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UNIVERSITÀ DEGLI STUDI DI GENOVA

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# BEYOND RESILIENCE

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# BEYOND RESILIENCE

real  
climate  
action  
now!

THIS IS  
OUR HOME

SCIENCE  
NOT  
SILENCE

**"THAT WHATEVER MADE YOU  
SUCCESSFUL IN THE PAST  
WON'T IN THE FUTURE."**



**LEW PLATT  
CHAIRMAN AND CEO OF HEWLETT-PACKARD CO**

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# BEYOND RESILIENCE

# PROLOGUE.

This doctoral thesis has the character of a disciplinary essay on one of the concepts with the most use - and abuse - within contemporary reflections about the city: The Concept of Resilience, on which we have been indirectly interested in a recurring way in all the academic work developed under my direction by the Laboratory of Urban Sciences of the Iaac, Institute for Advanced Architecture of Catalonia, and is part of an extensive research developed within this Lab, between 2015 and the present, a period in which we counted with the collaboration of different researchers whom I want to thank in the introduction to this Thesis for their energy, curiosity and constant socratic spirit, especially Jordi Vivaldi, with whom in some endless discussions edging the personal issues, we managed to approach positions on some ideas on which this work is based, and Maite Bravo, both of them collaborators during many years in the Urban Sciences Lab and in my X-Urban Studio Workshop within the Master of Advanced Architecture, as well as in many other diverse initiatives that continue today. To both of them I owe many of the ideas reflected on these pages.

Although every Thesis is ultimately a collective construction by nature, its genealogy is always a personal story. During the first years after my arrival to Barcelona, at the end of the '80s, when I carried out two years of the studies necessary to present my Doctoral Thesis at the UPC - under the direction of one of the greatest professors that I have heard as Ignasi de Solà Morales - I had the first opportunity to face this enormous challenge. The youth of that time minimized those efforts and compensated with plenty of innocence and energy many of the shortcomings and knowledge. It is a terrible paradox: it is the best time in one's life to do a Thesis, due to momentum, dedication, time and convictions, but there is a lack of experience, knowledge and maturity that are necessary to turn a bunch of ideas into a position, into a theory, into a project.

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I had a revealing experience: my Thesis project, called Thesis-Prosthesis, making a clear reference to the Derridian theories fashionable at that time, did not have an unsuspected reaction. Eugenio Trias, one of the most recognized philosophers in Spain and in Europe, who at that time was the Director of the UPC's Thesis Department, was especially clear with me. "Listen, young man, if you want to do philosophy, go do your thesis at the Faculty of Philosophy, this one is Architecture."

He could not be clearer and helped me that much. It was no longer needed to argue whether the thesis was based on the analysis of the monocular vision of Le Corbusier - who as a young man had suffered a retinal detachment that made him lose the vision of one eye - and his most famous and visionary book on his ideas of urban planning, precisely called "Precisions", with the original cover with his drawing of the 5 towers in front of the La Plata River, which, together with his obsession with the hand until the end of his days, made up a very interesting corpus to analyze: the difficulty of being precise, of finding objects with his hand where he thought they were due to the loss of depth of field. In another life it will be, but I cannot help but thank Eugenio for having released me from that inertia, because I started one of the most vital experiences of my professional and personal life in Barcelona, the one that goes from the foundation of Metápolis group to that of IaaC, from the participation in the Venezia Biennial of Massimiliano Fucksas to HyperCatalunya project, that gave me one of the greatest gifts that I have been able to have: meeting two of my great friends and colleagues, Vicente Guallart and Manuel Gausa, both different and great at the time, from whom I've never stopped learning. Thus here goes my gratitude, respect and recognition to both of them.

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And this is thanks to my great friend Manuel that many years later, already with a backpack loaded with successes and failures, and with more doubts than certainties, with more cunning than energy, and with more time behind than ahead, I have a new possibility to be able to complete one of my youth's dreams. To do my Doctoral Thesis, and, moreover, to do it at the University of Genoa, the city where all my maternal family comes from. I want to thank the entire team of professors for their kindness and critical support throughout the development of this work, under the mentorship and direction of my great friend Manuel, I will be eternally grateful.

*I dedicate these last lines to my intimate family, my wife Maria and my daughter Sofía, for all their unconditional support, and in a very special way to my mother Lydia Zappettini Terzaghi, (1933-2021), to whom this Thesis is dedicated.*

Barcelona, October 2021.

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# INTRODUCTION

BEYOND RESILIENCE

HOW TO  
BECOME  
RESILIENT

RESILIENCE

STRENGTH

# INTRODUCTION.

The city is a word that lately has rediscovered all its expressive and semantic meaning of what distinguishes it from what it is not. It is nowadays assuming once again urban, suburban and metropolitan scenarios, center and peripheries, in a new leap in scale from the polis to the megalopolis. The city is again at the center of a debate that has ceased to be an exclusive property of urbanism, being now understood as multidisciplinary encounter of sciences.

We are witnessing a diverse and prolific debate in almost all the human sciences, that takes place precisely within the idea of the city once again becoming the primary focus of research in terms of economy, politics, ecology, technology, health and logistics. We are in a new scenography that territorializes different visions in one common condition: belonging to a city. We are in the age of urban sciences.

Regardless of its economic, social or cultural development, its advantages and shortcomings, its magnitudes and miseries, or its structural inertia to the changes by the distribution of opportunities, the city witnesses these historical facts in a Braudelian way. For the first time in its global history, in the first decade of this twenty-first century there are more people living in urban environments than outside them, which has quickly made us become a global village of citizens in a massive way. This evolutionary leap of humanity, is the great challenge we face as a society that coincides with one of the technological revolutions that is transforming our society rapidly and having a huge impact on it.

From the beginning the focus of this research has been concentrated on current resilience strategies, which appeared in the sixties, but since the start of this century have received an indisputable global relevance.

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We will not deal with the concept of resilience itself here. We understand it from various points of view and references but involve a certain standardised, normalized, and almost a common use. We have learned to distinguish resilience and resistance, and from an opinion article or a speech by any political manager of a city till a family conversation we've got used to introducing it in our common language.

Resilience, however, which is a useful concept to understand and act in a complex, global world with signs of imbalances in the urban models that came from the past, has become today, despite its undeniable progressive vocation, a wildcard easy to use, almost an automatic response and in many cases that we will analyze in this thesis, an excessive load of confidence in the concept ends up making it the best excuse not to act.

Resilience is being cited as never before in politically correct discourses about its ability to face future threats but also its versatility in the face of real impacts in many indicators of our cities, making it a commonplace. The increasing impossibility of encrypting it, of limiting it and containing it, of approaching it from more reliable scientific principles, leads us to a conceptual drift that this thesis echoes, specifically relevant in some first-order items of our urban ecosystem.

Far from understanding and preparing for a system change, as propose many documents and very serious studies on the impacts of a particularly predatory way of the collective use of resources, consumption, and habits of a global society that will arrive in this century to 10 billion people, the resilient thinking is presented on many occasions as a survival table that facilitates the permanence of the established model, promoting small strategic modifications to a trust in a system that is increasingly compromised.

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In the first two decades of this century, the structural nature of the urban condition reveals itself unapproachable from a solely resilient vision: adapting an anachronistic model simply perpetuates its obsolescence, and despite generating temporary improvements, it does not offer us in its reformist vision a real solution to the problems that we will have to face.

Thomas Khun was one of the philosophers who best defined the concept of a paradigm, which we can etymologically define as an example, a model or pattern, and to which he gave its contemporary meaning when he adopted it to refer to the set of practices and knowledge that define a scientific discipline at any particular period of time. Kuhn defined a paradigm as "normal science" means research firmly based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice.

Achievements that share these two characteristics I shall henceforth refer to as 'paradigms', a term that relates closely to 'normal science'. In *The Structure of Scientific Revolutions* Kuhn wrote that "...the successive transition from one paradigm to another via revolution is the usual developmental pattern of mature science".

From this definition, which is the methodological basis of this thesis, Kuhn develops the theory of paradigmatic changes - paradigm shift - that occur within a model when the anomalies acquire recurrent frequency and acceleration, which ends up collapsing the entire model. It is in this sense that we will apply the concept of Kuhn's paradigm shifts to a series of indicators or phenomena that we understand to be the most relevant for the study of contemporary cities, especially those in which it is more evident due to their proximity to a collapse scenario and where the very concept of urban resilience is clearly overwhelmed.

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BEYOND RESILIENCE IS A THESIS IN THE FORM OF AN OPEN ESSAY THAT WILL ADDRESS THE LIMITS OF URBAN RESILIENCE CONCEPT NOT ONLY FROM ITS CURRENT SEMANTIC PERVERSION, BUT ALSO FROM A NEW PERSPECTIVE: THE RESILIENCE ITSELF AS A PROCESS OR AS A SYSTEM, ACCORDING TO KUHN'S APPROACH, AND ITS POSSIBLE PARADIGM SHIFT FROM POSITIVE RESILIENCE TO NEGATIVE RESILIENCE, TILL A HYPOTHETICAL COLLAPSE SCENARIO.



# CHAPTER 1

COLLAPSE  
*AGAINST*  
PROGRAMMED  
OBSOLESCENCE

*THE*  
*PININFARINA*  
*TRICK*

# CHAPTER 1.

## THE PININFARINA TRICK

The concept of urban collapse has been very much in the limelight during the last decades. The exponential growth of the cities has fostered the presence of “extreme” scenarios, abnormal situations that have become recurring. These anomalies disrupt the proper functioning of different urban dimensions such as public mobility, infrastructure, waste management or housing stock, to mention a few examples.

Yet the urban collapse that we are referring to is not only a disruption because of the exhaustion of expansive or predatory metropolitan dynamic associated with an economic system that uses the city as a means and not as an objective, but it also occurs as an unexpected event, as an undesirable circumstance that nearly always happens outside the predicted design and without any forecast that it would happen.

In recent centuries, the frequency of urban collapses has increased. In periods such as the Ancient time or Middle Ages the production of urban infrastructures for mobility and services needed several decades or even centuries to become obsolete. Today it is usual to find infrastructures that are born almost obsolete, not only because of the time elapsed between when they are initially designed and they are constructed, but also because of that the premises have changed fast enough to make the project useless or irrelevant.

Therefore, it seems necessary to rethink the notion of collapse, and above all the rather negative approach we apply to it, we must treat it as a surprise of the model.

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One of the great challenges of contemporary urbanism is to interpret the urban collapse not as a spontaneous unexpected element that is external to the project, but as an element of it, which it represents an event that is susceptible to be introduced and valued within the planning process itself. By using the programmed mode of this collapse, the decision perhaps would drastically change our usual methodology to design cities with new questions. In this sense, this book aims to approach concepts such as obsolescence, typical of other disciplines, and despite the negative sense that this expression has in the most progressive circles, its application in an urban project context can be extremely beneficial.

### **Scenarios of collapse**

Several management areas which are fundamental to the correct global functioning of the metropolis operate in coexistence: mobility, water, waste, infrastructure, green spaces, pollution.

Each one of these issues represents a different functional dimension, but, in turn, is connected to the rest of needs. This means that they are not completely independent worlds, and that therefore the collapse of one of them reverberates through the others in a metabolic way.

Although some of these dimensions are relatively recent, such as the use of sewers or the problem of pollution, the urban collapse is not a new phenomenon, but on the contrary it has accompanied the urban development of the vast majority of cities throughout their history. In this sense, traditionally the main catalyst for collapses has been the demographic growth, which together with technological development has caused many of the urban transformations of our cities.

One of the clearest examples of this is the medieval walls: great perimeter walls of the ancient medieval cities built between the twelfth and fourteenth centuries, as in the case of Barcelona, collapsed before demographic growth that was not able to be contained.

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The first response was to extend the radius of the walls by erecting another wall a few meters ahead. Although the demographic growth within the walls led the urban centers to the collapse and forced them to expand their walls, the technological development ended up deleting making the walls obsolete as an element itself, fostering their permanent demolition during the nineteenth century.

Nowadays this intimate relationship between urban collapse, technology and population growth acquires a very peculiar reading. Indeed, if something does characterize the contemporary urban dynamics it is its high dependence on unprecedented demographic growth and on unstoppable technological acceleration.

There have never been as many citizens as today, and the cities have never grown at the speed with which they are growing now. In this sense, if urban growth has historically been one of the main causes of urban collapse, it is logical that in parallel with the accelerated demographic increase, urban collapses have increased their intensity and frequency by reaching the point of becoming a standard and not an exception; going from the phenomena treated as extraordinary to the ones treated as ordinary.

One of the clearest examples of this phenomenon is the city of Sao Paulo and its recent management of the park of mobility infrastructures. At the beginning of the 21st century, around 30 billion euros were allocated for the expansion, modernization and interconnection of trains and metros.

The first stage, scheduled for 2025, should complete a basic underground network of a total of 163 km of tracks. However, it is expected that in less than 15 years there will be a new generation of inhabitants that will be much more numerous than the present one, and that it will largely exceed the capacity planned for the new track system.

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Although it seems irrational to start working for a structure that clearly will be born obsolete, it is at the same time difficult to avoid, since the need to expand public transport is urgent when faced with the absence of space for new avenues or highways. The infrastructures as designed today are not capable to absorb the needs of a faster population growth than ever before. About 30 years ago Sao Paulo had almost one million vehicles that circulated for about 14,000 km of paved roads in the city. Today, this has increased to 16,000 km but the vehicle fleet has increased sevenfold. The result is the traffic congestion of more than 280 km, something that makes all the new extensions obsolete because it is a problem of a structural nature and not merely accidental one.

### **Programmed obsolescence**

Despite the fact that in the field of architecture and urbanism the notion of collapse and obsolescence has traditionally been understood as a technical problem to avoid, it was the main purpose of planning that from other fields has been approached in a completely different way.

Probably the clearest example of obsolescence and paradigm shift can be found in the field of technology, and in particular it can be found in the example of public lighting. In the early 20th century the prototype of incandescent bulb created by Thomas Edison had a huge success and several companies got the orders for its fabrication.

Before Edison's invention the technology that illuminated the city was gas, with thousands of kilometers of extended tubes which would cease being useful overnight. It is interesting to observe how, when a status quo is threatened with the loss of control, the resilience appears as a retardant of any change: the gas industry has never had more improvements and inventions than during its last years of life.

There are many emblematic examples of these paradigmatic changes, such as the one of Nylon, the I-pod or the one of ink cartridges, although none of them is as representative as the one regarding the car industry.

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General Motors perceived that and changed its strategy: every year they were offering small aesthetic adjustments to its models, something that allowed the customers to change their cars much more often. This was the industrial evolution. What occurred was an episode of industrial revolution, the paradigm shift happened when, for the first time Sergio Pininfarina, the Italian car engineer and manufacturer, proposed his concept of programmed obsolescence, separating at different periods of fabrication, use and consumption three different parts of a car: the chassis, the engine and the body, that in that order had different calendars of design and expiration. He adjusted the model to a basically economic paradigm shift: the financing ends the object's period of life by opening a new business chain, from the used cars to the repair and the spare parts supply. Traditionally the programmed obsolescence has been understood in a negative way. The reason for that is the obsession existing in the capitalist economy to increase the consumption in a continuous progression, something that contributes to the exponential growth of the residues, the energy cost of mobility or the significant increase in global warming, notwithstanding the help to keep levels of work stable and to hold high dimension of research to be able to update the products very frequently.

The programmed obsolescence contains a radical contradiction with this system: in theory, the manufacturer should offer the best possible product and it is extremely counterintuitive to think that this happens due to it reducing its service life. Indeed, something that characterizes the programmed obsolescence is it's the willingness to turn the collapse into a more vital condition, and not only into a "spontaneous ending of its functionalities" at the resilience department's expense. In this sense, the collapse loses its common attributes of negativity and uncontrollability and becomes a planned, necessary and strategic subject introducing the paradigmatic thinking into the planning.

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## **The urban collapse**

In a context in which the high demographic and technological acceleration increases the frequency of occurrence of anomalies in urban environments, it is essential to start approaching the idea of the collapse as a part of a medium and long term metropolitan strategy, establishing a methodology that incorporates the concept of “the programmed urban collapse”.

Although the desire is to include a products shelf life in the design through programmed obsolescence, they differ substantially in their goals: far from being an option to increase the consumption of products, its determination is to anticipate the collapse and to enable the transition from one system to another, without overlooking small improvements.

Nowadays the strategy is the opposite, and it is based on the reuse of obsolete old infrastructures, through small interventions, from the new use of the High Line in New York, or the Miocao in Sao Paulo, or the 7th Avenue in Bogota, where every Sunday these are turned into a huge cycle path and pedestrian street. However, to what extent is this new urban planning and effective resistance?

The strategy proposed in this book is to understand if we are facing a paradigm shift, with the consequences we observe and with the objective of providing us with new tools to face them. In the age of mega-cities where it seems increasingly difficult to avoid collapse with resilience actions, the urban strategies must incorporate in the equation an expiration date that allows to plan and manage the limit points.

This must be assumed as a common element in the metropolitan contexts meaning it is crucial to have a great forecasting ability to understand where the urban dynamics of the present are headed. This is probably one of the great challenges of the contemporary urbanism: to program a collapse means, above all, to build a strategy, to develop a (pre) vision of those finite futures.

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An exercise that undoubtedly requires some great speculative and imaginative capacities, but at the same time a great effort to classify, is to organize and to compare the enormous amount of data and indicators available to us in the age characterized by the great speed with which social, cultural and technological changes occur. Our present has now become hyper-expanded where the past and the future collapse in a usual and not episodic way.

In this sense, the traditional areas of urban collapse, such as mobility, are witnessing a genuine revolution. The arrival of driverless cars seems to raise a series of logistical issues that would lead to the limit point of stress of the present infrastructures. It would not be enough to adapt the existing ones but it would be necessary to understand that the proposed change is a structural one where such long-held in our urban imagination concepts as traffic light, zebra crossing or sidewalk should be rethought.

Something similar could happen with drone-based mobility that Amazon is starting to implement, drawing an urban scenario in which the amount of space allocated to logistics would be drastically reduced. The arrival of Uber implies another revolution where traditional mechanical mobility turns into a hyper-connected mobility in which the car ceases to be a personal property and becomes a common public service that, leaving aside the direct consequences for the labor market, does have an important impact on our daily habits.

In the same sense, the rise of productive cities and especially the concept of km 0 implies a reduction in the number of km of necessary journey and means logistical reduction of the great scale.

Finally, the combination of all these technological changes with the rapid growth of the population of the 21st century is the constitution of a completely new urban scenario, a challenge to which we must start giving the right answers.

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MINHOCAO, SAO PAULO, BRAZIL

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# CHAPTER 2

INFRASTRUCTURES  
*AGAINST*  
CLIMATIC CHANGE

*A MISSTEP:  
LONG-TERM  
RESILIENCE*

# CHAPTER 2.

# A MISSTEP: LONG-TERM RESILIENCE

For some decades now, environmental concerns have been one of the main focuses of attention in our societies. In contrast to the modern myth whose idea of unlimited progress was developed from its particular optimism, the second half of the twentieth century contributed to restrain these expectations. Although this modern narration was already definitively jeopardized after World War II with the recognition of science as one of its causes, the acknowledgment of nature's vulnerability in the 60s and 70s was constituted as an added limit to the modern progress.

In the face of this situation and within a series of entities emerged during those years the presence of a statement that warned about the natural damages caused by the modern humanism. At the same time a series of measures with a palliative vocation that had their roots in the Malthusian thinking were proposed: the resources of the planet growth according to the arithmetic logic that is not enough to respond to a population growth of a geometric type.

The disadvantages of this mismatch go beyond the problems of lack of resources to raise other types of concerns. In this sense, climate change arises as one of the main contemporary difficulties that needs to be urgently approached from all disciplines.

Traditionally, urbanism has again focused this problem through the notion of resilience. However, it's becoming more and more difficult to take a position based on the concepts of adaptability and flexibility.

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In fact, nowadays the promotion of urbanism focused on relieving climate change through exalting nature's resilience is insufficient, and one of the most powerful changes has been the global consciousness that the Earth will go on without us despite our actions, but we won't. This change of approach caused a switch of social perception, of the ecological importance of our actions, which we can easily identify as a historical milestone in the creation of the ecological footprint concept born at the beginning of this century.

Therefore, it seems urgent to assume that climate change is a reality that has already become a parameter of collapse, and that while action must be taken to channel it, this should not overshadow one of the greatest challenges that the urban sciences of the 21st century faces: how to design cities capable of assuming the consequences of climate change as an immediate factual circumstance.

### **The ecological debate**

Climate change is already a reality. The distribution of the meteorological patterns of the last decades have experienced some important variations. Although these have historically depended on non-human factors such as solar variations, meteorites, atmospheric composition or ocean currents, it is estimated that from the 17th century onwards with the first Industrial Revolution, humankind has become a geologically determining factor, giving rise to what some analysts call Anthropocene.

The role of humans as of a climate agent began almost 10,000 years ago with the Agricultural Revolution situated in the Fertile Crescent and nourished by the rivers Tigris and Euphrates. Throughout this process the deforestation was systematic with the aim to transform the forests into agricultural and croplands, and that was the first way to massively modify the territory: the continuous conversion of forests into fields and irrigation. In this sense, the landscape of some areas was radically altered to convert them into humanized agricultural, farmer and forest landscapes.

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Therefore, there was a loss of biological diversity and simplification of trophic chains which paradoxically increased the genetic variability of the seeds, caused by a long artificial selection of species. In any case, the Industrial Revolution was the starting point for the massive production of greenhouse gas emissions. The discovery and generalization of coal as an energy source, and later oil as a natural resource, significantly multiplied the anthropological influence on the climate through the CO<sub>2</sub> and methane gas emissions of industrialization. The warming recorded by the planet in the last centuries is scientifically clear. It is also true that it will persist in the coming decades in an even more pronounced way, and human beings are directly responsible for it. In this sense, climate change seems to be unstoppable, and it is expected that in the rest of the century the temperatures will increase between 1.8 and 4 degrees depending on the measures taken to combat it.

The evidence of this phenomenon has been measured by thousands of scientists in recent decades: the temperature increases in the air and in the ocean, ice and snow are melting, the sea level rise is recorded among many other varied indicators. There are plenty of effects on the planet such as impoverishment of biodiversity, abundant rains and droughts, loss of ice in polar caps, desertification, increased intensity of tropical cyclones, cyclical flooding, and many others.

### **Urban Impact.**

In this century, climate changes have a special incidence on the cities and at the same time cities have a big impact on the climate change: they occupy only 1% of the Earth's surface but they consume 78% of its energy resources, producing 60% of all CO<sub>2</sub> released into the atmosphere, especially by the combustion of coal, oil and gasoline. This represents another differentiating and paradigmatic issue. If everything goes as foreseen, by the year 2100 the temperature of urban areas is expected to rise between 7 and 8 degrees Celsius.

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This means that by 2050 we will have a progressively more urban planet (70% of the world population will be living in cities) where the warming of the urban heat islands is going to spread, increasing its intensity and scale of affectation so it can be expected that it would represent a significant contribution to global warming.

Cities will inevitably suffer the so-called phenomenon of heat island. If we compare the natural environment that covers the same urban areas, cities such as Chicago, London or Sao Paulo have a larger area and the facades of buildings also have to be taken into consideration, especially the ones of the highest buildings since these facades reflect the most part of the solar radiation they receive towards the ground, generating what is known as canyon effect: high buildings and the ones that are very close to each other generate vertical air corridors between which the solar radiation is trapped.

Moreover, we must consider the heat sources made by human activities: buses, cars, industries, air conditioners, etc. In some locations the energy emitted to the atmosphere by human activities is almost 4 times the amount than the solar radiation produces. Thus, cities are highly vulnerable to climate change, especially because of the high population density and the need for services. In addition, there is another problem: the greater frequency and intensity of periods of heat multiplied by the phenomenon of heat island, will inevitably affect the air quality. This implies some important consequences for our health, especially for children, seniors and people suffering from respiratory or cardiac problems.

### **Infrastructures and ecological shift.**

Given this scenario, infrastructures play a decisive role. In the vast majority of its variants - energy, hydraulics, telecommunications and transport - the following paradox appears: on the one hand, it seems necessary that these are increasing in order to respond to the growing needs of the urban population, but on the other hand and in the long term, increasing its dimensions implies increasing the magnitude of the impact in every sense, from the congestion or levels of pollution, which in turn contributes to the climate change acceleration.

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In this sense, probably the best solution to the rising sea level is to not simply build a wall around the cities at risk to avoid water entry, but to combine this solution with the others that allow a controlled entry. Rather than concentrating the answers on hard solutions, it seems logical to think for example that the new urban edges should be rather soft, acting as an urban sponge. This would be a territorial element, capable of absorbing water in order to filter, purify, retain or distribute it as needed. Such an infrastructure would incorporate an associated socio-cultural program and should be able to contain and feed particular fauna and flora that increase local biodiversity.

These infrastructures would be soft, comprehensive and on a territorial scale, and should not reduce their activity to mere mechanical protection from water, but to make a reasonable use of it, taking advantage of its social, cultural and natural potential.

The 21st century urban planning can no longer concentrate its efforts on “adapting” the usual infrastructures to the new uses and levels of pollution. On the contrary, it’s fundamental to assume the reality and imminent threat of climate change consequences, and urgently understand that the magnitude of the problem requires a completely different approach.

The most common conclusion for this kind of reflections is that we must find different solutions to plan infrastructures in such a way that their use and development are less and less determinant in the ecological impact.

In this way, the strategies adopted today are based again on the idea of resilience, confidence in the capacity of ecosystems and communities to absorb disturbances without altering its structure in a decisive way, maintaining in this way the possibility of returning to its original state once the disturbance is over. The continuous attention given to reducing pollution to relieve climate change means not having understood the magnitude of the problem.

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Of course pollution must be reduced, and all the efforts in this direction are absolutely necessary. Nevertheless, it's not realistic thinking that we should do it because we are still in time to slow down and reverse climate change. This is a reality and we must keep on working to relieve it as much as possible, we have to be prepared to assume its immediate consequences and include them in the equation. Among them the one that is the most evident and alarming is probably the sea level rise.

During the centuries human beings have not only chosen the proximity to the sea coast as the best place to survive, but also built ground on the sea: the Netherlands, Venice or Saint Petersburg are great examples of this. However, the global warming effect is increasing the sea level of almost half a centimeter per year over the last three decades, which means, more than 10 centimeters since 1990.

This is basically happened due to three factors: the melting of glaciers and polar caps, the ice loss in Greenland and West Antarctica, and the phenomenon of thermal expansion: the oceans, when heated, take up more space.

As in everything related to the climate change, any forecast we can make has a high degree of uncertainty, as this depends on what we decide to do with the planet in the coming years.

However, most of the predictions give similar results: global warming will continue and will probably accelerate. Consequently, and although it is difficult to predict how fast it would be, the level of the oceans will continue to rise.

Some recent studies estimate that a rise of 4 degrees Celsius in the global temperature would mean an increase of almost 9 meters in the sea level. Despite the rise not being uniform, it depends on a multitude of geographic patterns.

In general, by the end of the 21st century, the seas are expected to increase from 0.4 to 1.2 meters depending on human activity. That means that between 147 million and 216 million people in the world could be at risk due to regular flooding by the year 2100.

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In Bangladesh for example, 15 million people would be at risk of being displaced if the sea levels rise by one meter. And more than 10% of the country would be drowned, and even some remote island countries could also disappear, such as Kiribati, the Maldives and the Marshall Islands. Cities like Miami, New York or Houston would be at risk. The conclusion is that in the near future we will have a larger population inhabiting a smaller area. Climate change also increases the intensity of typhoons, turning these into the other major dangers for urban settlements. As a result, it is speculated that by 2060 more than 1 billion people will be forced to leave their homes because of the rising sea levels or the strength of devastating storms.

This phenomenon has given rise to a status of an environmental refugee, a name that refers to the population that is forced to migrate or to be evacuated from their usual region because of the long-term or the short-term climate change in their local habitat. Actually, the population of Lataw on the Torres Islands in Vanuatu became the first climate refugees in 2004 when its 70 inhabitants had to move their villages several hundred meters from the coastline.

Given this global scenario, it seems necessary to implement a two-speed strategy: On the one hand, it is necessary to reduce CO<sub>2</sub> and methane gases emissions to relieve the climate change in the long term, but on the other hand, we must think hastily about what type of infrastructures we would need in order to assume its most immediate consequences. The cases such as those already mentioned suggest the necessity to be especially protected from the rising water levels, the urban heat and the increasingly active presence of typhoons.

Which kind of infrastructures do we need for this? Is it enough to adapt the infrastructures that we have today? Probably the answer is that it is necessary to work with a new type of infrastructure that is capable not only of responding to this new type of climatic needs, but also to take advantage of them. In this sense, probably the best solution to the rising sea level is to not simply build a wall around the cities at risk to avoid water entry, but to combine this solution with the others that allow a controlled entry.

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Rather than concentrating the answers on hard solutions, it seems logical to think for example that the new urban edges should be rather soft, acting as an urban sponge. This would be a territorial element, capable of absorbing water in order to filter, purify, retain or distribute it as needed. Such an infrastructure would incorporate an associated socio-cultural program and should be able to contain and feed particular fauna and flora that increase local biodiversity.

These infrastructures would be soft, comprehensive and on a territorial scale, and should not reduce their activity to mere mechanical protection from water, but to make a reasonable use of it, taking advantage of its social, cultural and natural potential.

The 21st century urban planning can no longer concentrate its efforts on “adapting” the usual infrastructures to the new uses and levels of pollution.

On the contrary, it’s fundamental to assume the reality and imminent threat of climate change consequences, and urgently understand that the magnitude of the problem requires a completely different approach.



