VERTICAL FARMING BUILDING TO FEATURE A SYSTEM THAT WRAPS AROUND THE WALLS, OVERLAID COLORFUL FACADE. PROVIDE EXAMPLES OF ARCHITECTURE WITH THIS METHOD.

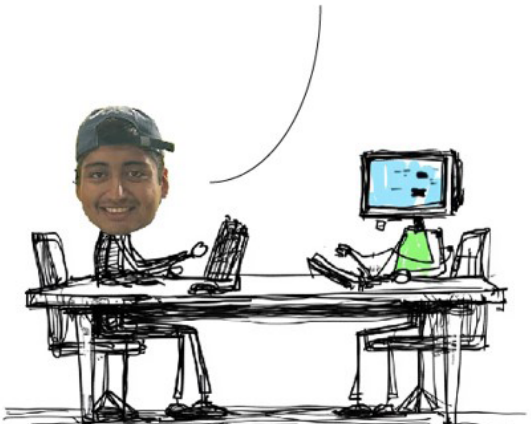


Image 25:
Conversation with ChatGPT

CENTRE POMPIDOU
THE COOPER UNION NEW ACADEMIC BUILDING
THE BEIJING NATIONAL STADIUM
THE SENDAI MEDIATHEQUE

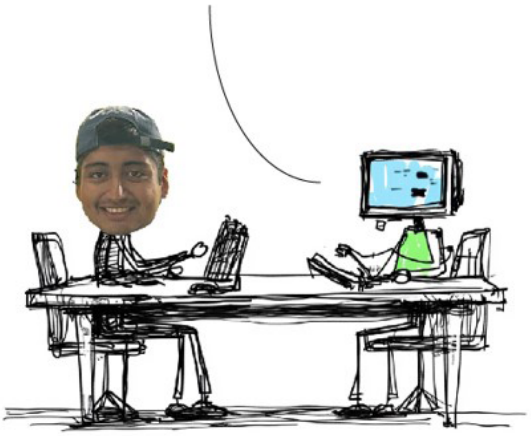


Image 26:
Conversation with ChatGPT

GENERATE A TRUSS DESIGN FOR THE USE OF FACADE STRUCTURE

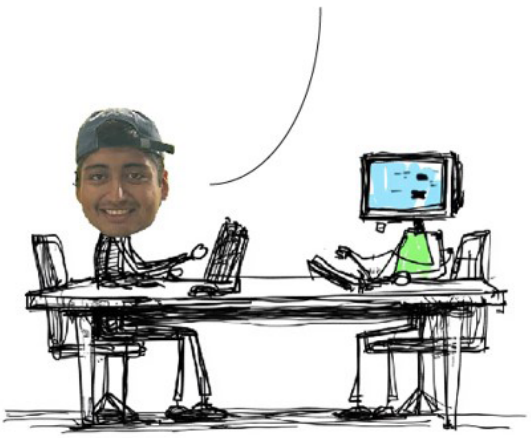


Image 27:
Conversation with ChatGPT

Image 28:
Conversation with ChatGPT

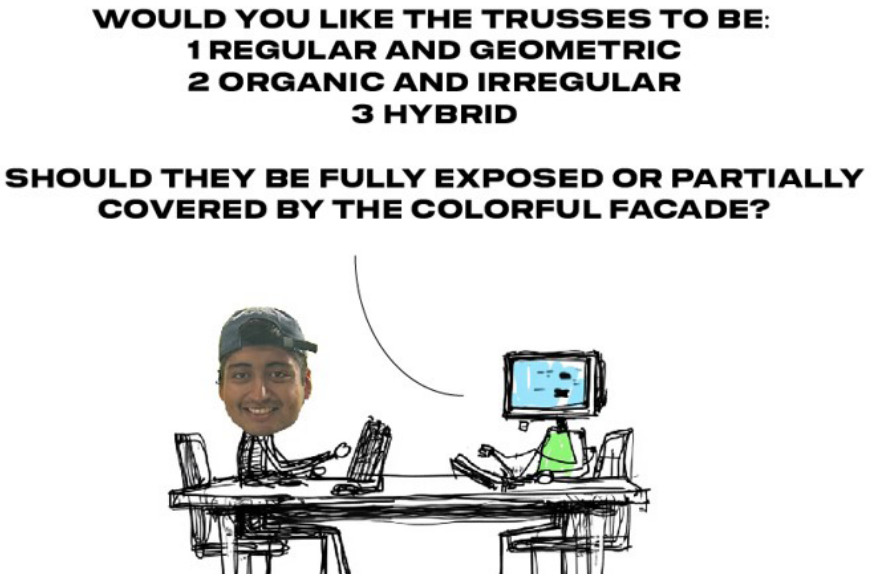


Image 29:
Conversation with ChatGPT

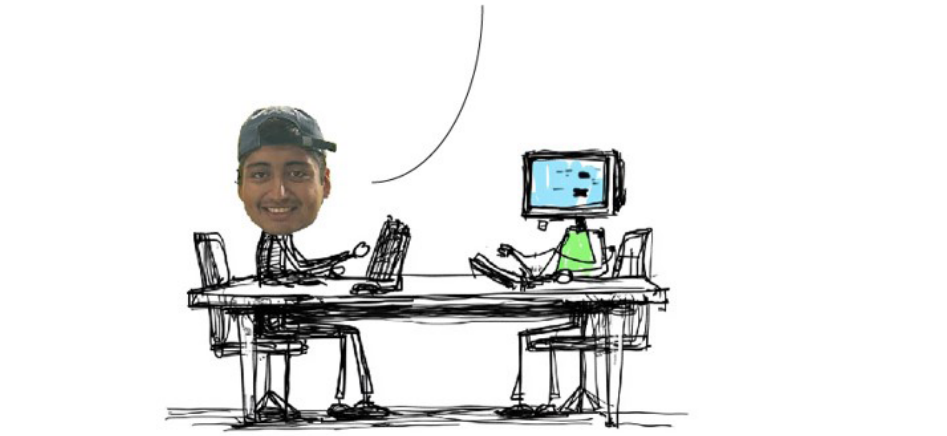
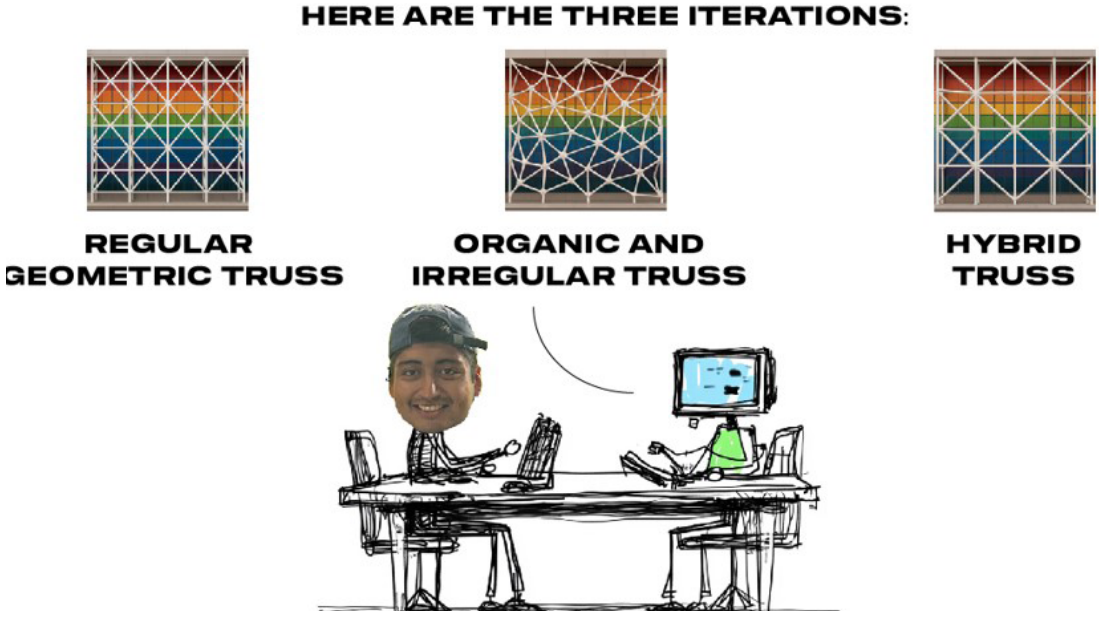


Image 30:
Conversation with ChatGPT



Informed by both human and AI-driven collaboration, I designed a skeletal wall truss system intended to transfer structural loads through a layered network of trusses anchored to the floating core masses. This approach not only resolved the cantilevered condition but also introduced a layered façade system that mimics the structure of neural networks referencing to AI within the building's form. A dramatic yet intentional moment that frames intricate views of Dayton while guiding users through a slow, suspended path along the elevated walkways. The experience becomes more than just movement; it becomes a narrative.

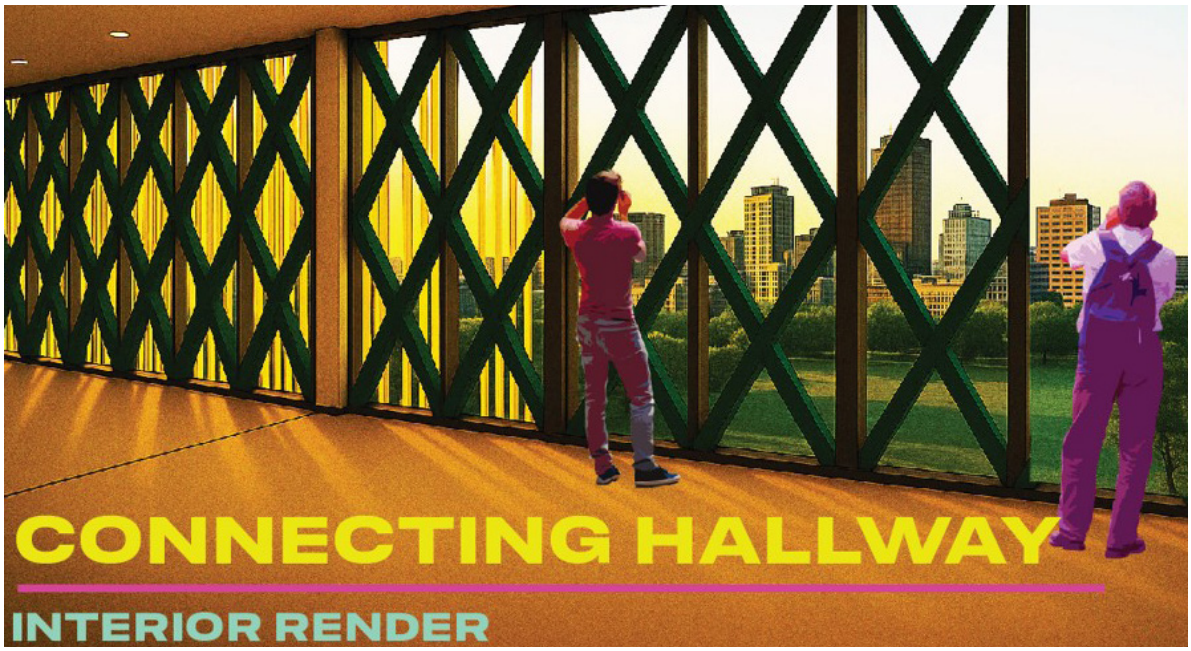


Image 31:
Interior render of connecting hallway

Elevated Walkway

Another design influence I created using AI was to enhance the tour of the life cycle of vertical farming. I wanted to create a moment of relief, knowing the complexity in form and program to take a break from the structure and program and admire the views of Dayton while creating suspense looking down on a half invisible floor.

This idea originated from a drawing I created, an exterior circulation path that exits the building envelope before curving back inward. To further explore its potential, I uploaded the drawing into ChatGPT and prompted it to generate variations. The AI responded with a series of alternative iterations, each maintaining the visual language of the original sketch. What emerged was a compelling dialogue between drawings, a back-and-forth exchange where my initial concept served as a foundation. This iterative conversation through visual language exemplified how machine learning can participate in the design process, not by replacing authorship, but by expanding the creative horizon through responsive feedback. Attached is the condensed conversation:

Jose Osnaya



Image 32:
Hand drawing of walkway design iteration

ChatGPT

This is compelling. Your walkway acts like a pier extending from the vertical farm—cutting across pitched roofs, highlighting the tension between old and new. You could amplify it with materials like grated metal outside, and mark the moment of exit with subtle shifts in ceiling height or lighting. Look at SANAA's Rolex Learning Center or Zaha Hadid's MAXXI for inspiration.

Would you like a refined sketch or image references?

Jose Osnaya
Both. And I like how the walkway interrupts—like the building lets you go briefly to show you something before drawing you back in.

ChatGPT
Exactly—it becomes a narrative pause. That outward step could align with a key view, shift materials, or reawaken the senses. Maybe from there you see other bridges or farming platforms, adding a layered effect. Want to explore how this plays out in section or see a few design variants?

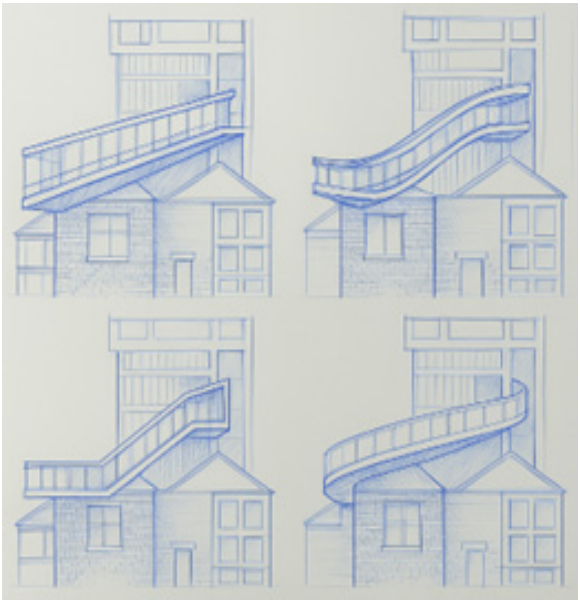


Image 33:
Response drawing from ChatGPT



Image 34:
Response drawing from ChatGPT

Jose Osnaya
Yes, but focus on how the form affects a person's spatial experience.

ChatGPT
Here are four variants:

Linear: A direct projection—sudden exposure, stillness, and contrast.

Angular: A sharp break that pivots your body—cinematic and dynamic.

Curved: A soft arc, guiding you gently outward—rhythmic and slow.

Spiral: A slight coil—brief disorientation that opens into a framed view, then reorients.

Each shapes movement and perception differently. Want to develop one?

Jose Osnaya
I think these are interesting images. I like the curvature in the top right and bottom right—though one's too subtle and the other too dramatic. Provide a variation that meets in the middle. Since most of the building is linear and rectangular, this walkway becomes a subtle break in the geometry—a quiet interruption that doesn't compete but adds a spatial pause. As we move toward final production, I want it to feel intentional and experiential—momentarily drawing you outward before folding you back into the building. It should register clearly in section and elevation as a light, deliberate extension. I think I've gotten enough information about the building design and how I want to draw it out. Finally, will you create a realistic render of the elevated walkway from the original sketch I uploaded.



Image 35:
Outside render produced by ChatGPT



Image 36:
Project introduction

Finalizing Building Design

This chapter concludes with the development of an architectural system that integrates adaptive reuse, vertical farming, and AI-driven design methods into a single built environment. The design is not centered on creating a fixed object, but rather on generating a sequence of spatial experiences shaped by movement and interaction. The existing site is comprised of a deteriorated brick building and a retro-futuristic metal structure. Instead of erasing these older elements, the project builds upon them, allowing the past to structure the present using AI.

Circulation plays a central role in how the building is experienced. Vertical movement is not only functional but becomes the organizational spine of the entire project. Walkways and elevators are designed to guide visitors through a series of shifts between light and dark, inside and outside, ground and air, while also creating a learning tour of the vertical farming aspect, showing the life cycle from beginning to end. One key moment is the elevated walkway that exits the vertical farming volume and extends outward before returning inside. This move is small in terms of geometry, but large in terms of experience. It creates a moment of openness and reflection, both physically and conceptually, giving visitors a brief pause from the density of the interior while framing the surrounding city.

Beyond circulation, the building is organized as a series of vertically connected zones: farming and research above, food processing and storage in the middle, and public-facing programs like the gallery, café, and market at the ground level. The design acknowledges these layers but deliberately avoids isolating them. Instead, they are linked through visual connections, shared thresholds, and overlapping uses. For example, the farming research spaces are adjacent to public exhibition zones, suggesting that production and education can occur in parallel. The AI labs and seed banks are physically connected to the farming core, underscoring the relationship between data, growth, and resource management.

The building operates as a hybrid system. It combines reused material with new structural additions, traditional program types with experimental ones, and intuitive spatial planning with algorithmic decision-making. Rather than simplifying these differences, the project allows them to remain visible. The transition between old and new materials, for example, is not hidden but revealed through details and surface articulation. In this way, the building makes its own process legible. AI helped optimize spatial organization, guide design iterations, and generate architectural alternatives. Yet the final decisions remain guided by spatial logic and human intention. This reflects the project's broader position: that AI should support architectural thinking, not replace it.

As this chapter closes, the focus shifts from forming a singular architectural solution to constructing a system of relationships between people, programs, tools, and space. The building is not presented as a finished object, but as an open framework that adapts, educates, and evolves. In connecting agriculture with art, reuse with innovation, and movement with meaning, this project offers a built model for how architecture can respond to layered challenges through integrated and intentional design.

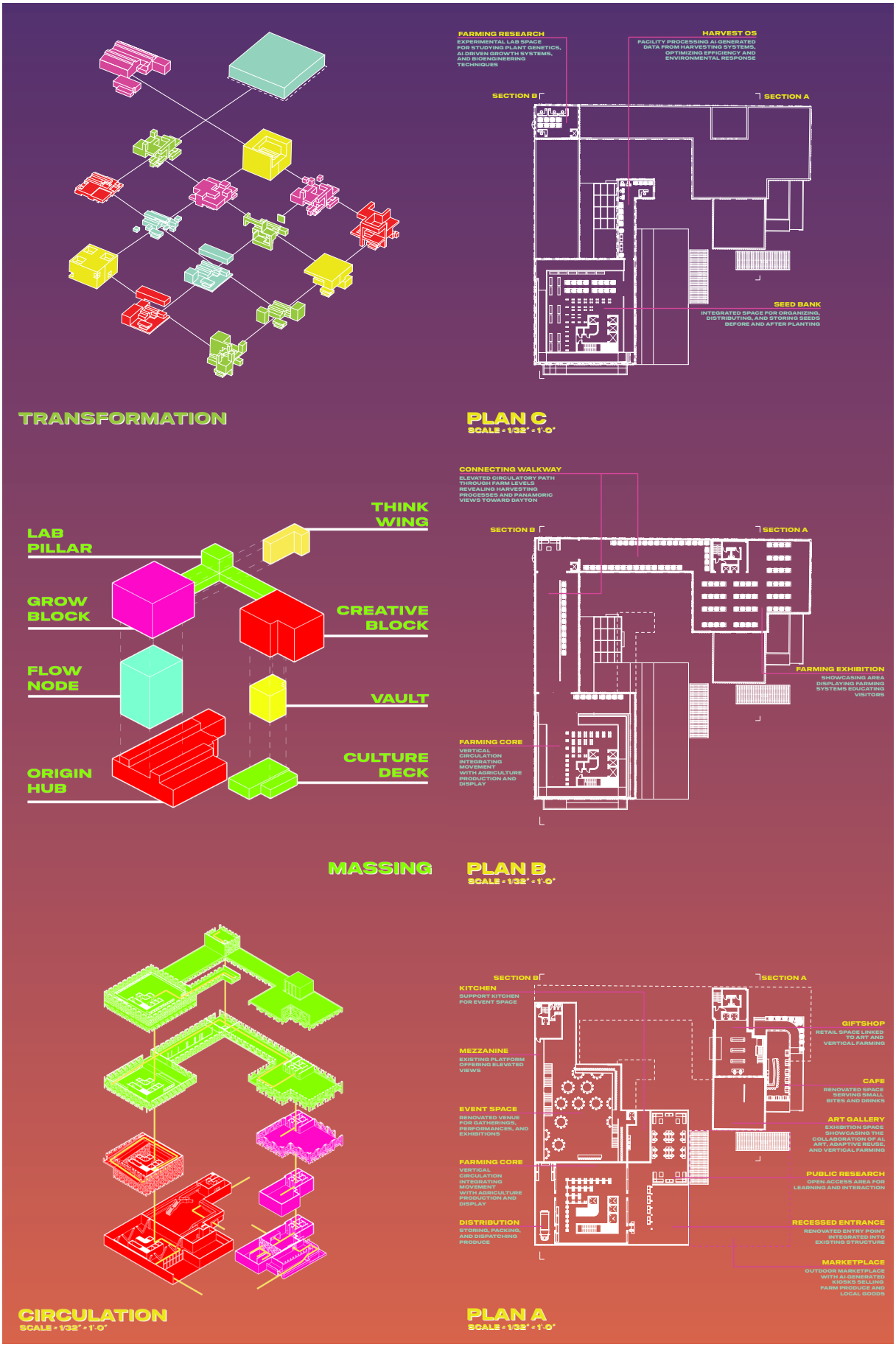


Image 37:
Project drawings

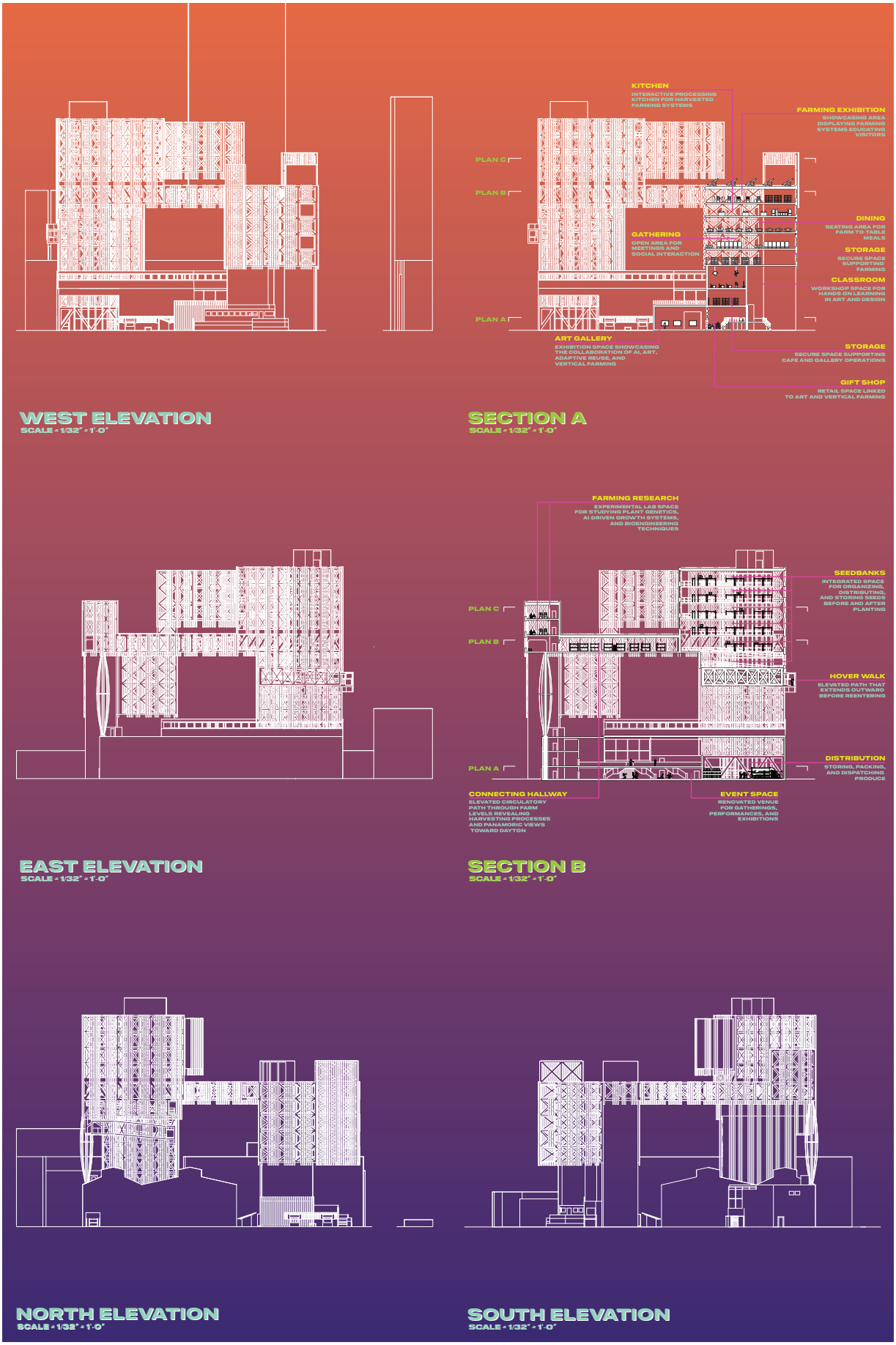


Image 38:
Project drawings

05

Artificial Intelligence in Interior Design

One of the primary goals of my independent study was to explore the potential applications of artificial intelligence within the field of interior design. While interior design shares many principles with architecture, it focuses more directly on how spatial composition, material selection, and atmospheric qualities influence human behavior and perception. With my background rooted in architecture, this shift in focus required a deeper investigation into how interior environments are shaped both physically and experientially, and how designers are responsible for shaping those interactions with care and intention.

Interior designers, like architects, are tasked with understanding the fundamental properties of the materials they select including visual and tactile qualities, but also their structural behavior, health implications, and environmental origins. It is not enough to choose materials based on aesthetics alone; the ethical and ecological footprint of each decision must be considered. This includes where the material is sourced, its lifespan and ability to withstand wear and tear, and how it will evolve over time. More importantly, designers must also consider how these materials impact the daily lives of the people who inhabit these spaces contributing to health, well-being, comfort, and inclusivity.

During this study, I aimed to bring these principles into alignment with the goals of my thesis. I conducted targeted research on case studies relevant to the art gallery program within my project, looking specifically at how materiality, lighting, surface treatment, and spatial rhythm create emotional and perceptual effects on a human scale. These project designs included Ward with V Dots by B+D Architects, Galeria Melissa NYC by Muti Randolph, and In-Sight Concept Store by OHLAB. These cases studies serve as existing projects that involve communal programs that shape an experience of a space.

AI served both as a design tool and a conceptual framework throughout this study. I explored its potential by testing various publicly available programs, including tools like AI Remodel – Interior Design, an app available on the Apple App Store. This platform, like many others in the growing field of AI-assisted interior design, required users to submit an image of an existing space and then select from a range of text prompts or predefined styles to generate alternative design renderings. However, despite its promise, the tool ultimately fell short. Much like other generative design platforms in architecture, it relied on repetitive outputs behind a paywall. The results did not respond meaningfully to the spatial conditions of the room, nor did they allow for nuanced user control or deep integration of material, lighting, or programmatic logic. This highlighted a key issue in current AI design applications: while they can generate visual variation, lacking the architectural intelligence required for informed and context-sensitive design outcomes.



Image 1:
Ward with V Dots precedent



Image 2:
Galeria Melissa NYC precedent



Image 3:
In-Sight Concept Store precedent

Applying AI in Interior Spaces

To assist in material selection, simulate user experience, and generate new formal possibilities, AI became a collaborative partner, offering multiple design directions and variations which I could then filter through the lens of interior spatial experience. Rather than using AI to design for me, I used it to provoke new questions, test iterations, and examine how small changes in material or layout could lead to significant shifts in spatial atmosphere.

Through this method, the design of the art gallery was shaped by a desire to create a space that evokes both exploration and suspense. The gallery is not merely as a static exhibition hall, but as a flexible environment capable of various artistic expression. Given the hybrid nature of the project, merging adaptive reuse with contemporary additions, the gallery needed to reflect a retro-futuristic atmosphere.

This aesthetic strategy positioned the space between the material memory of the existing buildings and the potential of new technologies. Moreover, the integration of AI throughout the project informed a future-facing design, requiring the interior to subtly express technological presence without becoming overtly digital. The gallery thus became a site where past and future could express, where architectural history and machine intelligence overlap. From these intentions, the following prompt was developed:

I need help rendering a couple images the first one has to do with the art gallery but I don't want you to change any of the geometry, but make it as realistic as possible. Play around with materials and do a subtle effect with the use of the retro futuristic color palette. The doorway to the left enters into a gift shop and the two walls in the middle are for hanging pictures or setting art.

Once the image was produced, a conversation was then initiated to modify the image.

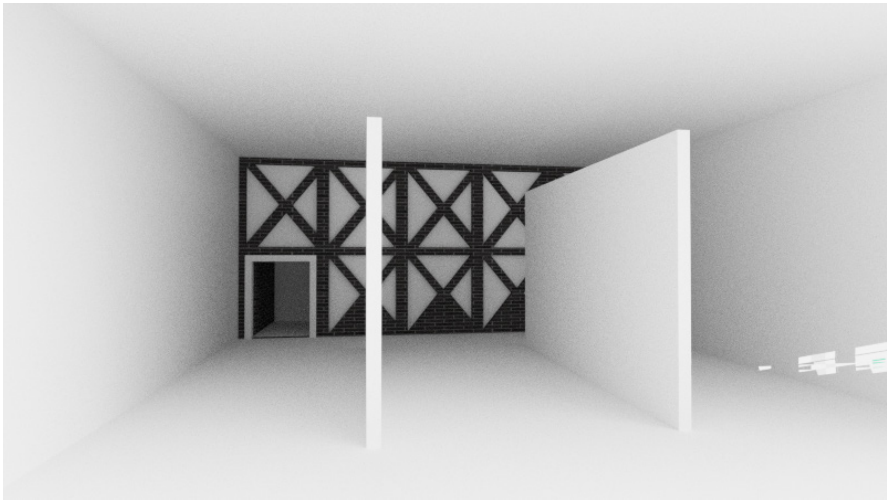


Image 4:
Interior render of art gallery

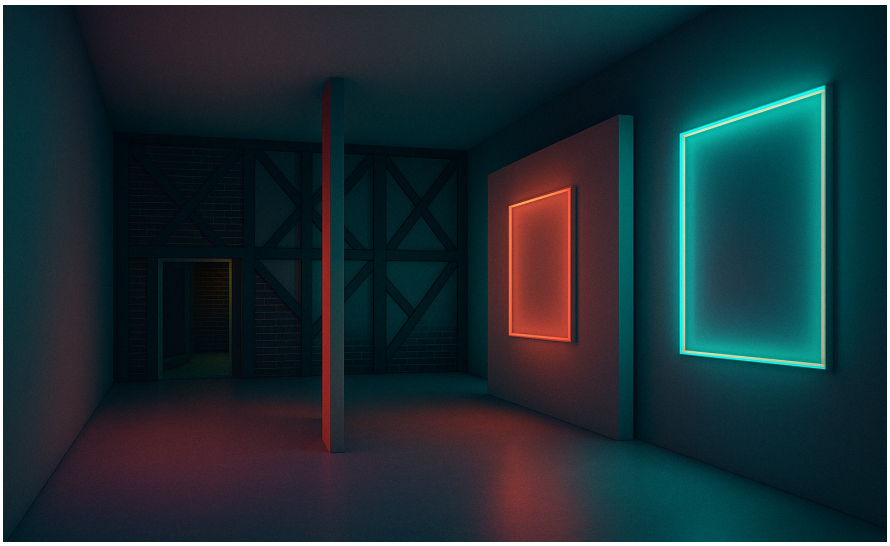


Image 5:
ChatGPT interior render variation 1

Curious to what other methods of attempting an interior space, I asked for a prompt to produce in Midjourney, an AI model that renders images based on specific prompts:

/imagine prompt: A futuristic, neon-lit art gallery interior with retro-futuristic ambiance. Maintain all original geometry from the uploaded image without modification. Add multiple glowing neon art frames on both the left and center walls. Introduce soft ambient glow to subtly reveal surrounding wall textures. Include minimal, modern display tables showcasing holographic or sci-fi-inspired art objects, illuminated with subtle internal light. The environment should reflect a cinematic, clean, and immersive mood, using a palette of teal, magenta, and deep red shadows.

The images generated through MidJourney revealed different opportunities for visual experimentation. What stood out immediately was the ability to produce multiple design variations within seconds, a process that traditionally could take hours or even days. This not only reduces the technical burden on hardware eliminating the all-too-familiar sound of laptops overheating but also allows designers to shift focus from production time to iteration and concept development. More importantly, these outputs raise questions about authorship and originality. Each image, while visually new, is composed of pixelated data that draws from countless existing visual references, combining fragments of prior imagery to produce something that has technically never existed before.

In the case of my art gallery design, this method allowed me to explore retro-futuristic atmospheres. The results exhibited signature characteristics of the style: glowing structural frames, neon and ambient lighting, stark contrasts between dark voids and illuminated zones all of which contributed to a cyberpunk-like spatial narrative. These images did more than visualize form; they created mood and context, suggesting how lighting and material might influence the interior experience.

Building upon this, I reintroduced ChatGPT into the process to generate modified images that merged MidJourney outputs with original renderings of my own gallery design. This move extended the creative workflow. In doing so, I was no longer working with a single AI system, but rather building a feedback loop between two platforms—MidJourney for visual direction, and ChatGPT for refinement and alignment with the architectural intent. The combination of tools demonstrated how AI can move beyond stylistic generation and instead support an integrated design process, one that spans ideation, visualization, and conceptual framing.

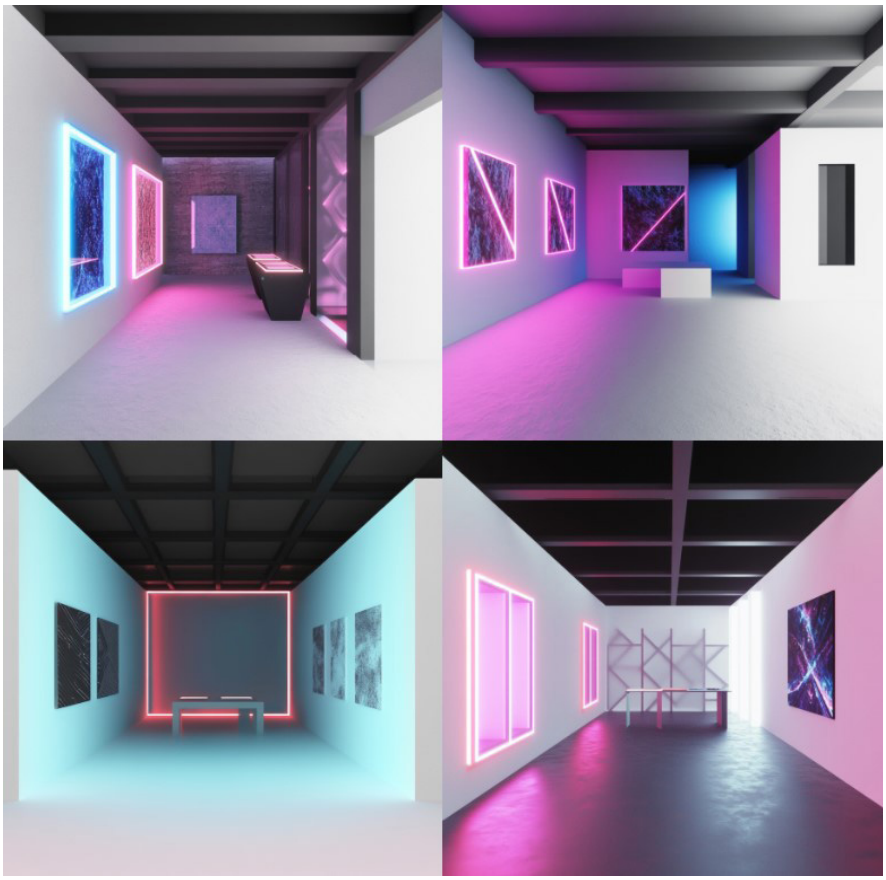


Image 6:
Midjourney interior render variation 1

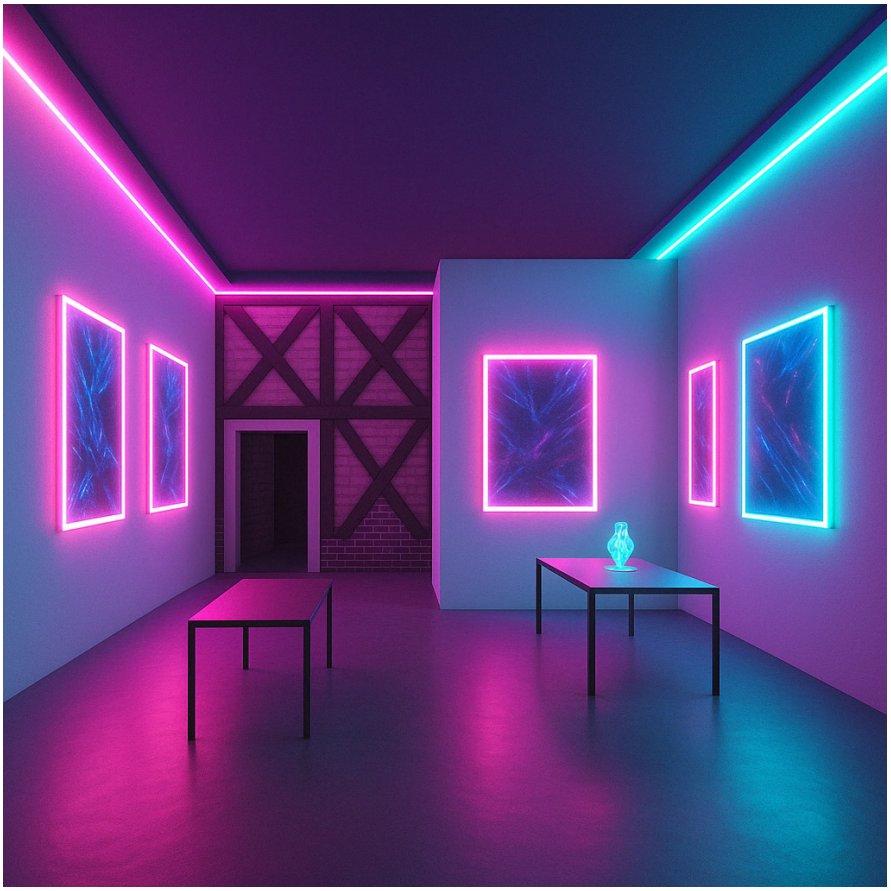


Image 7:
ChatGPT interior render variation 2

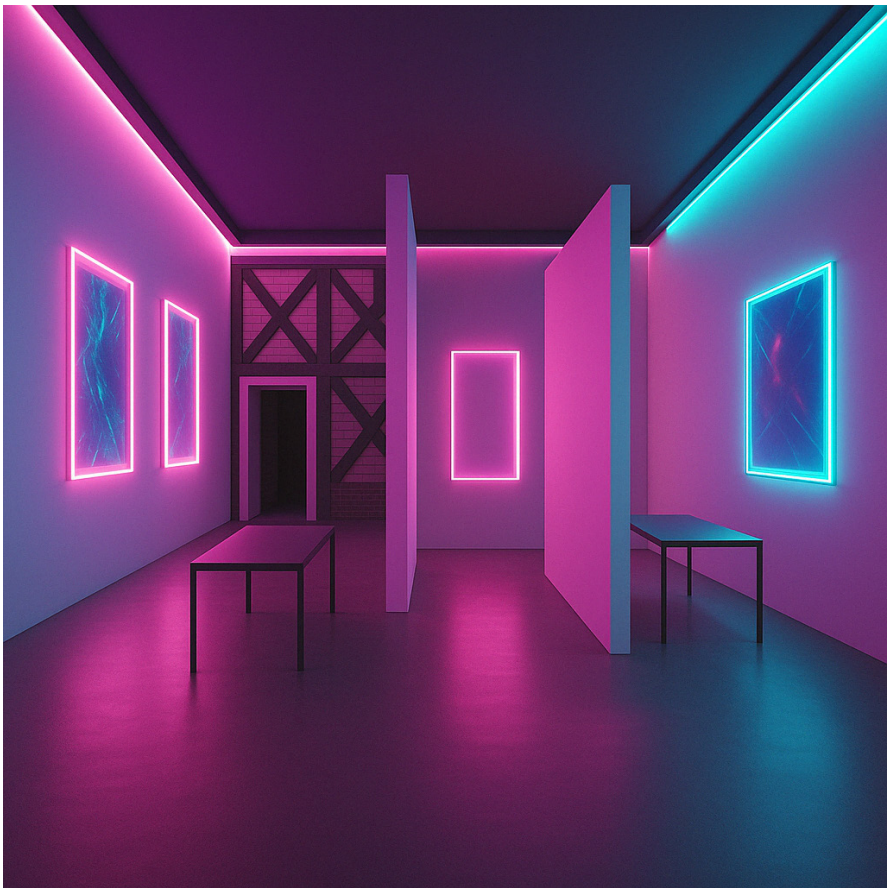


Image 8:
ChatGPT interior render variation 3

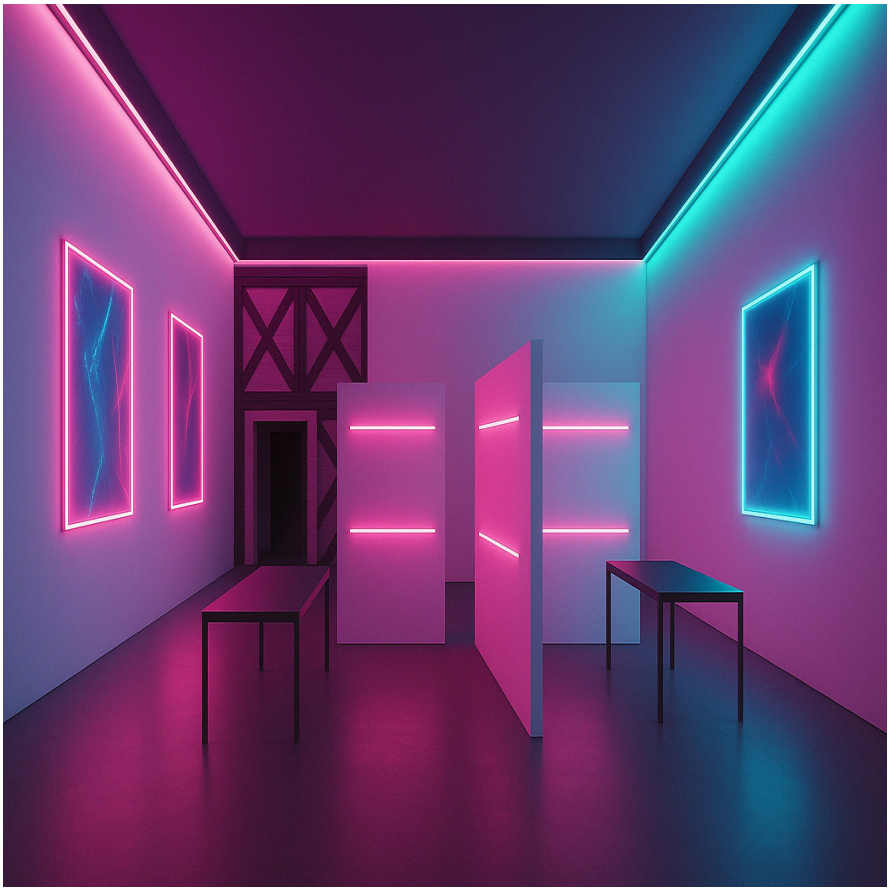


Image 9:
ChatGPT interior render variation 4

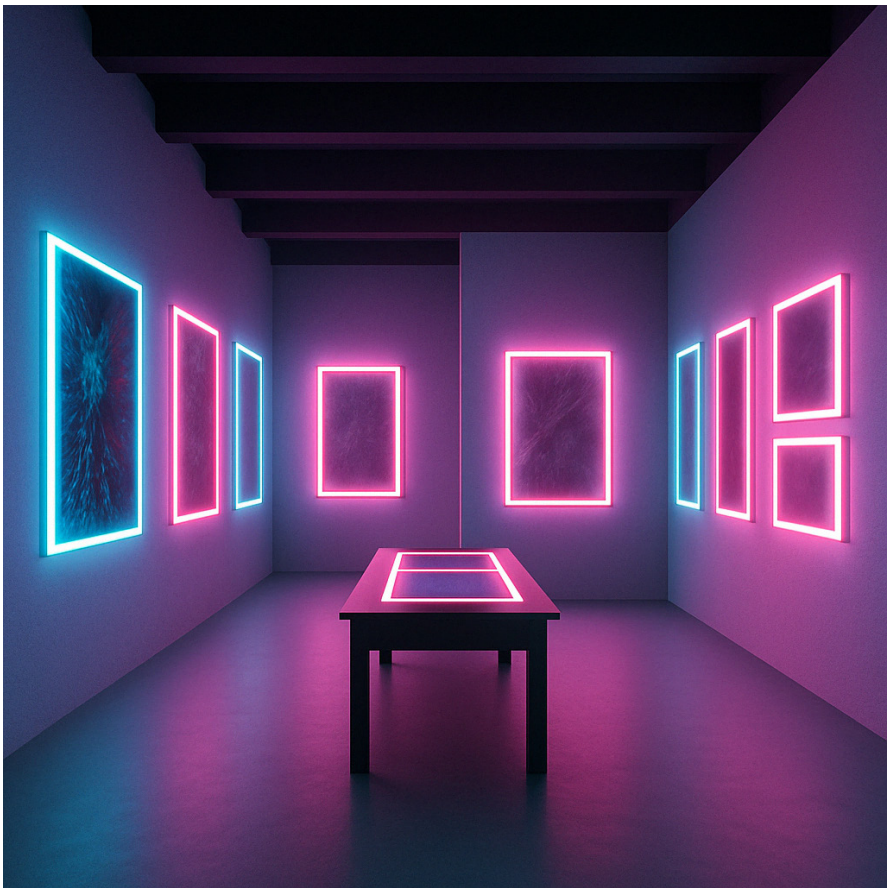


Image 10:
ChatGPT interior render variation 5

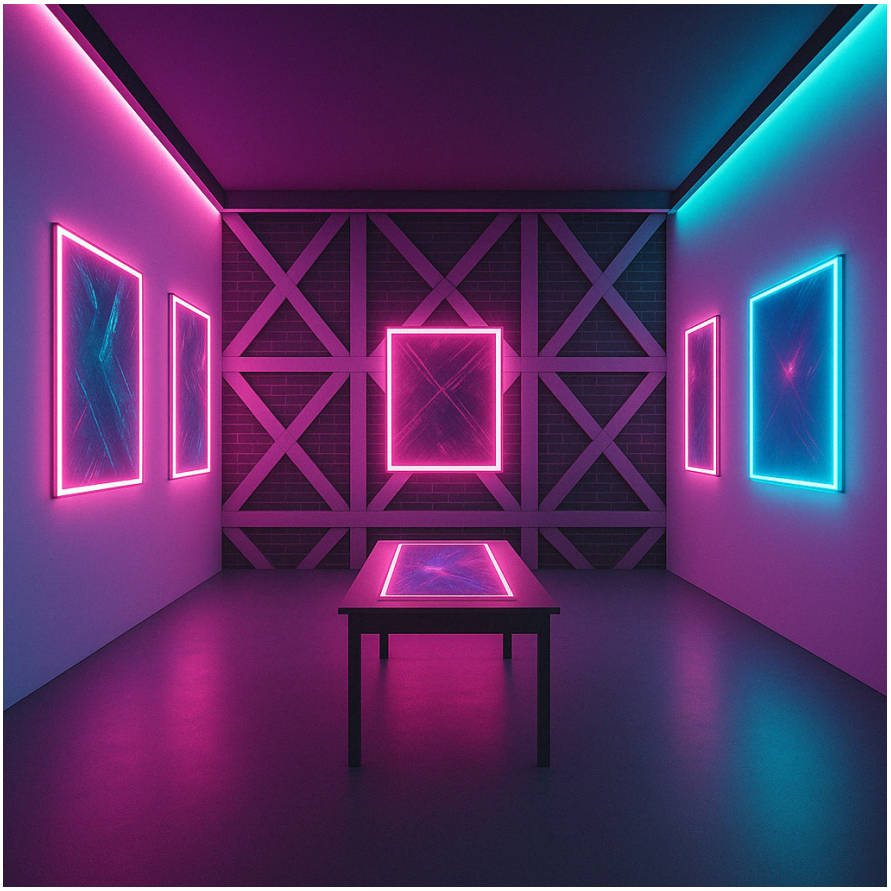


Image 11:
ChatGPT interior render variation 6

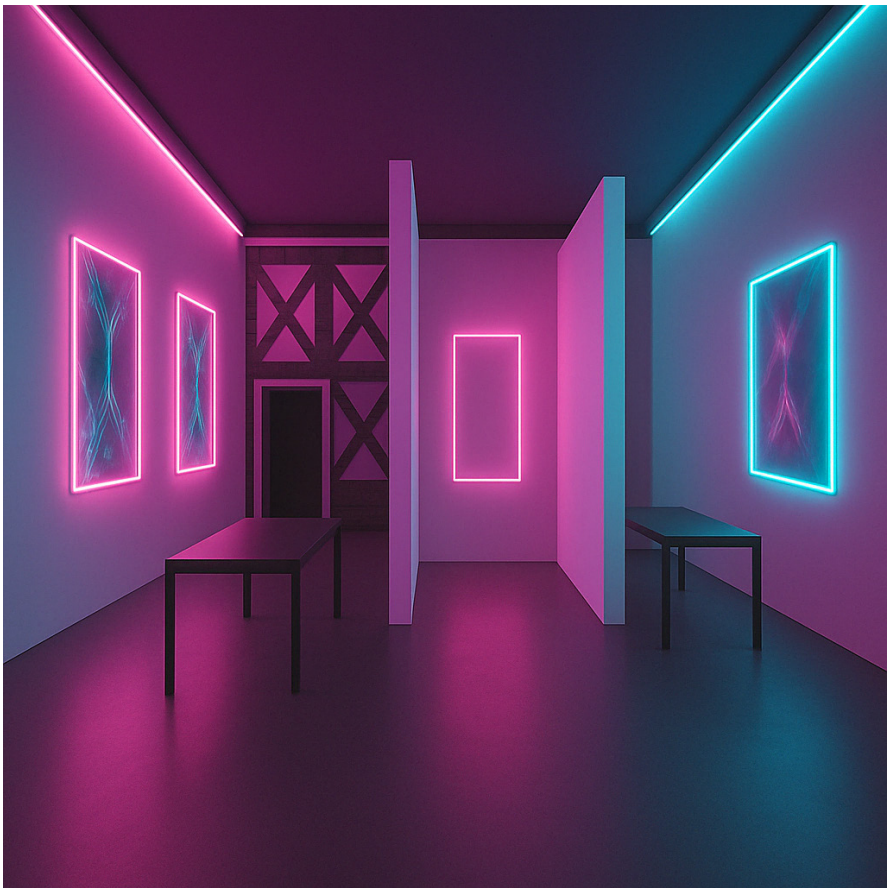


Image 12:
ChatGPT interior render variation 7

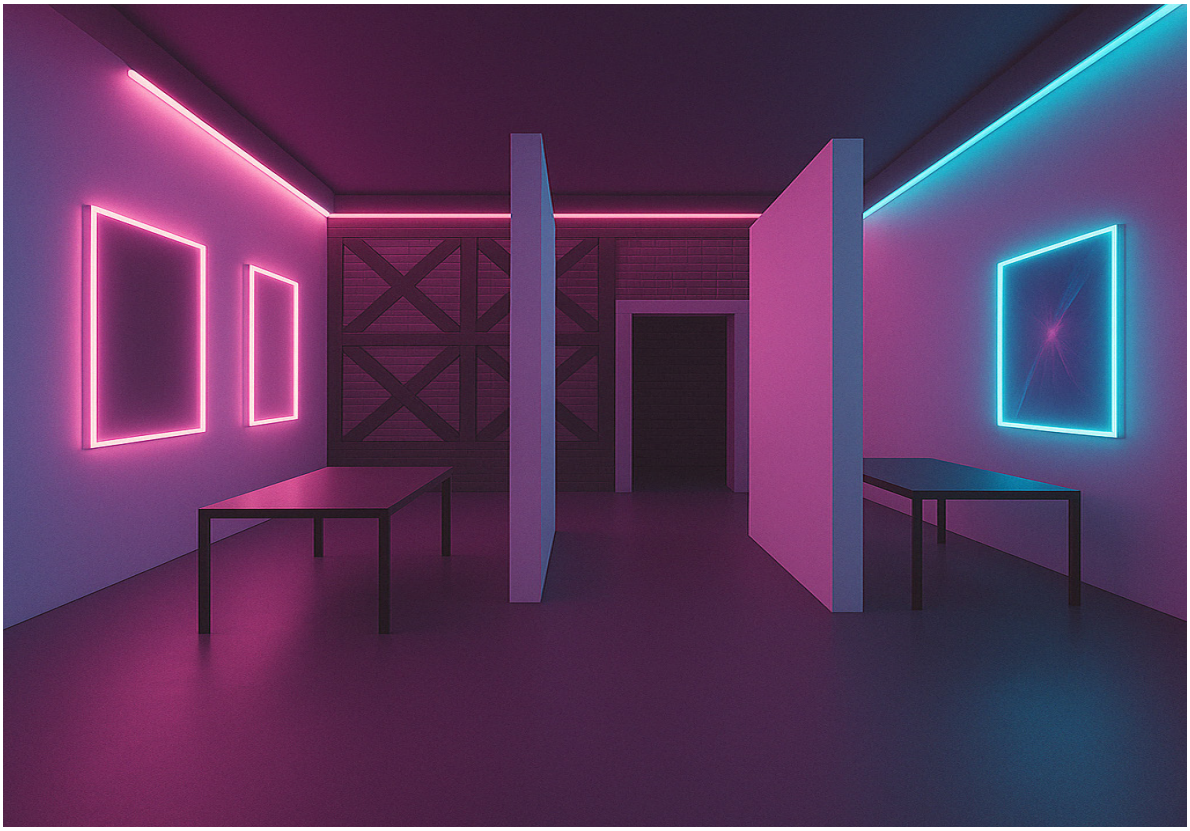


Image 13:
ChatGPT interior render variation 8

Final Interior Design Iteration

After refining the images through conversation, I wanted to start over as I felt none of the images were supporting this idea of an art gallery. To which was ChatGPT's response:

Perfect — to clarify, you'd like me to take the original grayscale render (the one with the two interior walls and exposed triangle beam pattern on the back wall) and apply a retro-futuristic visual treatment, while:

Preserving the geometry exactly

Adding neon lighting (e.g., magenta, cyan glows)

Subtly enhancing materials for realism (e.g., lighting, wall finish)

Possibly adding neon-framed artwork and minimal furniture if desired

Just confirm if:

You want artwork and tables included, or just lighting/materials?

You want the walls to stay in their original positions (not pulled forward like before)?

You want to keep the triangular wood pattern fully visible on the back?

Once I get that confirmation, I'll generate the updated render for you.

After my confirmation, ChatGPT generated an image that aligned closely with my design intent. The result featured retro-futuristic neon glow frames integrated into the walls while maintaining the original geometry of the space, and the picture frames were intentionally left empty to be filled later with digital artworks. The exoskeleton pattern on the back wall remained visible, acting as both a spatial backdrop and a compositional anchor. Importantly, the image did not include any holographic sculptures which helped keep the focus on how architectural space and human-scale materiality could still evoke a futuristic sensibility. In this case, the "futurism" was more grounded.

What emerged was a space that I found myself connecting with more deeply. It raised interesting questions about visualized environments produced through AI tools, spaces that do not yet exist. The gallery, as rendered, creates a suspenseful and speculative environment. It demonstrates how atmosphere and emotion can be simulated—and how designers may emotionally respond to something that is entirely constructed through digital tools.

Following the AI-generated render, the final step was to integrate artwork into the space using Photoshop. The empty neon frames became opportunities to explore how art can interact with and activate a space.

To do this, I inserted selected works by BEEPLE, a digital artist whose daily 3D graphics often depict dystopian and surreal commentaries on contemporary life and technology. His pieces, which combine human biology, machinery, and speculative futures, were especially fitting within the retro-futuristic setting. This layering of digital artwork within an AI-rendered interior began to blur the boundaries between space, narrative, and media.

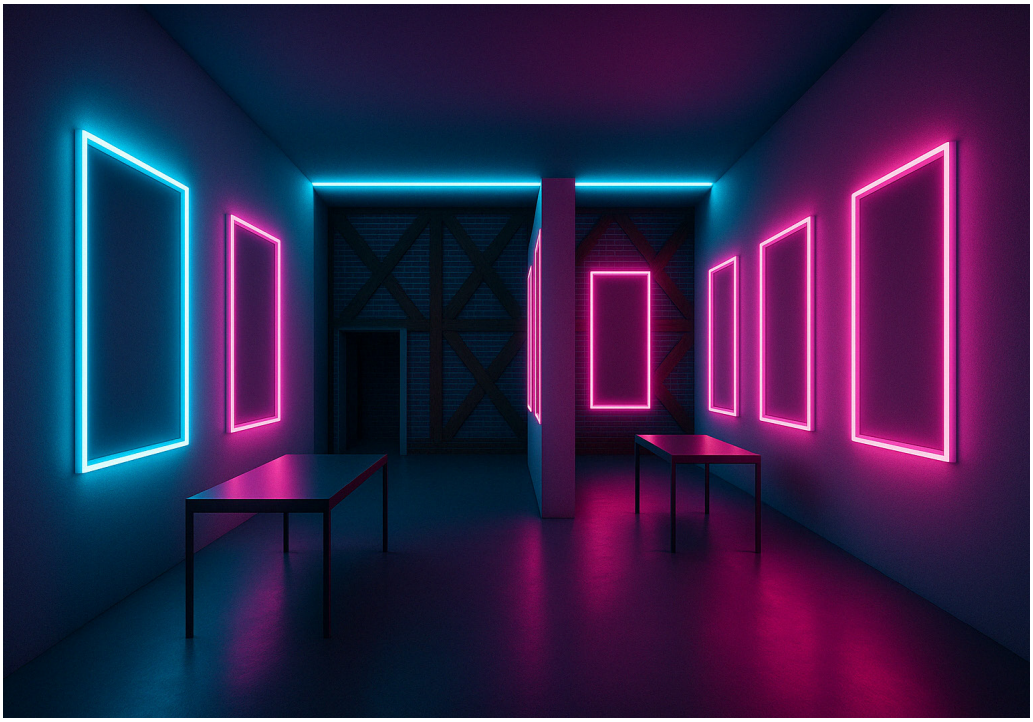


Image 14:
ChatGPT interior render variation 9



Image 15:
Final interior render of the art gallery



Image 16: Left
Beeple: Lego Spiderman 2020

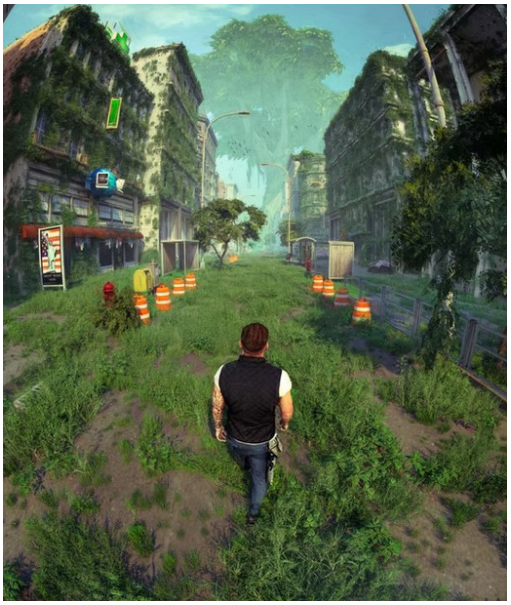


Image 17: Right
Beeple: Natural Reboot



Image 18: Left
Beeple: New Pipe

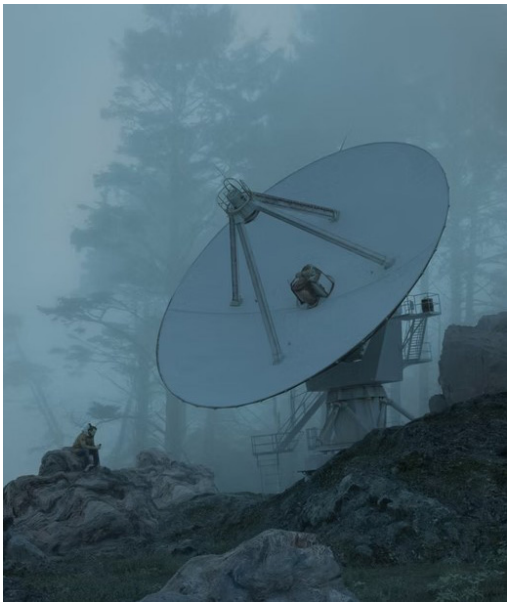


Image 19: Right
Beeple: No Signal



Image 20: Left
Beeple: Breathe



Image 21: Right
Beeple: Virus-Free Utopia

06

Redifining Intelligence

The future of architecture is inseparable from the rapid advancement of technology, especially artificial intelligence. While we cannot predict exactly what lies ahead, what is certain is the continued evolution of tools like NVIDIA Omniverse—a multi-GPU collaboration platform that enables real-time simulation, modeling, and asset sharing across industries. For architecture, platforms like this offer the ability to visualize and test spatial ideas at an unprecedented scale and speed, shifting how we design, communicate, and collaborate.

Throughout this thesis, AI emerged not as a replacement for human creativity but as a design assistant. Extending our ability to imagine, simulate, and iterate. AI tools introduce new ways of seeing and producing. Designers have a responsibility to question what these systems are trained on, how they generate content, and whose values are embedded within them. The outputs may be fast and visually compelling, but without thoughtful authorship, they risk becoming a background.

A key takeaway from this process was not only learning how to use AI, but learning through it. Each tool functioned as a partnership, offering interpretations I hadn't anticipated. The process is a conversation: between myself, the AI, and architecture. Through AI, I was able to test spatial atmospheres quickly, explore material moods, and embed speculative narratives into the design.

Ultimately, this thesis argues not for AI as a solution, but as a means of expanding the design process. The future of AI in architecture will depend on developing systems that understand context, structure, and ethics—qualities that remain deeply human. With thoughtful use, it can enhance rather than diminish the values of architecture: care, intention, and responsiveness.



Image 1: Left
Form generation through ChatGPT Process 1



Image 2: Right
Form generation through ChatGPT Process 2



Image 3: Left
Form generation through ChatGPT Process 3



Image 4: Right
Form generation through ChatGPT Process 4