Introduction: farewell to the Holocene city

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END OF THE HOLOCENE CITY

By far, the largest span of human history was lived by our ancestors as nomadic hunter-gatherers (Bettinger et al., 2015; Barnard, 2020), involving quite distinctive terms of relationship with Earth (Ingold, 1996). While *Homo Sapiens* appeared around 300,000 years ago, two major precursors to urban human civilization – sedentary agriculture and permanent human settlements – consolidated only 10,000 to 12,000 years ago. This corresponds with the emergence of the Holocene approximately 11,650 calendar years before the present (Walker et al., 2009), the geological epoch that is arguably now ending to give way to the Anthropocene (Zalasiewicz et al., 2019).

Marking the end of the last glacial period, the Holocene was characterized by fairly stable and particularly benign conditions for human life. It corresponds with the fast growth of our species worldwide and it witnessed most of written history, the rise and fall of civilizations and the transition to modern urban living. The city, in all its diverse shapes and cultures, is the epitome of modern human presence on Earth. Urban settlements have been the nesting shapes of human life in the singularly benevolent Holocene. Until now.

The Holocene also witnessed an unprecedented impact of human action on the Biosphere leading to the current anthropogenic existential threats to ecosystems. The proposed new epoch of the Anthropocene, as explained below, is marked by an environmental disruption of geological scale. The very dominance and expansion of the human species is now endangering its own survival. The uniquely benign conditions of the Holocene are giving way to more challenging conditions for the viability of human life. It is paradise lost.

As we leave the Holocene and come to terms with the realities of the Anthropocene, we are bound to experience unprecedented challenges to our prospects of continuing to inhabit this planet. The city, as the embodiment of our accommodation into the Earth System and the resulting urban culture, has been made possible only by its unique environmental conditions. As unique in geological history as they are fragile: around two-thirds of the Earth's history (first 10 bn. years) there was no life and once it appeared (4 bn. years

ago), microorganisms were and continue to be the most abundant lifeforms. After more complex organisms evolved, conditions for life have continued to change. Over the last 540 million years five major “Extinction Events” (sharp decrease in biodiversity of multicellular organisms) are documented, and we are arguably into the sixth one (Novacek & Cleland, 2001). Rather than a continuous and smooth evolution process, the history of life on Earth has been catastrophic and eventful. As human life support systems in the Biosphere enter a “state shift” (Barnosky et al., 2012), the whole foundations of urban living are bound to be shaken and disturbed.

For instance, the promise of endless supply resulting from indefinite growth cannot possibly be sustained. Continued access to regular basic inputs, such as food, water and energy cannot be taken for granted. The current COVID-19 pandemic, having caused such a severe social and economic global disruption, pales in comparison with the scale of the challenges ahead. Cities are extremely fragile complexes, card castles comprising diverse subsystems each subject to its own hazards. When several of these get disrupted at once, the whole city life crumbles.

In order to responsibly face the environmental conditions of the Anthropocene as these unfold, we must closely examine the axiological and conceptual foundations of our cities and question their environmental economic, cultural and political underpinnings. This requires a deep questioning not just of modern urban living, but of the whole way of inhabiting Earth. No urban mitigation, adaptation or reform will suffice unless such deeper scrutiny takes place. No fashionable urban development framework, be it the smart, sustainable or resilient city, is up to the task unless the whole Holocene City paradigm is scrutinized. This means letting go of the very way of life that brought us here. This means farewell to the Holocene City.

CITY PREPAREDNESS FOR THE CLIMATE CRISIS

What is then meant by “City Preparedness for the Climate Crisis”? Why is this topic relevant? Basically, the label refers to the historical concurrence of a compound of Planetary Boundaries being severely disrupted by human action (Rockström et al., 2009; Castree, 2017) and the extreme fragility of urban settlements developed under now untenable assumptions. On the one hand, the stable conditions of the Biosphere that allowed human civilizations to flourish are now experiencing a “state shift” due to anthropogenic impacts (Barnosky et al., 2012). On the other hand, urbanization has evolved taking for granted a stable integration between city life and its environment. How the existence of cities is challenged by the fast-escalating climate crisis and how cities can best react to cope with these imminent prospects is the main concern of this book. It raises the question to what extent urban life as we know it

might continue to be viable. Looking into several aspects of the Anthropocene existential threat might shed some light on possible futures, if any, to human cosmopolitan existence.

The term Anthropocene was introduced to describe the proposed geological epoch following the Holocene (Crutzen & Stoermer, 2000). It is characterized by an overwhelming mark of human activity on Earth so as to leave a geo-stratigraphical record (Zalasiewicz et al., 2010; Zalasiewicz et al., 2019). While there is ongoing debate regarding the starting date of the Anthropocene, a favoured milestone is the “Great Acceleration”: the surge of human impact on Earth since the mid-20th century (Steffen, Broadgate et al., 2015; McNeill & Engelke, 2016). Given the enormous significance of these facts and the observed and potential consequences for the Biosphere, the term has also been adopted to comprise its wider social, economic and cultural implications (Castree, 2017; Cohen & Colebrook, 2017; Malabou, 2017; Clark & Szerszynski, 2020), including transformative movements from within specific disciplines such as Architecture (Turpin, 2013), Sociology (Dietz et al., 2020), Economics (Rees, 2020) and Political Science (Hickman et al., 2018; Wainwright & Mann, 2018). This book adopts the wider use of the term insofar it conveys an essentially transdisciplinary “Anthropocenic turn” in contemporary culture (Oldfield et al., 2014; Hamilton et al., 2015; Carrillo, 2019; Dürbeck & Hüpkes, 2020; Krogh, 2020).

Anthropogenic environmental impacts are heading to disrupt our way of life in deeper ways and at a wider scale than anything previously experienced by mankind. The public imaginary and the media often reduce the Anthropocene challenges to either Climate Change or Global Warming. Within this narrative, even when there is an acceptance that these are caused by human action, the tone is of some climate discomfort and weather hazards that can be dealt with by greater resilience, improved infrastructure and advanced technology. These terms have been so diluted and politicized that they are being replaced by the more compelling “Climate Crisis” or “Climate Emergency” and “Global Heating” (Carrington, 2019; Ripple et al., 2019).

Actually, the Climate Emergency is only one of nine anthropogenic vectors of Earth System disruption, each having the potential to severely compromise the human habitability of our planet. These are: (i) Climate Change, (ii) Novel Entities (anthropogenic objects, materials and bio-actants), (iii) Stratospheric Ozone, (iv) Atmospheric Aerosol Loading (anthropogenic particles in the Atmosphere), (v) Ocean Acidification, (vi) Biogeochemical Flows (Nitrogen and Phosphorus cycles), (vii) Freshwater Use, (viii) Change in Land Use and (ix) Biodiversity Loss (Extinction rate). Each of these nine “Planetary Boundaries” is sustained by a delicate balance required to keep a “Safe Operating Space” for Humanity (Rockström et al., 2009). Hence, trespassing

each of these Planetary Boundaries conveys an Existential Risk to Humanity (Barnosky et al., 2012; Steffen, Richardson et al., 2015).

As this introduction is being written, a major anthropogenic landmark is being reached: what I call the Techno-Bio Inversion. For the first time in history, the added mass of human-created materials and objects exceeds the global biomass. According to a recent report (Elhacham et al., 2020), the current mass of all of the Earth's living creatures stands at about 1.1 trillion metric tons and has been systematically decreasing to nearly half the biomass existing at the dawn of human civilizations. Comparatively, the mass of the "Technosphere" or human-processed matter is currently estimated to weigh about the same as the biomass but is rapidly increasing at a rate of 30 billion tons a year. By the year 2040, it is expected to double to about 2.2 trillion tons. We are witnessing today the physical inversion between natural and artificial reality. But the Technosphere increase and the Biosphere decrease can only go so far as they are materially bounded and interdependent (Moore, 2016).

While Anthropogenic Global Existential Risks increasingly disrupt the conditions of the Biosphere that prevailed through the Holocene, the inner logic of the modern city remains oblivious. Our cities have developed in and for the Holocene. The Holocene has been from the dawn of civilization the space of possibilities for urban life. So long as this epoch is giving way to the Anthropocene, the whole idea of the globalized modern city needs to be urgently re-examined and re-designed not only in terms of structural functionality, but also in the very terms of human dwelling on Earth and the externalities of the built environment.

On the one hand, we need to deconstruct how the transition from nomadic hunter-gatherers and the emergence of agriculture and human settlements evolved from the Neolithic village to the megalopolis of today. Besides looking at the internal dynamics of urban growth (Smil, 2019) we need to also look at the historical interdependence between cities and their environments. Furthermore, we need to radically transform human settlements in ways that might still enable us to adapt to and mitigate anthropogenic impacts, and, above, all, to reinvent our Earth citizenship.

A NARROW WINDOW OF OPPORTUNITY

The window of opportunity for a viable transition from the Urban Holocene to the Urban Anthropocene is rather narrow and quickly closing down. Reference was made above to concepts such as Planetary Boundaries, Safe Operating Space, Anthropogenic Existential Risks and State Shift in the Earth's Biosphere. Other similar concepts such as Carrying Capacity (Ehrlich, 1982), Earth Overshoot (Wackernagel et al., 2002), Doomsday Clock (Mecklin, 2020) and Earth's Critical Zone (Xu & Liu, 2017), provide several

parameters to gauge the narrowing space of opportunity to redesign the bases of culture with regard to inhabiting a more-than-human world. Certainly, aggregate critical indicators have been identified, notably the increase in global average temperature above pre-industrial levels (the 2015 Paris Agreement set the goal to holding it “to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C”: Art. 2, 1.a) (Paris Agreement, 2015). Or the 350 parts-per-million (ppm) threshold of safe CO₂ concentration in the atmosphere (see “The Science” at www.350.org). Or “Climate Sensitivity” as a measure of the global temperature rise as a result of doubling pre-industrial CO₂ concentration in the atmosphere (Goodwin, 2018). Or the MCC “carbon budget” of CO₂ emissions to the atmosphere left before reaching the 1170 Gigatons required to keep the global temperature below 1.5°C (see “Remaining Carbon Budget” at www.mcc-berlin.net). These are all interrelated and all show the same worsening trend, leading at the current rate of deterioration towards a “Climate Breakdown” over the coming decades, with devastating consequences to any human futures (Jonas, 1976; Laybourn-Langton et al., 2019; Taylor, 2019).

The overwhelming evidence and scientific consensus on anthropogenic climate change do not provide, however, unequivocal guidelines for future response. In at least two regards we are aiming at a moving target. First, our reference constitutes a “shifting baseline”, since we have no “ground zero” for anthropogenic change (Pinnegar & Engelhard, 2008; Thomas, 2020). Second, the unfamiliar nature and sheer complexity of the Anthropocene (a “Hyperobject” in Timothy Morton’s term) means that we cannot aim at understanding and forecasting it on the basis of prior knowledge (Morton, 2013). Entering the Anthropocene means a discontinuity or regime change between the life-sustaining conditions of the Holocene and the yet unknown ones we are about to face. This compound situation provides an incentive to go beyond criteria such as the precautionary principle in ethics (Dupuy, 2015: 8) and opportunity cost discounting in policy making (Stern et al., 2006). New paradigms are required to deal with the sheer scale and potential derangement of urban Anthropocene futures (Farber, 2015). Unprecedented challenges demand unprecedented approaches. We are urged to venture into the imaginaries of post-urban development, post-carbon urban futures (Stone, 2012: 172–173; Luque-Ayala et al., 2018: Chapter 13; Hajer & Versteeg, 2019: 128; Arabindoo, 2020: 2311), well beyond the dominant paradigms of urban development.

All these urban paradigms are constrained by an incremental development perspective. Under that view, given enough effort and persistence, a desirable state shall eventually be reached. However, two things are becoming increasingly clear: that as much as the drivers for business as usual are bound to prevail as the cultural mindset of the industrial capitalist economy, the

Holocene economic culture is near its end (Moore, 2016; Snower, 2020). Perhaps the first and most common ground from major philosophers of the Anthropocene is that – by definition – this complex reality, despite being the product of human action, is upon us and cannot be undone, or controlled or in any significant way directed by humans. The key result is the de-centralization of human agency. Consequently, the traditional rationale for political economy and social planning became obsolete. Insofar as we confront unprecedented events, past urban paradigms are of limited value. Furthermore, potential tipping points, feedback loops and cascading effects (Klose et al., 2019; Lenton et al., 2019) may prevent a return to a familiar (Holocenic) state for hundreds, possibly thousands of years. We may have already abandoned the Earthly Paradise.

RE-IMAGINING HUMAN DWELLINGS

Contemporary urban governance is well behind the collaboratively creative thinking that it will take to cope with the huge challenges modern cities are bound to confront sooner rather than later. Cities contain a cumulative array of operative subsystems in an extremely vulnerable balance. Disruption in a subsystem may bring a sudden and devastating domino effect as recent experiences in major blackouts, floods, water shortages, earthquakes, and so on, testify. All these systems were subsequently piled up and reconfigured under the same expectations of continuous growth and endless supply. Attribution studies (National Academies, 2016; Zhai et al., 2018) increasingly exhibit the link between catastrophic climate events on urban centres and anthropogenic disruption of the Earth System. The Anthropocene will require cities to constantly adapt to extreme resource scarcity and disrupted services. Above all, the Anthropocene challenges the governability, state of law, community life and collective well-being that population density and urban scale brought along.

With almost every aspect of contemporary urban life bound to become dysfunctional – or to make evident how dysfunctional they were in the first place – human imagination will be tested to the limit: which way the city? City futures, if any, are neither smart, nor sustainable, nor resilient. All these paradigms bring improvements on the assumption of a *ceteris paribus* clause: everything else remains equal. Current urban environments are extremely volatile, extremely dangerous, extremely fragile and extremely unpredictable.

A number of warnings have already been issued on the lack of preparedness of our current industrial-capitalist society to cope with even the most foreseeable impacts of the climate crisis. The international project “Assessment of Impacts and Adaptations to Climate Change” stresses how vulnerability studies “...focus on the processes that shape the consequences of climate

variations and changes to identify the conditions that amplify or dampen vulnerability to adverse outcomes” (Leary et al., 2009: 4). The Urban Climate Change Research Network Report “The Future We Don’t Want: How Climate Change Could Impact the World’s Greatest Cities” warns on: “the unique risks that climate change poses to cities through a scientific global data analysis” (UCCRN, 2018). The Global Commission on Adaptation report (2019) clearly points out the challenge to cities and urban areas (Chapter 5):

Climate change is already bringing more damage, stresses, and suffering to the world’s cities ... Without a determined effort to adapt to these impacts, the economic toll and human pain in cities will inevitably climb – sometimes dramatically ... As a result, more and more people are in harm’s way all over the world, especially in rapidly growing, under resourced cities in developing countries that have limited capacity to adapt to climate change. (GCA, 2019: 39)

The very concept of urban preparedness is a contentious one. Whether or not cities can actually prepare for Anthropocene scenarios is a matter of debate. Incorporating that term into the title of this book intends to contribute to this debate rather than building an expectation on an actual state of preparedness. The intention is rather an open question: are cities prepared? Can they be? If so, what will it take?

Hence, if there is going to be an urban life in the Anthropocene, it has yet to be imagined. Not only the foundational questions of city planning will need to be reset. The primordial conditions of urban life will need to be defined afresh. What are the minimum viable conditions for human settlements at different size scales? How can the basic services provision be guaranteed for the whole population? What are the alternative models for city–region viable integration? What forms of governance and community life will be required to flexibly cope with the unpredictable impacts of state shift in the Biosphere? Can cities lead the building of the critical mass of international cooperation required to reach effective global engagement in mitigation and adaptation?

THE RESEARCH INTENTION

The monumental task of reinventing cities for the Anthropocene is only rivalled by the challenge of articulating the global human experience, so that the urgent supranational policies required to enact viable futures are agreed and enforced. Hence, the set of chapters constituting this book aim at shedding some light upon these questions. Rather than individual chapters providing separate answers, it is their collective transdisciplinarity that becomes meaningful. Even in their plurality and intersectionality, the set of contributions compounds a mosaic that might help articulate an urban reinvention for the Anthropocene.

The time is ripe for a publication like this book. As acknowledged above, there is a substantial set of precursors from different disciplines to various aspects of understanding urban climate mitigation and adaptation, as several of the contributions to this book will show. Yet, “City Preparedness for the Climate Crisis” as an analytic category on its own, has only partially been addressed in different platforms. Hence, this book constitutes the first volume wholly and directly concerned with issues related to the City coming to terms with Anthropocene.

The most relevant books preceding this approach towards the Urban Anthropocene include the first and second UCCRN (Urban Climate Change Research Network) Assessment Reports *Climate change and cities* (Rosenzweig et al., 2011, 2018); as well as Brian Stone’s *The city and the coming climate* (2012), excellent to understand Global Urban Heating. *Rethinking urban transitions*, edited by Andrés Luque-Ayala, Simon Marvin and Harriet Bulkeley (2018), transcends dominant urban development and sustainability frameworks to advance post-carbon perspectives. Convergent with this approach is Ashley Dawson’s *Extreme cities* (2017), where human settlements are set as the main scenario for the unfolding of the Climate Crisis. Douglas Kelbaugh’s *The urban fix* (2019) looks at aspects of design and policy making to deal with city thermal management, including the economic culture he explores in his contribution to this book. Along similar lines, *Cities and climate change* by Zaheer Allam, David Jones and Meelan Thondoo (2020) underscores the urgency to redesign urban policies under alternative economic perspectives, a topic further developed in Gavin Keeney, Owen O’Carroll and David Jones’ contribution to the present book (Chapter 25). Two of these plus another three books are jointly reviewed by Joel Cohen in an essay on “Cities and climate change” (Cohen, 2019). A particularly sensitive harbinger to this book’s intention is Ash Amin and Nigel Thrift’s *Seeing like a city* insofar it conveys the complex network of agents engaged in the Holocene city, thus providing clues as to how it must be reinvented for the Anthropocene (Amin & Thrift, 2017).

Amongst the most relevant journal literature serving as background to this book, two special issues stand out: *Urban Studies* 57(11), 2020 special issue ‘Why does everyone think cities can save the planet?’ (Angelo & Wachsmuth, 2020) and the 2020 *Review of World Planning Practice* Vol. 16 special issue on Post-Oil Urbanism, including a recollection of the influence of Knowledge-Based Development throughout the Middle East (Alraouf, 2020). With regard to individual papers, the assessment of climate planning capabilities from 885 cities in the EU is prominent (Reckien et al., 2018). The thorough study of Manchester adaptation capacities in the context of the EcoCities project (Carter et al., 2015) provides an excellent overview of urban adaptation issues. Other relevant papers on planning and adaptation include

Wamsler et al. (2013) and Giordano et al. (2020). Two doctoral dissertations deserve mention insofar as they have contributed to advance the field of urban climate planning and adaptation: Anja Wejs from Aalborg (Wejs, 2013) and Claudia Rivera from Lund (Rivera, 2016).

There is certainly a very extensive literature on city resilience, sustainability, and techno-capabilities. However, most of the abundant literature on urban planning, while considering to an extent environmental issues, do not challenge the terms of Earth habitation and therefore the dysfunctionality of modern urban design for the Anthropocene.

The “City Preparedness for the Climate Crisis” pursued by the World Capital Institute is founded on the following predicates and is subject to the evolution of the underlying scientific consensus:

- The climate crisis is real and has anthropogenic causes.
- The climate crisis poses an unprecedented challenge to cities to the extent the Holocene urban design is unprepared to cope with the Anthropocene.
- Cities need to urgently engage in a thorough exercise of mitigation, adaptation and civic engagement in order to redesign themselves for the Anthropocene.
- Cities are neither the problem nor the solution, but a transition to a human future will necessarily unfold on an urban arena.
- City coalitions can advance the international preparedness agenda for the Climate Crisis.

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