ARCHITECTS IN THE SECOND MACHINE REVOLUTION

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The TFM seeks through the case study of the Cutzamala system and Mexico City, a paper that was developed in class during the master's degree, to demonstrate the importance of the holistic vision during and before the design process in architecture.

Using the comparative-historical method as one of the analysis methods, we will examine the different systems that exist for water extraction, both in the ancient and current cities, to denote how sometimes the technological advances do not imply progress in the logic or common sense of society. Besides, we will go into detail about how water and the city relate all the way back to its initial foundation by the Aztecs. This deep dive into Mexico City will be used to accentuate the difference between the old Tenochtitlan that was designed with a holistic view and the new city that lacks these design concepts, among others. The focus will be on the water, which has been the constant defining feature of Mexico City from the beginning.

Through irony, we will show how the Cutzamala system is an example of an architectural project that, by not including a holistic vision, ended up creating new problems or a sterile solution.

The holistic vision that we propose will allow us to create an architecture that really dialogues with its context and understand how an architect plays a central role in the connection between art, design, and engineering. This holistic vision is relevant today more than ever because of new technologies like artificial intelligence (A.I) that allow us to study on a macro scale the interaction of different systems and the impacts generated by projects in a site or region in a way that was not possible before.

Lastly, we conclude the paper by analyzing the relationship that exists between a holistic vision when designing and ethical architecture.

Keywords: holistic view, Mexico City, water, systems, interconnectivity

Introduction

Architecture in recent decades made the decision not to respond to a context or a program, given that due to the rapid speed with which cities and uses change and the slow pace of architecture caused by its costs and the time it takes to build it. This has created a situation where designing only wrappers or containers is a viable architecture for today's rapid changes.

Architects are in a position where the need to create a hyper-flexible architecture for the future of the city has provoked that they can only have a profound impact in the building´s ¨skin¨ and its relationship with the context. In consequence, architecture has fallen into a new formalism. This formalism is accentuated by new CAD (computer-aided) design technologies, which has allowed the emergence of new design currents, such as parametric architecture.

The decision to discard the context and get the "liquid program" was not a wrong decision since the world evolves very fast, and architecture could not keep up with the pace of technological changes. However, today we find ourselves at the beginning of the Second Machine Revolution in which new technologies such as Big Data and Artificial Intelligence will allow architecture to study the context and analyze the territory in a previously impossible way.

These new technologies open the door to a new architecture that can give us a deep understanding of the area and the site of a project before the completion of the project, during its useful life, and when the time comes and the need to change arrives.

At the same time, sustainability due to the current situation on the planet has become a non-negotiable design factor for architecture, increasing the need to understand the site not only from an urban perspective but also from a geographical and systematic one (natural systems, urban systems, water cycle, and systems).

Big Data will allow us to study the society and the city in new ways and at the same time as the design process is

taking place. It will make available more details and information that will allow the architect to consider new aspects in the design process than were unthinkable before, for example, generational, cultural issues, sensitivity, climatology, project impact in different systems, psychological issues, among others.

All this new information will require the architect to take a "holistic architecture vision" where, by computer-aided design (also called CAD) and artificial intelligence, the study of the information and interpretation will be done by machines and the architects will choose and decide how to use these new tools.

It is essential to highlight that artificial intelligence advances are demonstrating that creativity is not magic or secret and that a computer will be able to replicate them in the near future. It is therefore essential to keep in mind that for an architect to remain relevant in the 21st century (especially in the construction of future cities) it is necessary to do a new design process from a position that artificial intelligence is not capable, which is the holistic vision in the design process flexibility and the ability to work towards a goal.

It should be emphasized that as these technologies evolve, they will be able to predict more accurately how projects and cities will develop. In the longer term, the future of cities and projects will be more critical to a large part of the population, thus increasing the importance of the technologies that will reduce the apparent or necessary liquidity of a project.

The idea of working on a skin or container is no longer viable from a merely formal perspective since this skin begins to behave way more similar to a real one thanks to advances in kinetic architecture and new biostatic materials. It can evolve into an architecture that reacts in real-time to the contextual situation not only in the skin but in its material, among others and spaces, reviving the value of the architect's hand in the project as an all.

Case study irony and water

Mexico City's location that is the valley of Mexico 2200 meters over sea level, is one of the two most strategic locations in the nation (the second one been Veracruz). It is so important that it has behaved as a capital for the territory for more than 5 different civilizations. This strategic value comes from the reality that Mexico is an extremely mountainous country with more than 70% of its area, so much that if you laid flat the complete surface area, it would be the size of Asia.

Mexico's valley is in the convergent place of 3 different mountain ranges, the Sierra Madre Oriental, Sierra Madre Occidental, and Sierra Nevada volcanic belt. These 3 mount ranges divide the country into 12 different regions, making it extremely hard to keep governmental control over its territory even now at days.

This apt location has created the need for over-centralization of power, economic, and cultural centers. This tendency has been used from the first empires like the Aztecs through its colonial period by the Spaniards and utility today's Mexico.

From its beginnings, Mexico's valley has been destined to become a city, and with today's population, one of the first megalopolis. The city is in a unique situation as a result of having been built on a lake that dried up due to multiple and fast construction works for urbanization, these massive changes to the valley created a new microclimate among other unintended effects that changed the region's original, whose effects we can perceive to this day, such as extreme heat in central areas and floods, among others. The fact that the city is built on a massive aquifer that cannot be used because it would accelerate its sinking process, and also amplify the earthquakes, places it in a very particular water situation.

After human hands had dried the lake, the city's only option not to die from dehydration was to create an extensive system for the movement of drinking water and a new artificial system of new lakes around her to be able to quench her massive thirst, known as the Cutzamala System (been another example of centralization).

Mexico, the surrealist city

In no way will I return to Mexico. I can't stand being in a more surreal country than my paintings.
Salvador Dalí

Figure 1 La gran Tenochtitlan' fresco mural by Diego Rivera, 1945, Palacio Nacional, México City.

The theme of surrealism in Mexico City is present from its foundation and its geographical characteristics. The unique complications of managing to inhabit and urbanize a lake followed by foreign attempts to bury it, pave it or disappear it, along with the total resistance of the site to be a city through floods, earthquakes and toxic air are the signs of a city that resists being friendly to humans. It seems that Mexico City only survives and persists by supernatural means and human´s irrational persistence.

We can see, as we mention earlier, Mexico City's surrealism nature differs from the holistic view in the control and decision making that surrealism lacks. This irrational nature is a consequence of a city design without the holistic view that tries to solve all the contradictions created by an automatic way of design (or surrealism design). Mexico City has been designed with the same processes throughout its entire history, and this situation is clearly seen in its latest water problem.

History

Tenochtitlan was the capital of the Aztecs civilization, founded in 1325. The state religion of the Aztec civilization built its city in the fulfillment of an ancient prophecy: the wandering tribes that came from the north would find the destined site for a great city whose location would be signaled by an eagle with a snake in its beak perched atop a cactus.

Figure 2 Lake of Texcoco before the Aztecs, images by Tomás Filsinger.

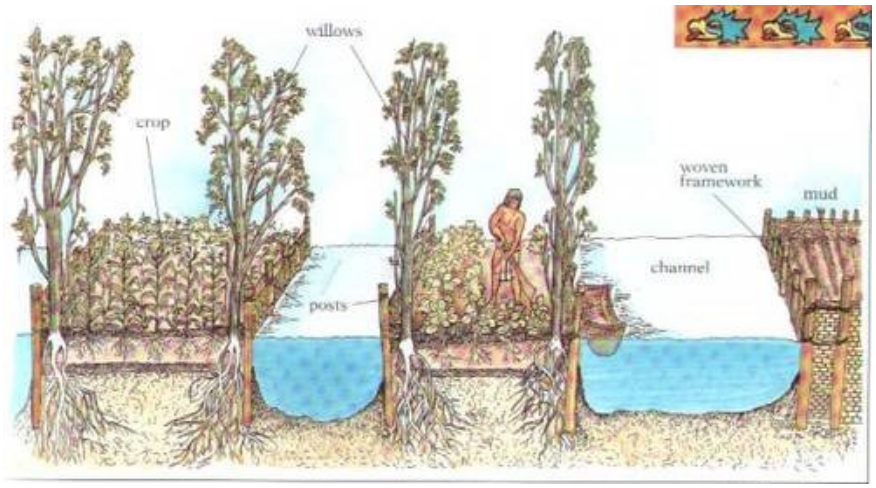

Figure 3 Traditional chinampa scheme, physical structure. According to Koohafkan (2012)

The Aztecs (called at that time the Mexica tribe) saw this vision on what a small swampy island in Lake Texcoco was then, a concept that is used until today in Mexico's coat of arms and on the Mexican flag. Not deterred by the unfavorable terrain and the hostile neighboring tribes, they set about building their city, using the *chinampa* system (misnamed as "floating gardens") for agriculture and to dry and expand the island.

A thriving culture developed, and the Aztec civilization came to dominate other tribes across Mexico lakes. The small natural island was perpetually enlarged as Tenochtitlan grew to become the largest and most powerful city in Mesoamerica (due to being a warrior culture, the expansion was more accessible because they occupied the power vacuum left by the Toltecs). Commercial routes were developed that brought goods from places as far as the Gulf of Mexico, the Pacific Ocean, and perhaps even the Inca Empire.

After a flood of Lake Texcoco destroyed part of the city, Tenochtitlan was rebuilt under the rule of Ahuitzotl in a new style that made it one of the grandest cities ever in Mesoamerica, being the first time that the symmetric greed was proposed.

Although some accessible sources put the number as high as 350,000, the most current estimates of the population are of over 200,000 people. One of the few comprehensive academic surveys of Mesoamerican city and town sizes came at a population of 212,500 living on 13.5 km2 (5.2 sq. mi). It is also believed that at one time, Moctezuma had rule over an empire of roughly five million people in central

and southern Mexico, because he had extended his rule to surrounding territories to gain tribute and prisoners to sacrifice to the gods. [1]

Creation of Tenochtitlan

From its beginnings as Tenochtitlan, the city´s building process has been a battle against its geography that has become more aggressive and chaotic over time due to the lack of a better design process from the colonial period onward.

The city was divided into four zones or camps; each group was divided into 20 districts, and each *calpulli*, or 'big house,' was crossed by streets or *tlaxilcalli*. Three main streets traversed the city, each leading to one of the three causeways to the mainland of Tepeyac, Iztapalapa, and Tlacopan. Bernal Díaz del Castillo reported that they were wide enough for ten horses. Surrounding the raised causeways were artificial gardens with canal waterways and gardens of plants, shrubs, and trees. The *calpullis* or city squares were divided by channels used for transportation, with wood bridges that were removed at night (fore safety and to allow the free movement of boats into the market in the early morning.) [2]

Figure 4 The earliest European images of the city were woodcuts published in Augsburg around 1522.

Figure 5 The Tlatelolco Marketplace as depicted at The Field Museum, Chicago

Each *calpulli* (from Classical Nahuatl calpōlli, Nahuatl pronunciation: [kaɬˈpoːlːi], meaning "large house") had its *tiyanquiztli* (marketplace). Still, there was also the central marketplace of Tlatelolco – Tenochtitlan's sister city (that later became one). Cortés estimated that Tlatelolco was twice the size of the city of Salamanca, with about 60,000 people trading daily. Bernardino de Sahagún offers a more conservative population estimate of 20,000 on ordinary days and 40,000 on feast days. There were also specialized markets in the other central Mexican cities.

Figure 6 A picture of Tenochtitlan and a model of the Templo Mayor at the National Museum of Anthropology of Mexico City

In the center of the city were the public buildings, temples, and palaces. Inside a walled square, 500 meters to aside, was the ceremonial center.

Figure 7 Architect Ignacio Marquina's famous 1951 reconstruction of Tenochtitlan city center

There were about 45 public buildings, including the Templo Mayor in the central plaza of the city, which was dedicated to the Aztec patron deity Huitzilopochtli and the Rain God Tlaloc; the temple of Quetzalcoatl; the *tlachtli* (ball game court) with the *tzompantli* or rack of skulls; the Sun Temple, which was dedicated to Tonatiuh; the Eagle's House, which was associated with warriors [3] class and the ancient power of rulers; the podiums for the gladiatorial sacrifice; and some minor temples. These central spaces were divided by "basements pyramidal," which are different heights in the public space to divide the identity from every space and to show how sacred each space was.

Outside was the palace of Moctezuma with 100 rooms, each with its own bath, for the aristocrats and ambassadors of allies and occupied people. Also, located nearby was the *cuicalli*, or house of the songs, and the *calmecac*.

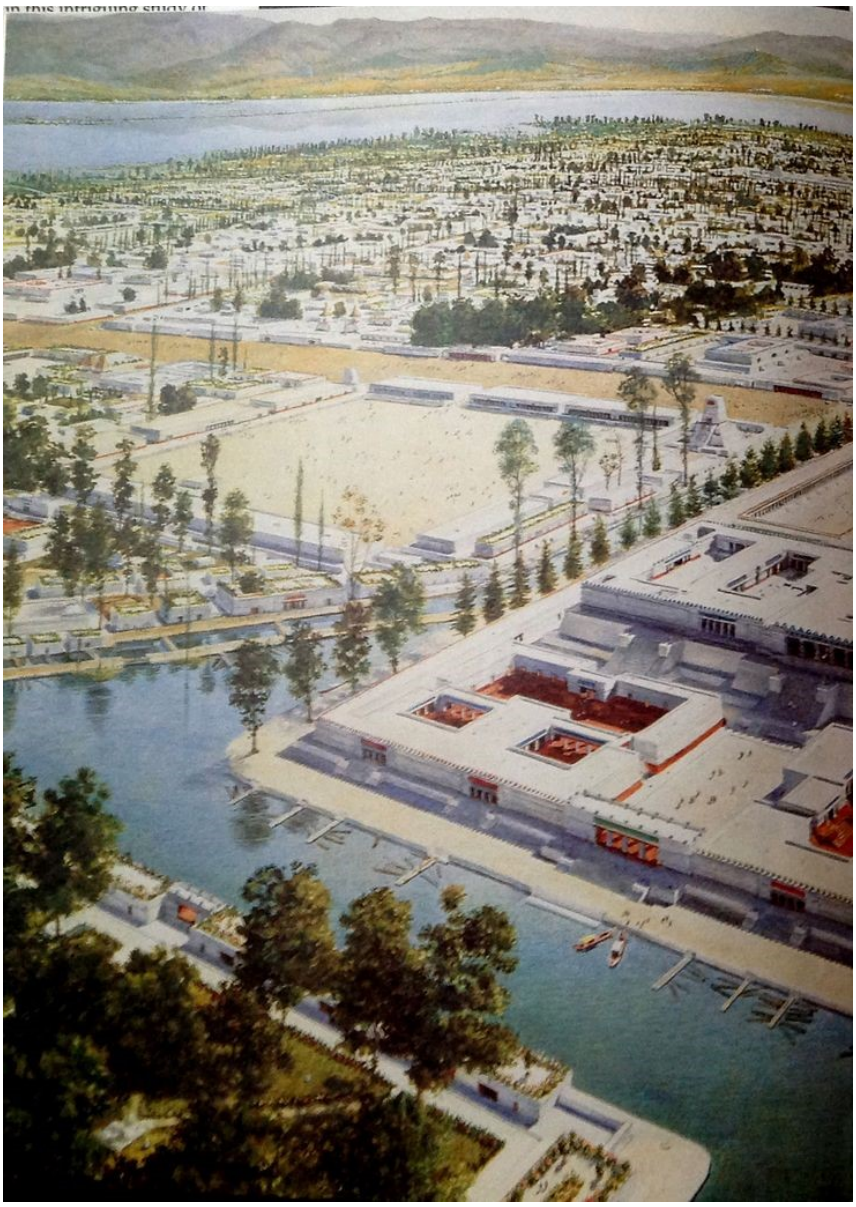

Figure 8 Moctezuma II's palace in the center of Tenochtitlan, painting by Scott Gentling

The city had precise proportions. All constructions had to be approved by the *calmimilocatl*, a functionary in charge of the city planning.

The palace of Moctezuma II also had two shelters or zoos, one for birds of prey and another for other birds, reptiles, and mammals. About 300 citizens were dedicated to the care of the creatures.

There was also a botanical garden and an aquarium. The aquarium had ten ponds of salt water and ten ponds of

fresh water, containing various fish and aquatic birds. Places like this also existed in Texcoco, Chapultepec, Huaxtepec (now called Oaxtepec), and Texcotzingo. [4]

Legend has it that the Mexicas left Aztlán (a place in northern Mexico) guided by their primary deity, Huitzilopochtli, in search of "the sign" (the eagle over the cactus) that would indicate the exact place where they should found their city, Mexico -Tenochtitlán.

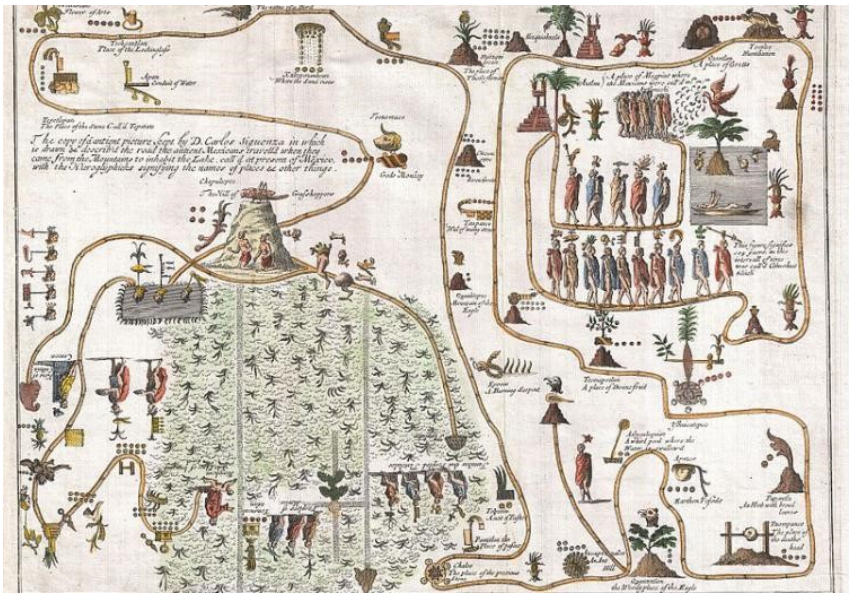

Figure 9 Shows the trip and foundation of the Aztecs civilization from the codex Mendoza by Frances F. Berdan and Patricia Rieff Anawalt

The almost impossible task of building over the lake and the immense complications and persistence from the Aztecs entails a contrast with the ease of having built on the edge of the lake, which remains as a testimony to the possible truth of this myth more than any other written or archaeological discovery.

Imperial capital

In the golden era of the Aztec empire, the capital city of Tenochtitlan was built in the strategic center of the valley of Mexico, which allowed the empire to control its territory and to access all of its resources from a single point.

Figure 10 1520 Tenochtitlan Images by Tomás Filsinger.

This over-centralization quality can be seen from the urban greed of the city all the way to the Aztecs road network that connected the city with all its territory. The Aztecs understood their territory so well even at a time were technologies like GPS or satellite images were not available. This understanding came from their culture, where the holistic view prevailed.

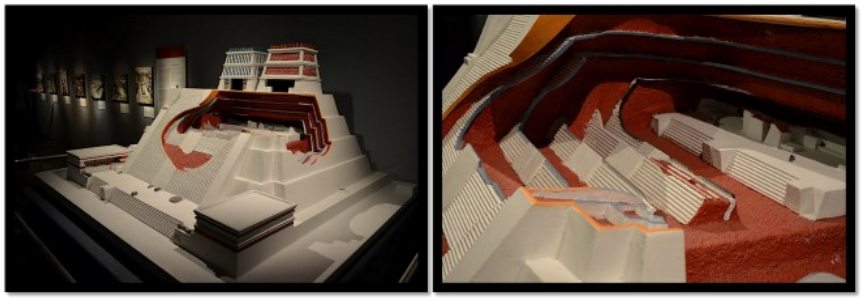

Figure 11 buiilding proces of Tenochtitlan main temple, we can see the older piramids in its intirior.

The Venice of America

And some of our soldiers even asked whether the things that we saw were not a dream? (...) I do not know how to describe it, seeing things as we did that had never been heard of or seen before, not even dreamed about.

—Bernal Díaz del Castillo, The Conquest of New Spain

Spanish conquistador Hernán Cortés arrived at Tenochtitlan on November 8th, 1519. Although there are no precise numbers, the city's population has been estimated at between 200,000–400,000 inhabitants, placing Tenochtitlan among the largest cities in the world at that time. Compared to the cities of Europe, only Paris, Venice and Constantinople might have rivaled it. It was five times the size of the London of Henry VIII. In a letter to the Spanish king, Cortés wrote that Tenochtitlan was as large as Seville or Córdoba. Cortes' men were in awe at the sight of the splendid city, and many wondered if they were dreaming.[5]

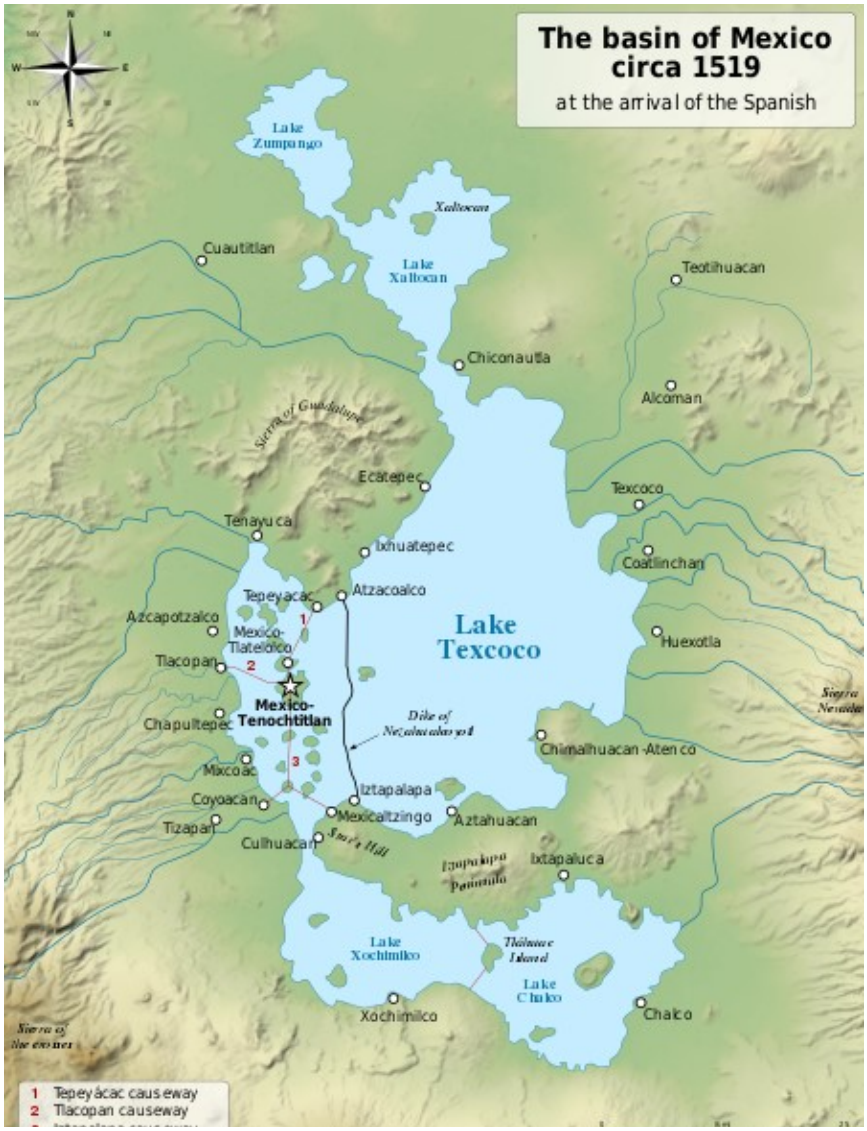

Figure 12 Lake of Texcoco with its salt water division and all the rivers that keep it alive

The image above (figure 12) is the first one where we can see that the valley of Mexico was capable of bringing water by natural means, which was exploited by the Aztecs by creating drainage systems and aquifers ducts to keep the water flow under control and clean.

Colonial capital

Through 300 years, Mexico City was the capital of Nueva España; during this time, the city began the destruction of the lake in a gradual process.

Figure 13 artistic depiction of Tenochtitlan

The death of the Venice of America

Figure 14 Tenochtitlan 1519 woodcuts published in Augsburg around 1519

Just after the Aztec empire was destroyed, Tenochtitlan started to change. Encouraged by the promises of wealth and sponsored by the Spanish crown, hundreds of new Spanish immigrants moved to what became la Nueva España.

Figure 15 Mexico City 1524

This movement caused a rapid change in the city's structure (like more significant streets for horses). It was accelerated by the Catholic Church insistence of destroying any cultural heritage from the Aztecs (looking to make evangelization faster and driven by the fear that the Aztec´s religious practices were satanic in origin).

Figure 16 Mexico City 1555

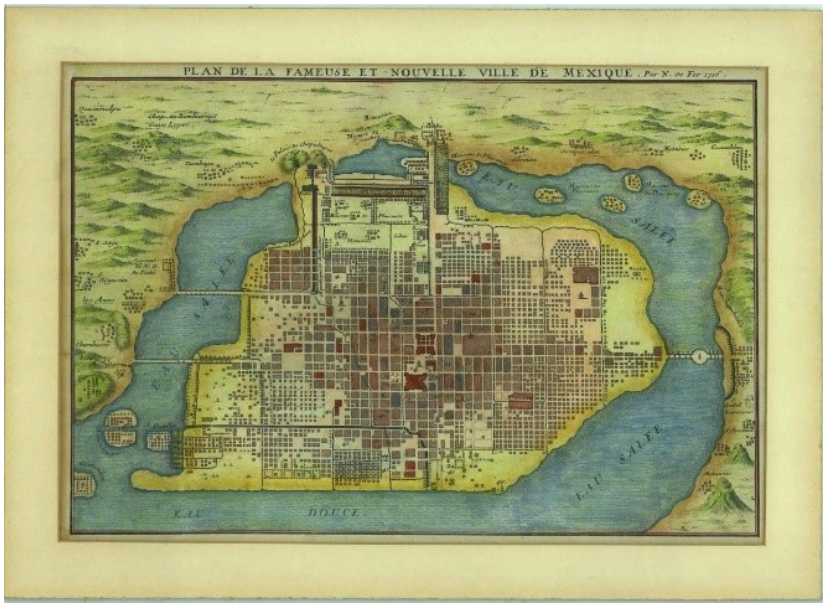

Figure 17 Mexico city 1715

Figure 17 Mexico city 1753 the lake in the city is gone

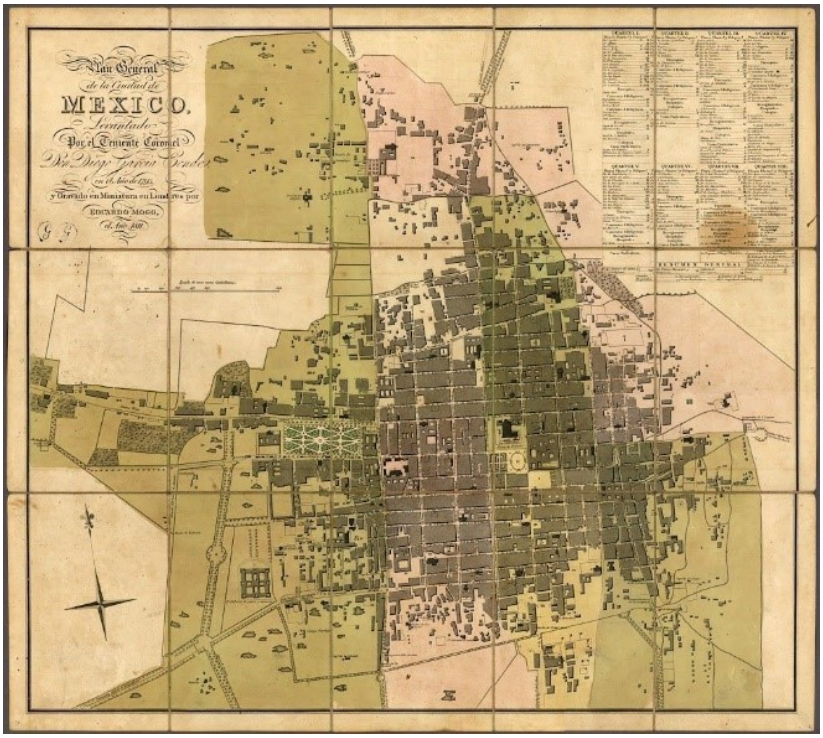

Figure 18 The lake surrounding the city starts to disappear ,1793.

Figure 19 Mexico City 1850 Images by Tomás Filsinger

Figure 20 Mexico City ,2000, image by Tomas Filsinger.

Figure 21 Mexico City today overlaid with the original lake.

In this last image, we can see the actual Mexico City overlaid with the original Tenochtitlan city. It is astonishing to see how the city follows the original road and the saltwater division that was present in Tenochtitlan, showing how outstanding the original city was built.

The rapid growth of Mexico City

Mexico City's rapid development began with the end of the Mexican revolution of 1910. This rapid development continued to accelerate until 2016, when the city, unable to sustain its population, began to search for new ways to

fulfill the demand by creating new transportation methods and changing the building height code limitation.

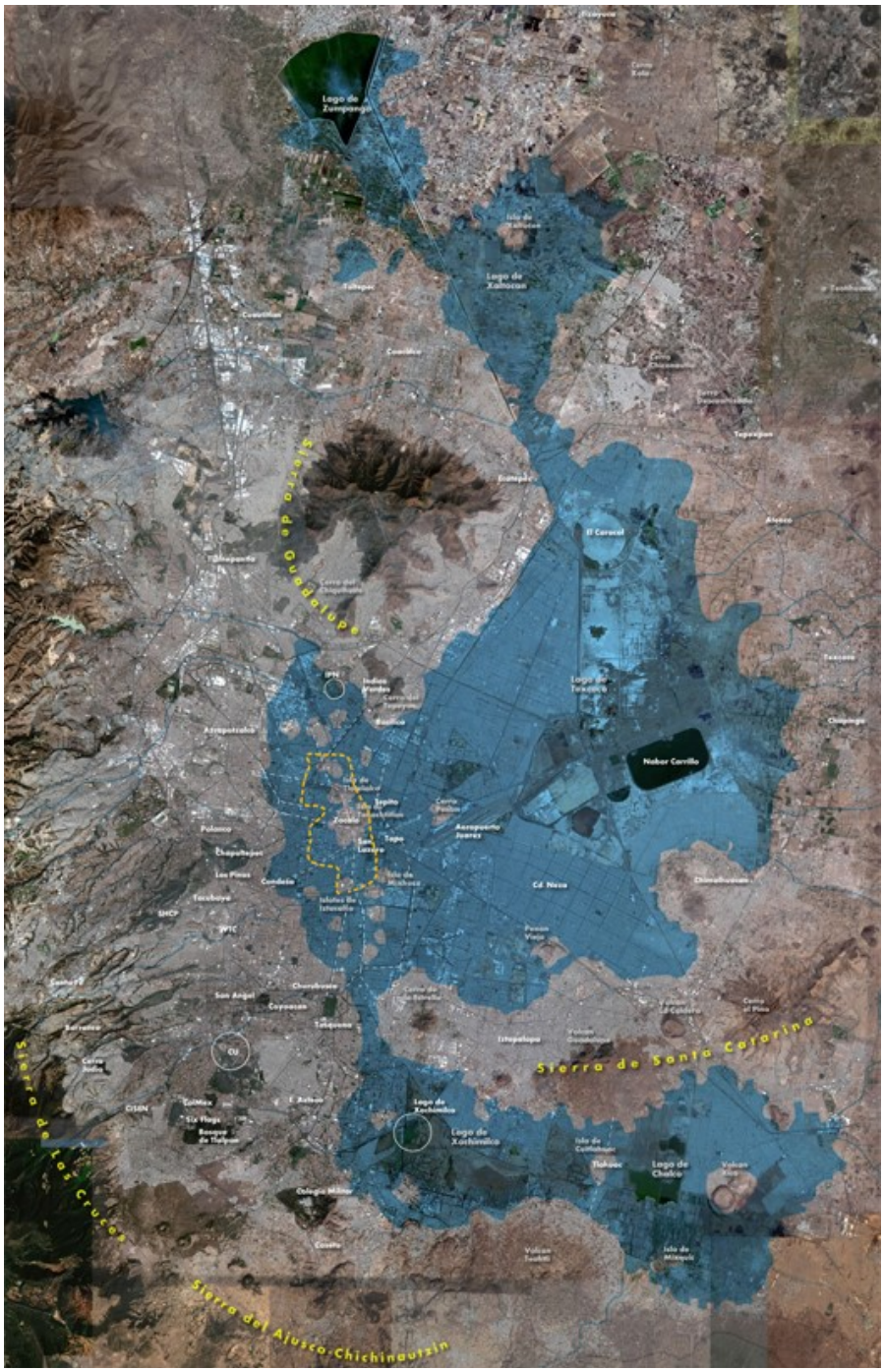

Figure 22 The area referred to, located in a reconstructed map Lake Texcoco, from 'Arqueología Mexicana' no. 86, Jul-Aug 2007

Strategic location

Mexico City will always be the testimony of man trying to inhabit a place that resists him. We can see this constant combat in its foundation, by building itself one above the other in a literal way (the Aztec, the Spanish, the Mexican, and the modernist along with current postmodernist). This location is so crucial to control the territory that the Spanish were not able to move the capital to a port (as they did with most of their colonies to ease the extraction of wealth from the territory).

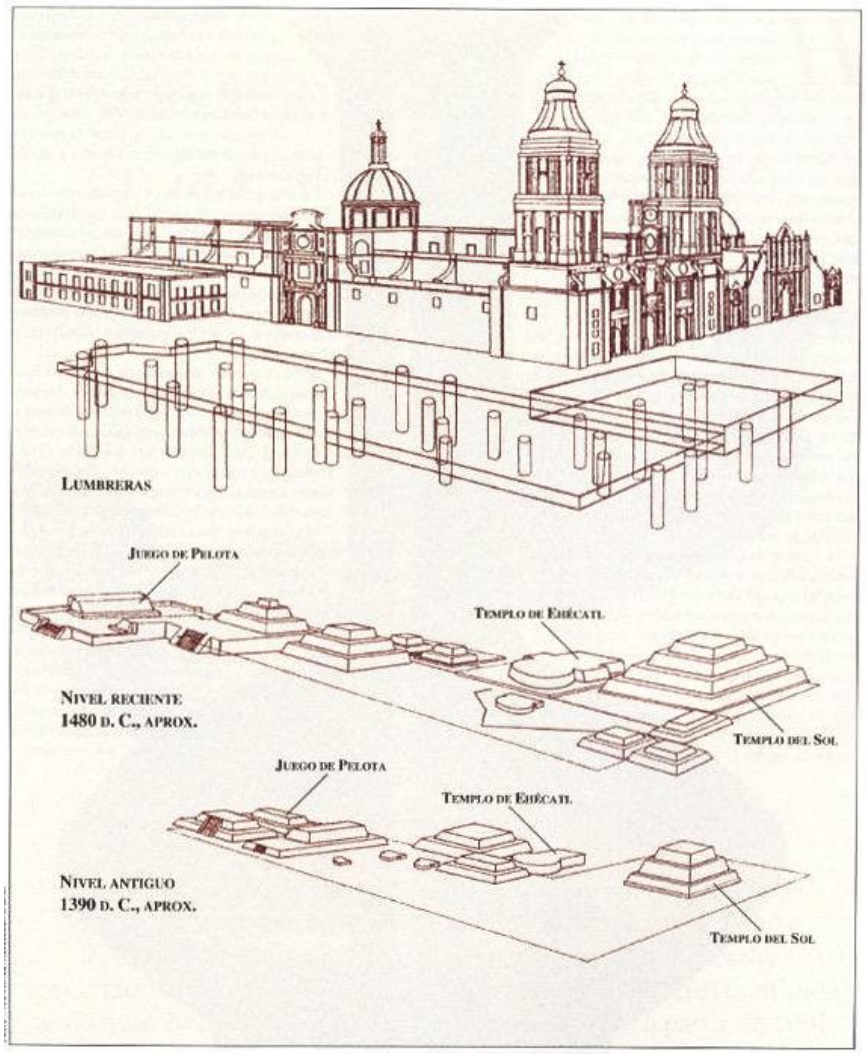

Figure 23 Building history of the sight that now is used by the National Cathedral.

The city of eternal crisis

Growth

The uncontrolled growth of Mexico City that began after the revolution in 1910 was accelerated by all the factors previously mentioned (corruption, strategic location, centralized power, and the disappearance of the lake).

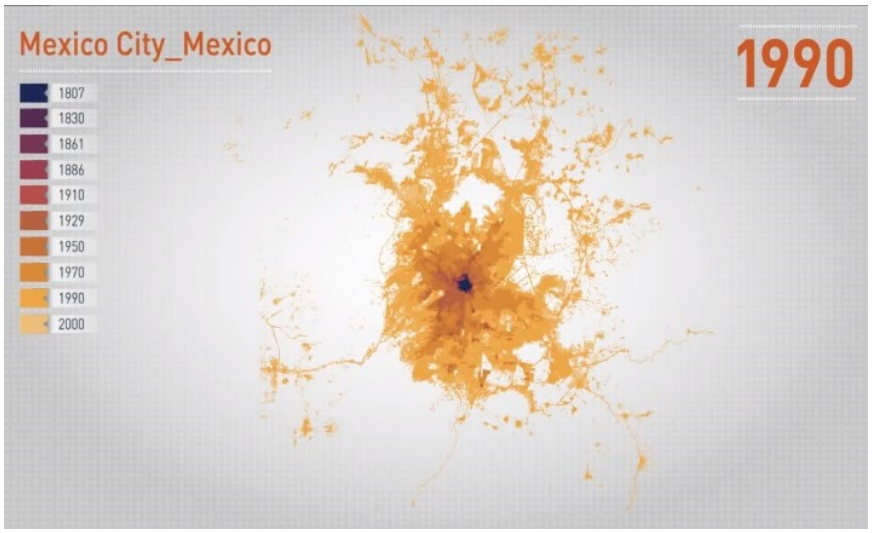

Figure 24 Mexico City from the darkest color to lightest the different growth stages – YouTube- Available at: https://www.youtube.com/watch?v=WtQjRCyOuVM. Accessed: 2020-06-29.

Most of Mexico City's problems are interconnected, from traffic to water demand, all the way to water extraction with earthquakes and flooding.

Water extraction

Even when the lake is gone, Mexico has a massive aquifer of water under it. This aquifer was extracted through a period of more than 100 years, sustaining the city for that time. Later, geologists noticed the rapid acceleration of the sinking of the city and found out that the extraction of water provoked it from underground.

The sinking of Mexico City

The origin of subsidence in the Valley of Mexico can be traced back to the early 20th century when rapid expansion of the urban area intensified groundwater exploitation to meet population and industrial growth. Although the rate of consolidation was initially relatively low at that time, Roberto Gayol, a Mexican civil engineer active in the late 1800s and early 1900s, correctly attributed the phenomenon to “loss of water” in the subsoil.

Nevertheless, speculation about different possible causes of the problem continued for two decades until civil engineers Nabor Carrillo, Raúl Marsal, and Marcos Mazari used Terzaghi’s newly developed theory of soil consolidation to finally establish beyond any doubt the quantitative correlation between water exploitation and ground subsidence at several locations within the Valley.

Figure 25 As Mexico City sinks, its structures twist and deform. JOSH HANER/THE NEW YORK TIMES

Intensive exploitation of groundwater explains why a large portion of Mexico City has subsided more than 10 m during the past century. The present rate of the settlement still reaches values as high as 40 cm/yr in some areas, as shown by recent measurements performed using the LiDAR technique. The nature and magnitude of the damage differ from one zone to another. The current rate of regional soil settlement varies from a few centimeters per year in some zones, up to 10 times as much in areas where the lacustrine soil deposits are the thickest. Consequently, those foundations of buildings in Mexico City with a light to moderate surcharge undergo large settlements. In contrast, foundations that are overcompensated for, or supported by point-bearing piles resting on a hard layer below the settling upper clay

formation, protrude notoriously above the surface of the ground.

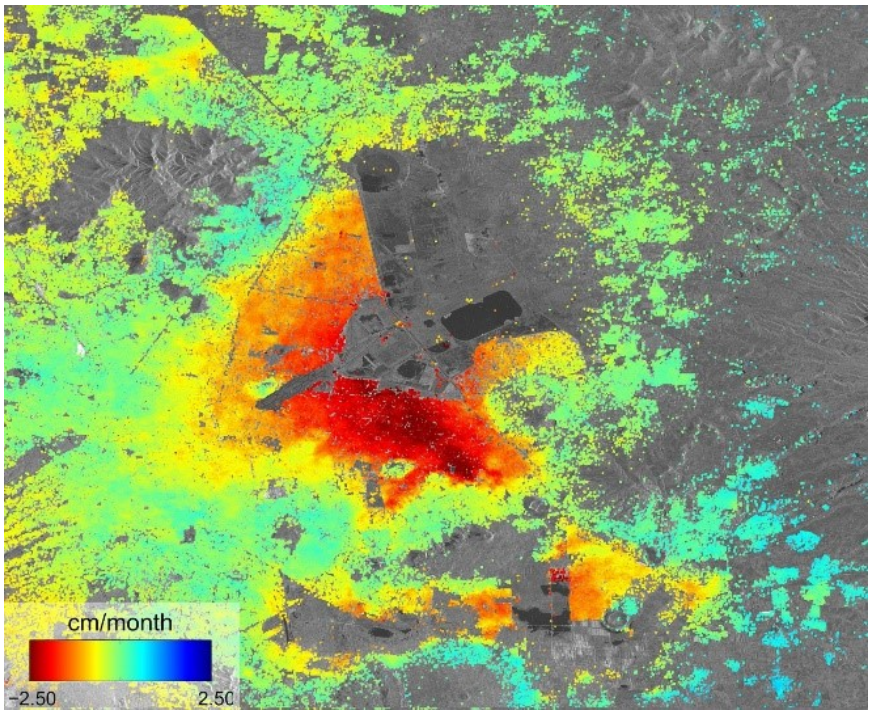

Figure 26 The sinking of Mexico City geological map.

The main problematic result is continued subsidence or sinking. Because both thickness and compressibility of the soil deposits at each site change slightly from location to location within this zone, differential settlements here are usually mild, though absolute subsidence is severe. On the other hand, in zones where thickness and compressibility of the soil deposits vary greatly, differential settlements become so disparate that when they increase beyond a specific limit, deep vertical cracks develop in the ground with or without vertical displacement between the two sides of the break.

Figure 27 Restoration Efforts Aim to Save the Sinking Basilica Guadalupe in Mexico City. Photograph by Jay Peeples / Flickr

Seismic soils amplification

The 1985 earthquake was so destructive because of seismic soil amplification unknown to Mexico City by the time.

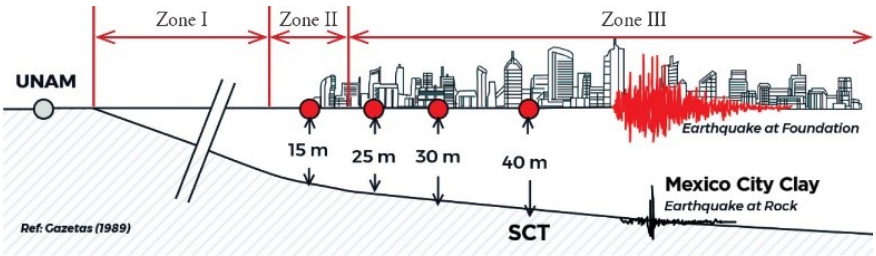

Figure 27 East-West section and code-specified seismic zones: Hilly (I), Transition (II), and Lake (III). Seismotectonics of Mexico, earthquake.usgs.gov.

The result of this amplified earthquake divided the city into three zones. The impacts of the earthquakes increase each year due to the sinking of the city incited by the extraction of water on the aquifer that lies under it.

Figure 28 The ruins of Hotel Regis in Mexico City after the 1985 temblor. (Derrick Ceyrac / AFP/Getty Images

The water extraction was responsible for creating a more aggressive earthquake. Water extraction from the aquifer under Mexico City was stopped in 1987, the seismic amplification was stopped from becoming more aggressive. This is another consequence that steams from the original decision of disappearing the lake and the poor understanding of the soil conditions by the engineers.

Figure 29 TEn 1985, el sismo en la ciudad de México provocó el derrumbe de varios edificios en Tlatelolco. En la imagen, el Nuevo LeónFoto Marco Antonio Cruz

The floods

Due to the city's geographic location, the constant subsidence flooding has become a common thing since 1969. It has been lately accentuated by global climate change, making rainy season shorter but more aggressive.

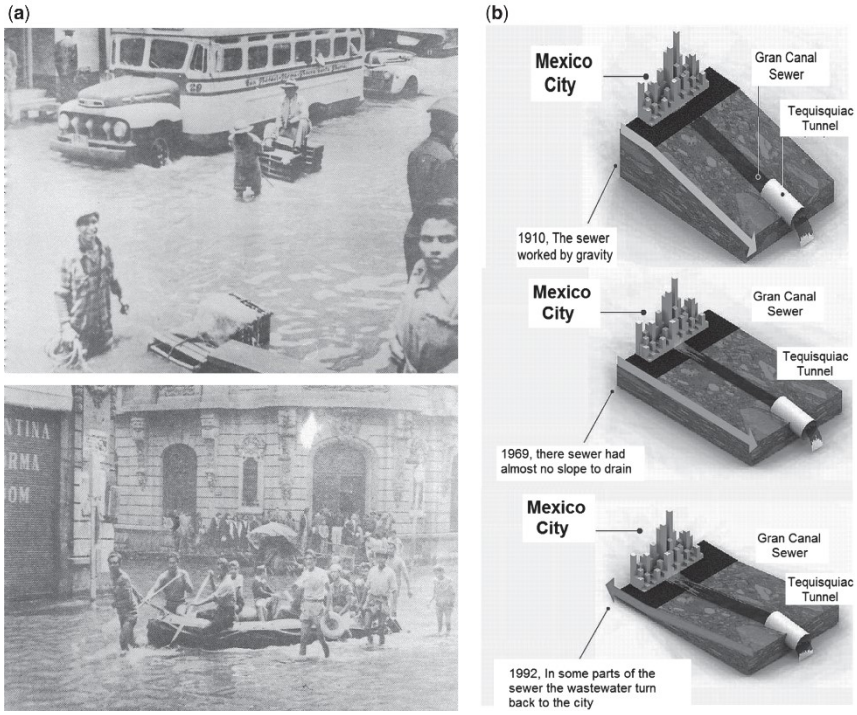

Figure 30The problem of floods in Mexico City: a) view of floods and b) effect sinking on the drainage. by Blanca Jiménez

The flooding has partially been controlled by another mega project of massive scale, the deep sewer of Mexico City. This project is on the same scale and problem-solving mentality as the Cutzamala System. Still, it is essential to mention it so we can understand how the combination of these two systems created a vicious cycle in which water is brought into the city by the Cutzamala System and instead of using it to restore or refill the underground aquifer it is drained out of the city.

Figure 31 A worker inside one of the tunnels that make up Mexico City's deep-drainage system. (Photo by Dario Lopez-Mills/Associated Press.)

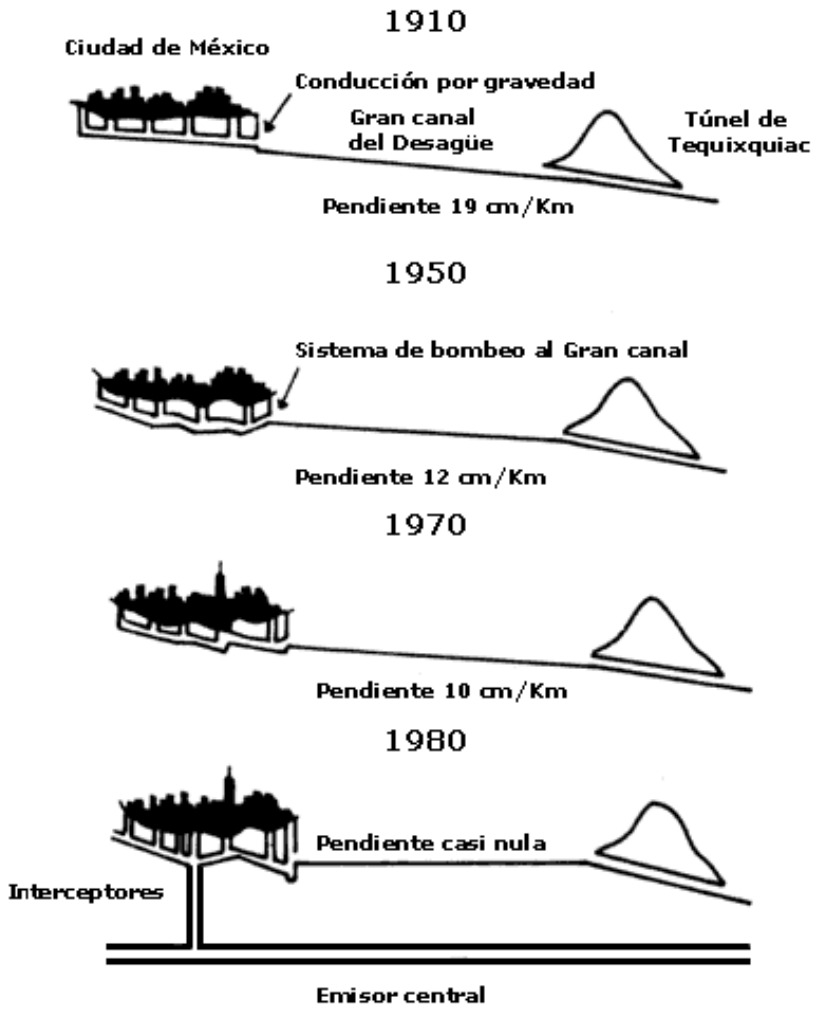

Figure 32 Effect of subsurface settlement on the drainage system (Source: Guerrero et al., 1982)

Dehydration in Mexico City

Mexico City suffers from flooding but, at the same time, a lack of potable water supplies. This is where the irony it's shown once more.

Destruction as preservation

As the first force of destruction and change of the city, we can appreciate the city on the lake where the waters are divided salty and sweet to create a city in it.

The Spanish conquest is the process that begins this second stage, where the lake starts to disappear completely, and the old city becomes the foundation of the new one, accentuated by the constant sinking of the city thanks to its lake soils.

Figure 33 Popocatepetl erupting while the city continues its normal day to day activities. Hilda Rios/EPA, via Shutterstock.

Historically, the destruction has been a regenerating force and has demonstrated the tremendous resilience of the city. This force is accentuated by urban planning that is subject to the pre-existence and destruction of the upper urban layer. The rebuild is delegated to other generations and cultures throughout history on the same site, thus creating the foundation for the next layer, defining the makeup of Mexico City and turning it into an exquisite corpse, where control is delegated to other architects and non-architects with different urban ideals.

The lack of legislation behaves like another destructive force. It is today a determining factor that allows unusual freedom for creativity, added to the historical need to create a city in that particular place. Having to resort to these processes of almost unconscious form, especially in all of the slums, that architects don't take part in the design, in which the inhabitants are generating in an automated way by the pure necessity to inhabit.

Buildings in all of Mexico City are so different and unique that it raises doubts about how they ended up there and

why all these different pieces of architecture live and prevail one next to another.

The destruction has given the city a chance to redefine itself (like Chicago city), but instead of trying that, it keeps true to its historical nature.

Mexico City Second-floor

The congestion has become a sickness that accentuates all of the problems of water in the city, it is the essential condition to materialize each of these metaphors in the reality of the grid. Only congestion can generate the "superhouse," the "mega village," the "mountain," and, finally, the modernized and automobile Venice that Mexico City has become.

Figure 34 second floor of periferico ring. Photos: Carlos Aranda.

Together, these metaphors form the foundation of a culture of congestion, which is the sincere endeavor of Mexican architects all the way from Tenochtitlan.

Figure 35 Harvey Wiley Corbett's 'solution' for congestion:

separation of traffic

The second floor of Mexico City is a full expression of the culture of congestion mentioned in the book *Delirious New York* written by Rem Koolhaas. It becomes a material reality that never managed to present itself where it was initially proposed, in it, we appreciate the definite answer to New York congestion problem, but with the massive scale of Mexico City mixed with its unique characteristics and where the cars go through the sky been as surrealist as possible.

Figure 36 Mexico´s second-floor Periferico ring circuit.

The congestion problem is not only a car problem. It cannot be solved with a new mega project, shown by the failure that the second floor of Mexico City is, it has not only not solved the problem but create the worst situation in which traffic becomes a reality only for lower-income inhabitants of the city, dividing more the city.

Allowing the city that already has low available water for the actual inhabitants to become mega dense and to support a large floating population accentuates, even more, the water crisis among all the interconnected others. This irrational decision is a result of a city's nature that, in that case of Mexico City, is a surrealist nature.

Cutzamala, the water crisis salvation

History
Stage I

After the stage of increased military activity of the Mexican Revolution and the government of the Sonorans was consolidated, in 1912 it was considered to take water from the Lerma River in the Toluca Valley to Mexico City, which at that time only had water sources from the artesian wells that were located throughout the city and that had been opened since colonial times, in addition to the aqueducts from Chapultepec, Santa Fe - Cuajimalpa and Xochimilco. What combined with the drainage works of the Valley of Mexico began to cause the collapse and consequent destruction of the buildings of the city.

Figure 37 Tláloc god of rain by Frida Kahlo, one of the public waterholes feed by Mexico City –Lerma-Cutzamala. Available at: gob.mx/conagua

But due to lack of money, political tensions, and a series of works that had to be carried out first in Mexico City, preliminary feasibility studies were postponed until 1940. In 1942 the viability of the project was confirmed, beginning to build the channels, pipes, tunnels, and storage tanks necessary for the water to go into the city.

In the year of 1951 the first half of stage I ends, with the conduction of water from the Lerma river through the Atarasquillo - Dos Ríos tunnel, which was considered a work of great importance in its time, since it crossed the Sierra de Las Cruces with a 2.5m diameter tube reinforced with precast concrete plates and with an internal part of shotcrete, allowing to build tunnels with the voussoirs and shotcrete system, this system ended in the Dolores Cárcamo a box or tank of storage that was built in the current section 2 of the Chapultepec forest in the west of Mexico City, whose powerhouse was adorned by murals by Diego Rivera and is characterized by having a monumental fountain with the seated figure of the Nahua god of Tláloc.

Figure 38 Diegos Rivera murals in Cárcamo de Dolores, water from the Lerma River to Mexico City –Lerma-Cutzamala- aviable at gob.mx/conagua

In the 1960s there was a drought and a notable increase in the population of Mexico City, causing a lack of water, which was temporarily saved by drilling 230 wells in the Toluca Valley and in the areas of Ixtlahuaca and Jocotitlán, thus ending the first stage in 1975, this stage is commonly known as Sistema Lerma,

Stage II

With the increase of the population of Mexico City, mostly due to immigration, the need for new water sources forces the use of the tributaries of the upper area of the Cutzamala River, which during the time of the first stage had been used for agricultural irrigation and for the generation of energy by means of dams, which formed the hydraulic system of Valle de Bravo. In 1976, stage II work began.

This stage was carried out in several sub-stages. The first of these consisted of building an aqueduct with metal pipes and channels that would carry the water from the Villa Victoria dam to a second tunnel in the Sierra de Monte de las Cruces, called the Analco-San José tunnel (42 kilometers long, with a portal of entry into the Santa María Atarasquillo community, in the municipality of Lerma), for which the first pumping plant had to be built, in order to raise it from the dam to 2545 meters over sea level and up to an oscillation tank at 2702 m and then, by gravity, lead the water to the city. This sub-stage was completed in 1982.

Between 1983 and 1992, stage II was concluded, with the construction of several pumping plants, the Berros Water Treatment Plant and the connection of the Valle de Bravo system with the Berros Water Treatment Plant, which is increased in capacity through channels, and the Agua Escondida tunnel, which allows liquid to enter from the Cutzamala river basin into the Toluca valley. At this stage, major civil engineering works are accomplished, such as the elevation from the Los Colorines dam to the oscillation tank, by 1,100 meters in height in five steps.

Stage III

From 1993 to this date, channels and pipes are built parallel to those already built to have a redundant system and avoid water cuts periodically, due to maintenance, must occur, and that usually occurs during the Easter, 7 when the demand in the city falls. At the same time, new pipe works are built to connect the system with several nearby cities, such as the city of Toluca.

Figure 39 Mexico City –Lerma-Cutzamala- available at gob.mx/conagua

In 1998, in Mexico City, the construction of the so-called Aquiferic began a distribution line that would allow water to be distributed more efficiently in the city, managing to take it to the eastern zone, where artesian wells are traditionally used for the liquid supply to the most densely populated area. The Aquifer project stopped in this area, in 2001, the Government of the Federal District (later called the Government of Mexico City) considered that the Water System of the Federal District (later called Aguas de la Ciudad de México) should be in charge of the work, and not the National Water Commission.

Stage IV

Due to the increase in population, especially in the area of the state of Mexico, Mexico City requires an increase in its flow of drinking water, for which it has been planned to channel the tributaries of the Temazcaltepec River, which would provide 5 m^3 / s to the flow, for which a new dam, called El Tule, and a new tunnel must be built, in addition to pumping systems. These works began at the preliminary project level, but have met with strong social opposition.

Scale

The main characteristics of the system are:

7 main dams.

6 pumping plants, which together consume 2,280 million kilowatts every hour, the equivalent of the consumption of electrical energy in the city of Puebla.

334.4 km of primary water pipes, distributed in 218 km of aqueducts through metal and concrete pipes, 43.9 km of tunnels, and 72.5 km of open channels.

1 water treatment plant with a capacity of 19 m^3 / s.
6 m^3 / s of water come from Lerma (31.5%), while 13 come from Cutzamala (68.5%), a contribution that represents a little more than 30% of the water consumed in Mexico City.
2,500 meters of pipes run from Atizapán to Mexico City.

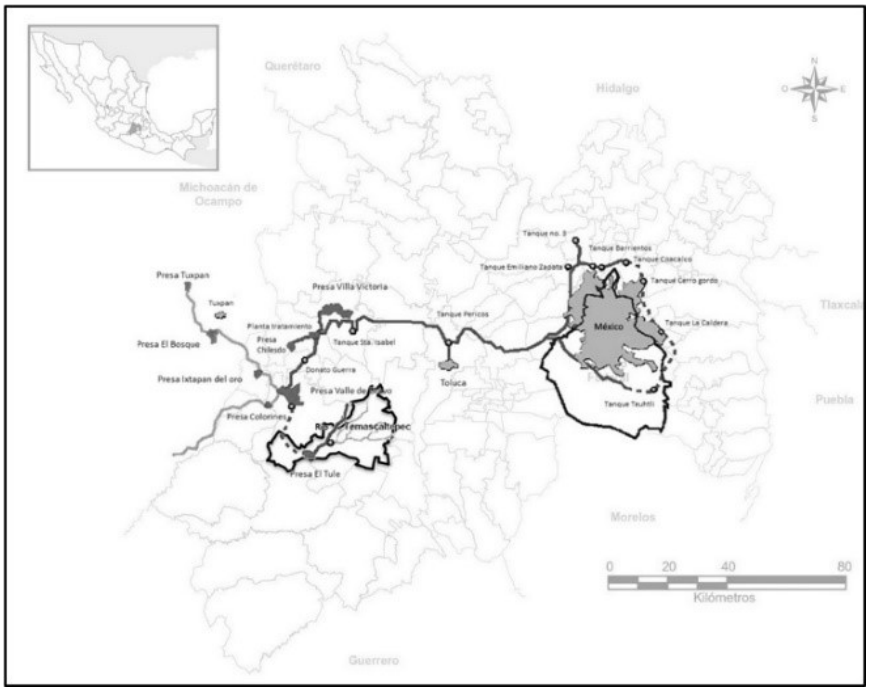

Figure 40 Cutzamala system map available at gob.mx/conagua

The regional scale of this project is unique in Mexico. The scale and a meager of understanding of the full impact creates a unique situation in which the system has changed so much of its context, the shape of the city, and the development of the whole region that now it looks like the system was before the context.

The impact on the city

Water for all but, not the same amount for everyone…

The Cutzamala System, when it arrives in the city, starts to lose its water capability almost instantaneously due to the high demand, barely been capable of delivering water to the most eastern part to the city (which consequently is the most impoverished zone).

Figure 41 Inequality in Mexico City, at the right, a "private" or housing complex that receives water from the Cutzamala System and at the left an illegal settlement.

On the country

Centralizing more the power of Mexico by increasing the water supply created a new escalation in immigration rates to Mexico City. It slowed down the development of the surrounding urban zones.

Economic impact

Water and urban development go hand to hand. The case of Santa Fe, Metepec, and Valle de Bravo appears as a consequence of this phenomenon.

Figure 42 park la mexicana less than 1 kilomiter from Mexico City – Cutzamala sistem in santa fe

This has provoked an urban phenomenon that consists of a dynamic about water accelerating urban development. More value zones built closer to the Cutzamala System and its access point to the city— creating a rapid and high price development in areas like Santa Fe that used to be a land filled and now is one of the most productive zones in the country.

Nature systems impact

No lake, no real solution: the Cutzamala System is not capable of delivering enough water, and it cannot solve all of the other problems provoked by the lake´s disappearance. The Cutzamala System behaves more like a life support system for the human body than an integral part of it (like an organ transplant).

Urbanism impacts

It has changed how the rest of the central plateau of Mexico has developed until today. Creating a new lake, Valle de Bravo, that has become a new tourist zone with a massive impact in a unique and critical area close to the monarch butterfly migration sanctuary, how this new urban development creates a critical relation with the city will be mentioned in more detail ahead.

Megastructures and Mexican culture

Mexico has a culture and history of fixing problems with single large projects, as we have analyzed throughout this text. Most of the city's significant problems are interconnected. Mexico has continued its long tradition of building megaprojects as a solution, and nowadays, with new technologies available, this has not changed and has been accentuated instead.

Figure 43 Cuenca del Valle de Mexico ('the Basin of Mexico') seen from the air, and, right, how it would look under the proposal to regenerate its lakes and reforest the area. Photograph: Taller de Arquitectura X.

The proposal for restoring the lake allows most of the mentioned problems to get a fix. With the cancelation of what was going to be the new international airport supposed to be built in that zone, these ideas take a new possibility and deserve to be studied and compared to the reality of the Cutzamala System.

Figure 44 Cuenca del Valle de Mexico ('the Basin of Mexico') seen from the air, and, right, how it would look under the proposal to regenerate its lakes and reforest the area. Photograph: Taller de Arquitectura X.

Water

The Cutzamala System presents itself as a temporary solution to the problem. By creating this massive system that imports water from the rest of the region, this solution is not sustainable in the long term. Today, the expectations of the metropolitan area, the growth, and boom of new cities like Toluca, Metepec, or Queretaro are creating a new restrain on the water of the region, reducing the system´s efficacy dramatically.

Having the unique situation of a city that has enough rain almost to sustain itself goes to show that a more permanent solution can be found by having a holistic approach in the design process. Holistically solving the water crisis implies by its nature a sustainable way that also will ease or solve all the correlated problems of the city. A holistic view of Mexico City will be an evolutionary step from the surrealist critical paranoiac methods use through its history, among others.

Sustainability and a new strategy

Understanding a city as a complex matrix of the interconnective system (or problems) allows planning, not only for the future but for the impact of new projects. With the new technologies, we can observe almost in real-time how they relate and interact.

Humanity without ethics cannot be sustained on a nature created for an ethical being. Man has reached the point of development where he has control of the entire planet and impacts on the lives of all his creatures.

Figure 45 (Aerial View of Mexico City, XIII), 2006 Pablo López Luz

Nature has become a mirror of humanity, and today we can see it on how ecosystems suffer our poor actions and decisions, the climate problem is not the disease, it is the symptom; the problem is in the values of today's global society and culture.

Humanity's lack of holistic view is only now relevant because we have the means and the need to do it better. We cannot judge the past architecture and older human cultures harshly because the means to understand it and fix it are only available in recent years.

Most of the harm has been provoked in the last 50 years by consumer culture and the need for rapidly developed countries, but been able to change the way we think, design, and build our cities can make a substantial positive impact on the situation.

Architects like bever before are called to action because of the responsibility that lies in us to determine the future of the cities and new megalopolis that are appearing in the

world. Understanding that Mexico City problems are like any other megalopolis problems (especially in the topics of water) allows to see that it is not only a problem of Mexican culture but a problem of the modern and post-modern way of seeing the world. This view needs to change, not because of love for nature or economic and political interest but because of the need for a stable planet, fairer cities, and the essential need and right of all the global community.

We have studied how the absence of a holistic view and flexibility demotes the merits of the Cutzamala System. Now by understanding the urgency produced by global warming, we can see how these values are urgent not only on the urban scale but also in the planetary one. We will study them on an individual project scale that is a positive example in contrast to Cutzamala System. Still, for that, we will need to understand the impacts created by a holistic view beginning with interconnectivity.

Interconnectivity

It indicates that a system and its properties are analyzed and design as a whole in a comprehensive and integrated way, from the holistic view, its operation can only be understood as an integral part of its context and not only as of the simple sum of its parts. The interconnectivity nature of this world is a critical aspect that one with a holistic view must consider, this includes ethical and sustainability decisions and impacts of one's design decisions.

We can see by studying nature that interconnectivity is one of its greats design assets and rules. All nature tends to work in interconnected systems, and as the biomimicry methods show, it worth coping it.

Holistic design

Holistic design transcends matter, space, and place, thus managing to touch all the dimensions of man from intellectual development to physical health and finally in the interaction with nature and the formation of communities, impacting the spiritual growth of the person.

Today we believe that sustainability has been a great discovery or that it is only possible with current technologies, but the reality is that sustainability was the only way to do things before, the only and right way.

The holistic design allows diversity to thrive because it offers integrated and interconnected answers to unique projects and situations, in consequence, creating more resilient cities (and human communities).

The UMA. an example for the rest

The location of the UMA was decided by the reality of saving the monarch butterfly sanctuary from the rapid urban development provoked by the new lake created by a water reservoir from the Cutzamala System, lake Valle de Bravo. The microclimate, called in Mexico “eternal spring”, became a massive attraction to the citizens of Mexico City.

Figure 47 Monarch butterfly migration in Cerro Pelon Butterfly Sanctuary, Mexico/Monarch butterfly migration by Elizaveta Kirina

Figure 48 Waterfall Velo de Novia in Valle de Bravo, a clear example of how the fog forest looks

The monarch butterfly sanctuary is surrounded by a cloud forest. This forest began to bee destroy with the rapid urban development triggered by tourism and vacation houses. Later vacation services began to use all of the lakes shore, the attractiveness of the lakes has become great that the urban sprawl was only stop by the UMA (government does nothing do to corruption).

When it arrived, the university UMA bought all the steal pristine forest location in the area including the monarch sanctuary, later on declaring it biosphere heritage. Along with this action, the university understood by a holistic design approach the possibility of creating synergies with local communities and a symbiotic relationship with Mexico City from a distance in the association created by water and how the UMA takes care of the lake, and its water replenishes lands. Provoking a positive impact from a distance. The university understood that the monarch butterfly is an insect responsible for most of the pollination needed for the growth of the crops of the USA and Mexico.

Figure 46 Valle de Bravo photo by hotel Rodavento

The UMA seeks to be able to demonstrate that this lake is not only a water reserve, but at the same time, it can be a diverse reserve without harming the city, the environment, local tourism, and local communities.

Figure 47 Valle de Bravo fromthe sky photo anonimus

The UMA, for these reasons, becomes a project able to achieve a social impact that creates synergies (or positive feedback cycles). It seeks to generate a benefit for all the systems in its context by becoming an interconnected node for them.

Figure 48 Nuestro Campus - Universidad del Medio Ambiente

https://umamexico.com/nuestro-campus/

The holistic design of the university systems is causing a synergy or symbiotic relationships already mentioned, the UMA is becoming an indispensable asset and thus ensuring its value and success for the future.

The expected impact in its design process has been a success. The monarch butterfly statuary has been protected, the lake has become an asset to the region and ten years after being completed the UMA is achieving through collaboration with local communities and coworking with international companies a stable dynamic to protect the sanctuaries for the future generations.

Figure 49 UMA access road https://umamexico.com/wp-content/uploads/2019/11/EntradaUMA.jpg

The UMA stands as a great example of how a new design strategy that understands the interconnectivity of systems through a holistic design approach is able not only to foresee all possible implications of a project but able to create a positive impact through synergy. The UMA becomes an asset that benefits all and creates easier conditions for a future project with the same values by becoming a reference.

Figure 50 Institutions and companies that the UMA has workwith

The unintelligible impact

All this project |(the UMA and the cutzamala system) shows how it is crucial to understand the full impacts of a project to its context, the old techniques, especially at this scale (too large for classic study methods) is becoming possible for today's architects. That is why we cannot keep designing like the old times the cities, projects, and allowing the intervention to fall into its own destiny.

Even if architects did not care to change or consider these new design ideas for the need an ethical pressure that exists, the rest of the world has started changing. Changing so fast and aggressively that we can call it a new revolution, the new digital or machine revolution is a new reason and pressure point to take these new ideas into the discipline.

The new machine revolution

Computers are helping to accomplish all types of goals. Digitization is improving the physical world, and these improvements are only going to become more critical. Among economic historians, there is a broad agreement, as Martin Weitzman puts it:

"The long-term growth of an advanced economy is dominated by the behavior of technical progress."

Technical progress is improving exponentially, digitization is going to bring with it some thorny challenges. This should not be too surprising or alarming, even the most beneficial developments have unpleasant consequences that must be managed. The industrial revolution was accompanied by soot-filled London skies and horrific exploitation of child labor (what will be their modern equivalents).

Rapid and accelerating digitization is likely to bring economic rather than environmental disruption, stemming from the fact that as computers get more powerful, companies have less need for some kinds of workers. Computer robots and other digital technologies are acquiring their skills and abilities at an extraordinary rate.

The second machine revolution unfolding right now, an inflection point in the history of our economies and societies, is happening because of digitization, and it's an inflection point in the right direction, bounty instead of scarcity, freedom instead of constraint, but one that will bring with it some difficult challenges and choices.

A few years earlier we were confident that computers would not be able to drive cars, excellent research and analysis conducted concluded that driving would persist as a human task for the foreseeable future, how they reached this conclusion and how technologies like this first started to overturn it in just a few years offer valuable lessons about digital progress.

In 2004, Frank Leavy and Richard Murnane published their book "The new division of Labor" the division they focused on was between human and digital labor. In other words, between people and computers. In any sensible economic system, people should focus on the tasks and jobs where they have a comparative advantage over computers leaving computers the work for which they are better suited.
Throughout decades, innovators designed machines that could take over more and more of human work; they were first mechanical, then electromechanical, and eventually digital. Today few people, if any, are employed to do arithmetic and record the results. Even in the lowest income countries, there are no human computers because the non-human ones are far cheaper, faster and more accurate. If you examine their inner workings, you realize that computers are not just number crunchers but also symbols processors.

Their circuitry can be interpreted in the language of ones and zeros but equally validly as true or false yes or no or any other symbolic system in principle they can do all manner of symbolic work from math to logic to language. Still, digital architects are not yet available, so people design all cities. We also haven't yet computerized the work of entrepreneurs, CEOs, scientists, nurse's restaurant busboys, or many other types of workers. Why not? What is it about their work that makes it harder to digitize?

Algorithms are simplifications; they can't and don't take everything into account, showing the first signs of the importance of a holistic view. Algorithms do, however,

include the most common and essential things, and they generally work quite well at tasks like predicting payback rates. Computers, therefore, can and should be used for mortgage approval but are lousy at pattern recognition.[6]

At the other end of the Levian Murnane spectrum, lies information processing tasks that cannot be boiled down to rules or algorithms like architecture. According to the authors, these are tasks that draw on the human capacity for pattern recognition. Our brains are extraordinarily good at taking in information via our senses and examining it for patterns and connecting it to different ideas. Still, we're quite bad at describing or figuring out how we're doing it, especially when a large volume of fast-changing information arrives at a rapid pace as the philosopher Michael Polanyi famously observed we know more than we can tell.

The crisis and architecture

White-collar workers and low skill workers all have things to worry about from automation, but perhaps architects are unfazed because we are uniquely creative, unique designers and artists.

Creativity may feel like magic but it is not. A brain is a complicated machine, perhaps the most complex machine in the whole universe, but that hasn't stopped us from trying to simulate it. There is this notion that just as mechanical muscles allowed us to move into thinking jobs that mechanical brains will allow us to move into creative work. Still, even if we assume the human mind is mystically creative, creativity is not what most jobs depend on.

Emily Howell is an A.I., and she could write an infinite amount of new music all day for free, and people cannot tell the difference between her human composers when putting on a blind test. Nonetheless, artificial creativity is a developing field. People used to think that playing chess was a uniquely creative human skill that machines might never do until the point they beat the best of us, and such will go for all human talents.

This may have been a lot to take in, and you might want to reject it. It is easy to be cynical of the endless and idiotic prediction of futures that never are so. That's why it's important to emphasize again that this stuff isn't science fiction; the bots are here right now. There is a terrifying amount of working automation in labs and warehouses around the world. We have been through economic revolutions before, but the second machine revolution is different.

The US census in 2016 a 1776 tracked new job types, there are hundreds of kinds of jobs, but the new ones are not a significant part of the labor force list of jobs ranked by the number of people who perform them it's a list with the transportation industry at the top continuing downward, all of this work existed in some form 100 years ago. Almost all of them are easy targets for automation only when we get to #33 on the list is there finally something new. Don't think that every barista or white-collar worker need to lose their job before things are a problem. "the unemployment rate during the Great Depression was 25% the first 30 jobs that A.I. can take balance to a 45% of the workforce pretty soon and given that even in our modern technological wonderland new kinds of work are not in a significant percentage of the economy," [8] this is big problem, automation is inevitable, it's a tool to produce abundance for little effort. We need to start thinking now about how we will face the unemployment crisis that is coming.

This crisis is the most impactful one from the industrial revolution, understanding how it will change not only architecture but the entire society goes to show how real and vital it is to be prepared to be capable of staying relevant in this Second Machine Revolution.
What we know is that machines are not good at pattern recognition. That machines are good at following rules and have to bee program to achieve a specific gold. That algorithm and are incapable of having a holistic view. This new revolution adds to all of the other reasons already discussed in the paper to show how important and urgent the holistic approach has become. This characteristic makes architects even more relevant in this Second Machine Age because of these 3 qualities:

A holistic sense

As we have discussed, the part of a holistic view that consists of a deep understanding of a project context and

all its interconnectivity systems impact design decisions that create synergy. All of this is only one part of a holistic view. The other one consists of the type of knowledge and mentality needed to achieve this as an individual. A holistic sense is the sum of an understanding of the dynamic that exists between these 4 disciplines:

Art -is for expression
Science – is for discovery
Engineering -is for creation
Design -is for communication

Holistic architecture is an understanding of the fields of science, engineering, design, and art. These 4 disciplines form a circle of advancement for architecture, among other disciplines. The circle begins to form with science. that by discovering new advancements and knowledge creates opportunities for engineering. Then comes engineering that invents new ways to use this new discovery, converting them into technologies or useful assets that design can use. After that comes design, that uses this new technology or in architecture case new construction systems or design methods to communicate, this communication creates new symbolic and formal dialects.

And at the end comes art, art intends to express by using this new dialectic, and by expressing it creates new questions, dilemmas, and paradigms that sciences use to question and provokes the beginning for new discoveries.

For example, in the last century, the discovery of reinforced concrete and steel provoked a new way of communication (or design) that by been used by great architects like Le Corbusier or Ludwig Mies van der Rohe created a new way of expression (like functionalism, organic architecture or the international style) this new expressions provoked a new paradigm and created new questions. Like for how the city is built for? Or if ornamentation is acceptable in a country full of poverty?

This new dilemma creates questions that science seeks to answer.

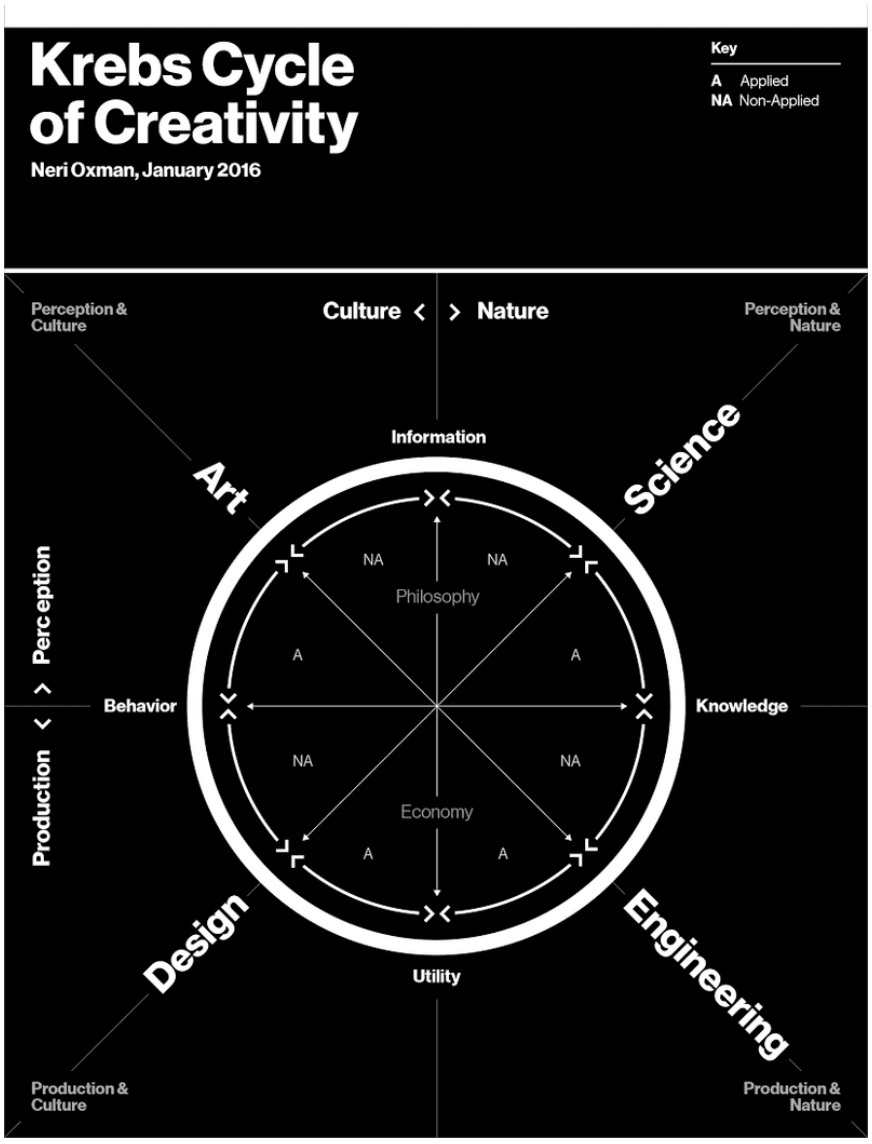

Figure 51 Krebs cycle by Neri Oxman

The Krebs circle is one part of the holistic sense, and for an architect, the ideal position is to stand in the middle. A holistic architecture is capable of seeing in which part of the circle a project belongs to and use this information to push forward, for example, a project that is capable of innovation in engineering (like the Guggenheim Bilbao) or that tries to create a social reform (like international movement urban designs) or a project that wants to express what's once was (museum of the holocaust Israel) all this different project understood in which part of the circle they were and into which one they should push forward to. In the case of science, holistic architects have the responsibility to understand what's going on and is

relevant in the present (like understanding what A.I. can do for us).

Being able to see the world from this perspective allows one to be flexible, and, as we discussed earlier, this quality will be essential in the near future.

Flexibility

“Coherence imposed on an architect worked either cosmetic, or the result of self-censorship…contradictions are not avoided in architecture.” [9]

Architects' ability to adapt to conditions and uncertain situations that they don’t fully understand becomes a new asset to them in this new working environment with AI. AI is unable of flexibility, it will attain at the rules it has learned or been programed to no matter what, and having to program each time and AI for new and different scenarios is not feasible even with machine learning.

Work toward uncertainty

“Architecture is a hazardous mixture of omnipotence and impotence. Ostensibly involved in shaping the world, for their thought to be mobilized, architects depend on the provocation of others. Therefore, incoherence, or more precisely, randomness, is the underlying structure of all architect's careers, the parameters they did not establish, in countries they hardly know, about issues they are only a\dimly aware of, to brains vastly superior to their own. Architecture is, by definition, a chaotic adventure.” [10]

This quality of architects is one of the architects defining skills; the ability to work towards an uncertain objective makes automation hard. As mentioned before, most low skill jobs will be lost, and in architectures case, most low skill projects will be automated. Still, hope for architects resides in the ability of an architect to be complement by A.I. in its design process and for this to happen this skill es fundamental.

Artificial intelligence and design process

The term A.I. is frequently utilized to the project of developing systems capable with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from experience. A.I. has evolved in the last years and mix with new emerging technology is creating different possibilities for architecture.

Despite continuing advances in super computer processing speed and memory space, there are as yet no programs that can match human flexibility over more extensive domains. This weakens A.I. on specific fills (like architecture) makes a holistic view more relevant. But these two new technologies (machine learning and neural network) are showing signs of fast and rapid improvement in the ability to relate or connect different fields and types of knowledge that will make them essential for architecture shortly.
This will make it easier for architects to focus on flexibility, and a holistic perspective, creating a new working dynamic.

When CAD became common in the architect's workflow, lots of this were lost, like the importance of hand drawing, but this allowed architects to focus on more important things, like the relation of a project with its context or how to interpret the form and city. A.I. will do the same, but it will allow architects to focus on other more humane and vital parts of the profession (holistic view, flexibility, and uncertainty work goals)

Machine learning

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer systems that can access data and use it to learn for themselves. [11]

The process of learning begins with observations or data, such as examples, direct experience, or instruction, to look for patterns in data and make better decisions in the future

based on the examples that we provide. The primary aim is to allow the computers to learn automatically without human intervention or assistance and adjust actions accordingly.

Neural network

A neural network is a type of machine learning which models itself after the human brain, creating an artificial neural network that, via an algorithm, allows the computer to learn by incorporating new data.

While there are plenty of artificial intelligence algorithms these days, neural networks can perform what has been termed deep learning. While the basic unit of the brain is the neuron, the essential building block of an artificial neural network is a perceptron which accomplishes simple signal processing, and these are then connected into a vast mesh network.

The computer with the neural network is taught to do a task by having it analyze training examples, which have been previously labeled in advance. A typical example of a task for a neural network using deep learning is an object recognition task, where the neural network is presented with a large number of objects of a specific type, such as a cat, or a street sign, and the computer, by analyzing the recurring patterns in the presented images, learns to categorize new images.[12]

Unlike other algorithms, neural networks with their deep learning cannot be programmed directly for the task. Instead, they have the requirement, just like a child's developing brain, that they need to learn the information.

Big Data

The term "big data" refers to data that is so large, fast, or complex that it's difficult or impossible to process using traditional methods. The act of accessing and storing large amounts of information for analytics has been around a long time. But the concept of big data gained momentum in the early 2000s when industry analyst Doug Laney articulated the now-mainstream definition of big data as the three V's:

Volume: Organizations collect data from a variety of sources, including business transactions, smart (IoT) devices, industrial equipment, videos, social media, and more. In the past, storing it would have been a problem – but cheaper storage on platforms like data lakes and Hadoop have eased the burden. [13]

Velocity: With the growth in the Internet of Things, data streams into businesses at an unprecedented speed and must be handled promptly. RFID tags, sensors, and smart meters are driving the need to deal with these torrents of data in near-real-time.

Variety: Data comes in all types of formats – from structured, numeric data in traditional databases to unstructured text documents, emails, videos, audios, stock ticker data, and financial transactions.

Big data is already in use by GIS programs, but artificial intelligence has yet to become critical in GIS.

A.I. will be integrated with big data to interpret and analyze de data in record time and more extensive data volumes than ever before, making in this prosses only the ability of the architect to interpret and apply this information relevant.

Having these skills (flexibility, holistic sense, and work toward uncertainty) will not only allow us to be retable in the future but also the best architects than ever before.

This new big data and AI mix will allow architects to use the 3 skill mentioned before, allowing us to understand the city in real-time, and have the useful information for us to carry out the holistic view. Problems like the Cutzamala System will be avoided, and more projects like the UMA will be possible with more ease and in record time.

Mexico City problems derive from the poor understanding of the site due to the fast urbanization speed, architects have not been able to study the site with the speed needed do to the tools at their disposal to them at that time. In contrast, Teotihuacan city was built with a holistic view, this happened not only because of a different mentality but also because the city at that time was never built at the speeds of today's cities, allowing builders to analyze the site and giving time to understand it. Big Data and AI will allow our understanding to be as fast or even faster the actual

building and urbanization speed, finally making architecture able to stay up to date with the rapid urbanization that he world is having ensuring that problems like the ones we see in Mexico City will not happen again.

Artificial Intelligence Added Designing (A.I.A.D.)

This new revolution will create a new way of designing in architecture. This quality of A.I. will bring a holistic view of the architect's mind to a new importance becoming an essential skill for all future architects.

This new way of designing will be as revolutionary as the CAD once were. We can see the closest example in science fiction, referring to the first Iron Man movie and how he's the design process of the suit is all the time added by an AI. This proses will be close resembling the architecture, one specialty all its deeply technical parts and schematics all the way to the construction process and materiality all calculations are done by computer (Jarvis). At the same time, the architect will trigger the fundamental ideas and questions that create the necessary motivation or guide to the objectives, so that the computer (or A.I.) can find them. He keeps correcting it during the process and perfecting the decisions made by it. At the same time, choosing a catalog of possibilities that the A.I. publish for the architect. The project will be polished each time architects decide, and the architects' flexibility allows the project to evolve until we create its final result.

This new design methods that will come with AI will make architecture design processes fast enough that the extra time will be used to create better architecture rasing the basic demand for better quality. Globally, we will see new and exciting architecture trends mixed with higher architecture quality.

Conclusion

The impact of a megalopolis

Mexico City, like the all-new megalopolis cities that are appearing in the world, will become one of the new laboratories for new urban strategies, and new problems that we had never face in history will emerge in them.

Therefore, studying these places becomes essential tasks of urbanism and architecture

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The impact of the cutzamala system in Mexico Valley and the rest of the central plateau of the country has become apparent that when this system was finished, the designers didn't understand or care about its impact and how it related to other systems.

The critical task that has become to study the systems and how it connects with others to become able to predict Impacts and interactions that will start to appear after their construction. It generates a new opportunity for architects to innovate and stay relevant in the Second Machine Revolution by employing a holistic view.

The holistic view was the design elements missing from the Cutzamala System, recognizing the interaction of the system with its environment (natural, economical, urban, climatological, biological, among others) was the critical error made by its designers. Study these cases allow us to value more a new reality, that a holistic design in which you consider all aspects, and impacts of the project in the region Is the only way that you can design in the 21st century, this new design method is now possible because of new technologies like artificial intelligence, GIS and Big data, that allows us to understand the project on a macro scale like never before in the history of humankind.

A new way to understand the city

Only today, it is possible to understand the city through living studies using it Big Data we do not understand the city in an earlier or frozen version that a study gave. We can understand it, I think at the moment and how it is behaving day by day.

This new way of understanding the city and the use of new technology like the internet to accumulate all this information and especially all the historical information obtained allows to create more realistic predictions of the future of a city, therefore reducing the argument that the context became relevant because architecture cannot respond to him and the argument that the program is liquid since the city changes too quickly for architecture to respond properly.

It should be emphasized that these reductions arguments (discarding the context and formalism) can not disqualify by technology on its own since the future is predicted by probability, not by certainty, and the change of the city sometimes means that buildings require flexibility in their interior programs. This is a new way of understanding the city (holistic view), allowing architecture to take on a responsibility and an understanding that was not possible before, thus creating a higher probability of creating correct responses to the context.

The future of architecture

Necessary evolution that will have to take the discipline to be able to give priority to these 3 new central concepts (flexibility, holistic view and work towards uncertainty) architect will need to be able to design by using and understanding new technology. This will reduce the importance of technical knowledge based on memory.

These 3 new characteristics allow us to develop a much more conscious architecture that manages to harmonize in a new way the interaction between the needs, the responsibility towards the environment, and the user. The flexibility needed and required to have an architecture that survives longer by evolving in a fast-changing world.

This Second Machine Revolution surpasses what the first did with labor and real works where humanity replaced biological muscles and human hands by mechanical muscles and robotic hands.
The second, the machine revolution seeks to achieve the same impact but to replace the mind and brain labor with artificial intelligence, which is to replace many works that require a low vision and understanding of the interconnectivity of things in the world and even more so in repetitive tasks and tasks of low cognitive need.

This makes many of the architect low skill jobs to become irrelevant, consequently creating the need for the holistic and integrated vision not only in the design but in the education and in the training of architects, as it will be the only way to stay relevant in an artificial intelligence era.

The way forward is the idea that an architect will be learning and training for the rest of their lives, to be able to keep this changes that are relevant in its profession, changing the notion that profession education ends after a

certain age or certification degree, will allow architects to be as relevant or even more in this second machine age.

Revisiting the past

Many techniques and schools of thought of architecture have been discarded, some because they have failed and others because they simply were not possible.

There are ideals of modernism that we can appreciate today that were unattainable at that time, we are again in a position where a technological revolution allows us to dream again (but having an eye on the past we know that architecture will not save the world and humanity) we can believe that having a holistic vision and using these new technologies will allow architecture to have the most positive, measurable and most significant impact that humanity has ever receive from us.

This opens the possibility of having to consider old manifest schools of thought or techniques that now become relevant with this new technology.

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