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Eulogy to Architecture: The Three-Dimensional Collage City of Nostalgia

A thesis submitted in partial fulfillment of the requirements of the
Honors Program of the Department of Architecture in
the School of Architecture, University of Arkansas

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“Fairy Tales” Competition Entry

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Introduction

In our time of existence on the Earth, human beings have designed and realized beautiful things. As we face the challenges that confront us today, we begin to understand the fragility of humankind's creations. Many of the world's cities and buildings lie in ruins, gazed at by tourists, studied by scholars, while more lie buried in the ground for hundreds of years, some never to be rediscovered.

Everything around us is an accumulation of knowledge and ideas built upon for centuries, now facing questionable circumstances. Of course, the more recent Aleppo and other Middle Eastern cities have fallen subject to bombings over the past years, now lost forever. Climate change threatens coastal cities around the world; natural disasters unexpectedly take from our grasp things that we have had for centuries.

Nothing is certain. Nothing lasts forever. Every built structure, no matter the value, eventually falls.

What if the earth is one day no longer ours? Its livelihood depends on us, and our sustained wars and climatic abuse continue to decay the soil we walk on and the air we breathe. Will humans be forced from the planet that we have forever called home? This project imagines a new world built on the framework of nostalgia. It is a eulogy to architecture, a compilation of fragments of our world to recreate a place once lost. The city is designed as a three-dimensionalization of Rowe's Collage City so as to create an assemblage of parts that form a whole. Various scales of fragments of earth, ranging from single buildings to neighborhood fabrics, are arranged in a volumetric space. This space is located away from the gravitational pull of the Earth, making it possible to collage fragments vertically as well as horizontally.

The city embraces both the beauty and imperfections of the collected places. To call it a utopia is forward, considering that the majority of each of the employed places were not originally

designed as utopian; thus one cannot project utopianism upon them simply because they have a different context. One might question how an organic system of organization could ever be considered utopian, considering the lack of planning. However, if utopianism is based on the perfection of the human itself rather than the environment, this city aims to imbue a sense of nostalgia in each human mind, with the idea that these places are inherently important to us as a species and to our connection to Earth itself.

This project is a visual essay about the importance of what humans have created for themselves on the Earth. It is a conceptual idea that aims to transcend fears of loss by giving hope for a new world collaged from existing fragments of built fabric.

The project is an entry submission into the “Fairy Tales” competition hosted by Blank Space Project. This paper aims to outline the process and explain the changes and stages that have occurred during the process; it also discusses the research done throughout the semester, even if not applicable to the final product. One important aspect of the project to note is that it can operate on multiple levels. Although the first two phases were not fully realized, they were crucial steps of the process and are still valid ways of looking at the city and at this project.

The project consisted of three main phases, successively becoming more abstract throughout the semester. Initially, the project was a highly speculative, ideological plea for cities to become sustainable and self-sufficient in order to combat major global issues such as urban sprawl and resource waste. Research for this phase was very technical, with direct implications to the world today.

The second phase of the project began soon after the decision was made to enter the project into the Fairy Tales Competition. Many of the technical problems were set aside in order to provide a more fantastical and compelling narrative that could be portrayed through images. The city was designed through the lens of both the Japanese Metabolist movement and the idea of Collage City put forward by Collin Rowe. Technology was still a strong factor in the conception of the

design; virtual reality and computerization of biological components of the city played large roles in the formulation of experiential aspects of the city.

The last phase of the project is a synthesis and extraction of data produced throughout the semester. It embraces ideas of collage and dystopian post-apocalypse but loses more technical aspects such as the Metabolist influence.

Phase 1

Initial Process

The project began with an engagement in a much more technical thinking process. The idea was to create a universal, modular city that could be retrofitted to any environment. This city could exist in complete isolation or be part of a larger group of cities. The exterior environmental conditions are negated because the city is completely enclosed in whatever the environment requires. If it is in space, it is in a spaceship; if it is on Mars, it is in a geodesic dome; etc.

Many humans will soon be living in some type of closed quarters isolated from any other civilization. The longest that anyone has spent in space is 438 consecutive days¹, and this will no doubt continue to increase. Space habitation is a topic that continues to gain momentum and feasibility. Research stations currently exist in isolated parts of the earth, and some people spend months, even years, working and living there without direct interaction to the global context. In these environments, the inhabitants interact directly only with those that are inside the same environment, in complete isolation from any exterior environment. Is it possible that the architecture of these programs plays a major role in human interaction and therefore, the outcome of these situations? These trends will continue, and most likely populations will increase, in the coming years; thus, the architecture of these places should be studied in order to have the best possible

outcome on its inhabitants.

Thinking of a city in these abstract terms allows the design to be more liberated. There are no environmental, social, political or cultural factors. The city responds to itself and itself alone. Cities were studied in a very abstract and generalized way. For example, urban planning mostly exists in plan. When we study cities, we study them in plan—zoning, streets, block layouts, etc. Properties are owned based on their location in plan. There are small exceptions, such as

underground subway systems and roads, elevated train systems, building height restrictions, etc., but these elements do not change the fabric of the city as a whole. Perhaps our cities' sectional qualities are not used to their full potential. However, these abstract cities can be studied "in the round." Sectional design can be just as important as designing in plan. Cities can be thought of as three-dimensional objects that take full advantage of every direction. Perhaps sectional urban planning could be a keystone in making more sustainable and efficient cities by reducing sprawl and building vertically.

Contained/Confined Population

In some parts of the world, cities are changing so rapidly that infrastructure can't keep up. Cities in China can grow at a rate of almost 20,000 people per week.² Populations shift every day; in 2008, half the world's population lived in urban areas, and by 2050 70% of the population will live in urban areas.³ While population and social structure of cities can change very quickly, the infrastructure and physicalities of a city change much more slowly. This city is based on the idea that these two variables are reversed. The population is maintained at a certain number. Efficiency would increase because the city would eventually know the exact necessary production and waste amounts. The city would be free to change itself physically, constantly, adapting to the new needs of the current residents. Infrastructure would be recycled and recreated for whatever the current need. The city would constantly improve and adapt, because it would not be constantly responding to outside forces. The city would respond to itself and itself alone.

What is this population? Since the 60s, researchers have tried to formulate a specific number of an "optimal population." This is defined as "that where the marginal social benefit from increased production scale is just equal to the marginal social cost of the additional increase in city size required."⁴ If the city is completely self-sufficient, the population must be large enough to

have enough workers to support life in the city. If the population is too large, however, certain factors increase, such as crime, sickness, etc. This was essentially a “dead end” research trail during the semester. The idea of an optimal population differs too much depending on inherent qualities of each city. For example, some cities have one large industry that most of their population relies on for jobs and revenue. The optimal population of this city differs greatly from a city that has many industries on which it relies. There are many other factors that affect this optimal population: geography, natural resources, general culture, economies of agglomeration, etc.⁴

However, researchers in the 70's and 80's surmised some basic, albeit scattered, statistics that can be applied to most cities. For example,

Cities over 2 million people are 8% more productive than cities under 2 million.⁵

Many industries are more productive in larger cities.⁶

Cities with 250,000-500,000 people have better relationships between earnings and quality of life.⁷

Much of this research slowed in the years after this until Geoffrey West entered the field of urban theory. West, coming from a physicalism background, believed that there are laws that govern everything in the universe, and believed that this applied to cities as well. He calls his field urban science, as opposed to urban theory, and after years of research, developed basic laws that apply to almost all cities in the world. According to West, when a city doubles in size,

Resources required increases 85%.

Economic activity increases 15%.

Crime increases 15%.

Traffic increases 15%.

AIDS increases 15%.

It doesn't matter how big the city is; these laws tend to remain the same. "What the data clearly shows, and what [Jane Jacobs] was clever enough to anticipate, is that when people come together, they become much more productive." The most fascinating part of West's research is that, according to the data, cities break away from the equations of biology. All biological equations are sublinear; as the type of species increases in size, it gets slower. In cities, the opposite happens. As cities grow, everything begins to accelerate. "There is no equivalent for this in nature. It would be like finding an elephant that's proportionally faster than a mouse."⁸

Again, although fascinating, these are simply basic rules for a city of any size. From the research that I found, there has not been a definite number of the optimal city size. In the end, I decided that the city should have a population of 500,000. Cities that consistently rank in the top of livability indexes for urban areas tend to be under a million people, including Helsinki, Copenhagen, Stockholm, and Zurich.⁹ This was also more manageable and was close to many of the researchers' ranges of "optimal populations," which tended to be between 200,000 – 1,000,000.¹⁰ Cities in the world that have a population of around 500,000: Liverpool, Nuremberg, Antwerp, The Hague, Hanover, Manchester, Lisbon, Dublin, Fresno, and Albuquerque.¹¹

MVRDV designed an experimental city, KM3, that was completely self-sustaining and could exist in isolation from other cities. The major difference between it and this project was that it is specifically located on the earth, rather than anywhere in the universe. MVRDV'S research was completely based on data rather than aesthetics, social structure, politics, etc. Based on the Dutch standards, the city exists in a cube and contains all resources available to sustain life. According to their research, there are eight main categories of program that must be accounted for: Agriculture (13.7%), Forest (44.81%), Waste (.32%), Water (4.39%), Energy (29.45%), Industry (.15%), Leisure (5.42%), and Housing/Office (1.03%).¹² Since my project is not necessarily located on earth, the

percentages would be a bit different. Energy would be accounted for in some other way outside of the city, depending on the environment. This changes the distribution of space to: Agriculture (19.4%), Forest (63.5%), Waste (.45%), Water (6.22%), Industry (.21%), Leisure (7.68%), and Housing/Office (1.46%). These categories would be split into two sub-categories: “poche” and “open.” The poche programs, Agriculture, Forest, Waste, Water, and Industry, can (but do not have to be) be stored in closed, smaller portions of the city. Leisure and Housing/Office, on the other hand, have more light and space requirements that call for larger, open spaces.

Feasibility of Space Habitation

Humans are set to land on Mars in 2027.¹³ Costs for space travel continue to be less and less expensive, thus making it increasingly easier to travel to space. Energy in free space (in the solar system) is relatively abundant, given that there is no night, clouds or atmosphere to block sunlight used for solar energy. Energy can then be transmitted through wires or wirelessly if the habitation lies on a planet or other mass (In fact, if large solar powered satellites were currently used and power was wirelessly transmitted to Earth, there would be zero emissions, relatively little ground space required, and the price would be lower than fossil fuels or nuclear plants).^{14, 15}

There are several speculative ideas for space transportation systems other than what we have used so far. Space elevators, sky hooks, cyclers and solar sails are all methods of space travel that are theoretically possible but have not been realized due to lack of resources or current level of technology.¹⁶ Space elevators were explored more thoroughly for this project. In this theory, a base station would be located in Earth’s geostationary orbit altitude. A cable would stretch from the station to Earth, and another would stretch the exact same length back into space the opposite direction. Anchored to the equator, the cable would transport materials from earth to the station. The entire system would rotate along with Earth. As of yet, we do not have a material strong

enough to make up the cable, although significant strides have been made in the last couple of years with carbon nanotubes and diamond nanothreads.^{17, 18}

Phase 2

Competition

A few weeks into the semester I decided to enter the project into the “Fairy Tales 2017” Competition sponsored by Blank Space Project. This competition calls for projects that combine architecture with some type of narrative. This allowed the project to be even more abstract and experimental. Many of the technical research done earlier in the semester is not directly apparent in the final submission, including data from KM3.

A fairy tale is a story understandable by all; it transcends cultural and demographical boundaries. “If narrative tells a story in time, architecture builds a story in space.” [Blank Space Competition prompt]. This project aims to do both. The competition calls for a narrative, between 800 – 1400 words, and five images, 11”x17” each.¹⁹

Utopia

I also studied an overview of the history of utopianism to understand the implications of creating a world different, and subjectively better or worse, than our own. The idea of utopia has existed for hundreds, probably thousands, of years. It was first fully discussed in Plato’s *Republic*. Many critics claim that his vision creates an unrealistic image of human beings, thus rendering the ideal city as a whole inconceivable. This coins the term “ou-topia,” meaning “no place,” because the ideal city cannot exist. On the contrary, the objection states that if the city cannot exist, it

should not exist. If this is true, then it is not an ideal city after all, coining the term “eu-topia,” meaning “good place.”²⁰

At the center of Plato’s utopia is an economic model. He asserts that each person should perform the task of which he is best suited. These tasks are split into three categories: producers, auxiliaries, and guardians. When all three of these aspects are in balance, society is just.²¹ These ideas are carried over to the narrative, in that the society would function by assigning people jobs based on their interests and skills. Freedom must be limited in order to create a fully-functioning economy (this is where ideas of dystopia arise).

Utopias ask questions. They arise from a discontentment about the way society exists at the time, and provide a critique and solution for how it could be better. For this project, the idea of utopia is used as a platform to think critically about the state that our cities are in today and how they can be better. By projecting into the future, we can begin to identify aspects of society that we want to either avoid or work towards.

Data Government

As the project became more invested in the narrative, the design became more and more abstract. The past few years have been a revolutionary increase in technology and accumulation of knowledge. In the next few decades, there will no doubt be fundamental breakthroughs in science and engineering, directly affecting the way we live and the way we navigate and design cities.

The history of human existence has been a transformation from qualitative value to quantitative value. Everything around us has fallen subject to research and knowledge. Everything that once held mythological and spiritual value now has a set of statistical values associated with it. The most obvious example is the sun. Almost universally, the sun was initially a cultural deity. Ra, Horus, Sol, Surya, Helios, the list of names of the sun as god goes on and on. The sun was the

source of one of the world's first monotheistic religions, Atenism.²² The sun was a mythological being, beholding mystery and immense power. It was the source of life, it had power over all of humanity. It was given human-like qualities, such as gender and the ability to have emotions and give birth. Today we recognize the sun as the source of our life on earth, because we understand its nature and patterns. Of course, the only sun-worshippers that remain are small groups of people in remote places on earth. The sun to us now is a ball of fire and gas in the sky. It lies 150 million kilometers from earth and its light takes eight minutes to reach us. It is 4.6 billion years old, and there are billions of other balls of gas in the sky just like it. It is just another number in the universe.²³

The quantitative today is not reserved for observable elements only. Every day, technology allows more and more qualitative aspects of life to be converted to a number. Most obviously is the golden ratio. A mathematical proportion that some claim is the most aesthetically pleasing, it is found in both human-built works and natural elements. The study of why we find things beautiful is important for the way we design, and the more answers we find the more our observable perceptions become calculated equations.

The spiritual is becoming obsolete, the mythological lies dormant in history books and dead traditions. This project is an exaggeration of this concept. The more we know, the more we suppress our animal-like qualities and become statistical values ourselves. The amount of knowledge that we have will soon be immensely cumulative and more powerful than we can imagine. If Moore's Law is true, or continues to be true, we will have technological beings much smarter than the human brain, very soon.²⁴

The narrative at this point held data as the ultimate knower of all things. Data would become government, religion, the answer to all questions. Rather than humans running political processes, the computer would recognize and understand the most efficient way to govern cities without allowing emotional interruptions or self-motivated decisions. Since data would control day-

to-day life with efficiency and improving accuracy, there would be no need for religion or spiritual aspects of life.

The structure of the city is a combination of the Metabolist movement and a three-dimensional collage city. Metabolism began in Japan in the 1960s, stemming from post-World War II reconstruction. The movement combines two ideas: architectural megastructures and organic growth.²⁵ These megastructures were later defined by Reyner Banham as long-term structural framework in which short-term modular units would exist. By having this permanent structural framework, the modular units could change or be replaced relatively easily.²⁶ These ideas were incorporated into the design of this project. A three-dimensional grid was the primary structural element of the city. Each point in the grid was located $\frac{1}{4}$ mile from the next, with five units in each direction, totaling 125 cubic units. Within the grid "tubes" was a high-speed transportation system, linking the entire city together. Transportation stops were located at each point within the grid. No other transportation system would exist. In this way, movement throughout the city is rigorously regulated and stops are located within reasonable walking distance from one another. The stops would also serve as high-activity nodes, creating centers for the micro communities.

Within this grid lies the three-dimensional collage city fabric that acts as an organism. The idea of the city as organism began with projects such as Ebenezer Howard's Garden City. Although not completely self-sufficient, it was designed to be supported primarily by its own systems, and the remaining needs would be met by neighboring communities. The Garden City had different systems that made up a complete body. The heart of the city was the center, containing public functions and civic buildings. Radiating outward from these were the main streets containing commercial and industrial fabric, and the residential areas were pocketed between these busier streets. The idea was a compact system of areas of high economies of agglomeration; programs support each other and work together to produce a high-functioning society.²⁷

The city evolves three-dimensionally and organically around this grid. Program is dispersed throughout the entire city completely based on efficiency. Microcommunities form where needed, and the whole city works together to become completely self-sufficient, a city that responds to itself and itself alone. For example, industry would be located throughout the city. Workers would agglomerate their living spaces around the industry that they work at, along with the necessary amenities: schools, commercial spaces, etc. Goods and services travel the least amount possible, as well as commuters. The city is essentially a flexible organism that rearranges its elements when needed.

City Governed by Virtual Reality

How can virtual reality begin to shape architecture and, furthermore, cities? Virtual reality is not only a visual reality; it is an increasingly auditory and tactile experience as well. The more “real” that virtual reality becomes, the more it can replace true reality. What will cities be like if virtual reality is a normal aspect of life? Do we need sunlight and ventilation? If virtual reality can mimic any space, does it matter what the true space looks and feels like?

If we assume that virtual reality can mimic sunlight and the outdoors (Rayleigh Scattering, developed into a product by CoeLux^{28, 29}), perhaps cities could be significantly more dense. Any interior space could be seen as exterior. Building facades could be completely virtually fabricated. Visual qualities could be changed very quickly; thus, the city itself could change very rapidly.

Phase 3

Final Product

As the project progressed, the design of the city became more and more fantastical and abstract. The final product is defined as a physical representation of the Internet. Today, technology allows us to explore places around the world without ever setting foot there. The Internet provides a resource that makes the world available to us through the tips of our fingers. In a sense, we carry the world with us in our pockets.

The final city is a three-dimensional collage of locations from around the globe. It is an incarnation of cyberspace, a dimension of our minds and of technology manifested into being. The city fits inside a cube, each side 1¼ miles long. Chaotic and disordered, it embodies a world of different city fabrics and landforms from around the world, merged together into a single space. Any direction—up, down, side to side—is a continuation of this city into space. Within these iconic places, the programs and functions are different than what they are today. The city contains everything inside of it that it needs to survive: food production, industry, housing, etc. Inside cathedrals one may find hydroponic farms. Inside Crown Hall one may find a computer science plant. On the exterior, it is a familiar city. On the inside, it is a working organism.

The gap between reality and the digital realm is narrowing quickly in the world we live in today; virtual reality is becoming more and more apparent and relevant. This city explores the thinning line between what is real and what is not, what is reality and what is fairy tale. Cyberspace is made up of parts in which physical and mechanical laws perform differently or not at all, compared to real space. These ideas are carried over to the city: spaces float and merge together, transcending natural laws and boundaries. The city becomes a complex collage of systems and landscapes.

The project is both a utopia and a dystopia. It is a culmination of all the best places of our world, merging together to create a homogeneous fabric. It peers into a world where physics does not govern the architectural design, but rather the mind and imagination create it. However, the story can also be seen as heavily post-apocalyptic and a revelation of the impetus of technology. It is up to us to determine where the line is drawn between reality and fantasy.

Although not all of the research throughout the semester was directly implemented into the final product, each phase of the process had a significant impact on how I thought about the city and what it could become. The final product would not have come about without the dead ends and initial highly technical research.

Bibliography

1. Schwirtz, Michael (2009-03-30). "Staying Put on Earth, Taking a Step to Mars". *The New York Times*. Retrieved 2016-08-29.
2. "Guangzhou Population 2016." *World Population Review*. N.p., 26 Oct. 2016. Web. 23 Sep. 2016.
3. World Population Prospects: The 2007 Revision, vol. I, Comprehensive Tables (United Nations publication, Sales No. E.07.XIII.2).
4. Getz, Malcolm. "Optimum City Size: Fact or Fancy?" *Law and Contemporary Problems* 43.2 (1979): 197. Web.
5. Segal, *Are There Returns to Scale in City Size?*, 58 Rev. Econ. & Statistics 399 (1978).
6. Sveikauskas, Leo. "The Productivity of Cities." *The Quarterly Journal of Economics* 89.3 (1975): 393. Web.
7. Getz & Huang, *Consumer Revealed Preference for Environmental Goods*, 60 Rev. Econ. & Statistics (1978)
8. Lehrer, Jonah. "A Physicist Solves the City." *The New York Times*. The New York Times, 18 Dec. 2010. Web. 02 Sept. 2016. http://www.nytimes.com/2010/12/19/magazine/19Urban_West-t.html?_r=0.
9. Podolyak, Padel. "The Pragmatist: Optimal City Population Size." *The Pragmatist: Optimal City*

Population Size. Blogspot, 30 Nov. 2014. Web. 25 Aug. 2016.

<http://pavelpodolyak.blogspot.com/2014/11/optimum-city-population-size.html>

10. Dasgupta, P.S. "On the Concept of Optimum Population." *The Review of Economic Studies* 36.3 (1969): 295-318. Web.
11. "Population Estimates." *United States Census Bureau*. US Department of Commerce, 15 July 2015. Web. 20 Sep. 2016.
12. Maas, Winy. MVRDV. *KM3: Three-Dimensionality Can be Seen as Architecture's Fundamental Existence, the Profession's Acclaimed Domain. In times of Globalization and Scale Enlargement, an Update of This Definition Seems Needed: Meters Turn into Kilometers, M3 Becomes: Excursions on Capacities*. Barcelona: Actar Editorial, 2005. Print.
13. "Mars One." *Mars One*. Mars One, 2010. Web. 19 Sept. 2016.
14. Anthony, Sebastian (2014-06-16). "[Space giants join forces to battle SpaceX: This is how cheap space travel begins](#)". *NASASpaceflight.com*. Retrieved 2014-10-10.
15. Morgan, Richard (2006-08-01). "[Life After Earth: Imagining Survival Beyond This Terra Firma](#)". *New York Times*. Retrieved 2010-05-23.
16. "[The Meaning of Space Settlement](#)". *Space Settlement Institute*. Retrieved 5 September 2014.
17. Edwards, Bradley Carl. [The NIAC Space Elevator Program](#). NASA Institute for Advanced Concepts
18. "[The Audacious Space Elevator](#)". *NASA Science News*. Retrieved September 27, 2008.
19. Hoffman, Matthew, and Francesca Giuliani. "BLANK SPACE | An Office for Thought Provocation." *BLANK SPACE*. Blank Space Project, 2016. Web. 20 Nov. 2016.
20. Sargent, Lyman Tower. *Utopianism: A Very Short Introduction*. Oxford: Oxford UP, 2010. Print.
21. Plato. Books I-X. *Plato Republic*. Indianapolis: Hackett, 2004. Print.
22. Teeter, Emily (2011). *Religion and Ritual in Ancient Egypt*. New York: Cambridge University Press.
23. Williams, D. R. (1 July 2013). "[Sun Fact Sheet](#)". [NASA Goddard Space Flight Center](#). Retrieved 12 August 2013.
24. Kurzweil, Ray. N.p.: Viking Adult, 1999. Print.
25. Boyd, Robin (1968). *New Directions in Japanese Architecture*. London, United Kingdom: Studio Vista.
26. Lin, Zhongjie (2010). *Kenzo Tange and the Metabolist Movement*. Routledge.
27. Levy, John M. *Contemporary Urban Planning*. Upper Saddle River, NJ: Prentice Hall, 2003. Print.
28. A. T. Young, "Rayleigh scattering," *Appl. Opt.* 20, 522–535, 1981.

29. "Home CoeLux." *Home CoeLux*. N.p., n.d. Web. 2 Nov. 2016.