Nomadic lessons on adaptability and hybridity

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Document best viewed in two-page display or printed as A5 format.

Preface

At the end of most academic curriculums, students are usually prompted with an ultimate task in order to generate a seamless transition with the professional world. They are required to reflect on their still freshly learned knowledge, and to write a final document called Thesis, *Mémoire*, or Report.

At the Swiss Federal Institute of Technology in Lausanne, during the last year of Master in Architecture, this document is produced in the first half of the year to introduce the final Master Project of the second half, and is called *énoncé théorique* (theoretical statement). The guidelines of this specific exercise focus on the relevance of a theoretical position as well as on the transition with the project per se. Intriguingly, there are no instructions about interconnectedness with any previous learnings nor latter professional premises. Somehow, the *énoncé théorique* is bounded to this specific year, as a large exercise on a single topic. Fortuitously, students acquire the freedom of choosing their subject of interest, as well as the supervisors and the assistant.

While the thesis, regardless its academic context, is an important step of every student's education, it is however severely weakened by its compulsory nature. This systematic prerequisite for receiving a diploma is generating an erratic production of speculations every year. This obligation of result can be seen as a miniaturized phenomenon of the larger and more prominent race for publications in academic research, and literature in general. Publications have become a business and their number is now an indicator of scholarly prestige.

In reaction to these issues, the following document, while respecting the framework of the *énoncé théorique*, is presented in both a larger and a narrower perspective. Firstly, the various discussed subjects relate to learnings acquired during more than a decade, either from academic instructions, professional experiences or personal devotions. Secondly and more prominently, this document introduces a post-diploma future. This *énoncé théorique* is rather thought as a personal and self-addressed manual to synthetically convey personal principles, convictions and civil engagements. It crystallizes theoretical and practical paths as a clarification of a personal stance for an architect in the making.

Furthermore, these writing are equally addressed to a larger audience: academic supervisors which are entangled to it by nature but also friends and curious minds, whether by interest or courtesy. This inherently defines a field for experimental theories and critical debates, fostering assumptive contents. Hence, this *énoncé* is developed in English for ease of accessibility and is made openly accessible under a creative common license. Redistribution can be made without the author consent, with the condition of maintaining proper credits. Under this license, both adaptations and commercial uses are allowed. By doing so, this document aims to contribute in open research and engage discussions more easily, and with everyone.

This document is conceived like a journey, a route from an initial location to a target destination, engendering a mental transition, and following a general direction occasionally prone to bifurcations. The journey notably welcomes wandering and detours, while punctuated by inevitable points of interest, crossing various landscapes and regions, each having various characteristics.

The journey is purposely broad and holistic, following Yona Friedman aspirations,[1] in reaction of a society of specialization and categorization heavily criticized by Richard Buckminster Fuller.[2] As such, the arguments in this document are confronted to a wide combination of subjects, in an attempt to uncover their underlaying linkage. As part of a polytechnic institution, this manifesto aims at bridging disciplines to interrogate the paradigm of Architecture as the Art of all Arts, in light of contemporary conditions.

Rather than a Master or PhD thesis aiming to extend the potentialities of a specific domain or application, this *énoncé théorique* composes an invitation to broaden multiple perspectives, for personal sake but also within an academic environment already comprised of experts. Therefore, this humility intentionally attempts to bring people together rather than sustaining a world of categorization.

The narrative aims to provide a degree of abstraction from any context while conferring poetic imaginaries based on existing paradigms. Condensed in an intensive text letting readers envision their own impressions, the suggested connections are sometimes voluntarily soft in order to generate novel aggregations without imposing a personal authority.

The *énoncé théorique* doesn't require to be strictly innovative, although some parts will address original subjects. However, it is felt as a contribution to society and developed consequently.[3] Attention is given to overcome taboos and ridiculousness without

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1 "I am not a typical professional man but rather one interested simultaneously in many fields" Friedman and Orazi, *The Dilution of Architecture*. p.25, commemorating this grandiose individual who recently passed away.

2 Fuller, *Operating Manual for Spaceship Earth*.

3 "Look for what needs to be done", Snyder, *The World of Buckminster Fuller*.

purposely generating avant-garde statements. The themes of this document were rather chosen to challenge personal and perspicacious considerations of non-scientific matter, especially in the midst of scientific and engineering conditions and educations.

Conceived and written a year after the first case of coronavirus, these writings take into account new paradigms which, despite their supposed temporality, are establishing themselves as the foundations of a new world.

Abstract

Arguments deployed to both nomadism and construction, although developed one after the other, aim at generating shared theories on adaptability and hybridity. The common ground of every part of the document relies on the concept of adaptability to specific contexts permitted by adequately selected hybridizations. Nomadism is particularly apprehended in this document as a lifestyle encompassing a variety of social and technological paradigms, while the world of construction is diligently scrutinized and metaphorically informed by relevant learnings applicable to both topics. Rather than a mono-oriented ethnographic study of nomadism and its recent resurgence, or a purely theoretical and independent approach of construction, the hybridity of explorations aims to activate appropriate and crucial transdisciplinarities in response to the diversity and intensity of world crises.

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I. Adaptability to societal shifts

Counter cultures and alternative lifestyles

In the animal world, moving is surviving. Since early lifeforms of humans, primitive needs have led to nomadic behaviors in order to remain alive. In the changing environment of Earth surface, being nomad is being able to adapt thus to survive. Therefore, the first human civilizations undeniably existed as nomadic communities.

Throughout history, despite the development of sedentism, nomadism perpetuated through various forms and importance, and remained a relevant lifestyle, either by primitive necessity or by culture. Some practices of nomadism have recently emerged again, either provoked economic constraints, expatriation, or in search of freedom, projecting nomads at the forefront of alternative cultures in sedentary societies.

MOBILITY = FREEDOM

The worst punishment in a contemporary western society is being sentenced to jail. To this day, putting someone in prison implies to utterly annihilate one's mobilities in order to keep this being under control, therefore oppositely defining the notion of freedom as being mobile. Gilles Deleuze and Felix Guatarri notably depicted through their treatise on nomadology[4] how the establishment of the state-form provided control over civilizations, thus leading primitive men to fight to deliberately remain nomadic, in order to specifically refute the

[4] Deleuze and Guattari, "Treatise on Nomadology : The War Machine" in *A Thousand Plateaus*.

emergence of a control from a state-form. If the lack of freedom is represented by the control from establishment of a state and by the image of the prison which precise role is to restrict mobilities, freedom is therefore intrinsically linked to mobility.

COUNTERCULTURAL MOVEMENTS

In an ever more diverse contemporary citizenry, humans have been growingly in search of freedom notably through countercultures massively appearing during the 20th century. Many of these countercultures rejected sedentarism in quest for freedom, reflected by mobility as their predominant requirement, thus fostering nomadism as an appealing lifestyle. Throughout incrementally distinct political and societal contexts, many alternatives increasingly appertain to lifestyles based on mobility. Beyond the resurgence of ecovillages echoing the hippie movement from the 1960s, many alternative lifestyles relate to the appealing idealization of nomadic civilizations, traditionally spread through the hedonic appearance of the circus, or other marginalized groups having a sturdy image of enjoyment.[5]

Such communities rejecting traditional societies can be tightly associated with Bohemianism, which include but not restrain to adventurers, wanderers and vagabonds. The noticeable ambition to metaphorically blow free like the wind was notably reflected in the Wandervogel movement in Germany, and appealed to many as an aspiring lifestyle, despite its rejection of conventional societies.

More recently, there has been an emergence of new alternatives through unconventional habitats such as tiny houses,[6] trailers,

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[5] Centre de création industrielle, *Errants, Nomades, Voyageurs*.

[6] Heavener, *Tiny House*.

camping cars, mobile home, etc.[7] Additionally, some approached such novel alternative condition even more radically by living inside transportation vehicles[8] such as trucks, buses, vans (hence van life), sailing boats, or yachts for the richest. As a matter of fact, Stewart Brand, author of several reference books for architects,[9] actively lives on a tugboat,[10] while famous visionary Richard Buckminster Fuller considered himself as a world nomad, travelling around Earth by means of regular plane flights across the globe, having 3 watches on his wrist to keep track of different time zones. The societal emancipation experienced throughout the action of movement infamously relate to the notion of adventure, shared among travelers,[11] as journeys allowing each fellow to shape its own life. The further the most intense this self-learning becomes. As part of a global era, contemporary nomads such as voluntary expatriates took advantage of digital technologies to establish Earth as their territory, thus becoming global nomads, as part as a worldwide exchange of values. The contemporary nomads therefore represent an opulent metaphor of highly technologized societies.[12]

Nomadism, under its broader definition, is however applicable to any current social class: from the poorest homeless in the street to the richest billionaire on a yacht, from modest urbans seeking a calmer life in the countryside to the busy worker going from

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7 Minguet, *Mobile Homes*.

8 Stewart, *More Mobile*.

9 The world of architecture markedly retained the famous diagram called Shearing Layers of Change from Brand, *How Buildings Learn*, drawn by Donald Ryan, and used to explain the distinct lifetimes of the building layers in construction. Stewart Brand is also the author of *The Last Whole Earth Catalog*, and the more radical *Whole Earth Discipline*.

10 Brand, "Stewart Brand - Frequently Asked Questions."

11 Daguzé et al., "Modes de Vie et Mobilités Atypique."

12 Conversation with Julien Lafontaine Carboni, PhD candidate at ALICE, EPFL

hotel to hotel, from the young and ephemeral "vanlifers" to the eternal Roma people. However, such lifestyles denote utterly distinctives lifespans and consequently induce a high variability in the experience and its significance over a lifetime. While communities experiencing permanent itinerancy are principally entangled to nomadism by culture, wealthier populations adopted such adaptability as a temporal experiment widening the definition of travel. The latter are notably growing exponentially in correlation with the booming of social media leading an intensive realm of glorified images.

CONSTRAINED OR CULTURAL

But nomadism did not always come in search of freedom nor alternative experimentations but occasionally as an imposed condition, either by economic constraints, politic denial, primitive necessity or cultural mores. From Noah forced to exile on an ark to save all species, to the widely spread diaspora, passing through the crisis of 1929 dumping many lives on the road, or even wandering homelessness in the streets of urban areas; constrained mobility conferred an equally pejorative image of nomadism. The filthy connotation of approximately 10 million European Roma people,[13] atop more tangible manifestations such as antiziganist protests, reveal the underlaying tension between nomadic and sedentary civilizations. The city therefore composes the playground of this opposition, where the two meet and cohabit in the same location. The reciprocal fear from the unknown is notably reflected in this conflict by the disquietude towards scavenger disturbances and became the source of numerous concerns[14] from sedentary people addressed to marginality.

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13 Council of Europe, "European Roma and Travellers Forum (ERTF)."

14 Centre de création industrielle, *Errants, Nomades, Voyageurs*.

Although mobile homes, camping cars, trailers, vans, tents, tiny houses, sailing boats, houseboats, containers, etc. are more and more frequently part of suburban landscapes, they remain relatively stealth, as if the society did not approve their existence. Whether by choice or by constraints, this furtive population have a tendency to remain hidden in order to avoid complications. This paradoxically generated territories of exclusion of their inhabitants. As a consequence, modern nomadism appears as a phenomenon simultaneously threatening and seducing sedentary civilizations.

In light of this prominent hostility, a part of sedentary citizens firmly rejects mobile habitats, especially containers as symbol of globalization and standardization.[15] They notably represent the economic forces which led to imagine apartment inside shipping containers, with the prominent idea of being freely moved around the world, cargo ships therefore becoming potential territories for novel cities. More than utopian visions of domesticity or flexibility, containers inherently became highly influential for nomads by delivering a powerful image of alternatives in an attempt escape furtivity.[16] Because of their lack of foundations, containers, as well as other mobile habitat, are legally considered as camping in most countries, and expose possible legislative constraints such the annihilation of voting rights.[17] What differs from sedentary civilizations is therefore the relation to the ground, engendering severe inequalities, notably for economic, administrative and professional activities. As the world becomes more international, novel legislations and procedures are gradually being implemented

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15 Le Marchand, "Les cités en conteneurs." p.180

16 Ibid., p.191

17 Ibid., p.184

in recognition of nomadic lifestyles, competing with their persisting marginalization. However, the reduction of economic power by lack of opportunity of credits forces nomads to be self-financed,[18] thus allowing only two main economic models. On one side, employment for volatile and punctual needs, and entrepreneurship on the other. Nomads, and in particular Roma people, are more successful as self-employed, notably through second-hand retailing, a discipline now at the forefront of circular economy.[19] This business model, although seen as opportunist and survivalist, is rather of high interest for the definition of local adaptability. By deeply understanding local contexts, local economies and local material managements, Roma people are able to earn a living based of resources uniquely available from the territory they temporarily inhabit, specific to each vicinity, yet achievable in every urban environment.

TABOO/KITSCH

Erratically, these alternatives are not investigated nor pursued by architects, in turns contributing to the marginalization of nomadic communities. Although there is an extensive literature from sociologists, ethnologists, or even economists, there is little to no scholarly inputs from architects.[20] Hence, why does neo-nomadism remain taboo for architects, especially with a plethoric background of counterculture studies?[21] The lack of interest and engagement from architects into contemporary alternatives can notably reiterate and augment the striking quote from Le Corbusier into "eyes which [still] do not see ("*Des yeux qui ne voient [toujours] pas*").

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18 Le Marchand, "Économie de bazar et économie morale." p.29

19 Ibid.,p.29

20 Except from Archigram, Yona Friedman and few others, but dating back from the 1960s.

21 Maniaque Benton, *Go west! des architectes au pays de la contre-culture*.

Such nomadic lifestyles have often an intimate affinity to kitsch designs, the latter being extensively theorized by architects after being persistently ignored. Perhaps such matters will come under the pen of architects once the mentioned alternatives will gain a significantly more explicit importance. For now, architects prefer to literally and metaphorically design[22] or refurbish prisons[23] rather than camping urbanism and facilities, illustrating their unconditional attention on control over freedom, in the sense of introduced notions on primitive nomadism. Moreover, the economic reality of the architecture profession, associated with such negation of social paradigms led architects to focus only on the top 1% of the world population?[24] Although vacation resorts are not prestigious enough and inherently denote pejorative semblance for most architects,[25] rudimentary urban analysis of campgrounds might yield intriguing outcomes.

ADAPTABILITY & HYBRIDITY

Furthermore, nomadism as a countercultural phenomenon does not systematically imply autarky nor complete autonomy, although it is a significant part of such lifestyle. As a general datum, neo-nomads are dependent on sedentary civilization notably for employment, technologies, infrastructures, food supplies, and more despite their de facto autonomy required in order to sustain itinerant

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22 "Koepel Panopticon Prison." One of the first architectural project of Rem Koolhaas after the publication of the famous *Delirious New York*

23 "OMA to Transform Amsterdam Prison into Vibrant Residential Tower Complex."

24 Parvin, *Architecture for the People by the People*.

25 During the final critic of Raphael Mottier's Master Project in Architecture at EPFL, on July 13th 2020, the vague resemblance of the project to a holiday resort exacerbated the jury for no justified reason. This behavior is commonly observable in academic context but also among professional practices.

lifestyles. This generates a necessary ability of understanding the bordering context and a high adaptability to changing conditions, while maintaining limited autonomy. The coronavirus has notably thrown many more people on the road, either by economic constraints or by travelling aspiration, in an ubiquitous world of remote working. [26]

One of the best strategies to efficiently adapt to such volatile circumstances remains the diversification of sources to resist the potential failing of constituting parts, therefore stressing the importance of hybridity. By their countercultural nature, nomads are notably able to successfully cope with societal changes through strategies of adaptability and understandings of autonomy. These concepts applied to architecture, and more particularly to construction, could yield remarkable lessons. Thus, this document oscillates between nomadic learnings and construction rationalities, which are intrinsically and metaphorically linked.

DEFINITIONS

Having sketch a rough depiction of various alternative lifestyles, the rest of this document focus on particular conditions which need to be defined for the scope of this *énoncé*. Additionally, some cited terms generally have wide definitions and require to be specified to establish an accurate common base:

-*mobility* refer, unless otherwise indicated, to one-way movement of beings through physical space.

-*transportation* similarly but distinctively address movement of objects through physical space.

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26 Gay, Cohen, and Stanik, "Les nomades numériques à l'ère du Covid-19."

-*hypermobility* exposes a paradigm of western societies defined by mobility that significantly exceeds average time spent or distance traveled on a recurring basis.

-*alternative lifestyles* refers widely to lifestyles opposing western sedentary standards of living.

-*nomads* identifies broadly beings having a lifestyle based on mobility.

-*neo-nomads* distinguishes more specifically nomads since the end of the first world war.

-*digital nomads* is eminently detailed in the chapter on Global Nomads and refers to neo-nomads relying on telecommunications.

-*adaptability* is being able to adapt to new conditions or for a new purpose[27], and will be thoughtfully theorized in all subsequent chapters, along with the following terms:

-*lability* is defined as likely to change or easily altered

-*hybridity* simply depicts combining multiple sources

-*synergy* represent an effect bigger than the sum of individual parts

-*synergetics,* according to its creator, is defined as a "[system] unpredicted by its separate parts."[28]

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27 Based on the definition of adaptability from Oxford University Press, Oxford English Dictionary

28 Fuller, *Operating Manual for Spaceship Earth*. p.72, also defined thoughtfully in Fuller, *Synergetics*.

A PARADIGM WORTHY OF LEARNINGS

Nomadism is here addressed as a modern paradigm that reflects contemporary conditions of society, between precarity and appealing lifestyle, seeking to adapt by experimenting novels approaches to changing contexts. This new phenomenon reflects societal and technological paradigms that echoes most conditions of Western society, and notably yields opportunities for understanding underlaying mechanisms in order to phosphor about the future of architecture. After a holistic exploration of the foundations for these emergences, the depiction of related theories enables to draw relevant lessons for construction, notably regarding the notions of adaptability and hybridity. In particular, the hybridization of opposite lifestyles unveils how it allowed the birth of global nomadism. Hence, the *énoncé* prominently questions in an initial segment how studies of nomadism and hypermobilities can inform architecture and construction in a subsequent fragment, adequately relating the two.

Roma barber - Fair of Giourjévo, Wallachia - July 11, 1837

Auguste Raffet - Public Domain

Wild neo-nomad - Emosson dam, Switzerland - 2020

Maxence Grangeot

Housing Crisis or Neo-Malthusianism

One of the causes that led to the emergence of alternatives is the difficulty to encounter available and affordable housing.
What is currently known as the housing crisis can be traced back to two main triggers: the consideration of Earth as a finite resource, and the permanent increase of global population. Without forging a novel World-Systems Theory as it has been repeatedly done in the 19th and 20th centuries, a critical overview allows to cast light on disputable yet primordial matters.

POPULATION BOMB

Human population rose for thousands of years and has been exponentially accelerated by the successive industrial revolutions.[29] Since the introduction of the concept of population control by Thomas Robert Malthus in 1798,[30] numerous scholars advocated the intendance of human population in reaction to overpopulation, an ideology defined as Neo-Malthusianism. Although the theory is based on a linear growth of food production facing an exponential growth of population, it does not account for behavior change, or adaptability, as a crucial input allowing to reach a balance before the "Malthusian catastrophe".[31] This self-regulation can notably be triggered by pandemics, wars or famines, but has rarely been considered as a voluntary mitigation. Contemporary consumption behaviors are inevitably leading to a perceivable crisis, unless those conducts are altered based on a voluntary drastic adaptation, recently baptized

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29 Ehrlich, *Population bomb*.

30 Malthus, *An Essay on the Principle of Population*.

31 Desrochers and Hoffbauer, "The Post War Intellectual Roots of the Population Bomb."

mitigation. Therefore, Malthusianism has occasionally been inversely questioned by assessing the number of additional lives Earth could support with more rational behaviors. For example, Yona Friedman estimated that the inhabitable part of emerged land could host more than 200 billion humans in accordance to his utopian vision of "mobile" urbanism.[32]

In fact, scholars have repeatedly considered overpopulation, but have rarely considered underpopulation given the potentialities of Earth resources, let alone the imaginary landscapes with a population of 200 billion primitive hunter-gatherers, or inversely 200 billion USA citizens. Population sustainability is therefore intrinsically correlated to human behavior, which remain the least arduous leverage of adaptation. However, those rising numbers are rather cherished by architects. As a business, architecture pleasingly welcomes an increasing population as it translates to an enlarged demand for built areas, hence offering more construction opportunities. Demographic studies established projections of around 9.7 billion people by 2050 and 10.9 billion by 2100,[33] while it remains largely uncertain if stagnation or decline might happen in a foreseeable future. A decline in population would induce enormous repercussions on architecture and infrastructures, and most likely on mobilities. But more importantly, the demographic evolution is highly heterogeneous across the globe: Asia is expected to double its population by 2050 to reach 3.5 billion, while sub-Saharan Africa is expected to welcome 1 billion additional inhabitants in the same period, representing by more than half of the growth of world population. More than a demographic evolution, these territories are expected to welcome large economic, environmental, and cultural transformations.[34] Despite the infamous

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32 Friedman, *L'architecture mobile*.

33 United Nations, *World Population Prospects Highlights*

34 Bolay, "Architecture, Urbanisme et Habitat."

50% urban threshold the world recently surpassed,[35] the relative proportion of urban population differ significantly across continents, and within national territories.

INHABITABLE BORDERS

This ever-increasing population however has taken place on a strictly finite amount of land, as another factor in the equation of the housing crisis. But as seen from outer space, environmentalists long used the blue marble image of Earth, as an attempt to unify all efforts, to promote Earth under a singular meaning, from which Buckminster Fuller established the analogy to a spaceship, hence the definition of spaceship Earth.[36] When seen as a vehicle, numerous questions arise, notably regarding the identities of the pilots, the global maneuverability, self-sufficiency to sustain all lives onboard, etc. Today, the mythical power of the legendary photograph of Earthrise can be commonly encountered through google maps, publicly rendering humans as inhabiting a surface rather than inhabiting a globe, and experienced as a thin crust of few hundred meters up and down,[37] yet largely substantial compared to the 12,742 km of diameter of the globe. This thin layer materializes also in the geological layer of the Anthropocene, representing a particular yet insignificant condition[38] when considering the totality of the layers generated during Earth's lifespan. From this outer layer, humankind has principally become a dry land specialist, by occupying 10% of total Earth surface.[39] From the total surface of 510 million km^2, 71% is submerged, and out of the

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35 AMO et al., *Koolhaas. Countryside, A Report*.

36 Fuller, *Operating Manual for Spaceship Earth*.

37 Latour, "Inside."

38 For a wider vulgarized study of the place of humankind in the universe, see the crowdsourced short movie : Courchamp, *Insignificant*.

39 Fuller, *Operating Manual for Spaceship Earth*.

149 million km^2 left, 10% are covered by glaciers and 19% by desert, leaving 104 million km^2 hospitable. Half of this inhabitable land is devoted to agriculture, while the built environment represents 1.5 million km^2.[40] All of which are unevenly distributed and partitioned by iteratively nested systems of artificial limits, as the totality of emerged land is divided by mostly invisible lines, products of common or conflictual interests. This surface is therefore subdivided into nation's borders, then subdivided again into administrative entities rarely with any artificial manifestations of boundaries, and subdivided again multiple times until cadastral parcels, representing entities with owners, subject to being sold or inherited. The size of these parcels in urban context are generally the decisive point of the price per unit of area, while larger subdivisions are detachedly managed.

Independently from the economy of land ownership, the globe is perpetually harnessed, while witnessing a permanent increase of inhabitant of Earth. Having natural resources unequally spread on the globe, the discussed breaking point of Malthusian catastrophe would occur under different phenomenon across these unequal territories. For a given territory, nation or globe, there have been significantly more control of territorial expansion than population control, the latter being ethically more disputable. The recent example of China, which long advocated a single child policy, have in the opposite neglected urban sprawl, resulting in a dense and heavily altered countryside.[41]

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40 Ritchie and Roser, "Land Use."

41 A simple google maps flythrough over the northeastern Chinese countryside generates numerous questions, including housing conditions.

This intensification of inhabitable land comes without surprises when considering an expanding population on a finite surface. If equally shared, the amount of land per capita is therefore constantly diminishing, while the value of land is independently and continuously increasing.[42] With construction prices relatively following the growth of average income per capita, the housing crisis is therefore generated by factors external to the architect's scope.

However, many architectural projects are tackling this phenomenon through the development of "affordable" housing but remain powerless facing speculation and economic loopholes. For example, the average price of housing in the United Kingdom has passed from 2 times the average annual salary in 1985 to 6 times in 2015,[43] leading solutions of "affordable" housing unable to cope with attractive costs from mass housing from post war eras.[44] The increasing value of land was notably accelerated by charging rent without gradually offering ownership, therefore indissolubly and permanently rising land value over time.[45] Thus, current housing economics are not authentically based on ownership but on rental schemes. Together with increasing standard of living and annihilation of illiteracy (from 79% in 1900 to 14% in 2010[46]) through popularization of communication technologies, housing availability and affordability experience a tremendous pressure, forcing or inciting people into

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42 See the argument of Buckminster Fuller on wealth that can only be larger, in *Operating Manual for Spaceship Earth*

43 Bengtsson and Lyons, "Revealed."

44 Knoll, Schularick, and Steger, "No Price Like Home: Global House Prices, 1870–2012."

45 Engels, *La Question Du Logement*.

46 Ironically, the electronic version of van Zanden et al., *How Was Life?* is freely made accessible to members of academic institutions only.

alternatives. Tiny houses, campers, vans and all sorts of habitat on wheels aim to detach from the rare(r) resource: land. Aside from innovative economic models for sedentary lifestyles, neo-nomads merely remove a single obstacle to establish a financially sustainable perspective: land ownership. In an increasingly urban world, where rents and mortgage represent the biggest expense price adjusted to income, the relevance of land ownership is increasingly disputed, between early securization and radical denial.

As a result, the concept of purposely becoming deterritorialized utterly reshape: the vision of ownership, the feeling of belonging to Earth, the fear of estate insecurity, the significant financial commitment, the geo-politic volatility, etc. Whether embracing a lifestyle of rejecting another one, nomads generate a severe threat to sedentary civilizations by backing different ambitions among a singular system, potentially reaching a breaking point, before an impending inversion of demand.

Moreover, land ownership becomes even more conflictual when acknowledging original acquisitions based on primary establishment or on wars, as the underlaying conflict is notably perpetuated within cities, where sedentary and nomadic communities meet. Roma people particularly encounter greater and greater difficulties to locate temporary places to stay, as they are persistently rejected from sedentary civilizations by cultural fear, hence solely threatened by their statutes. As a consequence, nomads which are not relying on technologies of information as a source of income are filling special tasks not suited for sedentary workers, such as seasonal works or outsourced little works. For this reason, they are often called «slaughterhouse gypsies» or «nuclear nomads», reflecting their dangerous or dirty work, although not inherently poorly paid.[47]

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[47] Le Marchand, "Économie de bazar et économie morale."

Unemployment, financial instability or more recently pandemics, also thrown people on the streets or on the road, not being able to afford a rent, therefore becoming “homeless" extremely rapidly. Urbanization generated a fragile system emphasizing the risk for people not to have a roof, despite being the only undisputable role of architecture: to provide shelter. « Homeless » can be translated through French in two distinctives definitions: *sans abri* which translates by “without shelter"; or *sans domicile fixe*, literally meaning “without stationary home". As such, under this last French definition, nomads can be characterized as homeless. But recognizably, most neo-nomads own a shelter, often being their vehicles. The notion of homelessness, or rather of homeness thereby becomes blurry.

The prominent neo-nomadic condition accentuated by the coronavirus pandemic notably jeopardize the contemporary state of the housing market through the denial of land ownership and rental systems, presumptively marking a turning point of the housing crisis before a foreseeable inversion and decline in estate prices.
The housing crisis notably represent a system inherited from centuries which was not able to adapt to changing conditions, while thousands of square meters remain unoccupied or abandoned. In reaction or by nature, nomads maintain a detachment from the ground by refusing land property, nimbly allowing them to adapt more easily to changing contexts.

Housing the multitude - La Paz, Bolivia - 2019

Maxence Grangeot

Hypermobility in a mobile realm

Amidst the subdivided territory of arduous housing conditions, nomads have extensively forged alternatives on mobility and hypermobility, yet mobilities also represent a significant part of sedentary lifestyles. Although essential mobilities are primarily based on biological capacities to sustain primitive needs, evolutions in technology have generated substantial shifts for transportation and subsequently for the built environment, affecting how humans inhabit and move on the planet. With every discovery, humankind has perpetually increased speed, reachable distance, and economic viability of transports, triggering a world of daily mobilities and intense hypermobilities. As a result, nomadic and sedentary communities nowadays cohabit by sharing transportation infrastructures and technologies.

TECHNOLOGICAL ADVANCEMENTS OF TRANSPORTATION SYSTEMS

Most importantly, terrestrial connections, which evolved from path to roads and then highways, underline the tremendous importance of terrestrial infrastructures to develop economic activities, social aliveness, expeditious wars, vibrant cities, and more.
Such network induced specific engineered solutions of mesmerizing aesthetics, for example through the establishment of roundabouts as miracle solutions for cities. These centers of city webs have accelerated space[48] through efficient distribution strategies of converging and crossing roads. Together with traffic lights, they form elegant

[48] Angélil, "Tales of Territory: Anthropocene, Urbicene, Capitalocene?"

systems, rhythming cities in symbiose, and reflecting the robustness[49] of hybrid systems.

Likewise, development of rails aimed at increasing the speed and efficiency of this modified terrestrial connections. The prominent exertion for increasing speed have fostered rail transportation innovations further, for example through the 1936 experiments in Calais consisting of loading train cars directly on boats, ultimately leading to the construction of the channel tunnel between Great Britain and France. Later again, the implementations of high-speed train lines represented one of the biggest impacts for the economy of two entire regions and for the territory they cross. The striking example of the successful Chinese highspeed train, which reunited megacities and ghost towns with the far inner countryside, is revived worldwide by the trendy pledges of the hyperloop, a nearly supersonic land transportation concept.

Roads, railways and all vehicles alike have profoundly altered perceptions of territories and cities, and inherently the way human perceive the world. The fantasy of caravels for discovering the unknown rapidly converted into the aesthetic efficiency of paquebots, upholding an appearance of evasion and immigration but also of technical innovations. Technological advances in vehicles and infrastructures principally maintained as primary goal to overcome and geographical barriers and to ease the mobilities across territories. An iconic example is the public transportation system of the capital of Bolivia, La Paz, relying on a large network of urban cable cars, developed by a swiss company. Such technology is used in alpine context for leisure purpose but could gradually become the symbol of an

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49 Robustness is defined here as the antonym of sensitivity, and denote a system able to withstand alterations with ease, a system allowing multiple configuration while maintaining its use.

alternative urban mobility. More recently, technological breakthroughs in aviation allowed to cross territories without notable infrastructure, using the atmosphere and aerodynamic sciences to bridge long distances in a reduced amount of time. Planes and drones have the particularity of breaking free from spatially and economically expensive infrastructures, transfiguring the landscape, and modifying once more the perception of territory.[50] In the hope of increasing speed once more, researchers from EPFL have developed a concept of detachable plane cabin compatible with land-based transports and mobilities, merging various infrastructures to foster increased results.[51]

MOBILITY

The gradation of technological advancements in transportation and mobility underline the persistent paradigm for faster and further expectations, leading to human lives filled with mobilities. Being indivisible from most contemporary lifestyles, the word "mobile" tends to disappear or be monopolized, for example as telecommunication devices gradually lost their adjective in "mobile phones" to become simply "phones" or "mobiles".

The predominance of mobilities surfaced again during the coronavirus lockdowns, explicitly revealing the ubiquitous intensity of mobilities for modern societies, from interacting with each other, to each trivial and singular action of western habits. The exclusive circumstance of widely annihilating mobilities felt unthinkable, yet was made possible by technologies allowing remote working. In turns, earning a living from home through internet became the norm

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50 Based on the unpublished academic work: Grangeot, "Pertinence Du Transport Par Drone." developed under the supervision of prof. Vincent Kaufmann and Claudio Leonardi. The document is freely available upon request to the author.

51 See the project :EPFL Transportation Center, "Clip-Air Concept.", and learn more through the thesis : Ellwanger, "CLIP-AIR-RAIL."

overnight, and got anchored deeper as investments were made accordingly to sustain this particular condition. In a society predominantly composed daily commuters, with journeys primarily to work or to school, remote working abruptly threatens cities as densification of related activities. In heavily mobile societies where most work can be executed from anywhere,[52] fewer and fewer reasons hold back citizens to remain sedentary. This is notably genuine when considering mobility as more than a spatial displacement, but also as an inner mutation. Assuredly, backpacking travels are a valid representation of this self-shaping journey, but such transition is also experienced daily by commuters on their way from home to work, to school or to other activities, as mobility acts as a transitory device, gradually altering privacy into a public state. However, this transition through mobility is absent in cases of remote working and generates new routines with unprecedented lacks of transitions. Further detailing of related phenomenon is addressed in the next part on acceleration and in the chapter on global nomads.

When mobility as a transitory space time is perceived as a resource, advancements in self-driving technologies resourcefully materialize novel spatial conditions. Up until modern days, shopping, working, resting, etc. occurred confined in the rigid walls of architecture, but such activities might soon transition to vehicles in order to cope with the increase of mobilities and social acceleration.[53]
While a subsequent part of this document is scrutinizing various nomadic habitats, world mobilities infiltrated architecture in more radical manners. As a matter of fact, most of the largest worldwide events continuously changing of location with every iteration, such as Olympic Games, World Fairs, academic symposiums, etc., punctually generate large economic stimulations beneath the vindication of broader

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52 Gay, Cohen, and Stanik, "Les nomades numériques à l'ère du Covid-19."

53 SPACE10 and foam studio, "Spaces on Wheels,"

and fairer reach. Such events can be granted a nomadic adjective or referred as mobile architecture as they federate similar events in different localities.

But despite the worldwide significance of mobilities, transportation infrastructures are not only unequally shared across the globe, but also within circumscribed territories. While the correlation between mobility and marginality is of eminent interest for sociologists,[54] infrastructures are rather used in dissimilar conducts by all actors, which are mostly defined by their lifestyles. This notably imply questions whether authorities and politicians should prioritize urban public transport systems over regional networks, or air hypermobilities over land proximobilities, for example.[55] The inherited investment therefore differs significantly, yet the best solution remains to allow multiple system to cohabit, thus allowing the whole system to stay afloat if one constituent part would fail, hence precisely denoting the behavior of synergetic systems.[56] This notably ease the transition and adaptation from one lifestyle to another and ensure a complementarity of lifestyles. Once again, hybridity of systems confers more robust behaviors than mono-purpose systems. This establishes a partial vindication while questioning how mobilities and hypermobilities can inform architecture and construction.

FLOWS

Intense mobilities have notably generated urban nomads as temporary inhabitants of large human-made artefacts, represented by the quintessential examples of hotels and peer-to-peer lodging economic models. Likewise, landscapes are witnessing an

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54 D'Andrea, "Neo-Nomadism."

55 Daguzé et al., "Modes de Vie et Mobilités Atypique."

56 Fuller, *Synergetics*.

intensification of both passengers and fret traffic, although quite distinctive, where most wealthy civilizations can travel anywhere or have anything delivered in less than 48h. The plane has notably introduced a novel relation to the territory, having for the first time brought the scale of Earth perceptible to mass populations. At the dawn of the 20th century, the sky was mostly free of human-made objects, whereas the contemporary skyscape is composed of numerous layers shared among domestic drones, planes and satellites, precariously intertwining those layers containing precious characteristics for upholding lifeforms.

The explosion of air traffic is actively followed by the increasing democratization of drones through a carefully planned and progressive social acceptance, anticipating the future of air mobility. This notably draws the premises of a paradox: the ease of transportation at large scale is particularly jeopardizing the long-lasting image of faraway travels as difficult adventures and personal learning experience to self-build and to self-discover.[57] Paradoxically, this chivalry has simultaneously become a commodity for middle classes, while it appears as a plague when applied to marginalized groups. This uncertain or ideal adventure oscillates between forced expatriation deprived of domestic security and holidays aspirations filled of iconic destinations. It notably translates by social class distinctions in transportation (1st class, business, economy, etc.), representative of the underlying social schism in society.

Remembering the previous argument on prisons as supreme punishment by physically restraining people in a bounded location, the marginalized groups experimenting with nomadic lifestyles therefore inherit a unique societal position of free distress, able to

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57 The famous example of the Beat Generation through Kerouac, *On the Road*.

cross any borders.[58] The cohabitation of sedentary and nomadic people notably allows an increasing acceptance of alternatives, similarly to the increase of tolerance to transport noises with the help of previous technologies, namely steam trains, thermal cars, highways, airplanes, drones, etc. The convergence of this gradually increased tolerance is symbolized by the image of city, currently orchestrated by traffic lights in an attempt to regulate the rhythm of the urban beat. Ironically, the city itself is most prone to alterations from mobilities as its size directly depend on it. Essentially, the very definition of the city is tightly correlated to the time allocated to cross it, which might affect future perceptions of cities as transports are exponentially gaining speed, in particular while considering developments in sealed tube transportation and drone mobility. This vehicle dependent size of the city situates technology at the core of, not only mobilities, but all derived activities.

TIME AND MOBILITY

While technological advancements aim at diminishing travel times or decupling distance reached, transportation and mobility ultimately rest upon the notion of speed, and eventually to the notion of time. Speed is rigorously defined by the expression of distance in a physical environment over an amount of time. By intrinsically relating to the notion of time, nomadism is more rooted into lives of citizens than architecture, long considered eternal in the eyes of their creators. Inversely, the principles of circular economy are notably reinjecting a conception of time into architecture and could greatly benefit principles of nomadism.

Universal time, or at least its human perception, has in fact been created by transportation needs during the industrial revolution,

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58 Centre de création industrielle, *Errants, Nomades, Voyageurs*.

in order to avoid collision of trains. Departure times markedly necessitated to be precisely synchronized between cities across the entire island of Great Britain, consequently leading to the standardization of time. In respect of punctuality, the time has been anchored to every wrist ever since.

In a period when travelling the world epitomizes a symbol of success, modern travels denote a relentless fight against time at the expense of a wide loss of space primacy. But researches in physics unveiled the astonishing speed of light, namely requiring 8 min to reach Earth from the sun. This realization applied to the entire celestial sphere led Buckminster Fuller to the understanding of Earth as a spaceship travelling through a space, non-existent by the simultaneous spatial state of the cosmos, but rather evolving within a series of events.[59]

59 Fuller, *Operating Manual for Spaceship Earth*.

Daily commute in the largest and most populous city - Tokyo, Japan - 2017

Maxence Grangeot

Overcoming natural barriers - Kalabaka, Greece - 2018

Maxence Grangeot

Acceleration Deceleration

TIME AND PRODUCTIVITY

Being deeply rooted to time through mobilities, humans rely on an intangible unit capable of objectively comparing and quantifying. By its finite supply per capita in a competitive society, time is seen as a natural resource to be wisely managed. Each human activity is therefore quantified by time, exerting a ubiquitous pressure where procrastination has become negative. As a rare resource of capitalism, the subjective and immaterial notion of time is converted into an objective and palpable monetary value,[60] monitored by watches, the most widespread technological device having per sole function to reveal time.

The mass standardization and centralization of time had as side effect the origination of rush hours based on strict week schedules, accentuated by the monetization of such quantifiable unit of work. Executing operations faster to allocate more personal time, or namely doing more things per unit of time, led to an abundance of free time, underlining the precious value of this intangible resource. Associated with the fear of loss of time, the increase of free time became the source of great paradoxes,[61] not knowing if time management defines a cause or a consequence of acceleration.

ACCELERATING

The centralization of time notably established a pace which remained unprecise until then. Keeping up the pace in an economic

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[60] Dannoritzer, *Le Temps, c'est de l'argent*.

[61] Rosa, *Aliénation et accélération*.

system based on competitivity intrinsically imply the augmentation of production, therefore acting as the drivers of acceleration. The successive industrial revolutions significantly altered how people eat, move, sleep, meet, etc. and happened at increasingly shorter intervals. This is made possible by a faster adaptability to new paradigms and is represented by an exponential development of technological breakthroughs, leading to the transition of lifestyles from intergenerational to intragenerational within a single century.[62] While professions and places of residence were formerly inherited from previous generations inside the closed circles of family, such transitions rapidly accelerated and are currently being reformed several times within singular lifetimes. This notably questions the new role of the family in the exponentially expanding convolutedness of "social" societies, as profound changes in the nature of established profession also interrogate the relevance of the current employment system. As an example, in the United States of America, an employee with higher education transitions of employment approximately eleven times in one career.[63]

The same social acceleration is perceived through the multiplication of places of residence, made more accessible by the previously introduced renting scheme, and is actively threatening the definition of sedentarism in modern times. The repetition of moving in and out, despite appearing anecdotic for most western societies,[64] essentially reflects preceptive characteristics of nomadic conditions. But contrastingly to fully nomadic lifestyles carrying all necessary goods, living simultaneously in different locations or accelerating

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62 Rosa.

63 Rosa.

64 By 19, the author lived on 3 different continents solely for academic motivations. Spanning 6 years only, the authors had 15 different places of residence including only one family residence, although being part of the French middle class.

moving in and out frequently offers distinctive relations to consumerism of household items and unused space.

Moreover, the perception of acceleration is amplified by the semi-permanent states of emergency[65] maintaining citizens under invisible pressure. However, the perverse side of acceleration in a competitive system is particularly experienced through feedback loops, nourishing a greasy slope of increased interdependence and from which it is harsher to escape over time.[66] Such a complex problem of modern civilization is recklessly assumed to be solvable through equally modern technologies, such as computers considered capable to solve acceleration the same way they solve many of other predicaments.[67] Yet the implications of acceleration are predominantly social, leading to social alienation, in a world prominently developed for efficiency and multitasking. This alienation notably deprived populations of self-imposed goals, rather led by social ones. The decline in religion as well as in afterlife belief accentuated this feeling of uncompletedness, as individuals gradually recognize the unlikelihood to experience everything in one life.

NO VISION NO FUTURE

Within such intense acceleration of society, it is getting harder for people to envision the(ir) future, especially since the pre-industrial dreams of machines to satisfy the needs of humankind maintained science as a driving force. Before the digital revolution, dreams of intelligence, calculating power and flying cars correspondingly stimulated a vision of future to look forward to. At the beginning of the 21st century, driven by the recognition of climate change as an

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65 Poulain, "État d'urgence : Plus c'est Long, Moins c'est Bon."

66 Rosa, *Aliénation et accélération*.

67 Fuller, *Operating Manual for Spaceship Earth*.

existential crisis and in the midst of an intensely accelerating condition, the amount of long-term visions is dauntingly shrinking, with the exception from the ones refuting existing archetypes. Hartmut Rosa would surely argue that such prospects are made impossible by the lack of time under an increasing social pressure. Moreover, the expectations of flying cars are presently turned into realities, likewise for machines replacing ungrateful tasks, but such advances are notably complemented by a loss of humanity and transition of trust. The age of technologies of information and communication notably made possible collaborations at a larger scale, the global scale, leading to the progressive and massive shift of trust to accommodate this unprecedent scale of collaboration. As denoted through the infamous example of Wikipedia, the largest and most visited encyclopedia in the world is freely alimented by thousands of contributors, and therefore comprises articles collaboratively developed with more sources that other mediums would render overly complex.

Yet, the aspiration related to free time and hobbies appear to be diminishing, crushed by this social pressure, therefore leading to a self-destruction of freedoms. The question then would rather relate on what more can Western societies possibly want. One could question if this lack of prospective projection turned into climate responsibility over equally important interests. Yona Friedman notably depicted modern city as places of boredom and advocated for cities of amusement with adequate use of free time.[68] Cities as worlds of successive events, appearing closer together than ever through systems of telecommunications[69], Western societies are on the verge of a crisis, unable to settle if pursued or inherited. Hence, the origins and

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68 Yona, *Architecture mobile*.

69 Picon, "Ville numérique, ville événement." and equally defended in Picon, *Smart Cities Theories et Critique d'un Ideal Auto-Réalisateur*.

underlying motivations for the aspirations of contemporary and sedentary societies remain relatively obscure.

ASPIRATIONS FOR DEGROWTH AND ANTI-CONSUMERISM

By definition, innovative lifestyles aspirations are profoundly breaking with pre-existing conditions, namely the current spatial dispersion of activities for the 21st century, therefore leading to the emergence of two radically opposite but complementary lifestyles: proximobility and hypermobility.

Most explicitly, proximobility instigate a decisive estrangement with social acceleration by seeking to slow down the general pace of life, and frequently to reconnect with land in the countryside, thus rejecting consumerism and urban life. This trend can notably be felt across westernized nations aspiring to reclaim their identity after a significant period of modernization and globalization. Trump Administration with the explicit slogan "Make America Great Again", the largely debated Brexit, anti-terrorist protests or even movements of ecovillages in numerous nations; such intensive retaliations prominently echo directions to a previously cherished gated community. Somehow, it can be seen as a Renaissance although the discoveries do not relate to known land, but rather relate to rediscoveries in intensity.[70]

The famous figure of Rem Koolhaas, which life-long interest focused solely in the congestion and urban areas, hence his "Office for Metropolitan Architecture", recently turned his interest to the countryside. He notably devoted an entire exhibition called

[70] Latour, "Inside."

Countryside, the Future[71] and a report[72] to the novel and staggering condition of the countryside, recognizing that 51% of world population in urban areas leave an almost equal number of humans in the countryside. Historic "back to the land" movements and recent trends in "homestead" defines alternative lifestyles which are gradually becoming mainstream. The rupture is equally represented by the recently high number of books and thesis with subjects singlehandedly focused on the countryside, farming, ecovillages, DIY, minimalism, etc. Such trend can be also witnessed on internet platforms, bringing people with different locations together, and would otherwise be difficult to assess due to scarcity and isolation. The irony notably erupts as desires for degrowth and social descent are getting ever more popular while societies seemingly maintain, and even increase, the pressuring acceleration, without noticeable environmental improvements.

EMPLOYMENT ASPIRATIONS

Recently, the massive switch to online working and teaching boosted the ambition to annihilate commutes through remote working, which might precipitate the end of in-person education and professional gatherings. This notably encourage the development of business models based on freelancing, taking advantage of the lack of physical limitations. The sanitary situation might have just enabled a step forward in building international and interdisciplinary teams with ease, as remote working is not simply considered an ideal lifestyle anymore, but the de facto rule for education and professional relations. However, this question previously existed in minor importance through the development of MOOCS, which interrogated the

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71 Exhibition at the Guggenheim Museum of New York : Koolhaas and Bantal, "Countryside."

72 AMO et al., *Koolhaas. Countryside, A Report*.

relevance of physical schools and physical interactions while aiming for universal education. On the other side, novel working aspirations especially derives from the precariousness of employment contracts and an increasing focus on leisure and self-fulfillment,[73] while domestic aspirations are based on the desire to become homeowner despite the housing crisis.

NOMADIC ASPIRATION

Out of this accelerating context, mobility aspirations come as a negotiation within this lifestyle paradox, and are defined under three main paths: Business as Usual, Proximobility and Hypermobility.[74] The first one is rather an enhancement and fluidification of existing system, for an increased comfort of commuting, Proximobility emphasizes on local services for reduced mobilities, while Hypermobility make use of transportation infrastructure as foundations of a highly mobile lifestyle. However, these orientations all denote, to some extent, an in-depth revision of mobility systems and territorial planning. Yet they do not compose three distinct materialized systems but rather a hybrid one permitting their cohabitation and easy interaction, while maintaining potentialities of permutations. This versatility adequately resonates for a multiplicity of uses, as societal changes occur more often than ever, and frequently generate new paradigms of mobilities.

There is, however, a paradox between the scenario of Proximobility lifestyle and the unstoppable loop of social acceleration, defining a strange cohabitation more intricate than a mere opposition between city and countryside. This particular ambiguity is notably felt through holiday periods when travels are both synonyms of faraway

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73 Greiller and Reitz, "NoLand's Man."

74 Kaufmann et al., "Quelles Mobilités Demain Avec La Voiture Autonome ?" p.23

intense discoveries and relaxation from routine. The most accurate aspirations can therefore be deducted from populations benefitting pure leisure during an extended period, namely through holidays destinations, but most importantly by the domestic and travelling habits during vacations. Beyond cultural travels in urban areas, holidays are often synonym of evasion through alternative yet pleasing lifestyles, based on regression, on amusement, and often on nomadism.

This is notably reflected in the figure of the camping site as a semi-rural condition benefiting rudimentary yet sufficient services, and equally informing about less intensive use of technology of telecommunications. However, holiday destinations and activities are not commensurable among the various age groups, as a parallel between age and physical distance from aspiration establish a clear correlation between social status and mobility. Among the youngest, travels are regularly associated with the image of being out in the wilderness while exploring, getting back in touch with nature, and especially with the outdoors. This is notably exemplified by the nomadic aspiration of being more present, as part of a temporary regime, not only as a characteristic of lifestyle but as a limitation of its lifetime. Neo-nomadism is therefore an alternative voluntarily breaking with acceleration, while simultaneously embracing its consequences. The timid yet rising number of people in their twenties and thirties who feel restrained without foreseeable futures, who have lost all professional goals and who are eager to travel, defines a growing part of neo-nomads and whose number is still arduous to assess.

Urban farm and school - Ecublens, Switzerland - 2020

Maxence Grangeot

Seasonal aspirations - Lacanau Océan, France - 2013

Maxence Grangeot

Architects in oblivion

DRIFTING WORLD

Architecture can be seen as a device to encapsulate beings and to assert some control over them. The generated conflicts between hopeful wanderers and armed residents, both seeking the ultimate and adequate life boat, is leading itself to a worldwide drift, famously illustrated by *Le radeau de la Méduse* and subsequent metaphors.[75] In a drifting world, alternatives lifestyles reject by definition the "control" of established systems, and therefore of architecture.

DRIFTING CITIES

The built environment, and cities in particular, predominantly represents the battleground of such drift, being of decisive presence on the territory notably through mobilities, therefore overturning the relevance of architecture. Eminent architect Peter Cook acutely highlighted the presence of rain as generating a more prominent impact than architecture,[76] and similarly acknowledging the movement of cars as generally overtaking the presence of the built environment, while especially embracing the elegance of flow, speed, movement and traffic in a living city.

Enlarging upon such unusual statement from an architect, the cartographic representations of territories explicitly emphasize such predominance of mobilities. Maps, including digital or touristic maps are mainly constituted of roads, while maintaining architecture as secondary information, therefore uncovering mobility at the heart

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75 The early theoretical work of Rem Koolhaas, including the raft metaphor, has been carefully studied in Gargiani, *Rem Koolhaas*.

76 Cook and Archigram (Group), *Archigram*.

of the most prominent representations of all environments. This abstraction illustrated by graphic patterns or color fillings for the representation of buildings, in opposition to a precise depiction of road networks, has been inversely questioned by the Nolli plans, much fewer in numbers, yet precisely portraying the public spaces offered through architecture and urbanism.
Such demystification of architecture is notably due to the lack of urban coherence of isolated monuments failing to dialog together nor to generate a well-defined public space,[77] leaving architecture as numbers, symbols, or at best as uniform colors, on cartographies rather based on flows.
More generally in intensely active societies, mobility is set to increasingly dislodge architecture, severely questioning if architecture should rather be based around mobilities. In this perspective, architecture seems to represent a minuscule portion of the true significance of the built environment.

DRIFTING ARCHITECTURE

As an objective assessment in comparison to engineers, architects offer no essential purpose other than constructing narratives. Until the 19th century, there was no distinction between architect and engineer, both referring to a single role, but during the 20th century, several architects attempted to reconcile with this lost part through the dream of mass production of housing. In response to housing shortage from the consequences of world wars, housing progressively transitioned to the vision of a machine to be industrially produced, and infamously referred by Le Corbusier as a machine to dwell. This vision of architecture as a performative object extends to contemporary imaginaries, notably in an accelerating world acknowledging time as a precious and housing as a necessary commodity.

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77 Pérez de Arce, *Urban Transformations*.

Through the extreme standardization of housing, many domestic apparatuses defy absolute rationalities due to successive injudicious inheritances while contexts kept fluctuating. Both of these subjects are addressed in greater details in the parts “annihilating standardization" and “architecture of climate".

One of the biggest challenges notably lies in the expected lifespan of buildings, either thought to be eternal or of reduced lifetime by design and by regulations, blatantly conveying problematic antipodal concepts of programmed obsolescence, hence of static architecture. Contrastingly, **the** Archigram collective heavily criticized Buckminster Fuller's Dymaxion House, having a lesser life expectancy than planned, thus reflecting a world of consumption where kitchen appliances feature longer warranties than cars. As a consequence, a ridiculous number of square meters perish in abandoned structures, and is also the subject of a detailed analysis in “scrap constructions".

Drifting architecture was moreover elucidated by megastructures, these city-scale buildings being so autonomous that they could freely move, independently from their context and from their architect.[78] This emancipation is more commonly felt at domestic scale in the personification of furniture within such dwelling machines, rearrangeable several times to cope with humans' intrinsic needs for change. In French language, the distinction is more prominently perceived through the ability to be moved, from the word *mobilier* (furniture) containing the notion of being mobile, opposed to *immobilier* (real estate) and denoting in the contrary the inability to be mobile. Nowadays buildings mostly represent necessary commodities to accommodate working activities which are conversely not universally enjoyed, or to host domestic activities

78 See detailed analysis in Banham, *Megastructure*.

which typically consist of sleeping in terms of relative time distribution in the 21st century. With this decline of time spent at home and unenjoyment, buildings are not built to meet primitive human needs anymore, but rather economic and social ones. As a consequence, the construction economy is witnessing little architectural progress, but more prominently technical-economic endeavors motivated by profits of real estate developers.

With this situation, associated with social acceleration, architecture gradually became a piece of equipment for humans to dwell, work, play, etc. fostering buildings as products without particular affection, as necessary structures rather than qualitative spaces of human cohabitation. This machinist vision of domesticity can be understood as an incentive for experimenting alternative lifestyles, free of constraints, such as neo-nomadic motivations.
The drifting of architecture equally rests upon the liability of architecture schools, persistently promoting prestigious and expensive realizations, thus focusing on architecture for the top 1% of the world population,[79] while the homeless are the most affected by the environment.

Lastly, the drifting of architecture, notably compared to the emergence of alternatives, originated from the architects' rejection of kitsch, grotesque and banal architecture, while always striving for novelty. Peter Cook strikingly expressed to "stop pretending about the significance of "Architects' Architecture".[80]

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79 Open Systems Lab, "WikiHouse."

80 About his Come-go project, in Chalk et al., *Archigram*. p.61

Alternatives are therefore named as such due to the architects' inability of adapting to new social contexts, due to the recognition of architecture as an element of control, an thus reflecting on the treatise of Gilles Deleuze and Felix Guattari.[81] Feeling they could not plan nor control the behavior of marginalized groups seeking for freedom, architects repulsed alternative lifestyles, which primarily became a refuge from land ownership and from architecture, therefore from control.

This is largely strengthened as nearly every western individual holds the ability to develop an embryonic creative character, in the midst of a noticeable DIY culture, even more prominent in the age of social medias, in which creativity is socially rewarded. Peter Cook notably emphasizes how "the role of the architect might lay in the interface of the DIY interchangeable kit of parts",[82] which can be related the long-lasting fascination of architects for the factory, Taylorism, and the mass production of housing units. The famous example of the Nakagin capsule tower was notably to set new standards and appropriate images, but modularity never came, unable to understand the collective needs of inhabitants. Since the beginning of industrialization, the design of objects has profoundly been shaped by creators or companies regardless of client inputs. Drastically in rupture with craftmanship by erasing any close collaboration between the craftsman and the final user, modern individuals are consequently subjected to a mere choice within a catalog without any prior design consultancy, hence establishing designers as dictators for users. This is equally true for

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81 Deleuze and Guattari, *Nomadology*.

82 Cook, *Archigram*. p.17

architects, as they are unable to dialog with all users especially when building for large number of people such as collective housing or public programs. As architects perpetuate their dictatorship, the absence of dialog emphasizes a high mutual frustration through objects remotely relevant for normalized requirements. But facing a large number of users and a wide set of professions each having their own distinctive interests, the profession of architect is becoming ever more complex,[83] and increasingly penetrating a state of unawareness and unconsciousness of the surrounding environment, namely oblivion.

However, on top of establishing sustainable construction practices,[84] the relevance of architects could well be to propose appropriate alternatives of living, in dialog with existing ones and changing paradigms, therefore incorporating relevant learnings on adaptability and hybridity from neo-nomadic lifestyles.

83 De Graaf, *Four Walls and a Roof*.

84 Rudofsky, *Architecture Without Architects*.

Architecture for architects - Les arcades du lac, France - 2019

Maxence Grangeot

Contrasting urbanity – Montreal, Canada - 2017

Maxence Grangeot

II. End of remoteness

The neo-nomadic condition, and more prominently during the 21st century, is substantially different from any previous nomadic movement. It is notably the first nomadic movement benefiting of advanced infrastructures at the scale of the globe, fundamentally upgrading their territories of exploration. As a parallel effect, the neo-nomadic condition is also defined as unrelated to primitive needs but rather to a sense of freedom on a fully domesticated surface. In order to appreciate relaxed and frequent adaptations to technological and social contexts, humankind previously and more impactfully adapted its environment at various intertwined scales analyzed hereafter. Hence this alteration of Earth by humans in order to better suit human needs marked the end of primitive conditions, therefore made possible by the extreme domestication of Earth as a whole. These alterations, notably through successive developments of technologies, became symbols for neo-nomadic movement, hence representing the end of this primitive condition through the end of remoteness.

Colonization

Before the 20th century, most humans experienced an astoundingly limited portions of Earth's surface, therefore behaving specifically in relation to immediate contexts. In this perspective, it is easier to understand early flat Earth theories and geo-centrism, proven wrong more than 25 centuries ago, yet not widely acknowledged until the photograph of *Earthrise* in 1968, and subsequently of the *Blue Marble* in 1972. This conception and its contraposed generated reveries of exploration among inquisitive beings,[85] despite their agricultural specializations on inhabitable dry land. In turns, the adaptative nature of humans enables to empirically become experts of previously unknown contexts and phenomena.

Since the migrations of homo erectus out of Africa, and gradually across all continents during the speciation of homo sapiens, further reach in land discovery was systematically based on abilities to adapt to new contexts, based on empirical findings and developments. Such nomadic migrations occurred through an emerged geography mildly distinctive from the current one, allowing to "bridge" maritime territories through land. Naval knowledge gradually permitted maritime nations such as Greece to rapidly colonize further land deemed suitable for agricultural activities. The remarkable importance of the Roman Empire and its fall permitted the emergence of the Huns, a community of nomadic horsemen in Asia, but more prominently the establishment of modern European nations, main protagonists of the Colonial Era. The growing access to land, wealth and knowledge ultimately led to the roughly complete discovery of

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85 In popular culture, famous narratives such as *Robinson Crusoe* or *The Martian,* or even Elon Musk, developed a western culture of nature capitalization, defined by Douglas Spencer as an *eco-imaginary* of capital.

emerged surfaces, confirming the understanding of Earth as a finite spherical territory.

Humans have notably spoiled 77% of the Earth's land surface excluding Antarctica and altered 87% of total marine wilderness.[86] Hence the total domestication of Earth through nomadic colonization is explicitly revealed by the trivial amount of unspoiled ground left.[87] Yet this nomadic domestication could only happen progressively, the precedent colonization allowing the following one, therefore conquering "uninhabitable" regions over large periods of time, ultimately increasing robustness of the human race. This robustness is equally in pace with explorations through hybridization of ethnic groups, known as crossbreeding in the animal world.

Since the first explorations and continuously through colonization of uncharted territories, the inquisitive nature of humans unsurprisingly qualifies humankind as a relentless nomadic species perpetually expanding its horizons. The neo-nomadic alternatives are notably in line with this explorative attitude, forever seeking for novel territories and remote areas. There is, however, nothing properly remote anymore, but rather discoveries of new grounds, although not denoting the expansion of physical land, preferring instead to territories of intensity and deeper scientific understandings.[88]

In turns, this assumption particularly questions the definition of a global age, and its corresponding starting point. Whether it is a precise event such as the arrival of Christopher Columbus in America, whether it is an epoch like the economic dominance of exportations and logistics, whether it is an infrastructural breakthrough such as

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86 Watson et al., "Protect the Last of the Wild."

87 Hooke and Martín-Duque, "Land Transformation by Humans."

88 Latour, "Inside."

the silk road or even technological devices like caravels, whether it is a social characteristic like cosmopolitanism or individualism, the definition of global age remain independent from the eternal nomadic explorations of the human race.

The last major and subsistent colonization is unfolding for the first time outside of Earth's crust, known as space exploration. This was notably symbolized by the *Earthrise* photograph and perpetuates nomadic expeditions of the human race outside of terrestrial boundaries, hence as an extra-terrestrial quest. However, it appears to exist greater amounts of efforts made to explore space and other celestial bodies than in exploring the intensity of Earth itself, demonstrated by the greater number of astronauts launched into space in comparison to the number of humans having explored the oceans floors.

The inner curiosity and willingness of discovering new territories is therefore stronger than understanding existing ones.
This notably represent a perpetual attempt to escape present conditions, relating to the previously introduced countercultural movements and nomadic alternatives. The opulent and contemporary dream of outer colonization, along with the domestication of the distant "inhabitable" land while existing territories lack of discoveries in intensity, particularly epitomize the modern attempt to escape from the self-induced sins and sorrow of humanity.

Although such colonization conversely relates more to science fiction and speculation at the beginning of the 21st century, the existing interest in space explorations is already tremendous. The race to the moon was formerly completed more than half a century ago, while billions are continuously invested into space missions, gradually becoming more privatized. Above all, there is already an established inhabitation in space, continuously occupied since 2000,

and representing the birth of a new scale for nomadism. As an eminently unconventional alternative habitat, the International Space Station follows a permanent journey keeping itself alive, and symbolizes one of the most powerful tools that elevate humankind scientific knowledge, and allows to develop cutting-edge technologies in non-terrestrial environments.

This hybridity remains relatively rare in such precarious settings, where human-made machines remotely inform humankind of distant phenomena but also related to domestic ones. In fact, Mars is the only known planet to be inhabited solely by such robotic artefacts and rovers, while other vehicles such as Voyageur 2, whose exploration outreach any commensurate notion of remoteness, informs beings it will never encounter again. Such sacrificial journey was also experienced on Earth-based lifeforms when the dog Laika was sent to space, but as Chris Hadfield prompts: "we are not machines exploring space, we are people, with our ability to adapt", while remembering unexpected events during a spacewalk.[89]

Following the receivable argument from Buckminster Fuller, of Earth being a spaceship which needs to be carefully sustained, going to Mars, as aspiring as it may sounds, ultimately denotes going from one spaceship to another other, by means of smaller engineered spaceships. However, in times of aspirations based around mobility and progress, Mars appears as the continuity of sought destinations for colonization of the distant unknown. Yet, present interrogations about land property, ownership, efficiency, rationality, adaptability and hybridity remain applicable. In order to work in synergy with a desired spaceship, the human race equally ought to behave respectfully towards its host spaceship. Such understandings would resonate more explicitly if humans were to inhabit a significantly smaller

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89 Hadfield, “What I Learned from Going Blind in Space."

spaceships, like asteroids or even boats and wheeled vehicles, therefore incarnated as nomads, in turns having a drastically different approach from current paradigms regarding material use.

Colonization and migrations hence carry the very essence of nomadism, notably through the inquisitive nature of the human race. Such explorations and evolutions were prominently made possible by the incredible ability of humans to adapt to new environments as well as the ability to develop increasing robustness through hybridity. Having explored mostly every of terrestrial and maritime areas on Earth, humankind can therefore be seen as highly robust and adaptable beings, migrating among a territory they fully domesticated. The notion of physical remoteness, despite being a major aspiration of neo-nomads, belongs to the past and therefore allows further discoveries rather in intensity.

Mapuche resisting Spanish colonization - Araucania, Chile - 1834

Johann Moritz Rugendas – Public domain

Earthrise: spaceship Earth seen from satellite spaceship Moon

NASA - Public domain

Geo-Infrastructures

Colonization, on top of representing particular nomadic journeys, offer distinctive opportunities to adapt to new contexts. This notably enables access to more resources to build upon, and therefore to withstand fluctuating needs. Particularly benefitting successive technological revolutions, humankind has therefore adapted colonized environment for ease of later adaptations to support human needs. Such manufactured contexts have transitioned the perception of Earth to an infrastructure in itself, enabling strenuous inhabitations and circulations. This substantial preliminary alteration subsequently allows neo-nomads to adapt relatively easily to a variety of contexts, hence drawing the premises of global nomads.

TRANSPORTATION INFRASTRUCTURE

The most prominent and noticeable alteration facilitating human activities on domesticated land are transportation infrastructure. Land based infrastructures such as roads represent significantly more that simple technical solution for efficiency of transportation and mobilities, they moreover federate a wide range of social, economic and constitutional values. Roads notably permit to overcome geographical barriers preventing such stimulus, which the creation of alpine road passes adequately exemplifies. Additionally, the suppression of internal customs associated with the freedom of goods and individual mobility permitted the free establishment of citizens, hence featuring a domestication of nation-wide territories. It goes without saying that transport infrastructures compose a driving factor of urbanization and economic activities through potential developments of trade. The birth of novel roads systematically anticipates development at point A, as well as at point B, but also along the entire infrastructure connecting A to B. As a contemporary example,

the belt and road initiative[90] connecting Asia to Europe and Africa is welcoming a modern silk road, passing through Chongqing in China, and encompassing a development considered resplendent even for Chinese citizens. Such project over ten thousand kilometers of road and rail is made possible through considerations of expected economic developments along the infrastructure, that more energy-efficient maritime cargo could not foster, although less expensive and equally linking the same end locations.

Trade inherently remains one of the main causes of maritime and land infrastructure expansions. In fact, rivers and oceans as main axis of commercial circulations primarily witnessed the formation of cities as centers of civilizations. Moreover, the perpetual flow of water as symbol of sanitation, hydration, health and commerce, cogently translated as the base of infrastructural watercourses and places of harvestable energy.

Additionally, in order to facilitate maritime transportation, humankind significantly altered natural formation by generating continuous water ways between oceans such as the Panama Canal and the Suez Canal.[91] On the other hand, there is currently no universal land-based connection such as bridges in high latitudes between continents even though the distance to cross is smaller than the length of canals. This notably nightlights the variability of pre-existing ease of transportation between maritime vessel requiring no intermediary infrastructures, and land-based networks such as rails and roads, requiring further domestication, and not economically viable. Efficient global transportations are therefore achieved through hybridization of specialized networks and of infrastructural cross-connections.

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90 Angélil, "Tales of Territory: Anthropocene, Urbicene, Capitalocene?"

91 Embassy of Egypt in Washington DC, "The Suez Canal Economic Zone: An Emerging International Commercial Hub."

The development of containers facilitated standardized transportation across various environments, exemplified by the mesmerizing logistics of harbor infrastructures and sea ports.
But such ease of transportation ultimately led to abuse and irrationalities, casually transporting goods back and force across continents, or even waste across the globe,[92] leading to alarming geographies of trash.[93] The absolute system of containerization prevents any potential adaptability to specific contexts despite its applicability to every international transportation.

Airports in turns harnessed the free transportation possibilities from the atmosphere, while representing a significant part of environmental threat and land alteration, often impacting entire metropoles or occasionally by creating artificial island, notably for one of the longest building in the world: the Kansai airport. The resulting intertwinement of all transportation infrastructures generates an unprecedented *connexe* (interconnected) network, continuously offering opportunities to directly or indirectly reach any destination. Naturally, helped by such engineered systems, nomadic communities experience easy adaptations and benefit established technologies, yet in a different occurrence for each location. In order to alleviate the human impact on the terrarium, the aquarium, and the planetarium,[94] one of the main solutions consist in reducing infrastructure needs, notably by efficient managements of transports, such as avoiding empty cargo through judicious optimizations. This

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92 More importantly than the worldwide trash exportations for "processing" in China, it is rather a problem of optimization as exemplified by tracked shoes which travelled several times across the US before being recycled. Reference from Picon, *Smart Cities Theories et Critique d'un Ideal Auto-Réalisateur*.

93 Ghosn and Jazairy, *Geographies of Trash*.

94 Ghosn and Jazairy, *Geostories*.

notably demonstrates the potentials of adaptability in logistic difficulties although not being individually the most efficient per trip, but rather optimized in totality, hence promoting a hybridity of mutually enriching capacities.

CARS, DRONES, CARGO SHIPS

Yet infrastructures would be of little use without vehicles, which in turns inhabit and size infrastructural networks. The car predominance is notably felt across all domesticated areas and represent the core of the built environment,[95] besides its importance for modern mobilities. Yet their increasing number paradoxically limit fluidifications of mobilities, leading to the emergence of public transportation. Despite related environmental and social concerns, automobiles have continuously increased in comfort, motorization, and weight, therefore accelerating associated issues, while several Japanese manufacturers revealed how moderated they could be. This importance of the vehicle and its impact is primordial for neo-nomadic communities whose habitat are precisely vehicles themselves, while infrastructures perform as their primary contexts.

However, the perpetual improvement of wheeled vehicles recently welcomed two major technological utopias facing global health: electric propulsion for "greener" transports and autonomous driving, notably in order to achieve freight automation. Such complex technological visions are in reality increasing the general stress of networks, but also increasing their adaptability potential by establishing alternative systems with additional vacancy for optimized hybrid circulations. This is particularly explicit through aeronautics innovation, offering new territorial perceptions, but more importantly profiting inexpensive materialization over valuable landscapes. The

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95 Henley, *L'Architecture du parking.*

development of Unmanned Aerial Vehicles (UAVs) is providing a precision and expansion of this territorial vision, but is more prominently affirming the future of transportation free of any pre-existing infrastructure, thus overcoming crucial modal hybridity.

The issue of vehicles notably comes with their number, which in most extreme cases surpass the number of citizens, in countries like Finland.[96] Vehicle and container handling make up rather complex sciences, which have long fascinated architecture through aesthetics of efficiency, in some case leading to translation of this machinist stance in attempts at industrializing building construction. But the visionary image carried by vehicles engineering outreach any predictable boundaries, as even the vocabulary perpetuated across new technologies, for example like "cabin" and "bridge" carried from boats to planes. Even the word "car" holds origins progressively evolving from "to run" in Proto-Indeo-European, therefore sharing the same root as "horse". Functionally however, a horse would seem closer to motorcycles, as pigeons from internet. The domestications of these animals are in reality key factors that permitted territorial expansion. While the role of the horse is explicit, pigeons were notably essential for communication purposes, and were even weaponized during the first world war, using them to photograph enemy territories or smuggling in prisons.[97] Anonymous vernacular architecture such as pigeon towers had in fact greater impacts on land domestication, through the supplementary production of fertilizer,[98] than dwellings and other "essential" architectures. Hence, vehicles, regardless of their nature, play a fundamental role in the alteration, control, and

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96 World Health Organization, *Global Status Report on Road Safety 2015*.

97 Corera, *Operation Columba*.

98 Bin Shabib and Bin Shabib, "Architecture for Pigeons."

exploration of new territories, and notably form the primary habitats of neo-nomads.

THE GLOBE AS A MACRO/META-INFRASTRUCTURE

Gradually, nature pleased as a resource that can be conquered, sold, altered, engineered, thus declaring the globe as prone to be converted into a geo-infrastructure. In order to welcome human activities on any natural territory, an intermediate alteration is almost systematically applied, generating zones suitable for conditions of human habitation. The essence of this alteration is notably introduced by Pier Vittorio Aureli under the notion of platforms. This definition is of particular interest notably when considering the leveling of the ground as a primitive act deliberately changing a specific context to better suit human activities and mobilities. As trivial as it may sound, flatness constitutes the essence of platforms by allowing the elemental importance of usage versatility in a given context, preceding the definition of infrastructures. Following this understanding, platforms naturally contain roads, floors, terraces, agricultural flats, etc. as infrastructural constructions, while social medias and online retailers' warehouses also relate to this notion of platform in specific ways. Therefore, land as a manageable resource for such platforms are presented with new significance through techno-utopianism,[99] and literally constitutes the primary resource of nomads.

However, the 21st century is substantially distinctive by the scale of such infrastructure extents, reflecting the globalization phenomena through universal infrastructure. [100] With more than 64

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99 Spencer, "Dialectic of Nature and Capital: Subjects of the Eco-Imaginary."

100 LeCavalier, *The Rule of Logistics*.

million kilometers of roads,[101] 6,22 million kilometers of pipelines,[102] 2,29 million kilometers of waterways,[103] and 1,37 million kilometers of rails,[104] the globe can decisively be perceived as a universal infrastructure. Yona Friedman notably proposed to design bridge-cities between continents, further domesticating the planet, and metaphorically completing the spaceship Earth. Such physical continental connections, hypothetically located on the Arctic circle, feed the fantasy of Earth as a geo-infrastructure, therefore fading the notion of contextual specificity and the concept of locality.

Free of location limitations, territories are often perceived for their potential productive value, landscapes therefore becoming infrastructure themselves,[105] symbolically represented by the prominent figures of damns, mines, etc. and equally valued by sedentary citizens and nomads alike. In reaction to large climatic events affecting specific territories, Earth is also seen as environmental infrastructure, a large property that can be engineered, notably exemplified through the recent projects of greenbelts in Africa to combat the progression of the Sahara Desert, and in China fighting laws of nature in the Gobi Desert. These pharaonic projects are nonetheless insignificant in light of the more prominent and disputed concept of geo-engineering, and addressed under the scope of the part on "invisible structures". However, the ultimate vision of Earth as a global and physical infrastructure is symbolized through its consideration as

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101 Based on arguments relating the transition of trust detailed in the "acceleration deceleration" part, citing Wikipedia is tolerated under moderate usage principally for the following set of data: Wikipedia, List of Countries by Road Network Size

102 Wikipedia, List of Countries by Total Length of Pipelines

103 Wikipedia, List of Countries by Waterways Length

104 Wikipedia. List of Countries by Rail Transport Network Size

105 Bélanger, *Landscape as Infrastructure*.

performative function of a terra-scope,[106] seeking to use the Earth's inherent characteristics as astronomical tools.

IMPACT ON LANDSCAPES

Inversely, transportation infrastructures are often considered having the largest impact on landscapes, affecting both ecosystems and human perceptions. However, such topographic and tectonic injuries are incumbent in order to construct transportation infrastructure such as high-speed rail lines and highways to name a few. Yet their impact on climatic conditions is mostly indirect, dominated by energy infrastructures such as damns, mines, photovoltaic farm, windmill field, oil platforms, etc. yet needed by every single modern activity. Paradoxically, only the hybridity of all systems permits the fragile continuation of every operational activities, while the impact of geo-infrastructures is in reality more complex than mere ecological and economic considerations. Infrastructures also alter ambient conditions forcing inevitable adaptations, notably referring to the permanent sound of cow bells which was rapidly supplemented by the noise of cars on highways as an incumbent paradigm of modern acoustic comfort.

However, some landscape warts could be attenuated by moderating and adapting their usage, especially considering their intermittent functioning. For example, the prominent impact of ski lifts in mountainous landscapes could be seen as a year-long affordable opportunity for alpine mobility, inducing new potentialities of lifestyles, heritage valorizations and physical manifestations.

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106 Kipping, "The 'Terrascope.'"

MAINTENANCE

The relation of these geo-infrastructures with time notably questions their lifespan and related implications, but more prominently interrogates the hidden impact of infrastructure maintenance. The rigorous cutting of roadside vegetation in reality obstruct the larger problem of infrastructure reuse, recently exemplified by the collapse of the Arecibo telescope,[107] which will presumably be left as is. The maintenance and afterlife of infrastructures is of particular importance for neo-nomads who heavily rely on these economically and territorially lavish expansions. The fields of wind turbines and photovoltaic panels conveying images of innovation and modernity might soon be perceived as wounds in the landscape as there is still no major consideration for their afterlife. Paradoxically taking place in an era of environmental sensibility, such perception might soon turn into disastrous and harmful performative objects, recalling the history of nuclear powerplant, thus conveying an impact beyond their size.

THE ROLE OF GLOBAL CITIES

Unsurprisingly, cities are built around transportation infrastructures and mobilities flows, and hold important roles in the apprehension of large interconnected systems. The predominance of transportation networks over buildings in the development of urbanized areas drastically forces architecture to inherit constraints based on urban circulations. In this sense, harbor cities witness intense cohabitations between local and global flows, between freight transportation and human mobilities, representing major characteristics of both global cities and nomadic lifestyles.

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[107] Associated Press, "Giant Arecibo Radio Telescope Collapses in Puerto Rico."

The metaphorical representation apex of nomads witnessing a flows diversification is defined through the concept of smart cities getting increasingly technologized,[108] hence highly sensitive, and prone to misfunctioning.[109] On a fully domesticated surface, available land not characterized by the city is instead valued through the implementation of infrastructures, in efforts of counterbalancing economic attractiveness of cities. This led numerous architects to project entire nomadic cities, advocating for the same economy of scale found on cargo ships compared to more timidly sized land-based transportation. Although remaining at the stage of fantasy, such visions can be related to the largest manmade vessel on land, an excavation machine,[110] hence altering its environment in a similar behavior a nomadic city would.

SOCIAL RELATION TO THE GEO-INFRASTRUCTURE

Nonetheless, the notion of geo-infrastructure was purposefully sought after, as denoted by the predominance of high-speed and high range transportation systems in most depictions of utopias. The imagination provoked by mobilities draws on a common excitement, on how they affect the city and the territory, how the planet is perceived, beyond materials and down-to-Earth rationalities. This is particularly intensified in the 21st century, as the sphericity of Earth is universally experienced through plane travels, time zones, satellite geolocation, etc. As a result, it seems harder and harder to mentally internalize the sprawl of contemporary cities especially global cities, which are notably victim of intermittent employment, post-Fordist gentrification and exodus to peripheries.[111] While distances were

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108 Picon, *Smart Cities, A Spatialised Intelligence*.

109 Picon, *Smart Cities Theories et Critique d'un Ideal Auto-Réalisateur*.

110 named Bagger 288

111 Le Marchand, "Travail intermittent et production de la ville post-fordiste."

historically expressed in time, current mobilities are rather based on arrival time since speed has mainly been overcame, leading any displacement feasible under 48 hours through the world's heavily developed infrastructures.

Either for transportation, for mobility, for energy production, or for material sourcing, sedentary civilization adapted Earth to their needs throughout the various industrial revolutions, converting the totality of domesticated areas as a geo-infrastructure in order to freely move on the globe's surface, thus strengthening the contemporary aspiration of freedom. Neo-nomads are in turn able to easily adapt to various environments as territories were largely adapted beforehand.

Global logistics - Puerto Montt, Chile – 2019

Maxence Grangeot

Access, energy and information in the desert - Yunchara, Bolivia - 2019

Maxence Grangeot

Preliminary adaptation - Agua calientes, Peru – 2019

Maxence Grangeot

Posthuman architectures

Atop a fully colonized surface domesticated through a continuous geo-infrastructure, civilizations have gradually developed production activities and facilities in order to support increasingly complex needs.

The first industrial revolution which led to the birth of trains also provoked the elaboration of the modern car, notably through the figure of Henry Ford. In order to bring the benefits of cars to larger audiences, a novel organization of production and labor was born under the notions of Fordism and Taylorism. This notably induced strong spatial disruptions of productive capacities while endlessly increasing the relative proportion of machines compared to human population. This heavy mechanization constitutes the basis of anonymous history,[112] and provoked the emergence of many visionary principles. Soon the dream of automation, or omni-automated production from the words of Buckminster Fuller, would unleash metaphysical capabilities of humans. This understandable statement is one of many which advocated for automatization, consequently freeing humans from their productive constraints.

Hence, automation is apprehended in this document as tools freeing sedentary civilizations from a demanding workforce, but most importantly from any physical presence. This establishes the premise of remote working by transposing the question of human freedom in the midst of intense productions. Automation has reached a significant threshold where human intervention is mostly unnecessary while its main purpose is to serve human needs. Hence, these

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112 Giedion, *Mechanization Takes Command*.

autonomous technological devices are defined as posthuman architectures, requiring no human to operate, although serving humans only.

FOOD AUTOMATION

Unsurprisingly, agriculture was one of the most impacted by mechanization during the industrial revolution, and more recently by automation. The production of food for an increasing population was notably made possible by the arrival of tractors in farms, marking the beginning of mass production and globalization. The concentration of population in cities led to large investigations of the countryside, and particularly to architectural studies of the related technological predominance.[113] Strikingly, besides the heavily technologized food production systems, the countryside is home to more and more posthuman architectures requiring extensive areas such as automated "greenhouses", electric automobile factories, fulfillment centers, data centers, etc.[114] In this perspective, the countryside is paradoxically even more technologized than cities, where autonomous urban farms sparsely pop up yet without sufficient scale nor underlaying rationality. The trends for novel "back to the land" movements associated with tremendous historical steps of mechanization and automation of food production announce the countryside as a major contributor of freedom from productive constraints, largely cherished by nomads. Such archetype notably questions whether the roots of sedentary civilizations are tied to the locality or to the workforce, hence allowing physical emancipation from land while guaranteeing universal production for neo-nomads to benefit. Once again, nomadic

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113 AMO et al., *Koolhaas. Countryside, A Report*.

114 One could virtually explore around 39°32'15.7"N 119°28'31.0"W with satellite cartography tools and notably compare the unconventional scale of such warehouses with the already sheer size of the neighboring city.

adaptability is made possible through previously altered environmental, stressing their strong interdependence.

LOGISTICS AUTOMATION

Countryside is also home to other posthuman architectures such as data centers, where human activity is only virtually present through rows of servers. Such infrastructures are also present at seas,[115] underwater in order to avoid land taxes and benefit permanent cooling, in efforts of maximizing efficiency at the expense of physical consequences. This extreme rationality of automatized services is also discernable in automated logistics centers and distribution warehouses. This is particularly due to the booming of online retailing and on demand deliveries, picturing the evolution of an industry of expendability and consumption. The mesmerizing flows and identification of unrelated items is notably inherited from the standardization of rail transportation through the popularization of barcodes,[116] and their adoption in factories, and their subsequent evolution into the ubiquitous Quick Response (QR) code. Automation is spreading remarkably fast among most industries and is increasingly experienced by consumers, for example through domestic vacuum or lawn mower robot, automated libraries or archives, street food distributors, vertical car parks, etc. augmenting the vision of robotic landscapes sustaining human needs.

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115 Roach, "Microsoft Finds Underwater Datacenters Are Reliable, Practical and Use Energy Sustainably."

116 Barcodes were initially circular and concentric to be read in every orientation but this system was rapidly transition to current barcodes due to inherent potentialities of printing inaccuracies.

Yet all these heavily technologized capacities do not relate to their immediate context and could be located almost anywhere. This is notably due to their consequent size, an irrational utopia repeatedly theorized during the 20th century as ultimately denying any context precepts,[117] governed only by internal rules. In conditions of disruption with physical anchorage, as they currently emerge, the notion of bigness[118] is notably defined by the concept of architectural lobotomy,[119] an envelope unable to epitomize its content. The multiplication of this principle to entire cities led to the fascination of architects for megastructures,[120] as buildings sufficiently large to contain the life of entire cities. Associated with an idea of growth, such principles have been largely experimented in Japan under the architectural concept of Metabolism.[121] Several science-fiction popular mediums proposed some representations of such fantasist postulation, notably through cities navigating on wheels,[122] across oceans, or even in space.

While such groundbreaking technologies literally allow humans to break free from the ground, to break free from productive constraints enabling them to become nomads, it remains difficult to assess whether the overall benefits outperform the underestimated damages. Since the first industrial revolution, humankind persistently relied on subsequent technologies in order to counterbalance the mutilations from the previous ones. The nomadic movements

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117 Unsurprising referring to the XL chapter within : Koolhaas et al., *S, M, L, XL*.

118 Koolhaas, *Bigness*.

119 Koolhaas, *Delirious New York*.

120 Banham, *Megastructure*.

121 Koolhaas et al., *Project Japan*.

122 Rivers, *Mortal Engines*.

throughout history have proved achievable the ability to adapt to any technological context, thus invalidating the need for evolutionary technology. This was notably questioned by Alexander Grothendieck when addressing distinguished colleagues and reminding the two sides of atomic research. He abruptly ended his prominent career by humbly asking his renowned colleagues whether humankind should continue scientific research.[123]

[123] Grothendieck, *Allons-Nous Continuer La Recherche Scientifique?*

Automated vertical parking - Osaka, Japan - 2017

Maxence Grangeot

Invisible structures

The perception of the whole Earth as a domesticated territory was recently accentuated by a wide variety of digital tools fostering invisible landscapes. The poetic of these intangible infrastructures originates from, and supplements, the introduced colonization, domestication and automation in their respective parts.

Metaphorically first, human nomadism can be reflected by the imperceptible and perpetual movement of the Earth through the cosmos, conferring the astronauts of spaceship Earth a metaphysical feeling of unity facing the dark extent of the unknown. This intangible feeling of belonging to a single system all together is relatively recent and can be credited to early environmentalists and their intensive usage of *The Blue Marble* photograph. Aboard this globe, geological formations of continents can also be granted with the nomadic adjective although their displacements are not directly perceptible to any lifeform due to the hefty disproportion of timescale.

In fact, this understanding of inhabitable areas as a crust in section rather than a globe in space allows to redefine the Anthropocene as a thin geological layer,[124] hence as an almost imperceptible physical layer at a global scale. Yet humankind eventually managed to establish a geography of artificial borders having impacts beyond the political entity they contain and the land control they establish. Borders notably attempt to intangibly establish social and cultural separation of unified systems, and carry physical manifestation of mobilities through infrastructures. As such, the concept of "global fluids" aims to delineate this intangible aspect of intense and

[124] Latour, "Inside."

malleable mobilities.[125] Such nomadic formations can't be predicted and are unevenly distributed, thus strengthening their invisible nature despite their importance. This underlying system, exemplified by water and oceans in this case, are part of wider structures anchored in physical territories. To elaborate this metaphor, global fluids are subjected to established rules of continent-wide drainage basins, forming natural barriers yet sometimes remaining as imperceptible lines.

On the economic side, the distant explorations during the colonial era precipitated the birth of insurances as intangible financial securities, based on the foundational dematerialization of value through money, allowing the nomadic quests to continue across further territories.[126] The potentialities offered by such immaterial resources is of particular interest as insurances became a paradigm of security for nearly every material possession of nomads but also of sedentary civilizations, hence conferring a particular hypothetic attribute to essentially tangible assets.

GEO-ENGINEERING

Additionally, the perception of Earth as a geo-infrastructure, associated with the consideration of nature as a resource that can be engineered, led to the birth of a heavily disputed discipline. Geo-engineering, an invisible science which purpose is to directly act on the environment in order to alter its behavior, is notably advertised as a miracle solution to climate change. Nevertheless, geo-engineering is persistently gaining more attention from scholars and scientists, but more dangerously from politicians and the global population. From *geo*, a global scale, and *engineering,* originally to construct war machines, geo-engineering is a deliberate action at a global scale and is

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125 D'Andrea, "Neo-Nomadism."

126 Centre de création industrielle, *Errants, Nomades, Voyageurs*.

principally not palpable. Considering climate change, one key argument of geo-engineering is the ability to rapidly lower the average temperature of Earth. Naturally, this solution is not acting at the source of the issue but is alarmingly more appealing to politicians and industrials since it represents the only massively acceptable technological solution to climate change to maintain contemporary standards of living and economies.[127]

Truthfully, geo-engineering has already been applied multiple times during the 20th century, and was born from climatology during the second world war when predicting the weather was crucial, but it remains difficult to assess the extent due to its intangible nature. The study of localized meteorology is notably reflecting the indiscernible yet strong impact of the climate by applying a theoretical grid to a given territory, allowing the register scalar fields containing multiple sets of data. When the first computers were able to predict the weather, it became clear that one could intervene on very few parameters in order to control the weather.[128] By dispersing droplets of water into the stratosphere, the former climatologists were able to provoke heavy rains or droughts, fog or clear skies, and this would turn decisive in times of war. More powerful than the atomic bomb, this new weapon was completely furtive as mankind had finally developed a science to control nature at a global scale.

The biblical metaphor is naturally in present, therefore fundamentally questioning the place of humans in nature and their ability to self-restrain. For Russia, largely constrained by an extreme climate, this "tool" could significantly impact their geography and economy. Climatic studies were notably the cause of tensions during the

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127 Klein, *This Changes Everything*.

128 Lévy, *Les Apprentis Sorciers Du Climat*.

cold war between the US and Russia, unable to distinguish scientific studies from military operations.

As for the ethics of engineering, the mere study of geo-engineering would give the opportunity to world leaders to use it, despite all efforts. In times of political failures and capitalist expectations, geo-engineering is severely gaining attractiveness both in research laboratories and institutional offices. Since geo-engineering knows no borders, its use would eventually leave every nation in the same tarnished environment, undermining a larger geopolitical conflict regardless of the belligerents. More importantly, a recurring discussion is related to the geo-engineering of Mars, abnormally called "terraforming", in order to create suitable conditions for the "natural" appearance of life, in a 100 years' timeline. In other words, humankind would impose its technology to the neighboring spaceship in order to convert it into a planet B, therefore allowing the continuation of scientific research without fundamental reassessment of its suitability. Geo-engineering and the International Chemical Weapons Convention are two notable examples marking the self-imposed technological limits of invisible structures engineered to sustain human activities.

ENERGY

Another prominent invisible structure of this fully domesticated and automated surface lies in both the perception and the substance of energy. Every activity, either belonging to sedentary of more nomadic processes involve the consumption of energy. Yet the physical manifestation of energy remains intangible, as electricity circulate into wires or lightnings, and cannot be straightforwardly altered. Oil and coal, despite being more easily palpable, are not conveying an understandable sensation of energy, requiring additional process to be exploited. Gaz and uranium also provide visible outcomes through

understandable procedures, but remain inherently intangible.[129] However, energy as invisible structures can physically impact territories, revealing geographies of externalities not perceived until then.[130] Electricity has notably made the territory of the globe isotropic, ensuring a continuity of the metropolis across domesticated land.
This present state of infrastructural homogeneity is particularly represented through the famous theoretical projects of No-Stop City,[131] or even the Supersurface.[132] Both projects exalt the recent isotropic and domestic condition of inhabitable land, Earth's surface metaphorically and physically becoming a global infrastructure on which anyone could plug anywhere and benefit from universal technological services.

Yet, the energy consumption of western civilizations and posthuman facilities are enormous but are not consciously apprehended due to the important distance separating production from consumption. This detachment provokes the feeling of invisible energy abundance, and leads to irrational consumptions as if such magical power could endlessly support human needs. This is notably accentuated by the transition from oil platforms, coal mines and gas wells to even more invisible "green" energies as their impact are rather deported to complex extraction processes, to brief lifespans of 15 years, to heavy foundations for windmills and visually denote less environmental alteration on the surface.

However, the related productivity is far from sufficient facing non-adaptable behaviors of sedentary civilizations, leading further

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129 Ghosh, *The Great Derangement*.

130 Ghosn and Jazairy, *Geostories*.

131 Branzi, *No-stop city*.

132 Superstudio, *Supersurface - An Alternative Model for Life on the Earth*.

researches into the development of more complex technologies to cope with irrational needs. There are notably large hopes in the process of replicating a miniature sun on Earth through projects of a nuclear fusion reactor in France and South Korea, yet far from being able to take advantage of the plural characteristics of the existing sun, such as heat, light, magnetic field, radiant energy, gravitational mass, and all other phenomena humans still can't understand.

DIGITALIZATION

Further than the intangible vision of energy, the development of digitalization has induced a dematerialized attitude towards domesticated territories, and is particularly embraced by the neonomadic movement. The most embryonic sample of territories dematerialization lies in the notion of localization and its extension to cartography. Coordinates systems are notably derivatives from attempts to figuratively represent the incommensurable extent of colonized land as an abstracted geography. Expressed in minutes or degrees, and based on invisible subdivision called meridian and parallels, coordinates on a cartography notably relay the uppermost physical information: a position in space-time. Hybridized to modern posthuman technology, these global localizations significantly increased in precision through satellites and the birth of Global Positioning System (GPS).

Satellite geolocation has the particularity of bringing together virtual and tangible through an equivalent point of flesh and data,[133] manifesting the first intersection of the virtual with the physical world.[134] This precise geolocation repeated millions of times generates point clouds thanks to Light Imagery Detection and Ranging

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133 Picon, *Smart Cities Theories et Critique d'un Ideal Auto-Réalisateur*.

134 Picon, *Smart Cities, A Spatialised Intelligence*.

(LIDAR) technologies, extending automobile capacities shortly after the introduction of intelligence in car through GPS generated itinerary. Point Clouds are equally of tremendous interest for architects, enabling to precisely depict the reality into digital data without noticeable imprecisions nor abstractions.

But the digitalization of localization added another numeric layer on the city towards the intangible development of smart cities. This is largely due to the progress in orbital posthuman vehicles, namely the satellites which functions comprise reflecting the communication signals within the spaceship Earth, and remotely informing humans on territorial conditions without requiring direct human workforce to operate. Their remoteness precisely permits their operation, yet equally generates a biased feeling of absence. Despite their distance to users hence their invisible nature, satellites belong to the spaceship Earth, requiring its mass to remain in orbit and remotely interacting with humans. In fact, there are generally 10 times more planes in the sky than satellites, however they are 5 times more manmade satellites in orbit than there are submarines in the world. Hence their relevance is unrelated to the human capacity to perceive them, complementing the importance of intangible infrastructures, and forming a world of invisible landscapes.

The revolution of satellite GPS is notably at the forefront of many applications across all industries, allowing the geographical tracking of equipment, containers, automated activities, and even livestock tracking, replacing the historical cow bell which became so distinctive in most territories. Hence the colonization and domestication of Earth as a geo-infrastructure is equally invisible and should not be underestimated by this intangible nature.

Satellites additionally provided unconventional imageries, publicly rendering people as Earth dwellers, but more prominently impacting wars and governmental control along with connectivity and research. This ending of a period of unknown territories was consequently replaced by this global fabric like a super-surface. Such dissolution of remoteness associated with the changing scale of space perception announced the end of Earth's colonization. However, despite their limited visibility, the infrastructure supporting invisible domestication have very tangible repercussions. Radio infrastructures are particularly ingenious through their rationality of location and for the material efficiency of radio tower in remote locations. As a consequence, antennas and other hidden communication infrastructures translate as much notions of mobilities and space domestication than architecture.

INTERNET

The dematerialization of global infrastructures notably permitted the creation of worldwide invisible landscapes such as the internet, transposing part of physical traffic into internet traffic. However, these immaterial landscapes, promoted through words like "cloud" are supported through physical yet hidden infrastructures, namely underwater cables, data centers, transmission towers, satellites, etc.[135] revealing dual and interdependent sceneries. Such promotion as fully dematerialized infrastructures is conceivably due to the historical nature of rapid airborne communications by pigeons, requiring no intermediary physical infrastructures.[136] However, virtual landscapes have become the essence of online social relations, video conferencing, magisterial education, etc. as a new category of space with novel social behaviors. This unprecedented isotropic and

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135 Radat, "L'Habitant de l'Interface."

136 Corera, *Operation Columba*.

invisible network of universal communication allows most of the world population to work and study from anywhere, thus breaking with traditional socio-spatial behaviors. The perception of internet as a virtual meeting point notably unveils the imminent obsoleteness of physical meeting points symbolized by the city, thus announcing the irrelevance of commute and the subsequent death of the city.

The complexity of such large networks also comes with great sensitivity and increasing risk to unpredictable behaviors. This can be linked to the notion of *synergetics* introduced by Buckminster Fuller as system unpredicted by the behaviors of its constituent part. Relating on geo-engineering and control of sedentary population, one could wonder what would happen, for example, if the weather forecast, was deliberately altered, or even if some specific roads were deleted from online cartography systems. This acquaintance swiftly explicit how humans are presently intrinsically tied to these invisible infrastructures.

Those invisible structures notably supplement other important steps in the full domestication of Earth, namely the end of a global colonization, an extreme spread of transportation infrastructures and the progressive automation of productive activities, which all together ascertain the end of remoteness among a finite terrestrial body. More than technological and historical figures, the complete domestication of Earth is now an intrinsic feeling of westernized societies, having the feeling that humankind understood everything, [137] went everywhere, and know how to deal with any issue. [138]

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137 This is particularly well represented in literature, with titles like: Brand, *The next Whole Earth Catalog, Access to Tools*.

138 Brand, *Whole Earth Discipline*.

Tangible infrastructures of invisible landscapes – Naye, Switzerland – 2020

Maxence Grangeot

III. Global nomads

Individuality through internet

Neo-nomadic lifestyles particularly rest upon high degrees of adaptability to novel social conditions of mobilities, yet this malleability is prominently made possible by prior establishment of a geo-infrastructure, posthuman architectures and invisible landscapes, thus annihilating the notion of remoteness. The hybridization of these formerly presented concepts leads to the definition of global nomads, simultaneously taking advantage of transportation and telecommunication systems. The extent of such territorial alterations combined with the intensity of social disruptions elevated nomads to global nomads, radically changing the scale of their context. The extracted principles of this novel paradigm notably aim at metaphorically informing architecture and construction in order to regain a meaningful dialog with contemporary civilizations.

GLOBAL NOMADS AS HYPERMOBILES

Being recently liberated from the land and other sedentary constraint, countercultural protagonists precipitously experienced the transcalarity enabled by unprecedented infrastructural networks. Their rapid movement on a free surface revealed various relations to the territory, to space, and to time, hence to mobilities. The generated adaptability is decisively permitted by reversibility in space, extreme flexibility in directions, as long as relevant hybridization of technical systems. Consequently, while nomads have a deterritorialized notion of space, neo-nomads do not translate as homeless, but rather as inhabitants of another scale, the scale of Earth. However, the location

of their minds significantly varies between constrained nomads i.e migrants with greater interest in the locality, and between "expressive expatriates" in search of freedom without rootedness into defined contexts.[139]

However, global nomads are emanated as a stinging diaspora, due to their mixed ethnicity, while refuting any attachment to a homeland. This understanding was notably introduced by Buckminster Fuller, declaring himself as a world nomad through regular planes travels, and wearing 3 watches to keep track of multiples time zones. Mobility therefore became a secondary nature for global nomads, and proliferated at an unprecedented rate, as byproducts of the social acceleration. The recent boom of "van life" reflects the synthetization of the aspiration from a travel generation, establishing nostalgic drawbacks to the former Beat generation. The spreading pace echoes an era of instant virality[140] and is nourished by an abundance of nomadic precedents and desirable references, paving the way for easier adoptions of alternative nomadic lifestyles.

This notably led to the emergence of novel spatiality in between private domesticity and working environments. These 3rd place, such as coffeehouse lounges, act as transitory yet social condenser, advocating both for personal exhibition of social attributes and relaxing environmental from the dazzling urban life. This particular socio-spatial duality is reflected in the historical figure of

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139 D'Andrea, "Neo-Nomadism."

140 The rising trend of digital nomads and neo-nomads is particularly difficult to statistically assess, but the worldwide upsurge of the "digital nomad" topic in google trends is concomitant with the birth of social medias. Moreover, the subreddits r/vandwellers and r/digitalnomad have more than 1 million members each, although this number does not constitute a factual statistic, as members are not necessarily experimenting such lifestyles, and as not every neo-nomad is a user of reddit neither member of such virtual communities.

Caravanserai, prominent inns for travelers along trade routes like the Silk Road. The intense propagation of such nomadic lifestyles notably encourages, or derives from, aspirations for anti-consumerism, as possessions appear more and more burdensome and wasteful. Global nomads notably aim at reducing their belonging to an optimum minimum, in most cases heavily oriented by the productivity achievable through an internet connection and a laptop, as two widespread representations of the 21st century.

DIGITAL NOMADS AS INTERNET ADDICTS

Such rationalism, often called minimalism, is made possible by the invisible infrastructures and all preceding breakthroughs detailed in the chapter "End of remoteness", triggering the birth of "digital nomads", able to work and live anywhere. The explosion of internet communications along with the intensive usage of satellites, or other invisible services becoming paradigmatic more rapidly than coal or electricity, render Earth as a unitary site for nomad ambulation.[141] The social impact of these intangible structures is consequently reshaped the territory from a "space of places" to "space of flows",[142] and enabling a variety of usage from an single infrastructure. The elegance of technologies like smartphones, laptops, social networks, etc. lies in the ultimate flexibility of personification among a globalized and unique system. The derived diversity of contents and practices is heavily personalized, announcing a new era of identity, in line with popular movements of social emancipation.[143] The most equivalent attempt of such personification in terms of architectural domesticity was promoted through the image of the unit cells of Nakagin Capsule Tower, and countless other failed attempts to generate

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141 Turner, *From Counterculture to Cyberculture*.

142 Castells, *The Rise of the Network Society*. p.453

143 Referring to : Gender equality, "Black Lives Matter", "Me too", etc.

diversity through standardized units, and is detailed in the "annihilating standardization" part.

Contemporary online "social" networks are particularly successful at generating bespoke cognizance, commonly through a succession of unrelated content generating novel synergies for each individual. But more prominently, these intangible structures connected relatives and people with similar interests from across the globe, regardless of their nationality, social status, profession, and of their locality. Such wide adoption notably comes at the prize of misuse, especially through the curse of geotagged photos,[144] and their daunting impact on the natural environment. Yet such butterfly effect is what rendered the idealization of alternative neo-nomadic lifestyles possible, noticeably by the enormous sharing of information, but also by the virality of numerous possible references. The major paradox of such lifestyle is therefore defined by the aspiration for minimalism and anti-consumerism thanks to flexible technologies, and in the other hand by an incommensurably influential expressivity, especially among young and active audiences, leading to extreme amounts of intangible consumptions.

If tools are perceived as externalizations of human capacities, then the notebook would be an externalization of the memory, while the computer and the smartphone would depict externalizations of personification and communication. Online tools particularly enable the free collection and sharing of knowledge, eventually promoting and elucidating alternative lifestyles. Internet therefore appears as a new context, an invisible territory among which digital nomads could virtually "travel", jumping from (web)site to (web)site, hoping onboard a nomadic journey full of virtual maps sightseeing, immersive wanderings on captured cartographies, spending more

144 Haubursin, "What Happens When Nature Goes Viral?"

time inhabiting the architecture of websites than physical sceneries. The spatial arrangement of websites is a particularly sophisticated metaphor of nomadic habitats, fluctuating according to changing contexts and users, yet widely variable, and available everywhere in a succession of unrelated states. Strikingly, the proportions and layout of an internet page defines the architecture colonized by digital nomads. The richness of such intangible structure notably reveals the shift of computers overturning humans as specialists, forcing humankind to reestablish, and exemplified by the subsistence of addresses only as emails.

WORKING

However, these immaterial technologies did not replace human abilities to develop and shape new intermittent working conditions, embracing variability rather than fearing it, therefore opposing precedent works derived from tangible undertakings.[145] The adaptability of neo-nomads to volatile needs, either for financial necessity or working aspirations, generates a noteworthy paradox, defining neo-nomads in between marginal and essential assets of hybrid societies. In fact, the volatility of needs is rather an entanglement inherited from the social acceleration in the late modernity.[146] Nomads and in particular Roma people, have adapted throughout history to every socio-economical context by developing circular economies solely based on local resources, hence allowing the repeatability of this system in any locality. By holistically understanding local material managements and meticulously identifying flaws, they established themselves as pioneers of circular economy, and are notably able to make a living out of it. Yet by definition, such small businesses are not

[145] Le Marchand, "Travail intermittent et production de la ville post-fordiste."

[146] Rosa, *Aliénation et accélération*.

genuinely profitable for nomads,[147] who largely prefer entrepreneurship over employment. However, the self-employment model of digital nomads radically changed this paradigm, as depicted by an increasing number of young individuals generating comfortable earnings through internet. The working conditions of nomads has been the main focus of scholarly publications by sociologists and economists concerning alternative movements,[148] however little has been analyzed about the emerging freelance working scheme of novel digital nomads, despite its significant importance.

FREELANCING

The appearance and development of remote working is often seen as an opportunity to work from even further away, and is particularly well suited for freelancers, seeking flexibility and diversity of works. Considering the intangible nature of internet as the ultimate furthest destination to self-shape, the freelancing model is particularly appealing for digital-nomads, taking advantages of globalized infrastructures both in their material and immaterial forms. Hence, their learning adventure becomes something else, able to work from nowhere but everywhere at the same time, working in a digital bubble and occasionally taken back to persistently changing physical realities. In this sense, digital nomads experience the internet in an opposite way from their sedentary counterparts, the latter enduring singular physical localities while navigating between scattered digital contents. However, digital nomads are heavily relying on internet in order to work, which remains quite a recent infrastructure, hence prone to volatility and sensitivity, notably since there are no equivalent alternatives. Conversely, several multi-continental tech companies exploit internet potentialities to

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147 Centre de création industrielle, *Errants, Nomades, Voyageurs*.

148 Reitz, "Assembler Son Quotidien Sur La Route."

constitute international and interdisciplinary teams, as military drone pilots can equally work from remote offices on the other side of the world. Some expatriates notably developed appealing lifestyles based on "passive" income through internet.[149] While a larger system of freelancers would allow greater flexibility of staff, of location, of skills, and office surfaces, freelancing prominently reflects a world of increasing specialization,[150] largely criticized by the lack of holistic understanding and synthetic thinking in the midst of complex worldwide crisis.[151] Some rather take advantages of these specialization and ease of remote work to take on more complex and demanding challenges requiring intense hybridizations of knowledge to face the highly convoluted nature of modern technologies and social behaviors.

VIRTUAL MOBILITY

The coronavirus lockdowns accentuated these phenomena, witnessing wider opportunities through freelance internet jobs, gradually overturning physical businesses, sinking under sanitary restrictions, or perhaps under a precipitated fate. The increasing number of global freelancers is noticeably due to waves of unemployment but also through the progressive switch to online operations. Dematerialized companies were notably the most spared by lockdowns and the ensuing economic crisis thanks to their higher flexibility of office necessities and high adaptability of staff lability. While the impacts are discernable on the midterm, the long-term effects might be of greater potencies, as the latter are based on new business models, novel mobilities and graduates with intensive remote habits. The longer the situation, the more irreversible changes are established,

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149 Ferriss, *La semaine de 4 heures*.

150 Fuller, *Operating Manual for Spaceship Earth*.

151 Ochsendorf et al., "The Edward and Mary Allen Lecture in Structural Design."

notably in terms of invisible infrastructures, thus gradually generating new paradigms.

The rapid events particularly provoked a series of instant capsizes such as meetings through video conferencing, rarely practiced for professional and academic purposes before. The situation prominently conveyed clear evidences that most jobs in the service sector are not physically constrained, leading to a long-term emancipation and dispersion of the office, and more largely of the city. Every individual are therefore dwellers of Earth rather than dwellers of specific streets, cities, or countries. Internet prominently overcame physical interactions and redefined Earth as a foundation for every inhabitant. Hence, from a common and singular virtual experience, participants are simultaneously experiencing various localities and their respective conditions.

This encouraged for worldwide adoption of open knowledge and exchange, notably among academic institutions, allowing students to attend lectures from various universities across the globe on the same day, causing an intense unification of the territory. With the irreversible development of persistent technological paradigms, the locality suddenly lost its primitive value, previously threatened in minor importance by other intangible structures. MOOCs, for example, timidly yet early questioned the relevance of in-person courses, until they became the norm overnight, relating to the new teaching paradigm. The situation generated a series of unexpected paradoxes, as people live more and more alone but digitally connected, and were able to work from anywhere, yet unable to move.

These motionless journeys can be associated with other lifestyles alternatives from the past, more attached to spiritual emancipations, such as ravers, New Agers, freaks, punks, hippies, drug enthusiast, etc. Teleworking particularly helped a preexisting distress in

Tokyo and large cities, with workers reportedly experiencing less stress, notably through a reduction of traffic in commutes. Japanese cybercafés were widely considered as refuges from the dazzling society where people sleep, shower and live,[152] and currently appear as the ultimate preceding example of being virtually mobile through digital means, while internet cafés were disappearing in the western world. This virtual mobility is intriguingly more and more present through online multiplayer videogames where players around the world usually evolve on an identical virtual map, connecting various individuals who never met before and probably never will neither in the games nor in reality, unless they virtually become "friends". Hence, screens are defining a new social and spatial paradigm, acting as an interface between two worlds, the second remaining largely unspoiled. However, the concept of remote working doesn't necessarily reduce mobilities as people can spend more time on more scattered occasions in commutes, in turns profoundly altering the perception of the territory.

NEED FOR LEGAL SHIFTS

As Karl Marx pointed out, every social revolution is preceded by a technical revolution. The development of geo-infrastructures markedly led to the booming of neo-nomadic behaviors, whether virtual or territorial, and subsequently to the emergence of novel societal needs. More specifically, one of the major drawbacks of neo and digital nomadism is the persistent lack of a relevant legal structure, the incumbent structure being inherited from a disproportional inertia compared to the pace of such transformations. The impediments appear to be the most abrupt facing the credit systems of financial institutions and other administrative entanglements.[153] Relating back

[152] Le Marchand, "Devenirs Métropole."

[153] Le Marchand, "Économie de bazar et économie morale."

to previous chapters, the impacts, not only on legal systems, but also on geo-infrastructures, energy production, social volatility, automated production, bank support, public services, etc. would drastically change if Earth was populated not by 7 billion sedentary people, but by 10 billion neo-nomads or even by 200 billion primitive nomads.

SEDENTARY PEOPLE, NEO-NOMADS AND TECHNOLOGY

Westernized contemporary lifestyles are heavily dependent on high-technologies such as internet, satellite connection, agriculture industrialization and the automation of many productive activities. However, such technologies are getting deployed around the globe as attempts to help developing countries to cope with the relative lack of infrastructures. Numerous countries in Africa for examples are relying on drones to perform important medical deliveries across the nations,[154] surpassing the enormous economical leap required in the construction and maintenance of transportation infrastructures. Such strategy is called "leapfrogging" and could provoke similar ultra-high shifts for lumberjack and farmers in developing region. In fact, some farmers from western African countries are already connected to drones in order to monitor the state of fields, as satellite monitoring remain too expensive. Hence, the development and democratization of technology could directly propel Africans from sedentary to neo-nomads without major intermediary hybridity witnessed in westernized countries. This is even more important as the latest handwritten generation epitomize the end of analogical understandings, while neo-nomadic aspirations are increasingly, if not fully, relying on digital lifestyles.

However, nomads and sedentary civilizations both rely on physical and intangible infrastructures while cohabiting on a single

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154 Ledgard, "The Droneport Project."

geo-surface, thus limiting any prioritization in favor of the hybridization of the various lifestyles. Undeniably, the global infrastructural system is robust enough to permit the alteration or even the collapse of one constituent part. However, such geo-infrastructure is sensitive to every presence, thus adequately questioning whether new developments should emphasize on hypermobilities, proximobilities, or even on the fluidification of existing systems.

The reliance on this universal system has particularly generated anxieties of network absence, for example translated by explorations mostly in reach of cellular reception due to the fear of not being able to contact emergency services. In turns, comforted by the presence of such geo-infrastructure, humans thus can be seen as nomads within Earth, but also as sedentary of Earth in a perspective of radical unknowns and multiplanetary apparatus.

Digital tools exploiting the end of remoteness - Bellevaux, France - 2020

Maxence Grangeot

Autonomy and Interdependence

As introduced by Buckminster Fuller, Earth can be considered as a spaceship with limited resources, every inhabitant thus representing astronauts.[155] Aboard this unique spaceship, each astronaut increasingly experiences lifestyles more emancipated from territorialized conditions, however applying the concept of autonomy to nomadic lifestyles is a critical misconception. In fact, nomads directly interact with sedentary civilizations and environments in order to sustain alternative lifestyles, hence adopting a necessary hybridity, and adaptability to different contexts.

AUTONOMY AND HYBRIDITY OF LIFESTYLES.

Hybridity is precisely the core of neo-nomadic lifestyles, exploiting technologies developed for sedentary civilization in alternative conducts. Conversely, sedentary civilizations require the presence of nomads to fulfill interim and fluctuating needs. As a consequence, robust systems must permit the cohabitation and collaboration of reciprocal needs. This forces nomads to be highly malleable to unsettled socio-economic conditions, notably revendicated through a pride of freedom.[156] The adaptability to uncertainty therefore represents a sine qua non condition of nomadic lifestyles. For example, less mobile pastoralists had the tendency to be more vulnerable to state control, thus suggesting a positive correlation between autonomy and mobility. And among Roma people, the word *gadjekane* specifically depicts their ability to adapt to sedentary

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155 Marvelously introduced by the author himself at the beginning of : Snyder, *The World of Buckminster Fuller*.
156 D'Andrea, "Neo-Nomadism."

societies,[157] translating the intense relation between mobility, freedom, adaptability and sedentarism.

The neo-nomads, seeking downsized alternatives from sedentary consumerist lifestyles, equally rest upon a crucial hybridity, simultaneously in transportations habits, in social behaviors and in technical tools. However, sedentarism and nomadism have long been opposed, the city acting as their meeting point but also as symbol of their mutual rejection. Their induced hybridity merely appeared during the emergence of the first settlements, deriving from primitive nomads able to live away from sedentary populations and technologies.

AUTONOMY AND HYBRIDITY OF RESOURCES.

Neo-nomads notably attempt to find a personal optimum balance between autonomy and hybridity, while integrating anti-consumerism,[158] minimalism, care for the environment despite increasingly relying extremely specific technologies. The equilibrium is particularly focused on maximizing comfort and independence from the grid while lowering possessions and environmental impact. This leads to relatively limited autonomy in water, electricity, fuel, food, leisure equipment, and productive capacities, forcing nomads to maintain connections with sedentary civilizations for replenishments. However, their intelligence rest upon their ability to discern the useful from the futile, forcing the reconsideration of items essentiality. This undoubtably applies to nomadism but is of tremendous learning for architecture and construction. The hybridity of resources is particularly vital to reduce volatility while partial autonomy resorbs fluctuating supply streams. However, the unsettled consumption is largely

157 Le Marchand, "Camp et campements."

158 Gros, "Origines Idéologiques et Implications Écologiques Des Choix de Vie Off the Grid."

counterbalanced by reduced sedentary impacts and nomadic production capacities, in turns immensely sensitive for such miniaturized portable technologies. As a simple example, if a photovoltaic panel, for any possible reason, would fail to provide energy longer than the battery capacities, most activities of the concerned individuals would be jeopardized. Neo-nomadism is therefore a precarious lifestyle prone to rapid obsolescence, and heavily reliant on sedentary civilizations.

ENERGY PRODUCTION VS CONSUMPTION

The question of energy is of tremendous importance for such lifestyles, composing between sporadic production, rational storing, permanent saving and parsimonious consumption. Architecture being precisely a mediation through energy, it might draw significant lessons from nomadic habits, representing miniature spaceships extremely attentive to their management of resource and energy. Moreover, every system can only be energy and generate related mediation about flows, mobility, between humans, non-humans, things, and contexts.

The obligation for rationality developed by neo-nomads notably brings to rethink domestic aberration in comparison to natural energies, body temperatures, climatic behaviors, building physics, etc. and is detailed in the "Architecture of climate" chapter. The analogy between nomadic habits and remote islands can notably yield relevant notions about importations (of fossil fuels), locally produced resources and renewable energies, and could particularly be applied to architecture. While energy production and consumption are usually separated in space hence inducing irrational behaviors because not directly witnessed, nomads develop more sensitive approach to energy processes and value. The important distance between sedentary production and sedentary consumption of energies produced a

feeling of endless abundance without noticeable impacts, leading to abuses of such precious commodity. On the other side, by producing energy on the go, neo-nomads spend energy rather wisely, largely re-introducing the question of modern comfort facing a global crisis.

SELF ADAPTABILITY

Nomads predominantly developed capacities to auto-regulate, demonstrating the benefits of self-adaptability facing uncertain contexts. The importance of this self-eco-organization for the 21st century repositions the threat of autonomy amidst unpredictable environments.[159] The figure of the camps connotes a certain regime of self-organization and most importantly a job market. Ephemeral campgrounds notably represent an economy of opportunities and arrangements, linked to the flexible and connective nature of nomadic ways of living.

While nomads experience an intensive need of autonomy in order to sustain lifestyles based on mobility, this limited autarchy is contemporarily balanced by the dependence on sedentary civilization for sourcing food, technology, repairs, employment, infrastructures, etc. Inversely, sedentary societies increasingly rely on the adaptability of neo-nomads to fulfill tasks specifically localized in time and space. Therefore, the reciprocal needs of the two opposed lifestyles shape a strong independence through numerous hybrids.

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159 Morin, "Autonomie Ou Dépendance de La Science."

Survivalist autonomy - Turtmannhütte, Switzerland - 2020

Maxence Grangeot

Remote interdependence - Oberems, Switzerland - 2020

Maxence Grangeot

IV. On nomadism

Labile creatures

Nomadic abilities of humankind are prominently due to the biological composition of human bodies, roughly half of which is dedicated to mobility, allowing them to adapt to various contexts. Unlike plants that feed themselves without moving, by generating their own food ecosystem through evaporation for rain and carbon dioxide circles, animals require to move in order to sustain primitive needs. However, both fauna and flora are sensitive yet robust to their environment, both can adapt to some extent, until the conditions are too severe, resulting in death. Among the many theories of evolution, natural selection notably depicts the adaptability of species over large periods of time and notably through hybridity. [160]

Yet within singular lifetimes, adaptation is equally part of every lifeform, manifested through movement in the animal world. Humans, despite not being the most performant species in any category,[161] are probably the species able to adapt to most environments within a single lifetime. This is notably caused by hybrid abilities, as a terrestrial biped also apt to explore maritime territories, yet biologically lacking the possibility of flight, conferring another degree of adaptability.

While dinosaurs moved to survive and plants do not, life existence is therefore not dependent on mobility, but rather on ability to

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160 Darwin, *On the Origin of Species by Means of Natural Selection*.

161 Courchamp, *Insignificant*.

adapt to different environments. Yet, if mobility is so deeply rooted in the animal world, and the wheel is the best energy conversion system, the inexistence of animal with wheels actually reflect on human evolutions rather than animal ones.[162] Wheels require flat surfaces to efficiently transform energy into meaningful movement. However, flat areas, or platforms, are not present in nature, but rather novel human artefacts to domesticate Earth. Such infrastructures require heavy prior alteration, only to be used later with lesser need for adaptability. This is reflected in the history of horse taming, primarily exploiting their large abilities for terrestrial discoveries, and consequently used even more efficiently as traction power for carriage on artificialized areas, simultaneously requiring to alter their biological abilities with horseshoes.

In the animal world, food does not pass by, but animals must seek and sometimes fight to fulfill this primitive need. Therefore, in a non-sedentary world, moving is surviving. As the first and only animal race to become static, to become sedentary, humans were forced to develop agriculture in order to rely on locally available resources and to survive. However, this fundamentally questions the definition of dwelling, [163] and whether dwelling is applicable solely to sedentary civilizations, or is extendable to migrating animals and nomadic humans.[164]

Conversely, in the 21st century and despite acceleration, hypermobilities and nomadic alternatives, humans have never been more static, judging by the percentage of increasing average daily time spent sitting or lying down. By becoming so rooted into anchored in specific places, humans had developed a strong feeling of

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162 Diamond, "Why Animals Run on Legs, Not on Wheels."

163 Heidegger, *Building Dwelling Thinking*.

164 Norberg-Schulz, *The concept of dwelling*.

ownership and superiority towards the place they inhabit. It is perhaps opportune to remind here the importance of the temporary nature of human lives, facing the much larger lifespan of natural environments. This strongly invalidate the perception of human ownership over nature, forcing to share it wisely and act for its preservation or even its enhancement over time. Placing labile creatures within those boundaries, territories become rather an anthropocentric perception and could instead be appreciated as living environments momentarily hosting humans.

Contemporary primitivity – Chiloe, Chile – 2019

Maxence Grangeot

Chronicles of nomadic communities

As a mobile animal species, humans' ancestors historically experienced lifestyles solely based on mobility in order to survive, commonly defined as primitive nomadism. Peculiarly, the word primitivism refers to early developments, but most strikingly to rather unsophisticated systems or communities. Comparing neo-nomads with primitive nomads, the differentiation between the two rest upon complexity and sensitivity inherited from complexity, without one being less "sophisticated" than the other. Consequently, the history of nomadic civilizations is tightly linked to technological developments, for example through the prominent invention of the wheel, however this relation is not reciprocal.

The birth of human communities is commonly credited to the control of fire, before the appearance of communication languages and before sedentary occupations. This first environmental alteration is considered to have generated civilizations and architecture, yet primitive humans survived without control of fire, leaving adaptability as main characteristic shared between primitive and modern humans. Fire notably federate the beginning of social interactions, as an element of gathering and for its collective value through light, protection and heat. In turns, cooking with fire has become an important symbol of nature domestication, and largely perpetuated through persistent hot meals.

The noteworthy advancements from hunter-gatherers are therefore the translation of animal needs through inventions and tools. However, the absence of defined settlements rendered such nomadic groups unaware of their mutual existence, the environment therefore witnessing highly malleable conditions. This phenomenon is equally a paradigm of digital nomads, notably through more and

more intangible and remote connections, in turn obstructing closer collaborations. As an evolution of hunter-gatherer who remained mobile to sustain primitive needs, nomadism was later experienced during wars in order to quickly adapt to changing conditions.

The roman military camps notably conveyed principles of rationality through efficient Hippodamian-like plans and the rapid setup of tents in order to temporally host troops. The combative nature of humans markedly generated numerous nomadic developments during wars or primitive fights, forcing belligerent to perpetually remain mobile or to dynamically adapt local conditions through military trenches and war camps. Moreover, the design of war machines notably required intense hybridity of knowledge resulting in innovations still largely in use.

However, nomadism was not only experienced in times of colonization and war but also as permanent lifestyles, notably related to cultural heritage or unusual working activities. Pastoral nomadism,[165] for example, is specifically defined by the transhumance, which involves the transportation of cattle from plains to the mountains in the spring and vice versa in autumn in alpine contexts. Differing from true nomadism as freedom of movement, pastoral nomadism is guided by seasonal and specific displacements to continuously provide fresh pasture to herds. Pastoralism is essentially opposed to agriculture, defining a spectrum where both sedentism and nomadism are conceivable in various degrees. Nomadic pastoral communities have existed across harsh natural environments and timidly persist as ethnic minorities like Kyrgyz, the Yörük from Turkey,[166] the Bedouin from North Africa, the Mongols and Tatar in central Asia, Samí from Northern Europe, Nenets people and Chukchis in

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165 Khazanov, Crookenden, and Gellner, *Nomads and the Outside World*.

166 Cribb, *Nomads in Archaeology*.

Russia, and countless more, representing an estimated population of 30 to 40 million nomads worldwide, yet slowly decreasing.

This type of nomadism is however constrained by domesticated animals, while other nomadic cultures rest upon different activities, like the diaspora of Roma people, known under various names such as Tsiganes, Roms, Romani, Gypsies, travelers, *Bohémiens*, *Romanichels*, *Gitans* (erroneously from "Egypt"), *Manouches*, etc. and divided in subgroups with even more specific names. Some of these designations denote pejorative meanings, notably through the widespread image of marginality but most severely of illegal activities, and are hereafter respectfully referred as Roma people or Roma. Their rejection of land ownership notably makes it difficult to temporally occupy public land in a capitalistic system, forcing them to establish into squats. Roma people heavily depend on sedentary societies in order to sustain their itinerant lifestyles, and have notably centered their economic activities on sedentary cultures. Distinctively, other nomadic communities provide iconic images of enjoyment while regularly shifting of urban context, notably trough the figure of the circus or fairgrounds.

On the other side, cultural nomadism witnessed the emergence of countercultures experimenting with nomadism as a driver of emancipation, in search of freedom. The Beat Generation, Wandervogel, Bohemianism, hippies, vagabonds and other counterculture movements rather denote nomadism as temporary lifestyles, extended in recent years by digital nomads. As a result, neo-nomadism is more heterogeneous and sporadic, an increasing number of young individuals experimenting with van conversion and "van life" in search for alternatives, rather embrace it as a temporary lifestyle spanning from several days to several years yet without intention to persistently extend such lifestyle.

However, the virality of this last nomadic movement is heavily questioning the authentic robustness of infrastructures to sudden interchangeability in usage. This question could notably be extended to mass migrations facing well established sedentary civilizations.
Lastly, the most successful form of nomadism is emphatically the most invisible one, experienced of regular basis yet not deemed of particular interest, like the vibrant life of open-air markets establishing ground only for few hours, or even the campground welcoming each summer week new domestic conditions between unrelated beings. The urbanism and spatial arrangement of camping sites portray a tangible image of contemporary aspirations, enigmatically resembling the plans of primitive settlements and other vernacular villages with distinctive social customs.[167]

167 Rudofsky, *Architecture Without Architects*.

Textile architectures of a Yörük encampment - Taurus, Turkey - 1879

British Library – Public domain

Nomadic nostalgia - Trient, Switzerland - 2020

Maxence Grangeot

Nomadic habitats

Nomadic communities, despite the significant differences in their manifestation, all share a consistent and original purpose. By moving their habitat with them, they carry a personal domesticity across various conditions in terms of climate and resources. Thus, the notion of mobile habitat reflects two fundamental principles: flexibility and adaptability. In opposition to sedentary architecture, nomadic architecture change of location multiple times, and carries multiple synonyms relating to similar artefacts: portable, mobile, itinerant architecture. Depending on environmental, social and technological contexts, the main activity related to the physical displacement defines the infrastructural support if any, and more importantly the materialization of the domestic space in motion. Therefore, nomadic habitats have adapted to nearly all possible circumstances, ranging from harsh natural environments like deserts and oceans, to intensive urbanity of energetic cities.

The preponderance of adaptability of such architecture is of increasing interest among ever more complex cities, more uncertain territories, more unclear boundaries and more changing structures. From primitive to emergency shelters, from Mongolian yurts to converted vans, nomadic architecture fascinated throughout history although it has rarely been constructed by architects. However, it conveys singular characteristics cherished by construction professionals, such as lightweight structures, optimum installation process and efficient practicality, despite incrementally growing away from sedentary architecture. Nomadic architecture is particularly celebrated for the judiciousness of construction processes and extreme domestic rationalities questioning the ideal balance between utility and comfort.

Beyond simple catalogues,[168] [169] an overview of different nomadic habitat can provide valuable insights in terms of socio-cultural customs, but also for architecture and metaphorical expression of construction processes.

BRIEF HISTORY OF TEXTILES AND TENTS

The relevance of textile-based structures is particularly widespread among nomadic communities, appreciated for the compactness during transports and versatility when deployed. Firstly, clothes are considered as the first nomadic architecture by locally modifying climatic conditions in order to provide additional human capacities. The extremely personal scale of such primitive architecture, concealing private areas while opening pieces of externalities (communication, dexterity, perceptive senses, etc.), represent to fundamental principles of domesticity in human civilizations. The protective function of textiles is unsurprisingly extendable to tents, largely used for their simplistic yet efficient alteration of climatic settings.

Considered as a primitive nomadic habitat, the rationality of tents conveys at first sight an architecture of survival. However, their relevance substantially surpasses the simple image of a protective shelter by establishing the maximum volume of controlled environment for a reduced amount of material. By simply enclosing air with thin tensile fabric, tents provide incredible thermal and structural properties,[170] notably by embracing deformations of tension rather than striving for compression stability. Supports, whether in bending

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168 Noël and Smith, "L'architecture Nomade."

169 Roke, *Mobitecture Architecture on the Move*.

170 Banham, *The Architecture of the Well-Tempered Environment*.

active or compression solicitations, contribute to the overall stability while maintaining the simplicity and speed of erection. This equally permits easy reversibility, while being effortlessly transported or found in situ, thus making fabrics and supports least likely to survive in archaeological context.[171] However, the history of tents is extensive and is not restrained to domestic applications, but also to wars and other ephemeral events.

In order to make suitable condition for human habitation, textiles have been used as primary dwelling for numerous nomadic communities, like the Berber or Tuareg tents in the Sahara,[172] or even yurts in various locations. This emblematic pastoralist habitat employing additional bending active latticework, and sometimes referred as kibitka, is notably emblematic of Mongols, Turkmens, Kyrgyz and Kazakhs.

Tipis represent another type of tent being quickly assembled or disassembled and packed, although attributed to north American indigenous, and known as lavvu in the north of Europe. The tipis built and unbuilt by Ostyak-Samoyeds were notably made of steamed birch bark for as cover, a renewable resource that can be found in many location and highly malleable while preserving necessary resistance. Tents are still intensely used for ephemeral activities in the 21st century, for example as emergency shelters, or for temporary cultural activities. Beyond the subsistence of the iconic architecture of circus,[173] tents are still used in recreational devices for temporary domesticities during travels and holidays, either at camping sites or out in the wilderness.

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171 Cribb, *Nomads in Archaeology*. p.84

172 Humbert and Penzel, *Middle of the Moment*.

173 Centre de création industrielle, *Errants, Nomades, Voyageurs*.

2 WHEELS

One of the most emblematic figure of contemporary domesticity on the move is the widespread container of two wheels, through caravans, mobiles homes, or tiny houses. Caravans, sometimes called camper or even trailer are the emblematic image of modernity, [174] providing a popularized perception of autonomy and freedom through embarked domesticity. The limited flexibility in domestic usage is notably due to the mass production of suboptimal shells, solely insulated with a thin layer of polyester or polyurethane, and filled with less expensive industrialized elements of modern domesticity. When occupied by such habitats, land is rather defined as camping site, denoting rudimentary yet sufficient services. This particular habitat has to be tracked to move but can easily be detached from the automobile, consequently disposing of a highly mobile vehicle and a partially nomadic habitat, and largely used by marginal communities like Roma people. Mobile homes significantly extend the notion of comfort at the expense of mobility, therefore decreasing the concept of moving houses.[175] Recently, a successive fruition of two-wheeled nomadic habitat was experimented through tiny houses, more in line with modern aspirations. Although they often have two wheels, the mobility is the tiny house is rather derived from legal reasons than nomadic aspirations, although providing a respectful attitude toward ground usage.

4 WHEELS

When integrally linked to 4-wheels vehicles, nomadic habitats inherently denote higher mobility, particularly more suited for

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174 Le Marchand, "Économie de bazar et économie morale."

175 Willemin, *Maisons Mobiles*.

explorations (i.e road trips) while enjoying the benefits of transportation infrastructures. Converted van, camping car, fitted truck[176] and all Recreational Vehicles (RVs) represent more intensive mobilities as part of temporary lifestyles, although they require adequate contexts to operate, such as at least flat land and usually many sensitive pieces of modern technologies to provide contemporary comfort.

In turns, the architecture of campers, vans and tiny houses can be seen as the most rational contemporary habitat, both as technical and ideological equipment. They represent the quintessence of personal domesticity and efficient spatial distribution of modern domestic life, in opposition to the marginality of the wheeled Kibitka as Roma wagon.

BOATS

Additionally, sailboats, yacht, and *péniches* (house boat) provide nomadic habitat for individuals seeking to explore more maritime territories, although less numerous due to the higher initial and maintenance costs of such vehicles. Sailing is particularly fascinating by explicitly displaying concepts of local adaptability by using nature through wind in order to move, only possible by precisely understanding the environment. Moreover, the process of boatbuilding is complex but reflect the accumulation of hybrid knowledge, consistently refining rationality as a malleable substance.

MISCELLANEOUS

Other nomadic habitats confirm and strengthen the predominance of necessary adaptability to changing contexts, either by using locally sourced materials for temporary shelters like igloos, or by

[176] Reitz, "Assembler Son Quotidien Sur La Route."

physically interacting with specific milieu as input for displacement, like ice huts, ice shacks, the International space station, hot air balloon (inhabited by Bertrand Piccard for 21 days[177]), and other inflatable structure providing shelter with local materials or urbanized areas (pressurized air). David Greene notably developed the Living Pod as a speculative caravan which can be plugged to larger structures or exist on its own.[178]

NO WHEELS

On a more radical approach, Buckminster Fuller developed projects of lightweight architectures like the 4D tower and the geodesic domes which could be delivered in site by air transportation. Other visionary nomadic projects include the walking city and the instant city by Archigram addressing the scale of the nomadic city, equally experimented in science fiction, Mortal Engines for example. The presence of tracks, legs and more traditionally wheels confer an intrinsic feeling of mobility through a language of displacement, as an itinerant architecture, or even sedentary constructions occasionally displaced.

NOMADIC LESSONS

Despite their variety, nomadic habitats provide significant lessons on domestic rationality and adaptability to various context. Every constituent regularly has more than a single purpose, reducing the number of items to be carried hence developing versatile tools. By gathering them in a confined "space" on the move, the habitat itself become a versatile object, a nomadic tool with a minimum amount of material, in line with anti-consumerist aspirations.

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177 "Bertrand Piccard - Balloon Flight."

178 Chalk et al., *Archigram*. p.160

Inducing regular changes in locality by carrying homes around, nomadic architecture is therefore dissociated from its original motherland, erecting, floating, rolling, expanding and shrinking over various environments. Such freedom can be associated with human thoughts, as a malleable substance constantly in motion while adapting to specific situations, repeatedly deployed to multiple localized conditions. Thus, nomadism represents the ultimate embodiment of personalized architecture, although considered eccentric.[179] This is notably incarnated by the customization of furniture, by definition meant to be displaced (mobilier), and metaphorically providing permanent nomadism to sedentary habitats.

Homes on the move notably reinstate questions about comfort facing utility, aiming for rudimentary yet sufficient services. They adequately seek to find a balance between enough and too much technology in order to rethink the fundaments of living rationally in the 21st century. Being inherently affected by climatic conditions, nomadic habitat portray larger attention to their environmental impact, but also to their degree of autonomy in energy, water, food supply and information, by hybridizing custom and standardized solutions, thus local and global knowledge, into an architecture without space.

Therefore, the relevance of nomadic habitats for the 21st century is addressed through a high adaptability to diverse contexts, a prominent hybridity of sources and technologies, striving for versatile essentialities. The derived rationality equally account for temporality, and perpetuate the feeling of belonging to Earth through embarked domesticity.

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179 Echavarria M, Pilar, and Mostaedi, *Architecture portative*.

Primitive commodity - Publier, France - 2020

Maxence Grangeot

Universal Domesticity

Domesticity knows no social nor geographical boundaries. Neo-nomadism demonstrates a domesticity regardless of specific localities, leading to an extreme decontextualization, and benefiting from highly adaptable habitats on a geo-infrastructure, therefore achieving a universal domesticity. The extent of neo-nomads' domesticity is thus as noticeable as their ability to adapt, independently of any defined vicinity. This demonstration highlights another intrinsic characteristic of domesticity, not governed by spatial rules, but rather by objects of utility, specific to each event.

These performative objects represent the starting point of embarked domesticity, memorably epitomized through the environment bubble of Reyner Banham and the embarked reality of Haus-Rucker-Co. Such technological wearables and portable environments are artistic transfiguration of astronaut spacesuits, confirming the role of clothes as primitive architecture, like single person spaceship aboard the larger and collective spaceship Earth.[180]

The universal domesticity is a direct consequence of the end of remoteness, where artificial spaceships (including from science-fiction) seem to accommodate complete domesticities despite harsh and labile external environments. This generate invisible cities of nomadic communities (homeless, Roma people, migrants, etc.), as groups wandering on the same invisible infrastructure, epitomized by the Supersurface, unaware of their mutual existence, yet sharing similar domestic behaviors. In order to alleviate the lack of complementary infrastructures for nomadic inhabitant, the production of reproductible mobile equipment could provide a hybrid solution for cities

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180 Fuller, *Operating Manual for Spaceship Earth*.

in development,[181] consequently reestablishing a balance between sedentary land owners and temporary nomads.

Hence, these infrastructures could embrace ephemeral contexts, generating spontaneous neighborhood, like in a camping site, where parcels are temporally privatized yet coexist in heavily socialized settings. By voluntarily preserving such ambiguous privacy, endlessly changing of inhabitant every week, the generated aspiration would certainly resemble to a vibrant city of trailers, previously imagined by Archigram through the project "free time node".[182] Such materialization would notably establish a convergence of nomadic charisma usually attributed to the places they temporarily inhabit, pushing the Airbnb model to another scale. Such archetype would replace to incumbent strategies to establish universal domesticity, notably represented by the increase in the popularity of fitness facilities. Beyond places of social exhibition and voyeurism, sport facilities or other universal services represent nomadic dropping points in urban areas, for example for showers, only given subscriptions valid nationwide. Nomads have adapted particularly well to such economic models, splitting expenses in monthly payments while ensuring constant and universal domestic services, allowing them to "remain highly malleable in adapting to turbulent conditions and economic uncertainties".[183]

This hyper-adaptability is particularly reflected by Roma' economic models, by generating wealth from waste,[184] universally applicable. However, travelling as a nomad denotes the necessity of

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181 Le Marchand, "L'art politique n'est pas un plan."

182 Chalk et al., *Archigram*. p.172-173

183 D'Andrea, "Neo-Nomadism."

184 Le Marchand, "Économie de bazar et économie morale."

solely embarking bare necessities, from domestic households to needed food. As a metaphor, carried ingredients are carefully selected depending on the next meals, in order to avoid the stockpiling of useless and perishable commodities. The importance of rational and cautious planning of domestic "objects" generate a self-awareness of restriction and limitation, solely achievable through an open and adaptable, thus nomadic, mind.[185] The complete domestication of Earth certainly announced the end of remoteness, but most prominently an anarchic territory free of external constraints. Earth dwellers, or global nomads, ubiquitously imposed the intrinsic signification of domesticity on Earth' surface, experienced in a relatively analogous manner regardless of the context, elevating nomads as messengers of universal domesticity.

[185] Le Marchand, "L'art politique n'est pas un plan."

Ubiquitous domesticity – Emosson dam, Switzerland, - 2020

Maxence Grangeot

Inhabit transports

The increase of mobilities defined transports as a propitious place for transitory inhabitation of sedentary populations, generating novel domestic practices within transits, logistics, and transportation systems.

Most depictions of utopia essentially include visions of inhabited hypermobility, occasionally aboard a vessel in perpetual motion. This fundamentally fail to perceive Earth itself as a ship that needs to be handled wisely. Going further, Buckminster Fuller demonstrated that "space" is not a state of spatiality but rather a scenario of distant events as physical remoteness, but also distant in time, composing a spectacle of light speed. The prior discernment of the world as energy famously Induced the understanding of perpetual transformation of matter, without absolute increase of decrease. Therefore, in a constantly changing world, Earth represent a spaceship moving through space-time and hosting travels within its own boundaries. The fascination of humans for vehicles rather denotes a transport-ception of a marching society within a moving world.

From survivalist approach, nomadism manufactured easily transportable habitats and objects,[186] in a culture of hyper-technology first rejected by architects and then embraced, notably by the collective Archigram and the culture of high-tech consumption, bringing an augmentation to the prior machinist vision of architecture. In turns, their theories and projects metaphorically or literally reflected moving cities, and were also investigated by the collective Superstudio, notably through the theorization of the Supersurface but also to the considerations of aircraft carriers as potentials for

[186] Centre de création industrielle, *Errants, Nomades, Voyageurs*.

architecture. This is unsurprisingly for architects in reaction to the "reminders" brought by Le Corbusier, praising the aesthetics of machines and vehicles, including *paquebots*.[187]

Beyond the on-board domesticity of cruising ships, the architecture and making of boat hull architecture epitomize the expression of machine efficiency. Most prominently, in the notorious book of Le Corbusier precisely entitled "Towards a new architecture", the word "towards" dominate the importance, as an image of direction to aim for, but also as a journey, a progression, a movement, not only as machines to live in, but also as machines to leave in. This is particularly explicit in the inhabitation of planes, also addressed by Le Corbusier for their image of innovation and rationality. As mobilities and hypermobilities are more and more prominent in the 21st century, the inhabitation of transports becomes an important, yet fearful subject to be addressed. However, this emancipation of domesticity primarily occurred during the first industrial revolution through the transposition of home furniture and woodwork in the first trains.[188]

This notion of embarked domesticity can therefore be applied to daily mobilities as spacewalks, where every human is an astronaut, and Earth is their collective spaceship. However, such inhabitation for neo-nomads is severely shaken by the lack of security relating to habitat and particularly the lack of anchorage in a defined locality coupled with the lack of land ownership. Collective transportation in opposition to precarious nomadic habitat redefines the spectrum of property, of collectivity, of security, of environmental impact and of right to belong on national grounds. However, such opposition cannot be objectively assessed due to the high variance of usage between sedentary and nomadic civilizations, but also within these

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187 Le Corbusier, *Vers une architecture*.

188 Giedion, *Railroad Comfort and Patent Furniture*.

categorizations. The space-time transition offered by mobility is notably redefined both for remote-working citizens and for neo-nomads, however in even more opposite sides, leading to an increasing risk of rejection of marginality. On one side, nomads are literally living within transports by moving their habitats, hence increasing the intensity of domestic life inside transports, and on the other hand, the disappearance of transitory space-time due to sudden remote-working and annihilations of some mobilities. This dangerous split could also gradually alter the transportations infrastructures and their respective domesticity more towards one side or the other, thus making hybridizations and adaptabilities more challenging on the long term.

Therefore, potential of world infrastructures can be exploited by inhabiting transports per se, engendering some of the most rational arrangement of domestic spaces, an intriguing architectural rationale that remains mostly taboo for architects.

Daily maritime commute – Lac léman, Switzerland/France – 2019

Maxence Grangeot

V. Sedentarism as chapter

The ease of mobility associated to western emancipation from productive and physical constraints leave principally emotional attachment to localities as a last anchor. Moreover, social acceleration and the booming of remote working derivatively induce the hypothesis that sedentarism might only portray a chapter in the evolution of humankind. However, this anthropological chapter does not announce a novel paradigm of mobility and lifestyles, but rather the intensification of hybrids.

Agriculture or environmental alteration

Contrary to primitive nomads, sedentary communities accommodated their surrounding environment in order to survive, agriculture thus marking the first appearance of a notable environmental alterations. Sedentarism was therefore concomitantly initiated with agriculture and architecture, [189] although there is no absolute settlement on which came first.

Restricting the mobility forced humans to domesticate their territory, making the environment their own,[190] to best suit human activities and food production. The control established by settlements in reality goes beyond local alterations of climatic and terrestrial conditions. Gilles Deleuze and Felix Guattari proclaimed how nomads purposely ejected sedentism as the establishment of a state control resting upon the war machine.[191] Michel Foucault complemented this argument through the affirmation of architecture as an intended control, therefore drawing parallels between building and restraining.
However, architecture and construction when applied democratically can also provoke and allow new encounters, new discoveries, both in spatial expansions and in intensity.

But the impact of such alterations has led to the definition of a geological era called the Anthropocene. Such period is inscribed as part of the geo-history, and specifically pinpoints the period of noticeable human modification of not only the environment, but of the Earth system. The affirmation of the Anthropocene as a geological

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189 Marot, Garagem Sul, and Trienal de Arquitectura de Lisboa, *Taking the Country's Side*.

190 Laugier, *Essai Sur L'architecture*.

191 Deleuze and Guattari, *Nomadology*. p.417

era is supported by the understanding of humans inhabiting and modifying only a cork, a very thin layer of Earth of few kilometers up and down.[192] This tiny skin hosts all human activities and encompasses the idea of globe, in turns annihilating the idea of living in a specific location.

Beyond agriculture, the sedentarism of humans affected their relation to the environment through various material sourcing, depending on their availability.[193] For example, the logging industry understood the importance of long-term planning and cyclic renewal, thus changing the location of forest exploitation each year. Mines and quarries also experience perpetual changing conditions based on their previous activities, thus self-generating new contexts to adapt. This mutating condition can also be observed in urban conditions, occasionally witnessing the emergence and the decline of villages and cities.

However, the current invisible geo-infrastructures like satellites and digital technologies (security cameras, data collection, etc.) recently inflicted universal and ubiquitous control, overcoming the restrains generated from architecture. On the other hand, the intensive usage of pesticides[194] notably exemplified the general direction of further environmental alterations in order to sustain sedentary needs. With the recent development of posthuman architecture, notably for food production thus automating the countryside, the physical constraints, precedingly tied to architecture and environmental alteration, are rapidly degrading facing invisible controls and automated capacities. Thus, free again from physical bounds, humans might have recently left the era of sedentarism,

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192 Latour, "Inside."

193 Rambert, *Hors Nature*.

194 Carson, *Silent Spring*.

rendering it as a chapter of evolution. While sedentary civilizations alter the environment, nomads only interact with it, therefore empowering the relevance of neo-nomadism in this new ideological chapter. However, this new era is not breaking from the two previous but is rather based both on primitive nomadism and sedentarism, establishing a robust hybrid. Considering the predominance of mobilities in the 21st century along with the expanding rise of neo-nomadic "alternatives", western societies seem to be already yet timidly anchored in such novel period of human history. Embracing this hybridity is therefore crucial to address contemporary challenges and foster inter-, trans-, and cross-disciplinarities.

Inca crops laboratory - Moray, Peru - 2019

Maxence Grangeot

Labile conditions of extraction sites - Chuquicamata, Chile - 2019

Maxence Grangeot

Encampment of prosperity

Advancement of societies and energy revolutions had mostly as objectives to modify Earth to make it more suitable for human life, continuously altering physical and intangible conditions of territories. Nonetheless, this notably questions the relevance of the developed systems to sustain primarily human activities. Since humans became sedentary, adaptability has mainly been imposed by men on its environment, but very occasionally in the other way, although more frequently as a consequence. Contemporary behaviors and standards of comfort are not rational facing the environment, yet they are deeply rooted in human evolution.

INADAPTABILITY

The primitive life expectancy of a contemporary human is 4 months,[195] rendering humans as inseparable from their technology. Moreover, the ability to alter the environment, by means of building, and more rarely unbuilding, is precisely with distinguishing the human race from every other lifeform. But within human populations, such practices are put in tension between sedentary life and the persistent essentiality of mobility to sustain interactions like trades, gatherings and conflicts.

Gradually with the scientific development of technologies, sedentary habits have gradually decreased in robustness, each time permitting less and less adaptions, or rather changes too frequent to let biological morphology evolve parallelly, therefore forcing to adapt the environment to rapidly changing behaviors. Hence, this encampment for prosperity without possibilities of adaptability was initiated

[195] Penn, *Into the Wild*.

long before the development of geo-infrastructures and invisible megastructures. In fact, this can be attributed to the birth of larger settlements with an socially organized division of labor, characterized by the birth of cities. Since then, all varieties of revolutions predominantly occurred in cities, notably concentrating intellectuals and resources in limited territories of physical expansions. Nature's inability to cope with the rhythm of artificial changes precisely led to these irreversible encampments, revealing nomads as hybrids willing to adjust to endlessly changing situations, yet still dependent on infrastructures and commerce.

SENSITIVITY THROUGH LACK OF ROBUSTNESS

However, the schism between engineered and inherent adaptability is solely of human source and is principally exhibited through the externalizations of the human body rather than the body itself. The deficiency of adaptability is therefore derived from sensitive tools solely capable of achieving single purpose undertakings rather than their promised robustness of usage. Machines and other late high-end technologies breaking with the versatile promises of tools notably threaten nomadic civilizations precisely resting upon principles of high versatility, but also threaten sedentarism as the multiplication of singular absurdities is dislodging the spaceship Earth from its nominal trajectory.

Industrial sensitivity – Noirefontaine, France – 2020

Maxence Grangeot

Tortuous procurement – Chuquicamata, Chile – 2019

Maxence Grangeot

Precarious journey

REACHING THE LIMITS

On board the isolated spaceship Earth travelling within non-simultaneous occurrences, humankind has drastically altered autonomous ecosystems until reaching the limits of irreversible impacts. Since the approximately two centuries, the Anthropocene has perforated this tolerable limit engaging the mothership into a precarious journey with little maneuverability. The scale of the increasing deviation is commonly attributed the hardly controllable growing rate of the world population, while the intensity of behaviors has been questioned only recently. Combined together, the two excess gradually generated an intense detachment from material value, notably by the progressive dematerialization of information, communications and value, but also transfiguring architecture as a consumer good.[196] At the verge of this novel existential crisis, a self-restrain strategy through incentivization is unlikely as sailors of explorative vessels need guidance from Great Pirates, considered the first world humans.[197]

However, the extent of political and technological powers in the 20th and the 21st centuries are beyond holistic and individual understanding.[198] The manipulation at atomic level notably permit extensive energy consumption despite its first purpose of mass destruction. Geo-engineering was equally developed to control the weather in times of war and is now seriously considered as a strategy towards climate change. In fact, the engineering of climatic

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196 Archigram, *Archigram*.

197 Fuller, *Operating Manual for Spaceship Earth*.

198 Bridle, *New Dark Age*.

conditions at large scale is already underway through the massive reforestation to counterbalance deforestations, or even the deployment of great green walls in China, in sub-Saharan Africa and in Pakistan,[199] in order to prevent accelerated degradations of continentwide environmental phenomenon like desertic progressions and tsunamis, among countless others.

Other geo-engineered solutions include the diffusion of reflective particles in the atmosphere to reflect more radiation from the sun, therefore "cooling" Earth's surface temperature. However, these outsourced solutions are clearly acting far in the causality chain while allowing to maintain present behaviors, hence adequality characterizing the exceeded limits.

Moreover, Rania Ghosn mentions other "technological externalities, such as oil extraction, deep-sea mining, ocean acidification, water shortage, air pollution, trash, space debris, and a host of other social-ecological issues",[200] affect entire ecosystems by the hand of humans. However, the same way societies went into globalization, the infrastructural transformations are precedingly required to induce a revolution of the superstructure such as social-cultural changes. The expansion of posthuman architectures precisely defined sedentariness as a chapter of human evolution preceding hybrid nomads. Hence, the recent explosion of territorial emancipation led to explorations of alternative lifestyles with limited duration, but most importantly to the experimentation of universal freedom beyond ecosystem limits through neo-nomadism.

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199 Ebrahim, "Pakistan."

200 Ghosn and Jazairy, *Geostories*.

MOBILITY OF RESOURCES

Since human sedentarism, and especially since the end of the world wars, architecture and mobility have lost sight of each other, rather denoting two worlds affecting yet conflicting each other. The global increase of mobilities overturn the relevance of qualitative architecture in the 21st century, thus establishing appropriate rivalries between the movement of people and matter, especially since the infrastructure is shared among the two ends of this spectrum. Reflecting further one their respective definitions, matter can be expressed in terms of energy, through the famous formula $e=mc^2$ by Albert Einstein, or any physic law linking mass to energy, like potential or kinetic energy.[201] In fact, the notion of speed precisely depict an amount of physical matter, distance, over a period of time, and is carried into the expression of speed units. The correlation with social acceleration becomes noticeable when the quantifiable value of production is expressed as physical unit over time. Moreover, heat was demonstrated to be linked to the speed of molecular movement. Hence the notion of energy is intrinsically tied to displacement.

The uneven distribution of resources on Earth notably encourages transportation in order to reach wide complementarity of shared resources,[202] therefore requiring displacement of matter to alleviate resources scarcity and prices disparity. The particular location of architecture at the interaction between material transportation and increased mobilities confer new adaptation challenges for architecture, while simultaneously being anchored in deeply local places, and participating to the worldwide exchange of values. From this perspective, construction could benefit valuable lessons from Roma

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201 A body of mass m (kg) and translation speed s (m/s) has a kinectic energy (J) $E = 0.5 \times ms^2$, while the potential energy is defined as $E = mgh$ where $g = 9.81\ m/s^2$ is the gravity of Earth and h the relative height (m).

202 Fuller, *Operating Manual for Spaceship Earth*.

people as pioneers of the circular economy business model.[203] By adapting to every place and establishing an economic system based on gathering, sorting and selling waste as raw material to build upon, the economic insertion of Roma people satisfactorily linked mobility with the transport and life cycle of products, by intervening both at the beginning for the development of innovations and at the end for their recycling. This is even more crucial in multipolar technological, cultural, social, political and economic contexts merging into incomparable speed and scale.[204]

NO PLACE FOR HYBRIDITY AND ADAPTABILITY

With complex environments, the prominent separatist rationalism carried by the encampment of sedentary civilizations struggles to accommodate experimentations and processualization, leaving no place for hybridity nor adaptability. In fact, the nesting of complexities forced sedentary communities to split tasks, each requiring increasingly more expertise, thus leading to intricacies of unrelated subjects. This modern categorization notably prevents incentives of crossdisciplinarity evolutions, hence upholding the multiplication of sensitivities as severe shackles to novel adaptabilities through transdisciplinary hybrids. The inertia is also affective, as capitalization of goods is strongly anchored into modern behaviors, including from objects without strong collective value but preserving an affective significance through the cultivation of memories. Without falling into the silliness of frugality, sedentarism can notably be held accountable for developing global mass consumerism without acknowledging for consequences. On the contrary, neo-nomads appear at the forefront of global and local intertwinements, evolving on an expanding geo-infrastructure while adapting to confined specificities. This lack of

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203 Le Marchand, "Économie de bazar et économie morale."

204 D'Andrea, "Neo-Nomadism."

adaptability from sedentary civilizations is reflected in the increasing difficulty to punctually modify human artefacts in order to repair or upgrade them, and often specifically engineered to avoid such alterations, or at least with expensive spare parts and abundant packaging. Sadly, the second hand market, although present and efficient, is unable to overturn consumerist paradigms and deeply secured conditionings. The growing heterogeneity is equally reflected in the multiplication of freelancers, despite prompting less annoyances and conflicts, engenders stronger senses of individuality in a disparate world.

ARCHITECTURAL NON-SENSE

Despite profound aspirations for intense versatility in architecture, epitomized by the illustrious conception of mobile architecture developed by Yona Friedman,[205] architecture has rarely succeeded to welcome modifications as intended in original designs. Paradoxically as most operations happen on existing architectural fabric, the tremendous value in the existing fades behind promises of improved holistic strategies. This perpetuates the irrational development from highly domesticated and sensitive humans, leaving opportunities for poorly designed architecture standing within historical relevance, exemplified by the incessant emergence of kitsch building within the city of Skopje.

It becomes clear the world no longer needs architects who can build but rather ones who can deconstruct to better rebuild. Similarly, the world no longer needs engineers to design new systems but rather ones to maintain and optimize the existing. Yet it is still complicated to be acknowledged. This is notably revealed as the symbolic function of walls is getting increasingly fulfilled by technological

205 Friedman, *L'architecture mobile*.

devices, as specific domestic requirements are sustained by standardized consumer products, thus rendering architecture more as an engineered infrastructure than worthy spatial attributes. The conceptualization of the Supersurface was particularly adequate to express Earth as a unified territory of domesticity, such novel scale of human activities forcing the inhabitant to move within such artificialization. This perception precedes the death of the city as hyper-centric typology, but rather defines a wide urbanity on which nomads rely cities for life necessities.

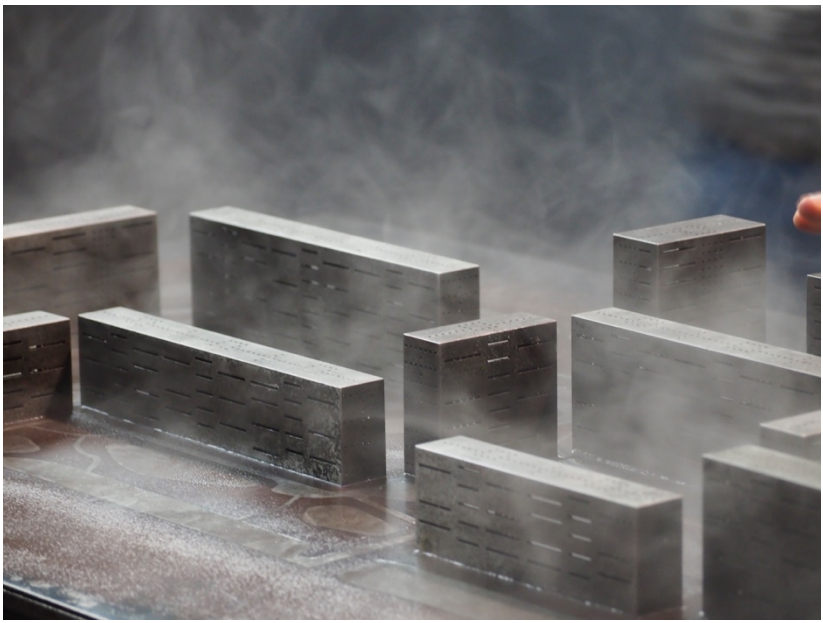
But in opposition to primitive times when one could freely move and establish settlement anywhere, the current densely populated territories impose more strict building and moving permissions through driving licenses and building permits as formalization within contemporary societies. These permits act both as authorizations but also as responsibilities, mirroring the control of traffic through strict regulations of construction, especially in terms of territorial implantation and environmental impact, equally related to transportation.

CLIMATIC NON-SENSE

Facing a major existential crisis, the reaction to climate change so far has principally relied on protecting the city without specific care for the countryside where productive supply to nourished urban areas are unreasonably implemented at a survivalist yet unconscious pace. The dilemma lies in the reasoning of stakeholders to alleviate environmental alteration not by building new and better, but from used to best. As architects are obsessed with the future while urban planners develop scheme according to pre-existing fabric, this clash over the importance of the past generates a mutual frustration leading to generalized hypocrisies. This notably accentuated as there are still no noticeable results over climate change since it would

require more drastic changes. The sought radicality is however endangered by a potential decrease of interest, but more worryingly by mediatic coverups and blushing facades of green architecture through a wave of timber and bio-sourced material, yet hiding a persistent and unsolvable inconveniency. However, the derailing spaceship doesn't account for promises as respect of its limited capacity and seem to continue its deviation without maneuverability. As copilot astronauts living onboard this unique ark, humans are failing to maintain self-sustain evolutions and developments as they fail to grasp the exceeded boundaries of their vehicle.

In turns, modern humans are not genuinely trying to save the planet, but rather to save themselves, as planet Earth will continue, following a different trajectory than human activities. This proclaims an imperative shift in order to attempt to reposition humankind on the same trajectory as its mothership.



Emissions calamity of architecture – Venice, Italy – 2018

Maxence Grangeot

VI. Derailing spaceship Earth

Within the metaphoric autonomy of this collective vehicle, natural ecosystems are experiencing major disturbances of self-sufficiency induced by humans, pushing Earth over the edge of a nominal trajectory.

Armamentarium

The recognized sophistication of Earth's crust is contrastingly associated to its inherent fragility.[206] The richness of natural and geological conditions has long been comprehended as a resource for human production and exploitations, and often conflicts with environmental preservation. This capitalization of nature reached a turning point through an unprecedented scale of material depletion,[207] by means of heavy utilization without substitution, thus restraining adaptabilities of pre-existing systems. These ever more destructive and profound extractions are notably correlated with the height and technicity of novel constructions, and made possible by the dispersion of activities around the surface of the globe.

The development of an ubiquitous infrastructure together with the standardization of transportation through containers allowed the flourishing of multi-site productions,[208] leading to a complex global system with local specializations. The disparity turned into hybridity with intensive transportations led to a perception of abundance of readily available resources, generating a calamity of greenhouse gas emissions, among other environmental "side" effects. However, those often intangible consequences are precisely demonstrated to be the cause of an abnormal increase of global average temperature, in turns affecting the totality of ecosystems with an unmatched strength and pace. Some territories however perceived this climatic modification as an advantage to deplete new land, for example due to the melting of the permafrost despite the collapse of pre-existing systems and infrastructures.

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206 Arthus-Bertrand, *Regards partagés*.

207 Goodbun, *Scarcity*.

208 Le Marchand, "Les cités en conteneurs."

In order to prevent the drastic turn of environmental condition which undoubtably worsen habitability, there are two major strategies advertised to alleviate this global phenomenon: mitigation and adaptation, one acting at the origin, the other on repercussions. Shimmering a world of categorization, they are labelled as two distinctive strategies to be tackled individually, without acknowledging mitigation as an act of adaptation, despite the persistent mutable state of the blue marble. Those strategies inculcated more comprehensive, at best respectful, approaches to the environment, advocating to leave no traces, with a shifting philosophy of "better not enough than too much" rather the widespread contraposed.

Inherently, the principles of a circular economy appear to perpetuate an increase in value of artefacts while limiting extractions thus material depletions to a minimum. Recycling, although more energy demanding, enable to increase the efficiency at each cycle in phase with the latest developments, therefore increasing the output performances for a constant amount of resources, helping to maintain high standard of living at lower environmental impact. Fatalist slogans like "sustainability will be achieved eventually, either by disaster or by design" tend to incentivize designers and architects about their potentialities facing climate change, but lack a deeper understanding of the true lever for potential of actions. As explicated in "sedentarism as chapter", climatic alteration is the natural consequence of human encampment within labile conditions. The scale of such changes is the most threatening characteristic when considered relative to true willingness of collective actions for the climate. Sedentary politicians and citizens demonstrate no real intentions of bringing down emission and reusing when economical health prevail.

Even the auto-proclaimed "greenest" companies proclaim to have environmental concern as their main priority actually spend

more energy to figure how to make more profit out of it. There are more relevant alternatives however they are economically less profitable. Under the green hat of reversibility and versatility, the perpetual development of modular elements is notably sold as environmentally-friendly, thus continuing a reckless production of absurdities while relevant reuse strategies would outperform any novel design. However, such schemes remain underutilized due to their poor source of revenue, or even because they would require many established actors to be rapidly out of business.

The paradox goes on in the transportation sector where empty travels are often less expensive than fully optimized logistics, and where vehicles have increased their weight and size despite shorter urban journeys which could be realized through other means of transportations. Likewise, architects have little direct impact over climatic consequences, while urban planners and policy makers hold more decisive judgements. In the best scenarios, architect can optimize the projected carbon footprint of the building but they can't question the relevance for a new construction, especially in ex-nihilo contexts. Moreover, most emissions from the built environment are due to inherited irrationalities, both from domestic usage of energy and from standardization of building components and materials.

Linear economy - Bellevaux, France - 2020

Maxence Grangeot

Sensitive apparatuses – Chuquicamata, Chile – 2019

Maxence Grangeot

Architecture of climate

The role of architecture is primarily to adapt locally and punctually a given environment in order to be metamorphosed into human imperatives.[209] The alteration of climate is the beginning of architecture, as an ad-hoc adaptation to generate livable conditions. This is why some grant the origin of architecture to the control of fire, which gathered humans into communities but also provided light, heat and protection on demand. Agriculture is another environmental adaptation allowing humans to develop within chosen territories.
However, the empirical evolution based on sedentary habits of increasing alteration progressively broke apart from universal laws of nature, for the sake of comfort.

DOMESTIC COMFORT

When considered as an environmental alteration, architecture therefore aims to establish ideal conditions for human inhabitation. The primary and persistent definition of environment for human is naturally the surrounding air provided by the unique condition of Earth's atmosphere. However, the ideal characteristics of air for human inhabitation are plural and intrinsically became the first material of design for architects,[210] such as air quality but most importantly air temperature hence stressing the prominence of a well-tempered environment.[211] Thermal laws and properties therefore defines elements of design relative to the temperature of the human body of approximatively 37°C, while temperate indoor environments drift around 20°C. This tempered condition notably differ when considering water

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209 Rahm, *Constructed atmospheres*.

210 Rahm, *Histoire naturelle de l'architecture*.

211 Banham, *The Architecture of the Well-Tempered Environment*.

as direct interaction with the body, bringing an ideal temperature for sanitary hot water of approximately 38°C for showering and 27°C for swimming. However, reaching and maintaining such precise conditions required the development of multiple sensitive technologies, but most importantly an permanent increase of energy to suit increasing human comfort. The challenge of maintaining heated environment rapidly revealed the importance of insulated envelops and other incredible technicity to maintain stable temperature indoors despite fluctuating outdoor conditions.[212]

With the successive implementation of overly complex technologies, sedentary dwellings have iteratively lost sense of rationality, until reaching energetic absurdities. The historical importance of fire as provocation of architecture and as a multi-functional element gathering people, later around a fireplace in a central position as a heritage (the French word *foyer* simultaneously carries various definitions including "center of fire", "place to live" and "family"). Gradually the pluri-functionality of fire was split into the oven and stove for cooking in a dedicated room called kitchen, while the central provision of heat progressively switched to radiators against walls, hence not centered and centralized anymore. However, this last evolution is relatively unwise as a significant part of the heat is directly lost outside and do not efficiently contribute to more uniform and indirect distribution of calorific energy. This latter downside is equally reflected in the sensitivity of every machine being only able to operate within temperatures of domesticated spaces.

The clogging within technologization of sedentary habitats is getting more and more paradoxical as novel household items try to counteract weakness from pre-existing ones, thus only increasing the degree of complexity for the sake of comfort optimization, but at

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212 Pawlyn, *Biomimicry in Architecture*. p.93

the expanse of energy consumption and rational behaviors. As such, without double flow exchanger or other intricate and sensitive technological systems, the efforts of insulation to retain or reject heat are annihilated by the need for ventilation to eliminate humidity and vicious air from interiors environments, thus intentionally breaking the difficulty to achieve air-tightness.

Fridge operating in winter are probably one of the most absurd products of domestication, by actively cooling a volume within a heated environment within naturally cold conditions. Other cooling strategy like air conditioning and ventilators are equally representative of the awfully intricate situation of architecture requiring artificial devices instead of understanding local climatic conditions and efficiently using them without noticeable operational energy. The problem goes on for the production of heat through ovens, stoves, microwaves, radiators, heat pumps, central heating systems, hot water tank maintaining a constant temperature, etc. Although they do not compose a problem per se, their heavy consumption multiplied by the enormous amount of domestic spaces grouped in similar settings however seriously threaten entire ecosystems through the tremendous amount of invisible energy required. On top of having massive alterations in the landscape like the rapid implantation of electrical poles, the network or grid defined by the synchronous needs to sustain human comfort exerts incommensurate pressure on natural environments in order to provide the required amount of energy. The intangible nature of energy detailed in “invisible structures” make it more difficult for users to assess the respective consumption of each device. In this perspective, the recurrent blaming for keeping lights at night with a room of public buildings is to be considered relatively to the consumption of the heating maintained during the same period at the scale of entire buildings.

Despite the inability of humans to visually perceived these incoherencies, the development of thermal cameras allows to make energy more visible, yet only a tiny proportion of architects are observing buildings with those inexpensive accessories for smartphones.[213] Through the successive implementation of these sensitive technologies, sedentary civilization have lost sense of primitive understandings of climatic phenomena, while nomads efficiently use and rationally adapt local climatic conditions to sustain primitive needs. The of peak of sedentary technological nonsense is represented by the indoor treadmill and stationary bikes, designed to provide naturally available conditions to high domesticated indoor environments. Additionally, the multiplicity of usage within domestic boundaries progressively led to large increase of required areas due to the proliferation of single purpose rooms despite being able to simultaneously use several at the same time. Domestic dogs in the opposite do not require beds and are able adapt to the environment of each room, by inherently selecting appropriate climates.

A rational approach to space optimization acknowledging the necessary collective action to alleviate built sprawling would be to merge the rooms of different usage in order to mutualize space and technical equipment, seeking for the efficiency of studios if based on schemes of individual living units. Notably, the mutualization of pipes and technical conduits could reduce the complexity and cost of installations using running water, thus alleviating the domestic stupidity represented by pumping water from kilometers away. Historically, the first settlements and cities were specifically established around rivers and watercourses for their sanitary characteristic, on top of being important for trade as maritime routes. The proximity to these

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213 Consumer-ready affordable thermal imagery cameras have been available since 2015, however only a few architects are using them as an analysis and design tool.

natural welfares has however lost any domestic interest or sanitary rationality, for washing clothes for example, and are rather appreciated for the nature they bring into artificialized territories. Underneath the visible crust lies underground pipelines infrastructures of water transportation, either for grey water management or for the production of hydroelectric energy.

In order to guarantee the drinkability of running water, its composition is altered into chlorinated water, thus reflecting once again the sensitivity of sedentary spaces' successive technologization. There is, or rather was, however a threshold of comfort defining the limit before requiring constant development of novel technologies. This long-surpassed limit is notably represented by the maximum volume of comfortable environment solely heated by a singular human body with respect of thermic losses of the envelope, expressed somewhere between the volume of a tent and of clothes. This threshold has the particularly to precisely indicate the optimum proportions and dimensions of domestic space, without needing additional heating equipment. Rather than designing sedentary architecture to best suit human comfort, this strategy is intended for provide deep understandings of natural phenomena, including human metabolism, in order to better interact with them and allow more nomadic lifestyles evolving in various conditions.

CONSTRUCTIVE COMFORT

The constructive aspect of domesticity is therefore undeniably linked to the notion of comfort, as demonstrated for the primitive example of tents in the “nomadic habitats” part. Tents notably challenge the notion of mass for inertia, which have been understood as an important asset for passive energy systems. The strong thermal rationality of tents therefore questions strategies relying on materials with important thermal mass and reduced carbon footprints, like raw

stone or compressed earth bricks, which doesn't require heating processes. Insulation is often considered an essential layer of the envelop but only when considering modern standards of comfort, and could well be composed of tampon spaces insensitive to temperature, such a storage or technical spaces. On top of reducing the effective heated surface, this strategy takes advantage of static air within the mentioned space as an insultation, thus expanding the behavior of insulation to relevant volumes. Carrying further this rationality of minimal exterior surface over maximum volume, the most optimized geometries are defined by spherical spaces,[214] but offer areas less suitable for efficient furnishing.

Environmental comfort is also defined through material usage and their respective carbon footprint. The hype around timber for its supposed carbon neutrality is to be considered in light of the still intense processing and the transportation required. More detailed arguments on timber and round wood are notably discussed in "inherent performances". However, the carbon sequestration offered by timber provide a tangible storage of carbon, similarly to bread turn into stiff carbon foam,[215] and its potentialities for universal adaptations.

On the other hand, the improvement of timber properties through *torrefaction*, i.e. the process of heating above its ignition value without oxygen and therefore without combustion, represent an immense calorific need, therefore losing the environmental advantages of wood. But some industrial ecologist advocate to stop the war against CO_2 by inducing a circular economy of carbon dioxide,[216]

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214 An notable antithesis is the duplication of façade surfaces from typologies of boxes within boxes, such as the Blue Factory in Fribourg.

215 Yuan et al., "Multifunctional Stiff Carbon Foam Derived from Bread."

216 Erkman, *Vers une écologie industrielle*.

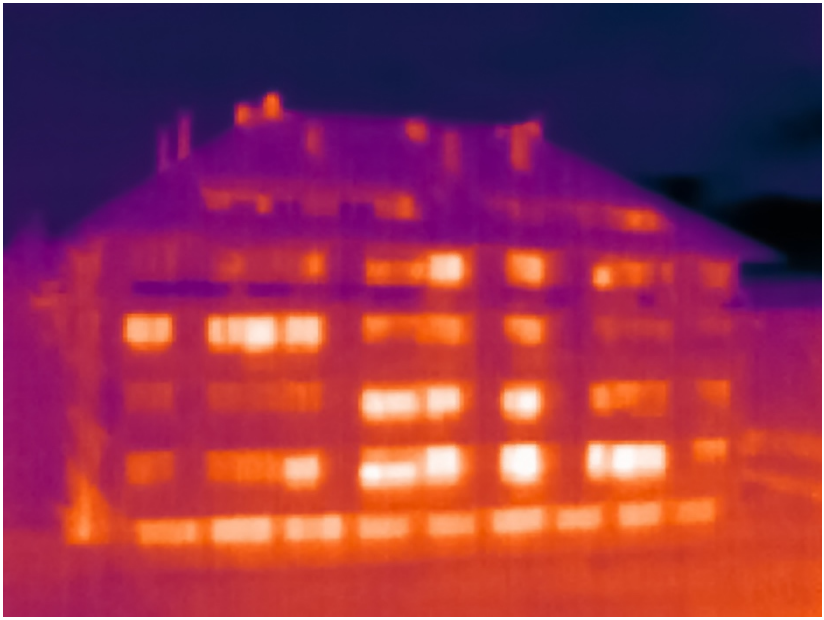
especially through the production of carbon-rich materials such as diamond, and wood… This last strategy demonstrates the dispute around the massive adaptations required to effectively mitigate the impact of human activities. More than thinking materials over their whole life cycle, the indispensable adaptation requires the development of novel hybrids.

MANUFACTURED NATURE

The construction of artificial climates to sustain human needs sometimes also refers to constructing novel manufactured nature in dense contexts of cities, like parks but also zoos. This reverse approach to artificially bring back elements of nature within domesticated spaces is notably experienced annually by the intrusion of Christmas trees in every houses of Christians culture.

Eventually, the adaptation towards a variety of environments to accommodate human conditions, balanced by the artificial recreation and valorization of nature in urban areas, the role of architects is therefore understood as to defend life in the world.[217]

[217] Paolo Deganello, founder of Archizoom, during critics of "Superstudio" in December 2020



Unveiling intangible energies through thermography - Thonon, France - 2021

Maxence Grangeot

Domestic wood-burning device - Pucon, Chile - 2019

Maxence Grangeot

Remote sourcing - Chuquicamata, Chile - 2019

Maxence Grangeot

Annihilating standardization

The expansion of human infrastructure, globalization and increase of comfort were notably made possible by standardization. Although it brings many advantages, subjecting materials and people to universal standards is irrelevant for the locality, while neo-nomads are satisfactorily evolving at the forefront of local and global intertwinements. Predominantly, standardization is strict by nature and doesn't allow adaptations to specific contexts. Nomadic countercultures notably reject normalization of society but also depend on globalization, and daily embrace standardization to some extent.

STANDARDIZATION OF LIFE

The intricacy of complexities within poly-cultural societies inexorably defines a world of specialization and categorization, heavily criticized by Buckminster Fuller.[218] However, the very principle of civilizations is to gather in order to ultimately subdivide labor and knowledge into reasonable endeavors for individuals, coherently forming communities around exchange, thus collectively increasing convenience as the community expand. The complex nature of such exchanges has often been based on shared structures: communication is based on standardized alphabets and offers an infinity of possible meanings through choices of aggregation, while units are representing identical amounts in between all individuals.

Such common structure eases the sharing of resources and knowledge, and allowed the empirical development of fundamentally every characteristic defining sedentary civilizations. However, the overuse of collective structures threatens some acts of individuality,

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218 Fuller, *Operating Manual for Spaceship Earth*.

locality and specificity through an underlaying homogenization. This is notably felt as problematic through the current monetary and grading systems, as if everything should be subjected to a normalization and standardization, as a way to "objectively" quantify or qualify any given topic. What originally was conceived to establish a sense of understanding and rationality to complex environments and actions ultimately led a world of intense irrationalities.[219] However, while standardization is particularly struggling to offer personalization and customization, the reactionary emergence of the Do It Yourself (DIY) trend, or system D(ébrouille) in French,[220] has overcome the centralized production of universal value by reinstating local knowledge and materials. Yet these original constituents must respond to similar requirements in order to perform in relatively identical manners despite their uniqueness in construction and purpose. This ambivalence of normalization and personification is ubiquitous in a heavily standardized society, representing both a potency and a flaw.

Discernibly, contemporary smartphones contain similar hardware and software compositions, even across brands and products at a given time, yet the experience is intensively personalized. Additionally, the contents on social medias and other intangible platforms are inherently identical for every user, only their appearance and prioritization vary, depending on recent evolution of digital tracking and user actions. This subtle variability within heavily normalized occurrences can also be observed in gastronomy, transportation, vehicles, tools, furniture, domestic conditions, etc.

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219 During a cycle of conferences as part of the Superstudio led by Prof. Roberto Gargiani at EPFL in autumn 2020, addressing the notion of rationalism in the 21st century, the lecture by Atelier Kempe Thill (Kempe, "Prototypes.") was initiated by the striking sentence "The world is irrational".

220 Reitz, "Assembler Son Quotidien Sur La Route."

Eventually, even denominations and identifications convey such dualism, from first names to barcodes. This tend to echo languages attributed to machines yet applied to everyday manifestations of sedentary and nomadic societies, like the situation of a locality through coordinates or an address through a number within a street and a postal code. As such, these underlaying structures tend to become invisible despite having substantial tangible implications, for example looking upon the invisible standardization within cities by the urbanism regulations and the building zones, imperceptible to any citizens yet defining essential conditions of architects' professions and physical outcomes. Although the 21st century epitomize a globalized era, localities retain their specificities and differ from one to the other in the accumulation and intensity of normalized elements.[221]

Hence, based on the cited examples and extending further, standardization is inextricably linked to a specific degree of free aggregation, establishing a large number of potential compositions, yet constrained within the system they operate in.

STANDARDIZATION OF TRANSPORTATION

The underlying principle of globalization is particularly based on intensive transportations of parts and products across all continents, made possible through the standardization of transportation. Understandably, in order to allow multiple vehicles onto a singular infrastructure, attributes must correspond, and were notably developed during the first industrial revolution for the development of trains and

[221] The online platform "GeoGuessr" particularly emphasize the retention of contextual specificities, by randomly using Google Street View and prompting the user to identify the associated location on a world map within a given timeframe. Surprisingly, the elements defining the locality through a simple panoramic photography are sufficient enough to provide rough estimation of the locality.

railroads. Barcodes were originally invented as concentric circles for the identification of wagons, reflecting the present importance of license plates for cars as symbol of hyper-standardization. To facilitate the interoperability and efficiency of merchandise transfer among various infrastructural networks, the standardization of transportation occurred through the rapid development and implementation of containers of normalized size, representing the culmination of universal unit within a globalized context. The particular downside of such ubiquitous module generated a strong paradigm of dimensioning for any product. Since transportation is solely based on the unit of the container, every element transported on the infrastructure must conform to restrictions identical worldwide, even though they literally all belong in different contexts, with different requirements, and different material procurement. The unit of the container has therefore a far larger impact than conceivably perceptible. Every single object deemed to be transported or issued from multisite production is directly subjected to a universal logic, and by definition not specific to a particular condition which could be more rational. This notably affects tectonic, economic, political, technical, geometrical and rational aspects of products by also the production processes of those products, as long as their aggregation into larger products or into architecture.

The structural and practical conditions to operate containers require opaque sealing, generating numerous delicate situations in favor of illicit or dangerous operations with more difficult inspections and control, especially considering their important number. Transportation infrastructures therefore define a support welcoming fluid liquidity of movement, populated by millions of containers in perpetual motion. These commodities hidden from customers are entirely engineered to remain goods in motion, acting as the interface to multisite productions and consumptions. Through containerization, the delocalization of production evidently harmed the environment and

local business, as production and waste (thus CO_2) are outsourced, but most prominently the essential concept of local adaptability and hybridity to existing conditions are progressively degrading. The most effective solutions are firstly to alleviate stress on transportation infrastructures, on production capacities and on "recycling" facilities by focusing on already produced goods rather than making new ones,[222] and secondly to reinstate more local production, in turn promoting relevant knowledge and vernacular craftsmanship.
But the contemporary trend is looking into the opposite direction, trying the fit students and low-income citizens into containers like objects or merchandise yet revendicating a vision of affordable architecture. The container is acutely reflecting the troubling loss of territorial anchorage by the absence of foundations and the image of easy transportability, yet without truly being qualified as a nomadic habitat.[223]

Despite the imaginary city which could be envisioned aboard cargo ships, the container is merely a unit optimized for the standardized transportation of goods atop oceans, asphalt or railroads, with intersections forming important economical nodes of transition, epitomized by the dazzling harbor infrastructure of shipping ports.

STANDARDIZATION OF CONSTRUCTION

Appealed by the rationality of standardization widely spread through transportation, architecture repeatedly attempted to follow a similar path, especially through mass production of housing to alleviate housing shortage after the wars and more recently as a meager solution to the housing crisis.

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222 Birtchnell, Savitzky, and Urry, *Cargomobilities*.

223 Le Marchand, "Les cités en conteneurs."

The industrialization of domestic spaces and construction was praised by numerous rewarded architects in the 20th century like Le Corbusier and the *unité d'habitation* or Jean Prouvé and the "6x9" demountable house,[224] or even Buckminster Fuller and the Dymaxion House. However, standardization can sometimes become a source of trivializations,[225] leaving existing elements without fundamental re-questioning of their relevance and their absolute efficiencies.

Conversely, the impact of standardization over construction elements can foster wonderings oscillating between nostalgy and evolutionary rationality, for example like the interrogations "why beams are inherently inefficient and why we use them anyway?" proposed by Edward Allen.[226] Essentially, beam as structural elements are the most wasteful in terms of quantity of material for a given load case, but they convey easy production and transportation, and can be subjected to wide variety of load cases. Their convenience also lies on their dimensional efficiency not for load resistance but for transportation and spatial impact with a construction, by having a minimum total height to span ratio (compared to arches and cables), a convenient flat top and bottom, but most importantly they apply no residual forces (thrust), which means they do not directly affect neighboring components, hence easing processes of assembly and dismantling. However, the geometrical requirements for such conditions are not ideal in terms of material efficiency, and in some cases even less rational considering the full manufacture process.

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224 Picon, *Histoire et Enjeux de l'industrialisation de La Construction Au XXe Siècle*.

225 Statement originally sustained by Prof. Aurelio Muttoni, a renowned engineer and professor of courses merging architecture and engineering, and author of the book Muttoni, *The Art of Structures*.

226 Allen, Zalewski, and Iano, *Form and Forces*. p.466

The particular case of constant rectangular cross section timber elements derived from tapered, round and irregular logs is an example of such irrationalities and is detailed in the “inherent performances part". When observing a detail drawing of any contemporary construction, every single characteristic is derived from constraints established at a global scale and are often the product of irrationalities for local and inherent material properties. In opposition, the detailing of English scaffolding is flexible enough to account for variability in the dimensions of elements, or at least in the tolerances, while maintaining standardized connections and elements, therefore strengthening the concept of “robustness" in the field of political economy of design.

This hyper-industrialization and hyper-standardization of construction is consequently the source of hyper-sensitive material, processes and technologies, illustrated by the recurring images of complex mechanical, electrical and plumbing systems (MEP) within buildings as symbol of lack of reciprocal adaptation.[227] Reflecting on the history of construction, sensitivity never stopped increasing, at the expanse of diminishing tolerances, fostering ever more complex but complicated designs, and equally reflected in the tools used to fabricate, erect and dismantle buildings and building components. This hitch is particularly caused by the massive application of standardization to architectural elements, and transgressing local understanding by the consideration of detailing based on catalogs. Innovations of the industrial revolution, such collections offer a centralization of product characteristic, rendering architecture to a mere selection and aggregation of mass-produced elements deprived of local specificities. This vision of construction gloomily continues to expand through the growing plague of catalogs within architects' tools, such as softwares like Revit and ArchiCAD. Without mentioning the

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227 *Salmaan Craig, Building Form and Energy Circulation.*

intrinsic vulnerability to lobbying, such digital tools are also celebrated to bring optimization of construction through a complete digitalization associated with a shared structure among all actors, and is called Building Information Modelling (BIM).

The extreme precision required along with the complexity to format every habit into a unified organization prominently prevent any local adaptability, analog hybridity and construction tolerances behind promises of improved efficiency with stock images and the paradigmatic blind trust into the digital. Moreover, the ubiquitous presence of standardization in the 21st century has obliterated the idea of non-standard as the multiplicity of possible paths on the same infrastructure. Non-standard structures are wrongfully rejected, a de-facto marginalization obstructing more rational and respectful considerations of adaptability to local environments, and hybridity with locally more relevant materials and knowledge. A widespread strategy facing environmental concerns is to forge reusable modular components, merely an appealing argument for boosting sales hence worsening the situation. Meanwhile, there are insufficient efforts tackling design from reuse for reuse, as a meaningful engagement towards the climate through theoretically endless lifecycles, notably because they are not profitable enough. However, under the pledged interchangeability of standardization, modularity repeatedly failed although convincing and reasonably simple in theory. This selling argument persistently proved to be inefficient, as extensions and modifications based on existing modular elements rarely occurred, un able to welcome new standards decades later, or purely by laziness, or even lassitude.

But the delusion of universal solution is not recent, and can be traced back to the creation of measuring units, or rather to the proliferation of wider set of rules in architecture. Such normalizations

are often encountered in treatises or manuals,[228] allowing tremendous density of knowledge but also specific attitudes to be replicated.

Beyond resourceful designs, construction processes have become more standardized than buildings components adjudging by the tremendous number of distinctive constituents, leading to even more incongruous applications by attempting to enact specific production logics onto unrelated situations. Hence, standardization shattered potentialities of adaptability by neglecting the locality while aiming to be universal. Standardization equally endangers hybridity, as potential aggregations of standardized elements must share common attributes for the ground up, leaving no room for original hybrids.

228 Among the most famous: Neufert and Neufert, *Architects' Data*; Deplazes, *Construire l'architecture*; Vittone, *Bâtir*; Vitruvius, *Ten Books on Architecture*.

Standardized landscapes - Bratislava, Slovakia - 2018

Maxence Grangeot

Failure of prefabrication

In the construction industry, standardization was translated by promises of prefabrication, but repeatedly failed. The objective was initially to mass produce housing in challenging times, and ultimately to lower on-site construction costs. In times of housing crisis and intense economic competition, prefabrication is prominently foreseen as potential catalyzer of construction efficiency into offsite factories.

Certainly, the prefabrication of 2D or 3D parts in the factory to later transport them on site significantly reduces the construction time, yet it merely postpones this intangible workforce to the workshop, admittedly with more suitable conditions. However, the delocalization of fabrication is precisely responsible for the outsourcing of knowledge, labor and CO_2, therefore alienating construction worker and architects alike from traditional crafts and the richness of local resources. In that sense, prefabrication generate more intense deterritorializations than nomads, who consume locally despite evolving at the forefront of the two ends of the scale spectrum. Moreover, the bigger the prefabricated parts, the less expensive in terms of onsite costs, therefore affirming whole prefabricated buildings as the most economical implantation of domestic spaces on variable sites, hence defining the precept of nomad architecture. Eventually, caravans, tents, converted vans, etc. merely epitomize the failure of prefabrication through lifestyles perfectly suited to their physical manifestations in opposition to sedentary civilizations relying on construction design to be transported but remaining static.

Germany is considered as leader with approximately 9% of offsite construction, yet did not demonstrate noticeable performances in terms of cost and efficiency. However, throughout history, they have

repeatedly developed systems fostering intensive prefabrication and normalization, notably the mero system for triangulated metal structures. Furnitures and catalog products for domestic usage, in the contrary, represent a widely adopted rationality of prefabrication, however depending on a distinctive complexity of production less prone to adaptability.

Some systems have attempted to carry the manufacturing logic of industrially produced goods to building construction without revolutionary results. For example, WikiHouse is promoting "open source" architecture through the establishment of a design and fabrication platform based on CNC machines locally available and custom generated kit of parts. Other strategies include standardized connections able to accept a variety of linear elements such as geodesic hubs, or even the processing of already standardized elements into modular systems for potential refurbishment like GridBeams.

This last system was invented in the 1970s, carrying every virtues of industrialization through linear elements of square section drilled at regular intervals, encompassing the utopian waste-less construction standardization, yet remained unsuccessful. Despite the reasonable load repartition of GridBeams through less material in the center but kept on the outer section, such system was promoted to be easily assembled, but required in reality lots of effort to replicate at home, with requirements in precision not easily achievable. Thus, widespread reconfigurable adaptability comes with hidden costs that are not yet accepted and understood.[229] The most efficient system to account for dimensional variability and tolerance remain the English scaffoldings.

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229 Le Marchand, "Travail intermittent et production de la ville post-fordiste."

THE FAILURE OF PREFABRICATION AND MASS MANUFACTURING

Throughout history, and most importantly during the 20th century, the efficiency of construction represented a major challenge to bring domestic surfaces to the larger number of persons with the least amount of materials and costs. The socialist movements eventually succeeded to build collective housings, but only a few mass production systems of individual housing managed to surpass the state of prototypes. The historic importance of the Dymaxion house, the *Maison en série*,[230] or even the *Bétonbox*[231] however influenced the recent development of container homes, literally emerging from the most standardized object, and customized into singular units, inducing a novel circular economy of standardized singularities.[232]

The failure of prefabrication and mass manufacturing of housing is therefore a problem of politic, economic and social rationalities rather than architectural intent. In particular, the lack of adaptability provoked by standardization, associated with the lack of hybridity due to prefabrication has led to a mechanization of architecture less successful than the mechanization of agriculture.

MATERIAL PREPROCESSING

However, standardization in construction requires to dig further, notably into materiality, to fully grasp the extent of derived irrationalities. The material processing of steel plates, bolts, Cross-Laminated Timber (CLT), etc. is reflected by multi-site chains of procurement and production which cannot be applied to architecture due to the complexity, the singularity and intricacy of building construction. However, the Fordist rationality had large impacts on the means of

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230 Le Corbusier, *Vers une architecture*.

231 Friedman and Orazi, *The Dilution of Architecture*.

232 Le Marchand, "Les cités en conteneurs."

onsite production, for example by progressively annihilating single-use formworks. This efficiency is to be balance with the mentioned impacts on standardized architecture, announcing the precepts of a fierce conflict. Additionally, considering the most rational geometry defined by the sphere, the problem lies in the economical production of the complex surface. This oscillation between rationality and complexity underlines the relevance of selecting adequate criteria for construction, eventually deemed to be optimized. For example, geodesic domes, despite representing quasi-optimal geometries, are to be balanced with the technicity and price of the respective enclosure as long as their expected performance. Double layer paperboard, having high tensile and compressive strength and 5cts/square foot could provide 3000 affordable shelters a day, in comparison with regular enclosure at 2$/square foot but less prone to climatic alterations.
Furthermore, wood construction has recently turned to prefabrication, having sourcing and processing sites dissimilar from the final building site, thus developing contemporary packing problem of logistics, especially with increasing curved elements generating lost space and severely restrained by infrastructure limitations and standardized processes. The praised Cross-Laminated Timber (CLT) and Laminated Veneer Lumber (LVL) notably have fairly complex production processes, in turn having large impact in their usage and their respective lifecycles. On-site production, or in situ fabrication, adequately cancel those limitations while reinstating local knowledge, materials, and craftsmanship.

Plug and Pray – Montpellier, France – 2018

Maxence Grangeot

Legitimacy of prefabrication – Sion, Switzerland – 2020

Maxence Grangeot

Impeaching digital fabrication

ILLUSION OF DIGITALIZATION

Standardization and prefabrication perpetuated a world of specialization, despite their lack of adaptability and hybridity, leading to increasing complexity. This complexity is prominently reflected in the ubiquitous illusion and conditioning of digitalization, as intangible and hardly understandable technologies,[233] increasing the ignorance and alienation of most users. However, the "Digital" as a new paradigm is praised to bring revolutions in many applications, hence augmenting scholarly and academic interest into a disruption.[234] Moreover, the digital has already proven to be of fundamental importance, allegedly increasing health potentialities, logistics rationality, and industrial automation, design productivity and feasibility, etc. The emergence of alternative lifestyles based on digital technologies and mobilities, digital nomadism, is especially presented in the "Global nomads" chapter.

The Digital is notably acclaimed when tackling automation and the trendy denotation of "Artificial Intelligence", this last one remaining mostly an evasive dodge for public appeal, mediatization and grant funding. Behind this vastly ornamented facade, "Artificial Intelligence" cannot self-reliantly commit appropriate correspondences as expected from the "intelligent" and "smart" adjectives. However, the employed "Neural Networks" or "Machine Learning", developed to train algorithms into more accurate recognition and actions from specified input sets, perform satisfactorily from a human perception as the amount of data and speed of calculations are beyond

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233 Bridle, *New Dark Age*.

234 Stiegler et al., *The Age of Disruption Technology and Madness in Computational Capitalism*.

any human acquaintance. Conversely, such algorithms can produce unexpected associations, hence inviting computers engineers to voluntarily generated pleasant mistakes for bewildering outcomes.
However, this demonstrates the submissiveness of technologies, as autonomous productions are conceived by humans, to serve humans, hence depending on human interaction. Digital technologies do not execute any relevant performance without human intervention in the process, as even computers are operated daily by tangible and analogical hands.

Digital technologies are equally used in architecture at various levels, from informing intricate conception to allowing novel fabrications. Admitting intended vulgarizations, data-driven urbanism and architecture notably engendered the emergence of many "computational design" academic laboratories, and has equally been granted with the generic appellation "artificial intelligence".[235] Moreover, the development of procedural generation for cinema and video games has been envisioned as generative tools for original designs in architecture speculation. Although a large number of resulting designs are predominantly developed as formal demonstrations of innovative digital design processes, a smaller but resisting percentage of scholars are tackling construction projects through digital tools by including more parameters than human can handle during the initial conception, schematic design, and construction supervision phases. For example, by simultaneously including solar emissivity, wind trajectories, passive efficiency, occupant usability, acoustic reverberation, thermal comfort, material performance, construction optimization, technical feasibility and more through digital means, architecture can be advertised as increasingly rational and sustainable. In turns, digital tools can help the construction sector to resourcefully tackle a transition towards circular economy.

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235 Chaillou, "AI & Architecture."

However, the promises of the Digital to help design from technical, social, political, legal, sentimental, ethical, economical concerns, for humans and non-humans, can rhetorically question the relevance of novel technologies to solve problems caused through the previous ones. Considering the lack of self-restrain as the biggest sin of modern sedentary civilizations, the question of using technology to solve contemporary issues rapidly shifted from *should* to *which*.

Pondering the multiplicity of actors and the diversity of issues involved, their relative priority and core objective remain arduous to determine, reflected in the profession of the architect, and remain equally valid when using digital technologies, artificial intelligence, and optimization algorithms. Consequently, the role of the architects in this essential dilemma rest upon their qualities of mediators and advisors, and might only be endangered by algorithms if clients could precisely define those priorities in respect of their desires.

However, automation is actively tackled in construction, notably through fabrication processes such as 3D printing, robotic fabrication, CNC milling and more, gathered in a novel field named digital fabrication, occasionally shortened as "dfab". But more explicitly, automation in construction is developed behind a usual smokescreen of alleviation of physically-intensive and repetitive tasks, but most research projects also aim at replacing human operators or builders by computers and robots for the sake of efficiency and "sustainable development". However, the absolute benefits for every related category is yet to be proven, as human intelligence still outperforms machines in those complex fields. The usage of "neural networks" notably aims at teaching machines on how to adapt themselves, but this adaptation is only specific to reduce applications and ranges. Genuine adaptability in the opposite includes authentic intelligence, which machines and robots still do not possess and might never do. This

notably reflects the tremendous lack of fundamental and honest questioning of technology relevance for specific purposes, rather suffering from academic speculation due to personal interests, political obligations and economic justifications, yet without dominant sincere reasoning.

ILLUSION OF DIGITAL FABRICATION

The application of digital technologies for fabrication in architecture denotes the reactivation of mythical forces through the animation of matter, while architecture forms an art of animation per se. The myth, defined by the ability to enable contradictory elements,[236] lies for digital fabrication in the rivalry between product of nature and automation. More comprehensively, the ultimate goal of digital fabrication is to automate bespoke construction, conferring adaptability to design through novel digital tools and innovative fabrication. However, the sought adaptability only applies to design phases as fabrication is more complex and sensitive. This paradox is notably felt through robotic arms, initially intended for mass production and repetitive tasks, but became the compelling symbol of customizable and bespoke design in architectural research.

Despite the recent trend for digital fabrication,[237] the digital had already a tremendous positive impact and have saved many lives although it is difficult to assess the holistic contributions brought.[238]

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236 Picon, "Digital Fabrication, Between Disruption and Nostalgia."

237 See the numerous examples of innovative academic projects using digital technologies for fabrication since the beginning of the century in Gramazio et al., Fabricate, 2011, Gramazio et al., Fabricate, 2014 and Gramazio, Kohler, and Langenberg, Fabricate. 2017

238 Grangeot, Maxence (2019), "Forgotten rationality of digital fabrication in construction: towards a Darwinist industry for a sustainable circular economy" Essay written for the AR-497 class "Building Designers in the Circular Economy" held by

However, the illusion of digital fabrication for automating bespoke construction widely reflect the inability of machines to self-reliantly adapt, despite the conducted effort to adapt their operational trajectories to generate custom designs, and could be used more wisely when necessary. The speculative development for the sake of potential future fabrication led this particular research domain into irrational outcomes when facing the urgent challenges described as drivers, eventually acknowledged as "digital grotesque".[239]

The most hazardous aspect of such research is the advertised relevance for environmental purpose and for the health of construction workers, while the envisioned solutions remain objectively expensive, complex, burdensome and most importantly not optimized for environmental concerns. The illusion of digital fabrication is therefore directly defined as a green illusion.[240] Moreover, the complexity and expertise knowledge required to austerely design and operate related machinery is beyond the scope of architects knowledge, but most worryingly beyond the scope of most construction workers, leading to their alienation. The developed methodologies rarely integrate socio-economic considerations and the inertia of architectural education, thus generating irrelevant and overpriced solutions, while mutilating traditional craftsmanship. The tremendous disproportion between empowerment of existing analog profession and the relentless development of obscure digital technologies is notably represented during international symposium and conferences, gathering most academics from research in construction. Behind generic arguments of aging construction workers,[241] dishonest need of built areas

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prof. Corentin Fivet in the autumn semester of 2019-2020 [not published] The document is freely available upon request to the author.

239 Hansmeyer and Dillenburger, "Digital Grotesque."

240 Hence belonging to the numerous cases described in : Zehner, *Green Illusions*.

241 Most of construction workers in Hong Kong are over 50 years old.

and environmental crisis, the research in digital fabrication, on site automation and artificial intelligence rather compose an academic subterfuge for prestige, leading to the alienation and the suppression of human presence from construction.

With this progressive eviction, academics are equally weakening the valuable adaptability so characteristic of humans in comparison to machines. For example, robotic arms perform their tasks unaware of their environment, therefore without detection of toolpath collision, becoming particularly challenging for persistently fluctuating construction conditions on site. Thus, the appraised potentialities of robotic choreography are to be balanced with the absence of feedback sensors, hence the lack of referential environment fundamentally intrinsic to human perception. Moreover, the geometric requirements for the fabrication with robotic arms, CNC machines, laser cutters, waterjet cutters, 3D printers, etc. entail designers to significantly adapt the whole design based on machine constraints, most of the time through empirical processes of trial and errors.

Digital fabrication is equally less prone to adaptability due to the extremely low tolerances permissible for the assembly of all elements, leaving no latitude for errors nor imprecisions. The reduction of tolerance due to the increase in precision brought by machines is notably the cause of extreme sensitivity translated into an important lack of robustness, and dangerously continues to evolve towards to the impossible tolerance zero. The incremental development of digital fabrication process for architectural applications make design equally sensitive to those specific technologies, contributing to additional lack of future adaptability and hybridity. Moreover, the technical constraints and specific processes in order to achieve relevant outcomes force designers to generate irrationalities, in terms of initial samples, of number of steps, of material consumption, etc.

Additionally, while digital fabrication academic laboratories are mainly focusing on automating the manufacture of bespoke designs, the ambition of most doctoral researchers in this field rather lies in the desire to provide relevant tools to designers, notably through the creation of digital plugins. However, their exploration of such complex tools requires to design complex prototypes, hence for complex architectural applications, in order to justify the need of robots and other high-end technologies. This is particularly reflected in a substantial number of PhD thesis initially searching what to do rather than departing from real expectations from the construction industry. In turns, the outcomes of research in digital fabrication and related fields is often unserviceable, at best translated into publication of plugins, or of « design methodology » for theoretical and historical topics.

However, only a limited number of conclusions transitioned to tangible applications, regardless of their relevance for adaptability and environmental response. In order to faithfully enhance the feasibility of digital fabrication for construction, the manufacturing machines must leave the perfect conditions of laboratories to tackle the perpetual adaptations on construction sites.[242]

The confrontation could provoke multiple considerations essential for the successful application of innovations, notably after long and expensive developments within controlled environments. Bringing 3D printing of clay, automatic brick laying, CNC machines, robotic arms or outcome products to the construction site could therefore demonstrate the relative usefulness for society. To

[242] The Chair of Gramazio Kohler Research at ETH Zurich and the experiments in Hooke Park at the AA, despite being recognized as artistically expressive, are two notable academic environment bringing digital tools to the site.

overcome the image of futuristic perceptions, the transfer of technology into the present build environment would ultimately generate interactions between the general public and public funding applications, following the transitions of robots from factories to domestic tools, thus affirming the visibility of machines into a mutant architecture like a nomadic habitat.

ANALOGIC TOOLS & FORM FINDING

Prior to the development of digital fabrication and computational tools, the analogic fabrication was informed by numerous relevant analogic tools. In structural design, the notion of form finding was notably developed through physical models. Analogic form finding notably helped develop efficient structures with materials following the flow of forces through prominent small scales models, using the hanging chain model or soap form finding. Heinz Hisler, a prominent engineer who intensively used structural experimentations of shell structures though physical models by hanging tissues, plastering, and reversing them; and was particularly against computational form finding technics. The clear didactics of analogical processes contrast with modern digital form-finding and topology optimization technics that are often not fully understood, transforming the architect into a decision maker rather than a structural designer.

Naturally stabilized tension-based structures, largely employed by nomadic communities, are the most lightweight and compact structures once folded, therefore best suited for transportation, and can easily be determined by analogical form finding with soap. This analogical optimization offered by natural laws can equally be found in the intrinsic stability of screes through the natural arrangement taken by stones under gravity, thus questioning the relevance of algorithmic arrangement, and more widely the relevance of digital processes for conception and fabrication in architecture.

Exploiting further natural and mechanical laws, analogic construction can benefit from existing potential energy, under both of its meanings. For example, the wheel does not only represent a potential for translational movement, but also permitted the development of pulley systems, allowing to mechanically multiply the amount of force at the expense of length. To elevate a load, the longer the distance, the smaller the force required yet during longer period, therefore applying this principle both to pulleys via force transfer, but also to zigzag routes with gentler slopes than straight and steep paths. Hence, the distance always compensates for the effort, and can turn invaluable to construction processes, along with the principle of leverage to equally increase force, or the principle of Archimedes for leveling constructions using water tubes as large levels for example, yet more precise and less expensive than sophisticated rotating laser levels.

RELEVANT TOOLS

When adequately considering tools for appropriate purposes, modern construction can take advantage of best individual characteristics to generate global rationalities of construction through an adapted hybridity of relevant tools, echoing nomadic principles.

Analog and mechanical tools such as hoists, *chèvres*, Japanese saws, etc. have notably been used for centuries as they confer the most adaptability and retain human intelligence for custom manufacturing, while augmenting human capabilities. A relevant and hybrid evolution of cranes is notably represented by cable driven parallel robots. This novel multiple "axis" crane can execute precise operations of robotic arms yet with less dimensional limitations as the scale of operation is theoretically unrestrained. Hypothetically anchored to sturdier building poles and augmented with a rotating platform for greater reachability, the potential for human-machine

collaboration is enormous, especially through hybridizations with relevant tools, like a Kinect for low-cost point cloud acquisition, visual feedback, fiducial positioning and eventually used for photogrammetry with referenced camera positions. Such system is particularly suited for hybridizations for onsite construction as the scale of reachability can cover large areas and the potential for open source advances is still largely untapped. Moreover, the development of accessible tools is carried by a growing community of "makers" advocating for open source collaborations, therefore announcing a novel paradox of high replicability within a globalized world despite a lack of nodal control, blurring the fine line between free evolution on isotropic territory and anarchy.

Such communities of "makers" have notably transposed the development of high-end 3D printing to accessible additive extrusion for inexpensive local production, inspiring architects and designers to develop 3D printers at larger scale for construction, notably using steel, concrete, clay or mud. Despite the lack of potentialities for future reuse, the use of locally sourced soil transformed through mobile 3D printers can augment the local potentialities. This material usually considered as the biggest waste of construction can therefore translate into efficient geometries for architectural application, like ribbed surfaces incorporating larger buckling load resistances than smooth surfaces with double thickness.

However, the employed tools and related designs might differ significantly depending on considerations of costs of production, for example increasing from laser cutting to CNC milling to 3D printing for metallic fabrication.[243] Inversely, numerous digital tools have witnessed a drastic decline in price, allowing architects to affordably develop more relevant designs thanks to widespread technologies, such

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243 Lienhard, "New Hybrids."

as thermal cameras as "superpower" vision to see invisible energies through inexpensive smartphone accessories, or the utilization of second-hand Kinects as low-cost 3D scanners.

Recent development in Light Detection and Ranging (LIDAR) for applications in surveying and autonomous vehicles have offered particularly valuable tools for architects in the form of point clouds. Considering the geo-localization within mobile applications as the closest equivalence between a point of physical location and data information,[244] the point cloud extracted from 3D scanners are defined by millions, even billions, or such points offering accurate digitals model of a precise realities, allowing architects to better understand characteristics of a site. This simultaneous representation of material and data in 3D space is often defined within 1mm of tolerance, accurately revealing the site with more sensitive perception for architectural interventions. Raw point clouds are therefore a hybrid digital-analog surveying matter preventing oversimplification or hidden defect, enabling humans to see the unseen in order to virtually design with the existing, preceding the project, while optimizing risk reduction. LIDAR technologies or similar point cloud acquisition devices are getting increasingly inexpensive and appeared early in consumer-ready products such as game controller for consoles and more recently into mobile phones, opening more potentialities for relevant applications.[245] Building virtual libraries of existing non-standard elements is therefore more straightforward and can ultimately permit a sufficient large scale database to be truly relevant for circular economy by hybridizing compatible or near elements.

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244 Picon, *Smart Cities Theories et Critique d'un Ideal Auto-Réalisateur*.

245 The recent upsurge of numerous proofs of concept applications for LIDAR scanning on iOS devices exemplifies the extent of potentialities.

The acquisition of non-standard elements or complex geometries, or simply any rough 3D surveying, can however be achieved without any specifically designed sensor, but only given a camera and open source software. Such inexpensive technology is known as photogrammetry and can notably be used as ultra-affordable scanning principle, and can be used anywhere, nearly by anyone, offering larger hybridity and adaptability between digital and analogic processes.

TOWARDS DIGITAL ANALOG HYBRIDITY

Historically, tools were adequately used according the requirement of the specific tasks, and were combined when relevant, the sum of these hybrids forming the notion of traditional craftsmanship. The rationality of the outcomes was a direct consequence of the combination of technology and knowledge used in a precise and relevant order and process. For architectural applications, as every project vary from another, adaptability ought to equally be reflected in the employed tools, both during design and construction phases. However, digital fabrication tools are still not optimized for onsite adaptability despite the development of "bespoke automation", leaving adaptability for human minds. Conversely, the considerations of digital fabrication in architecture are to be radically distinguished from the traditional high tech versus low-tech opposition, as some digital processes can inform low-tech fabrication, notably through intensive and integrated collaborations. While the digital inherits the productive appeal from repetitive yet malleable industrial processes, analog fabrication denotes by nature symbols of specific uniqueness. Moreover, while the Digital is represented by unthinkable computation capabilities surpassing human aptitudes but lacking of holistic understanding, the Analog is conferred with inherent adaptability of the human mind associated with essential global understandings

and planning. Therefore, the hybridity of the Digital and the Analog[246] could provide primordial methodologies to address urging concerns and aptly relate to contemporary conditions of societies and construction processes. Rather than rejecting or fully embracing digital technologies, appropriate utilizations allow to rather design with it, retaining architecture in the feasible scale without heavily depending on complex and sensitive processes. When considering the geometry as the technology, and the construction rationality as optimization criteria, graphic statics appear as one of the most worthwhile tool,[247] with potentialities translatable from analogic principles to digital flexibility. Adapting design through analog-digital, and fabricating through digital-analog processes could ultimately confer a reasoned use technology in order to relevantly address urgent crisis of climatic and architectural conditions.

The inducted hybridization of computational tools and analog fabrication is not an analogical substitution but rather a suitable hybridity in order to manufacture "by hand" or by through digital fabrication alike, hence preserving the relevance of construction workers. For example, combining optimized algorithmic models with manual execution through digitally aided referencing can simplify the technical expertise required, while achieving faster, less expensive and more rational construction.

The importance of analog effectiveness is notably reflected in the more agile behaviors of pigeons in comparison to the most advanced drone, leading in terms of adaptability due to millions of years of evolution. Equally, the analog construction before the appearance of digital and motorized technologies denotes extreme rationalities due to manual operation and calculations, and could be

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246 Carpo, *The Alphabet and the Algorithm*.

247 Ochsendorf et al., "The Edward and Mary Allen Lecture in Structural Design."

carried into hybrid realizations helped by more complex computerized calculations.

Moreover, digital tools rely on standardized elements while analogic construction can adequately welcome irregular structures, allowing tolerance to imprecisions.[248] This can notably generate unpredicted outcomes[249] and imposed improvisation better handle by humans than machines. Hence, by embracing improvisation through hybridity, construction could use present forces instead of fighting them.[250]

As academic research instinctively followed fully digital promises without truly questioning where and when it is most relevant to use digital or alternatively analog processes, such deep questionings would have revealed the underlying efficiency and relevance that can be yield from a mutual collaboration. The development of such hybrids particularly opens new possible relationships between humans and non-humans,[251] working hand in hand with robots,[252] and is gently emerging from academics[253] and scholars.[254]

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248 Friedman and Orazi, *The Dilution of Architecture*. p.172

249 For the Festival des Architectures Vives 2019 in Montpellier, the author proposed a pavilion composed of 50 000 clothespins to be collectively arranged by the public, leading to unpredicted yet pleasing results.

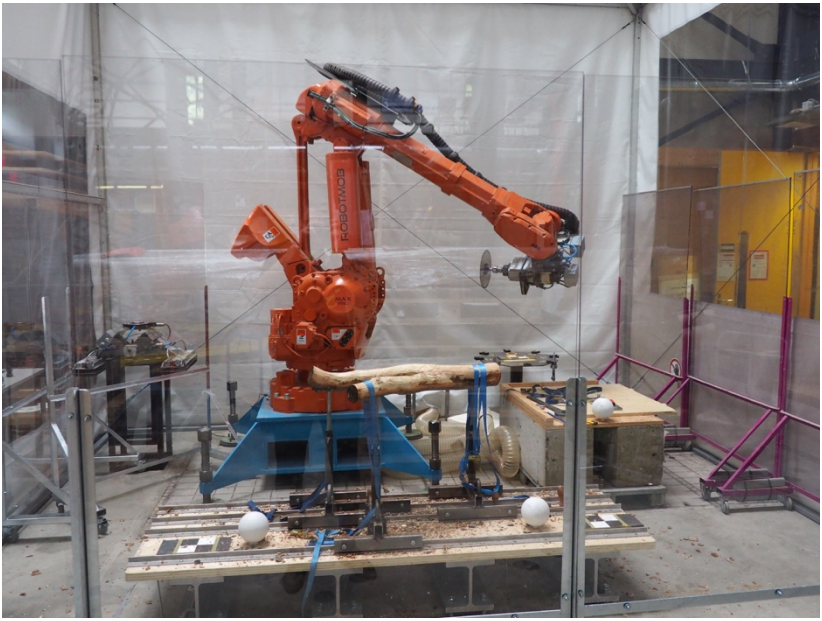
250 Reflecting on the famous quote from Richard Buckminster Fuller "Don't fight forces, use them"

251 Verschuere, "L'Ouvert."

252 See the thesis : Parascho, "Cooperative Robotic Assembly.", and the inspiring work initiated by Stefana Parascho through the create laboratory in Princeton.

253 Beyond the notorious examples in the chair of Gramazio and Kohler at ETHZ, or the exploration of non-standard analog fabrication in Hooke Park as part of the Architectural Association, such collaborations are experienced in smaller scales, notably in : Larsson, Yoshida, and Igarashi, "Human-in-the-Loop Fabrication of 3D Surfaces with Natural Tree Branches."

254 Carpo, *The Second Digital Turn*.



Digital disequilibrium - EPFL, Switzerland - 2020

Maxence Grangeot

Academic embracement of complexity – Barcelona, Spain – 2019

Maxence Grangeot

Scrap constructions

The perpetual increase in production and sensitivity notably contributed to the derailing of spaceship Earth through perpetual outdated structures as symbol of the sedentary lack of local adaptability, manifested by inhabited surfaces deemed obsolete.

BUILDING MORE

Motivated by increase of population, architects and academics proclaimed the necessity to increase built areas, considering western standard of comfort and domestic life as examples to be replicated. Repeatedly, the upsurge of global population serves as main cause, along with environmental concerns, to relentlessly continue speculative academic research and industrial expansion, however without honest intentions.[255] Acknowledging the various crisis generated through similar statements since the end of the first world war, the need for an increase of building areas can appropriately be challenged, therefore bring numerous interrogations, notably regarding the relevance of construction. Counterculture movements markedly rejected such unrestrained developments, ultimately impeaching the importance of the city, filled with constructions and ideologies to be scrapped.

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255 Areti Markopoulou, the academic director of the Institute for Advanced Architecture of Catalonia, opened up the Fabricate 2020 Conference Series with the statement "We need to build more!". Additionally, Prof. Dr. Philippe Block, director of the Block Research Group at ETH Zurich, begins all conferences with punchy numbers on expected population, including during the first plenary lecture of the 2019 Symposium of the International Association for Shells and Spatial Structures

The importance of considering the relevance of constructions is notably due to the prominent difference of lifespans between buildings and inhabitants. The mortality of humans is evidently opposed to the longer lifespan of Earth ecosystem, often erroneously considered eternal. Curiously, architecture has rarely integrated the notion of usage over time,[256] while it is inherent of nomadic lifestyles, and could adequately integrate conditions of temporality. Consequently, the development of mono-use building with insufficient planification of lifespans led to intensive obsolescence of existing building stock, transforming abandoned buildings into ruins deprived of inherent value. Hence, the "durability" of scrap constructions conveys nomadic movement as more respectful lifestyles anchored in specific periods and historical conditions.

Moreover, the planned obsolescence of architecture as consumer product was inherited from principles of mass production,[257] particularly important for domestic items with limited warranty. Comparatively to the 30 years in France, and the 25 years in the United States of America to consider a car as antique or collection, buildings in Europe are conceived with a meager 50 years lifespan to conform to Eurocodes, approximately corresponding to the expected longevity of infrastructures. However, there are more car collectors, than architecture collectors as buildings represent a collective heritage in the hands of public entities, deprived of means to adequately maintain or restore such heritage. Conversely, the average service life of dwellings is remarkably long in Switzerland, as high as 180 years, much

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256 Brand, *How Buildings Learn*.

257 The Dymaxion House of Buckminster Fuller was particularly criticized in Archigram, *Archigram*. for its reduced lifespan.

more important than the proposed standard of often 60 years.[258] Therefore, most architectural interventions occur on existing fabric, defining a concealed gospel for architects, as new buildings are often subjected to international competitions and denote merely a small part of architectural interventions, even though they occupy the majority of publications and promotions.

Therefore, the ruins, like elders, cannot be considered as elegant or unpleasant, but rather as is, through their reassuring qualities, in opposition to the rust of obsolete machines.[259] However the geo-infrastructure is dimensioned for a maximum demographic capacity, defining a particular moment from which the decline dangerously dispute the health and relevance of such perishing built environment, strengthening the interrogation of infrastructure lifespans for temporal adaptability and hybridity with the existing building fabric.

REUSE

In order to avoid redundancy of spaces as many areas slowly degrade in abandonment, the most efficient strategies rely on the repurposing of spaces as is, for example by modifying existing unused buildings or infrastructures to welcome new functions, such as urban food production like *Growing underground*, therefore certifying of a relevant adaptability to tangible and socio-economical contexts through ad hoc alterations,[260] potentially successive thus endless. Another relevant strategy to value existing built structures is to consider the potential of material accumulation from abandoned infrastructures and buildings as stock of reusable components, therefore

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258 Kornmann and Queisser, "Service life of the building stock of Switzerland."

259 Picon, "De la ruine à la rouille."

260 Angélil, "Tales of Territory: Anthropocene, Urbicene, Capitalocene?"

perceiving buildings as rich material banks.[261] Structural elements, floorings, windows, train tracks, etc. form relevant elements to be reused, through an initial selective deconstruction,[262] [263] [264] to then be reassembled in an alternate context with supplementary components, successfully adapting to novel conditions with pre-existing elements. The rich lifecycles offered by this hybrid framework of raw and manufactured resource to be considered as endogenous fragment of the present and future environment is notably made possible through construction details designed for dry assembly and disassembly rather than irreversible construction only deemed to be demolished with dynamite.

Additional strategies to alleviate the intensive demand of novel built areas include flexible and moveable spaces like caravans or other nomadic habitats, to respond to fluctuating needs despite their paradoxical representation of domestic duplication for leisure purpose, consequently leading to an excess of materials and areas in regards to simultaneous use.

The centralization of building occupation notably allows alternative systems, such as the exchange of apartments, equally allowing to discover new territories without duplicating the built surfaces. However, similar structures such as peer-to-peer lodging also reveals abrupt limits in capitalistic societies, as almost half of apartments in large cities are empty and reserved for punctual and expensive renting, while countless homeless cannot afford basic

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261 Capelle, "Buildings As Material Banks D14."

262 Fivet and Küpfer, "Déconstruction Sélective, Construction Réversible."

263 Durmisevic, *Circular Economy in Construction, Design Strategies for Reversible Buildings*.

264 Durmisevic, "Transformable Building Structures. Design for Dissassembly as a Way to Introduce Sustainable Engineering to Building Design & Construction."

necessities in the same locality, hence explicating the general lack of adaptability regarding existing built structures facing numerous intensive crisis.

Moreover, although novel constructions require considerable amounts of energy and materials, the interest in the pre-existing stock woefully remain under-estimated as built environments predominantly turn towards the promises of green technologies.

Disregarding disruption – Humberstone, Chile – 2019

Maxence Grangeot

Green vulnerability

GEOPOLITICAL FAÇADE

In order to attempt to reposition the derailing spaceship Earth on a nominal trajectory, politicians and scientists have developed numerous strategies under a common worldwide goal named “sustainable development", supposedly more environmentally friendly and notably advertised through “green" technologies, and “resilient" policies. The notion of “sustainable development" is particularly carried by the United Nations through 17 goals, ranging from social to economic and environmental developments while maintaining sufficient opportunities for future generations to equally perpetuate such developments. Within 9 years of the deadline, every nation is far from honorably reaching the established goals, as sustainability rather denotes development opportunities rather than ecological transitions. Sustainability has pitifully become an ordinary label, including in architecture, hiding geopolitics failures, capitalist brandings and philanthropist mirages.

Surprisingly, environmentalism is ubiquitously advertised as fundamental focus of every physical and moral entity, precisely when the situation continues to worsen, as underlaying operations have not fundamentally changed. The universal hypocrisy is predominantly reflected in corporations where climate actions are secondary to profit, but also in the majority of individuals seeking to preserve comfort at the expense of environmental deterioration. This ridiculous lack of sedentary adaptation is equally reflected in the definition of resilience, denoting the capacity of returning to a prior state, thus annihilating the concept of adaptability. In a world where quantitative surpasses the qualitative, the opportunities of architecture oscillate between necessity and frugality, therefore tackling the question of

sufficiency, notably through the increasing aspiration for deceleration and DIY.[265]

However, the facadism of green commitment echoes the identical threat about geo-engineering, by unwittingly relying on placid technology to sustain irrational lifestyles. Such behaviors are widely adopted since government funding seem better invested in innovation research than degrowth, especially in a competitive environment. Such supreme understanding and control over nature is however an illusion reflecting the inability of humans to self-restrain, even when acknowledging the genuine guilt, therefore impugning scientific research.[266] Consequently, the egocentric attitude of humans merely delegates late adaptations as unique capabilities facing existential predicaments.

"You knew what you had to do, what did you do?"[267]

GREEN TECH SENSITIVITY

One of the most prominent sustainable development strategy facing climate change is the elaboration of "green" technologies, allowing the booming of academic researches as well as industrial applications. However, the focus on such sensitive and complex technologies merely serves as a smokescreen for green illusions,[268] increasingly hiding grotesque infrastructural and architectural casualties. The collective vision for green architecture heavily relies on high-end technologies like photovoltaic cells, high-capacity alternators, lithium-ion batteries, nuclear fusion reactors, etc. and extremely

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265 Reitz, "Assembler Son Quotidien Sur La Route."

266 Grothendieck, *Allons-Nous Continuer La Recherche Scientifique?*

267 Citation quoted in Ghosn, "Terrarium of the Anthropocene."

268 Zehner, *Green Illusions*.

sensitive processes for manufacturing and energy distribution, having enormous impacts on territories despite marginal returns. Among the widespread greenwashing of vulnerable and sensitive technologies, the threat for architecture is to primarily become of shell for technical equipment, being merely subjected to standardized catalogs rather than actor of sustainable products and practices. The sensitivity of green technologies for building applications notably increases the lack of robustness in construction, paradoxically reducing the service life of holistic planification. Despite the importance of their implementation within architecture, the critical input from architects is particularly important for long-term serviceability and relevance, as there are no possible means to determine whether present solutions will remain valid and significant in 50 or 100 years.
Moreover, the sincere development of "green" energy might incite for further transportation, counterbalancing the contemporary efforts to reduce mobility in order to lower environmental impacts, therefore generating cleaner transportation in turns increasingly sensitive, loading humanity into an unstoppable technological loop.

BIO-SOURCED MATERIALS

The green hypocrisy is particularly advertised within societies of heavy consumption by orienting consumers into “greener” yet novel items, thus perpetuating the emission calamity through relentless consumerism. In architecture, this phenomenon is reflected by headlines focusing on tectonic appearances, image of a limited adaptability. As construction persistently requires novel materials supply, the trendy solution rest upon the usage of bio-sourced materials considered carbon-neutral or renewable. The pleonastic description notably project timber as symbol of a green architecture, regardless of the sourcing location and the implementation with the design, having significantly different impacts depending on the rationality of processes and usage.

However, the post-modernist approach to materials only constitutes a tiny part of the emissions problem,[269] despite being at the forefront of contemporary publications. Surely since novel construction is less energy intensive as operational costs at the expense of embodied energy, old uninsulated constructions remain one of the major contributions to environmental alteration yet they are not considered as an emergency and are not subjected to equivalent considerations. Therefore, the lack of restrictions for existing building fabric jeopardize the relevance of strict novel constructions, rendering most efforts mostly futile on the medium-term.

GREEN OVER ARCHITECTURE

The genuine danger for architecture lies in ecology and technology taking over the essential condition of architecture, namely to locally adapt the environment in order to primarily suit human activities. Adequate materials, circular economy, rational use of energy, passive performances, use of BIM or digital fabrication processes, etc. only constitute tools in order to help architects respond to contemporary crisis while providing relevant architecture to the people. Moreover, there is no such thing as green architecture, nor sustainable development, rendering the green threat based on insubstantial purposes potentially leading to irrelevant adaptabilities.

Rather than mitigating our impact, which naturally includes adaptation, governments and scholars turned towards technological innovations, consequently initiating the green threat to architecture. The vulnerability of architects facing this increasing number of engineered technologies redefines architects as catalog experts rather than ad hoc designers. Buildings are becoming so fitted with technology and complexity that they are starting to overcome, for the first

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269 Decq et al., "Quel Futur Pour l'architecture ?"

time in history, the degree of technology of vehicles and machines. However, the climatic crisis remains of primary importance and requires architects to willingly tackle pressing irrationalities of design, construction, and deconstruction respectively.

The derailing status quo of the spaceship Earth is consequently threatening the rational development of life forms aboard. The lack of adaptability manifested through standardized processes, prefabrication, digital reveries and green sensitivity depict major conditions caused by unrestrained humans and widening the divergence from a nominal trajectory. In order to attempt an adequate repositioning, deployed strategies in respect of social and environmental conditions would largely benefit reterritorialized solutions through down to earth principles.

Modern publicizing façade - La Paz, Bolivia – 2019

Maxence Grangeot

VII. Down to Earth

In Situ / Off-Site

As architecture is intrinsically associated with materials, their sourcing inherently plays a significant importance of realizations, in light of social and environmental concerns. Instead of imposing universal logic, by definition not made for a particular context, the adaptation of nomads to specific contexts provides novel dimensions to vernacular processes, notably by taking advantage of the locality, such as natural or reusable elements present on site.

VALUE OF THE LOCALITY

Acknowledging the eternal presence of a site in comparison to human alteration,[270] sedentary civilizations could take advantages of sites specificities,[271] echoing the understanding of nomadic communities for the value of the locality. In a globalized world, the relevance of an architecture anchored in its locality can be outlined through the notion of Genius loci,[272] notably by taking advantage of the qualities and elements available on site. The environment, analyzed from a holistic point of view at various scales, might notably reveal potentialities for relevant programs and conceivable manifestations, while considerately preserving and carefully handling local resources.

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[270] Brand, *How Buildings Learn*.

[271] For urban contexts, see Kaijima, Kuroda, and Tsukamoto, *Made in Tokyo*.

[272] Norberg-Schulz, *Genius Loci*.

The learnings from Incas, Romans, Greeks civilization, the medieval constructions, the swiss granaries, etc. represent invaluable examples of in situ adaptability for construction by respectfully arranging existing capitals into inhabitable environments. Moreover, the accumulation of this manufactured capital forming the contemporary built environment in turns became a resource for subsequent constructions, consisting of approximately 200kg/capita in the European Union.[273] The existing material stock of the built environment is still a largely underestimated value, often referred as construction waste after the end of its first service life,[274] although such denomination can legally be avoided if material remains on site after deconstruction.[275] Thus, the strategy of reuse through selective deconstruction[276] relevantly complement the presence of natural resources, rendering the process of construction as an selection and assembly rather than an alteration, mirroring the sublimation of elements as found from ready-mades.[277] This hybrid attitude towards the context is fervently augmented since most architectural interventions of western societies in the 21st century occur on existing building fabric, rather than inconsiderate ex nihilo developments.

IN SITU PRODUCTION – SITE AS ISLANDS

The value of the locality is regularly transcended by the means of in situ production offered by the conditions of the site, consequently surpassing the genuine valuation of delimited territories

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[273] Weisz et al., "Reducing Urban Greenhouse Gas Footprints."
[274] Friedman, *Utopies réalisables*. "Rubbish is beautiful ou de l'utilisation des déchets"
[275] Statement proclaimed by Barbara Lambec during a lecture for a privately held symposium in Ellwangen in 2020, based on an exhibition by Bellastock. The veracity of this information could not be verified.
[276] Bellastock, "REPAR 2 : Le Réemploi Passerelle Entre Architecture et Industrie."
[277] "MoMA | Marcel Duchamp and the Readymade."

through the underlaying potentialities they offer. Hence, the potential of fertile ground for agricultural exploitation assuredly increases the potential of local food production and consumption, but simultaneously contributes to the localized increase of wealth independently of sensitive externalities. Therefore, the in-situ production and consumption of food can metaphorically inform architecture on relative autonomy and contextual sensitivity, pleasantly resembling the interdependence of global nomads. Additionally, mobile phones and laptops rely on internal computing capabilities rather than remote externalities, therefore reducing dependency on outer conditions prone to vulnerabilities by means of intensive optimization of local individuality. This emphasis on situated production is equally reflected in the European guidelines for the in-situ production of renewable energy, thus echoing the contemporary situation of secluded island reliant on fossil fuel importations and seeking to gain autonomy through locally produced renewable energy. The energetic analogy notably enables to highlight the potential for more rational domestic conducts by bringing closer the historically distant locations of energy production and consumption.

Besides, unlike such sensitive pieces of technology, architecture does not rely on rare materials, therefore enlarging the opportunities for local production of building materials. The on-site transformation of resources for construction such as structural hay, compressed soil, fired earth, timber, stone, gravel, clay, etc. similarly induces wiser depletion through measured and visible alterations, contributing to the impact reduction of construction over the natural environment.

OFF-SITE PRODUCTION - IMPORTATIONS

Architecture by nature represent the hybridization of in situ material sourcing and diverse importations generating the essence

of concentrated adaptability. The ability of humans to compose environmental alterations into rational materializations is notably reflect into material procurement such as lumber transported using the natural forces of river streams to be cut by off-site sawmills in opposition to in-situ processing for local utilization. This variance in resource handling perpetuated with mobile sawmill as contemporary forestry operations account for natural regeneration, despite the perseverance of stationary sawmills. Equally, the notion of importations of raw material is particularly explicit for the consideration of in-situ stone quarry for local extraction and erection in opposition the fastidious transportation of stones, exemplarily illustrated in the hybrid composition of Egyptians pyramids. Alternatively, shipyards constitute contexts of inversed spatiality equally defined by the accumulation human engineering, therefore generating the peculiar yet recurring production of off-site apparatuses.

Architecture however intervenes at the intersection of local availability, in-situ production, remote importation and extensive dissemination, thus acting as figuratively mobile, like a digital nomad, able to adapt and take advantage of distinctive environments, through relevant hybridizations. Therefore, such "nomad" architecture welcomes infinite reorganizations, defining a malleable substance of perpetual rearrangement given specific materials yet encountered in multiple localities. Acknowledging the potential for reuse in a distinct locality, vigilant permutations of existing elements provide incommensurable opportunities to materialize such versatile substance, establishing a relevant platform for chronic reuse projects at large scale.[278] However, the flows of mutual importations as part of

[278] As part of the 2019 annual symposium of the International Association of Shell and Spatial Structures, the SXL laboratory from EPFL proposed the 1to3 pavilion, fostering 3 distinctives designs with the same set of parts. Carried at large scale, such innovation on structural versatility could alleviate environmental depletion.

a larger network require to be restricted to minimum amount of material, framing an architecture of survival as envisioned by Frei Otto.

Conversely, the intensive reliance on outsource products for architectural assembly form a global threat to localized knowledge and specific adaptabilities, notably due to the dematerialization of architectural design and the globalization of infrastructures. The ultimate failure to reinstate judicious externalization for relevant hybridization might lead architects into purchasing slabs, windows and other building elements from online retailers, with multi-site production chains but labeled by a primary provenance, eventually leading to an extreme deterritorialization applied to buildings "made in china". Moreover, the dilemma between prefabrication for in-situ assembly, and on-site construction with local materials rest upon economic considerations of in-situ versus off-site labor, equally affecting the relevance and cost of reused components, despite a market valued per net floor area. However, the off-site construction advertised for safety, rapidity and quality control can be balanced with the limited capabilities of automation in construction and the poor adaptability of on-site robotics, thus genuinely casting doubts on the relevance of importations for local adaptability and hybridity.

(IR)RELEVANCE OF TRANSPORTATION

Transportation of resources inherently questions the potentialities of the locality facing the relevance of importations, in respect of freedom of movement within significant infrastructural capabilities. Without a geo-infrastructure, nomads could not be qualified with the global adjective despite the hybrid purpose of intended flows. While it remains in the nature of labile creatures and their externalities to move in order to live, materials are not provided with such nomadic capacity by default and require prior human alterations or engineering.

However, the ambition of globalization has been to rationalize and produce in greater quantities in a single locality, precisely relying on permanent circulation of goods. Such centralization of means of production notably contributed to the intensive development of infrastructural networks at a global scale, but also caused the alienation of local craftmanship along an increasing apathy towards fundamental qualities of the locality. However, the thriving of aspirations for social deceleration largely pressure to revoke such strategy as rapidly as it appeared through a decentralization and reterritorialization of productive capacities. Conversely, this desirable return, felt within multiple sectors and nations, cannot gauge the extent of opposite mechanisms, notably the local impact from the multiplication of infrastructures and factories, and unable to predict the evolution of standardization and industrialization. It remains difficult to objectively and holistically weight the relevance of decentralized production for local exchange of goods, facing the rationalized centralization associated with international transportation. However, the nomadic nature of living beings in opposition to stationary resources highlights the rationality of minimum transportation in terms of energy and local relevance. Therefore, mobility is an authentic luxury and can be observed in the primordial importance of public transportation, or the development of efficient commutes and logistics, rendering mobility more affordable through mutualization.

However, the criteria to qualify the necessity of transportation can range from scarcity to weight, or even remoteness and price, but usually consisting a combination of them.
Since the energy required for transportation is directly relative to the mass,[279] weight notably appear as an essential consideration to determine the threshold for relevant transportation over local sourcing.

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279 See the part « Precarious journey »

Humans and tools being fairly light in comparison to construction materials, calculations rapidly reveal the absurdity of transporting any heavy building elements, but to be balanced with the other characteristics, notably scarcity and remoteness.

Therefore, the environmental impact of transportation is largely related to the weight of cargo but also of vehicles, inciting countries to instate a weight penalty for the automobile industry.[280] In the balance between intensive transportation and multiple local reuse for a identical weight, fundamental calculations immediately underline transportation as the biggest part of construction's carbon footprint.[281]

While construction sites represent a series of exceptions, the ubiquitous provision of standardized elements or material cannot guarantee relevant local hybridity and specific adaptability. The precarious condition of material transportation is therefore not optimum for interventions on existing fabric suitable for local reuse, notably because of logistical and environmental losses, but can occasionally augment the relevance of (re)construction especially through the hybridization of reused and new materials.

This perceptibly comes in revulsion to the paradigmatic transportation of waste across large territories, in turn worsening environmental crisis and the sensitive reliance on external structures. Inversely, the intangible extent of trash logistics and remoteness[282]

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280 Following the recommendation of several NGO, France established a tax of 10€/kg when buying cars over 1800 kg, starting in 2022. Source : Leblanc, “Malus sur le poids des voitures."

281 Statement based on an academic project as part of the "Architecture and Sustainability: Performance Studies" course at EPFL during the 2019 autumn semester.

282 Dagognet, *Des Détritus, Des Déchets, de l'abject*.

became the source of stylized scenarios integrating landfills in peripheries of cities, construction debris, e-waste and energy as site for architectural intervention, but also as spatial project.[283]

However, the transportation of decommissioned materials can advance the development of emerging countries not only in terms of physical resource, but equally in the learnings derived from building with reused components, eventually providing valuable insights on construction for later reuse. The lifework Toni Rüttimann particularly deserve applauses for the participative erection of pedestrian bridges bringing mobility to more than 2 million people in South America and Southeastern Asia, solely using reused cables from swiss cable cars compagnies and upcycled decommissioned pipeline from oil corporations. The necessary transportation of such specific yet valuable material from the other side of the world emphasizes the prevalence of socially beneficial engagements over absolute short-term environmental concerns.

This example broadens the contemporary perception of vernacular architecture, notably through suitable materials present on site, but equally enriched from the hybridity with relevant imported resources, including analog-digital externalities. The adequate hybridization of material procurement with fundamental knowledge and technologies might strikingly forge inhabitable environments, like nomads adapting to every context, each time through distinctive modalities.

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283 Ghosn, "Terrarium of the Anthropocene."

Construction sites as semi-autonomous entities - Naye, Switzerland - 2020

Maxence Grangeot

Striving for rudimentary importations - Patagonia, Chile - 2019

Maxence Grangeot

Externalizations

Beyond the nomadic nature of humans, transportation is equally applicable for manufactured tools as externalization of the human body capabilities, generating exceptions within the displacement restraints of matter.

WHAT IS A TOOL

Originally, the notion of tools notably connotes externalizations of inner body functions, therefore not creating new alteration principles, but rather extending the range of existing ones. Under this definition, a computer represents an extension of the brain capacities, and is subjected to later enhancements.

While internalized functions are exclusive by definition, tools in the other hand can be shared, thus serving as externalities to multiple bodies, in turns qualified between crafts as tools empirically created by singular individual in the wild, and industrial tools requiring association of technologies and creators to be fabricated.[284] From the stick, considered as primitive tool, humans developed thousands of tools, instruments, machines and vehicles to progressively increase production and to reach further territories, yet fewer machines were conceived to produce more qualitatively and to enhance the importance of the locality. However, tools are defined by an accumulation of intermediary material shaped to perform specific externalities, therefore designating materials as tools to some extent. In architecture, this boundary is even more dull as construction elements equally enable to alter environment in order to create suitable conditions, metaphorically resembling the purpose of tools.

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284 Fuller, *Operating Manual for Spaceship Earth*.

Indisputably for assembly and construction processes, but also for the manufacturing of construction elements, architecture relies on tools, and intrinsically mirrors them, as exemplified in the concrete joints due to molds, the vertical expansion through the crane or the elevator, the procurement and usage steel during the development of the train, etc. eventually having more influence on architecture than architectural theory.

INTANGIBLE TOOLS

The unquestionable influence of tools over architecture is getting increasingly elusive as contemporary tools tend shift into intangible structures, such as documentation through satellite photography, offering unprecedented perspectives to contexts and projects. Most development of tools in the 21st century rest upon principles to make visible and accessible elements of interest for architecture, originating in the depiction of forces through graphic statics. Such magical tools notably include affordable point cloud acquisition sensors and thermal cameras, thus revealing 3D data of complex realities[285] and invisible energies through infrared sensor capturing heat signatures literally out of the visible spectrum. As human activities are increasingly assisted by machines, and particularly by digital technologies, the hybridization of human adaptability with intangible tools, such as laser projection or on-screen video overlay of expectation over reality, for localization of analog executions can adequately integrate the invaluable humans' internal functions for hybrid construction processes. Ultimately, as Roma people exploiting local

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285 Following the thesis : Radat, "L'Habitant de l'Interface.", Philippine Radat developed unexpected representation and imaginaries of space and time through unusual point clouds generated from footage at various speeds and nourishing a process of photogrammetry.

potentialities for circular economy,[286] knowledge appear as the most powerful yet intangible tool for localized construction, and can be freely shared. Such extreme dematerialization of tooling emphasizes the relevance of reducing the weight of transportation, therefore largely prioritizing the free displacement of externalities over materials and building components.[287]

VEHICLES AS TOOLS

The recent obsolescence of the charrette particularly questioned its condition as the most efficient tool, or rather as a vehicle. By extension of the trivial denomination of shaped matter allowing the alteration of another, vehicles are therefore a particular category of tools, providing tangible alteration through territorial displacement of materials, but equally of other tools. Charette, trucks, boats, wagons historically preceded the development of aerial vehicles having far larger reach and revolutionary application such as meteorological assessment,[288] internet connectivity,[289] and even vital deliveries.[290]

Thus, such qualification of vehicles broadens nomadic and performance attributes detailed in the chapter "on nomadism", and eventually include folkloric example of moved architecture, like the occasional displacement of buildings momentarily qualifiable as

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286 Le Marchand, "Économie de bazar et économie morale."

287 For example, for the master thesis of Haag and Ineichen, named "The Accurate Inaccurate.", the author used locally available snow and iterative scanning to shape an mold in situ for a concrete vault.

288 Such as weather sensors

289 Google, "Project Loon."

290 In Rwanda and other African countries, Johnathan Ledgard, through "The Droneport Project.", in association with Sir Norman Foster and academics, aim at delivering supplies in remote location by drone, recently leading to the emergence of the Zipline startup, delivering blood to hospitals as part of the blue line project.

vehicles thus tools,[291] or even food trucks and kermess wagons. The ultimate application of such theorem project the spaceship Earth as an absolute tool to be carefully and collectively handled to generate or maintain suitable conditions for the respectful inhabitation of all astronauts and non-astronauts within self-sustaining environments.

PREMISES OF A NOMADIC FACTORY FOR IN-SITU UPCYCLING HYBRIDS

The essence of every architectural intervention therefore stands out, pointing towards a rational nomination between mobility of humans, transportations of materials, and exchange of tools, seeking to reach an optimum repartition in light of environmental and social considerations, particularly tied to their relative weight. In turns, the speculative imagination of a vehicle containing all tools generates numerous interrogations about an original tool-ception through the premises of a nomadic factory for in-situ hybrid upcycling.

291 The displacement of churches, such as Schitul Maicilor, and other fascinating building displacement, alter local environments in usual ways, fundamentally delocalizing an architecture from its original and rational condition.

Tools parade - EPFL, Switzerland - 2020

Maxence Grangeot

Nomadic factory - Chuquicamata, Chile - 2019

Maxence Grangeot

Inherent performances

By carefully listening to the local properties of (de)construction sites, a novel and rational architecture appeal can be generated, following inherent qualities of places, traditions, materials and behaviors.

SITE INHERENCE

More than mere elements predestined for a specific construction site, buildings material equally encompass the atmosphere of the sourcing site, as well as every intermediary process, merging the rationalities of distinct contexts into a precise and tangible manifestations. As sourcing and building are intrinsically linked, bringing them together into a specific locality yield relevant characteristics qualifiable as site inherence. The available resources on site therefore explicit the range of possibilities for architectural interventions in respect of local inherences, notably by embracing vernacular craftmanship, expertise and cleverness, and by informing the design based on local availability.[292] This attitude is largely represented in the strategy of In-Situ Resource Utilization (I.S.R.U) developed by NASA to establish infrastructures on the moon,[293] and was extended to architectural applications through re-discoveries of such rational conduct. [294] Material gestures in accordance to a specific site are therefore undetachable from their anchorage, metaphorically

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292 Brütting, Senatore, and Fivet, "Form Follows Availability – Designing Structures through Reuse."

293 NASA, "In-Situ Resource Utilization."

294 The MIT summer course of the artist Tom Sachs (Sachs and De Monchaux, "How to Build a Geodesic Dome.") notably gained a large social interest, among architecture students and the public alike, through the making of geodesic domes out of local materials.

resembling yet physically contrasting with nomads, and particularly resonated through the image of architecture by subtraction[295] conferred by notable examples such as temples in Petra, Jordan and troglodytes' habitats. The inherent qualities of a site undoubtably make up significant properties of any vernacular endeavor, as notoriously reflected in Dogon architecture.[296] However, the adaptability of architecture not only to local materials, but simultaneously to local traditions, craftsmanship, proficiencies and aspirations interrogates the definition of a localized action, and more broadly the threshold designating an intervention as architectural. Jacques Lucan notably highlights the essence of every architectural project as an alteration of reality,[297] therefore defining the built environment as the sum of these ad hoc alterations.[298]

Embodied in the locality, the structuring elements to similarly yet distinctively compose alterations like the nest of birds or the more complex vault formed with molds out of in-situ snow[299] or earth.[300] While vernacular architecture was based on materials found on the site, infrastructures before the industrial revolution were equally made from in situ materials, notably demonstrated by the Roman roads, aqueducts and bridges. Inversely, the heretic development of several modern infrastructures, iconically represented by the United Arab Emirates and Qatar, defy any reasoning of local suitability

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295 Rudofsky, *Architecture Without Architects*.

296 Oliver, *Built to Meet Needs*.

297 Lucan, *Composition, non-composition*.

298 Angélil, "Tales of Territory: Anthropocene, Urbicene, Capitalocene?"

299 The use of snow or ice in remote alpine context offer naturally available and easily alteration material for molds, particularly explored through the master thesis : Haag and Ineichen, "The Accurate Inaccurate."

300 See the "Callipod." project from master students of the Architectural Association in Hooke Park

through speculative urbanism and cities in the middle of deserts built out of imported concrete and steel.

WASTE AS RESOURCE

The inherence performance of specific localities equally rest upon existing structures, therefore defining waste as a spatial landmark, but more prominently as a resource. Observing the context at various scales therefore virtually annihilates the notion of waste by perceiving discarded elements as a primary resource depending of the circular system its can be integrated into. However, the lack of intermediary scale for reuse and recycling, between recycling facilities or salvage yards and domestic DIY upcycling projects, leave considerable inadequacies and insensibilities of "waste" as inherent resources from a context. The scale of the neighborhood, between production and user, represent particularly appropriate openings to tackle such issues within collectivities and incentivize populations to progressively regain capacities of adaptability.

For architectural applications, considering waste as an inherent resource fundamentally is prominently shifting contemporary design practices to delicate devotions for in situ availability, in turns largely orienting impactful design decisions. Consequently, two strategies stand out and oppose each other for conception processes: design and then seek for relevant material stock, or design directly from a known and precise stock. These radically distinctives strategies allegedly denote respective benefits, including wider availability and competitivity for the first traditional approach, and sensitivity to available stock for the considerate second. While there are little considerations of the waste generated by formworks, leftovers, and material irreversibility for concrete construction, limited stocks

markedly leave little tolerance for errors, for interchangeability and for optimization without external interactions.[301]

However, the adaptability induced by local availability is still largely underexploited as leading nations in sustainable construction such as Switzerland and France, offer construction and demolition permits, but no deconstruction nor disassembly permits. Reuse is therefore a design strategy promoting adaptability to specific environments, robustness throughout lifecycles and high tolerance flexibility, but more importantly reuse form an inherent performance advocating to embrace imperfections rather than rejecting them, thus generating novel ethos.[302]

TECTONIC INHERENCE

The inherent qualities of localities have dejectedly been obliterated by standardization, prefabrication and ubiquitous movements through the geo-infrastructure, fostering productions so artificial they lost sight of absolute rationalities. In architecture and construction, this is notably felt through an decreasing understanding of the inherent properties of materials and their sourcing, leading to the alienation of architects. As more complex and hardly reversible materials like composites and concrete enter the spectrum of construction, the acquaintance of nature strengths is gradually lost, widening the gap between tectonic inherences and human behaviors. The Digital particularly reflects such rupture in many aspects, but is particularly exemplified by the primitive lack of understanding of modern screens operation, as black pixels denote a neutral state equivalent to white paper, yet only recently appeared in the development of dark themes although for different reasons than consumption and

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301 Marshall, "UnMaking Architecture."

302 Buser, "Reuse and New Aesthetics."

tectonic rationalities. This massive disappearance of inherent lucidities stresses how tectonics must be fully re-questioned in light of historical precedents and present conditions of production, distribution, usage, and reuse.

The inherent qualities of stones as propitious for compression loads are therefore able to sustainably compete with concrete given proper stressing, and for other use cases if appropriately hybridized.[303] Their arrangements can be carefully planned with the help of digital technologies to affordably and sustainably provide large infrastructural work like retaining walls,[304] or to generate upcycled architecture,[305] and even to reinstate mineral tiles as roof stales.[306] Natural stone as a construction element notably carry traces of geological formation, traces due to excavation in mines or quarries, traces due to displacement, assembly and finishing, acting as didactic markings informing tectonic elaborations.[307] Stone is equally of tremendous value with relevant hybridization, generating novel imaginaries through the innovative development of tools,[308] and subsequently engendering the creation of novel architectural spaces appealing to such inherences through closer interactions.[309]

Nonetheless, the compressive strength of stone can be achieved by understanding the intrinsic characteristics of materials, such as earth and clay, when hybridized with alteration processes like

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303 Perraudin, *Construire en pierre de taille aujourd'hui*.

304 Johns et al., "Autonomous Dry Stone."

305 Marshall, "UnMaking Architecture."

306 Ishigami, "Serpentine Pavilion."

307 Holtrop et al., *Studio Anne Holtrop*.

308 Gramazio Kohler Research, "Design and Robotic Fabrication of Jammed Architectural Structures."

309 Ishigami, Freeing Architecture.

molding and firing to fabricate blocks with normalized dimensions. Such standardized elements equally define construction modules for other materials available throughout different environments, such as bricks out of salt, used for walls and pillars of domestic erections in the Salar de Uyuni, or even more largely celebrated igloos out of local snow and ice.

The information contained within materials also apply to wood, rather than timber, by acknowledging the continuity of fibers and other mechanical behaviors rendering irrational the traditional process of regularization of lumber. Extracting constant rectangular cross section timber elements from tapered, round and often irregular logs systematically generates a loss of material, but more importantly a discontinuity of fibers through straight cuts, adding to the structural losses of already diminished potential static height. The manufacturing processes of timber is therefore one of the most irrational use of input material for the produced output, thus conditioning forest managements and ecosystems at an intangible scale. Although nearly all derivative from raw wood are valorized, the sensitive necessities of normalized elements for standardized construction impose strict rules for the growth of trees for their straightness, strength, age, diameter, twist, consequently impacting the management of surrounding trees, animals and ecosystems. The unfortunate and numerous trees failing to simultaneously satisfy all requirements are either left for natural ecosystem regeneration, or in the worst case felled but undervalued for potential construction application. Moreover, the felling of trees precisely obliterates the naturally formed moment-resistant interface between planar and linear elements, a strong connection particularly challenging to artificially replicate. Instead of felling trees thus living dead roots in living ground, The uprooting of trees prevent such waste while simultaneously preserving important mechanical properties with high potentialities for architectural applications. Additionally, the carbon sequestration benefits for

climate change mitigation is occasionally canceled by the energy intensive processes of timber processing, and notably the *torrefaction* of wood, the sum of all irrationalities thus demonstrating the lack of adaptability to tectonics inherences. The structural properties and related connections of lumber equally enable local reuse with lifecycles potentially spanning several centuries.[310]

However, these numerous tectonic understandings were gradually lost through the development of standardized process since the beginning of the industrial revolution, and worsened with the advances in composites and materials relying on intensive usage of irreversible adhesives. With contemporary technology and climatic awareness, several pilot projects attempt to reconcile with the forgotten inherences, for example by reading wood fibers to design building elements[311] and connections,[312] by integrating the irregular geometry of crooked logs[313] or forks[314] within design and structural principles,[315]and directly informing processes of digital fabrication.[316] The preservation of the cylindrical geometry made possible through

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310 For example, the timber elements of the bridge in Reinau were reused in a barn 2km further, also preserving traces of details, for a total lifespan of component span over more than 2 centuries, and thoroughly analyzed in Brütting, "Optimum Design of Low Environmental Impact Structures through Component Reuse." p.24

311 Zivkovic and Lok, "Making Form Work."

312 See the "Library Skeleton." project from master students of the Architectural Association in Hooke Park.

313 Shah et al., "Wood Chip Barn."

314 Mollica, "Tree Fork Truss."

315 Mollica, "Cultivating Complexity."

316 Mollica and Self, *Advances in Architectural Geometry 2015 - Tree Fork Truss*.

novel digital surveying[317] and design tools[318] enabled to utilize small diameter and irregular wood deemed undervalued as a locally available resource for complex projects, thus expanding the range of sourcing and potentialities with naturally available bio sourced materials.

However, such approaches equally come with limitations sadly rarely discussed and therefore preventing larger developments, notably regarding the hypersensitivity of design and fabrication to a specific stock requiring larger databases or importations to be sustainably optimized.[319] A large amount of limitations is also due to the fabrication process employing digital manufacturing machinery from industrialized application to be used for specific and bespoke alterations, leading to a precarious reduction of tolerances towards an unreasonable zero. The technical specifications addressed in the "impeaching digital fabrication" part forcibly translate into limited reachability of robotic path, and difficulties in 3D referencing, along with machine limitations and complex phasing. In turns, the potentialities of digital acquisition[320] and design hybridized with the high adaptability of analogic fabrication foster the emergence of rich collaborations

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317 Referring to LIDAR Scanners and other 3D data acquisition methods such as photogrammetry or Kinect Point Cloud Scanning.

318 Referring to algorithmic and parametric tools enabling the efficient management of large and complex data set and heavy computing optimizations of target geometries based on input stock and fabrication processes, for example observable in the "Biomass Boiler House." project by master students of the Architectural Association in Hooke Park

319 Allner, Kroehnert, and Rossi, "Mediating Irregularity."

320 Simple strategies such as photographing distant or large objects using the inclinometer of smartphones, measuring the distance to the objects and applying basic geometric calculations can provide rough estimate of true scale without using complex and expensive 3D scanning devices. Moreover, a strategy to increase the resolution of poor-quality images, from thermal cameras for example, rest upon the simple process of taking multiple initial photographs and using a straightforward image processing method called Super-Resolution.

between humans and non-humans for a more suitable and sustainable built environment.[321] More than a perpetuating an opposition between analog and digital, the researches in material inherencies and behaviors are increasingly shaping the future of construction,[322] but equally threatening the role of architecture through mono-oriented focuses and tectonic characteristics and sourcing.

CRITIC OF BIOMIMICRY

Inspired by forms and material inherences present in nature, the principles of biomimicry[323] rest upon a formalistic mimetic acting as pretexts to generate a non-standard architecture, rather than efficient and relevant alterations inspired from natural inherences. The resulting architectures are piteously complicated without retaining the core expediency of natural complexities forming larger eco-systems. Rather than frivolously building with living organism[324] or naively mimicking nature,[325] more valuable lessons can emerge from its understanding, [326] potentially leading to efficient strategies when using selected inherent properties accordingly, and was advocated by numerous prominent architects and engineers such as Buckminster Fuller, Eduardo Torroja, Antonio Gaudí, Frei Otto and more, all

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321 The agile craftmanship with irregular round wood logs can be informed by printed wrapped refencing or laser projections, or even on-screen video overlay, to display cutting locations for manual operations. Other strategies involve human intervention in digital fabrication process, for example described in : Larsson, Yoshida, and Igarashi, "Human-in-the-Loop Fabrication of 3D Surfaces with Natural Tree Branches."

322 Kraus, "Matter(s)."

323 Lee, *Biomimicry*.

324 Steiner et al., *Neri Oxman*.

325 Finsterwalder, Feireiss, and Otto, *Form follows nature*.

326 Pawlyn, *Biomimicry in Architecture*.

stressing the importance of studying nature to admit human existence and behaviors as part of Earth.

Throughout the history and theory of architecture, several anatomical metaphors have been drawn between the human body and construction expressivity, notably the skeleton with the structure, the skin with the enclosure, the organs with equipment or rooms. Such metaphor can be extended in light of nomadic behaviors and architectures, evidently through parallels of mobility, but equally through a high adaptability conferred through an intense pluri-functionality of each elements echoing principles of versatility, forming a mutual symbiosis and a global coherence.

FORM AND FORCES

The inherent performances found in nature unfailingly surpass bare tectonic learnings by displaying the intimate and flawless equilibrium between matter and inner stress, between form and forces.[327] The famous statement "don't fight against forces, use them" from Buckminster Fuller precisely apply to architectural considerations, enabling to persistently rethink human alterations and manufactured structure in relation to the efficiency of material allocation coordinated to stress distribution. By carefully examining the flow of external and intrinsic forces within structures or individual elements, numerous optimizations ranging from structure topology to material topology constitute essential principles of form through geometry,[328] and can often be determined by analogic or digital form-finding methodologies. Such understanding of inherent structural performance enabled architects and engineers such as Eladio Dieste, Robert Maillart, Pier Luigi Nervi, Eero Saarinen, and more to conceive

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327 Allen, Zalewski, and Iano, *Form and Forces*.

328 Block, "Strength through Geometry Learning for the Master Builders."

ingenious structures minimizing material consumption and costs. The predominant development and usage of graphic statics enabled to manipulate geometries and optimize material based on their inherent behavior notably by establishing pairs of diagrams representing form and forces in a correlated manner, thus revealing the intangible nature of forces through geometrical rules. The hybridity of thinking between form and force, reciprocally empowering, composes the compelling factor of intuitive and rapid adaptability.

In turns, the inherent structural properties of materials and structures when simultaneously considered delimit the potential of rationalities, namely the preliminary architectural triangulation rather than subsequent bracing of unstable geometries, or inversely the self-stabilizing relevance and material economy of tension-based or bending active elements, largely employed in nomadic applications. The precise understanding of forces and geometry provides opportunities to imagine material-efficient structure, sometime of few millimeters in pure compression for large spans.[329]

Such rationalities are encountered daily yet remain invisible due to their prominent success,[330] notably through corrugated

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329 The Ice Shell Project was formed by a precisely shaped fabric put in tension and sprayed with water, generating a complex vault of thin ice in pure compression once the supports were to be removed, achieving unthinkable thinness for large spans. This project was developed by the same authors as "the accurate inaccurate" thesis at ETHZ under the supervision of Prof. Philippe Block. Such structural efficiencies come with the geometrical expertise derived from simple analogic principle of the hanging chain model, as well as genuine construction processes, echoing the rationality of the Catalan vaulting system developed by Rafael Guastavino allowing the construction of vaults without formwork. Such advances have been reused by Prof. Philippe Block along with John Ochsendorf and more, as part of the MIT masonry laboratory and notably applied for the Mapungubwe Interpretation Center in South Africa. Prof. Philippe Block is continuing researches on material-efficient vault systems through his chair at ETHZ.

330 Lang, Hellstern, and Hauger, *Visionaries and Unsung Heroes*. p.9

materials augmenting structural efficiency independently from variance in thickness, thus enabling to developed material efficient component like corrugated galvanized iron or cardboard, recently re-discovered and developed for 3D printing. However, the inherent performances of structural behaviors within matter are often disguised behind enclosures or paint, incautiously or willingly erasing the importance of structural stability and efficient, thus reflecting the contemporary paradigm of social behaviors and corporate hypocrisies dissimulating reality in a ubiquitous world of images. Conversely, the exposure and expressivity of structural inherences therefore constitute a political gesture, but most importantly to hold a didactic role in order to reveal the structural logic in rejection of the ornamentation and facadism obstructing the full picture.

INHERENT CLIMATE

Beyond the abstraction of forces, inherent performances also intangibly lie in environmental and climatic properties through simple principles of thermodynamic and other laws of physics. Architecture notably intervene at the intersection of all laws, requiring holistic understandings and hybridity of multiple principles, namely convection, conduction, and radiation for thermal comfort, transmission and reflectance for visual comfort, natural lighting and energy gains.
The intangible nature of these complex phenomena only adds up to the tremendous amount of decisions and optimization to be made in light of local conditions. However, the recent development of inexpensive thermal camera imagery revealed the inherent thermal properties of spaces, materials and process through differences and flows of energy, henceforth visible on smartphone display to enter the realm of inherences, consequently fostering rational architectures.

Such reclaiming of intrinsic characteristic of domestic suitability additionally exposes the inherent properties of permanently

tempered environments, or subjected to reduced variability, notably few meters inside the ground, but also within large bodies of water such as rivers, lakes, seas and oceans. The intangibility of inherences regarding water ecosystems equally expend to the invisible drainage divide inducing distinct conditions from one side to the other despite similar geographical localities.

In summary, the relevance of inherent properties, whether contextual, material, tectonic, natural, environmental or thermal, define valuable potentials for hybridizations, but most primarily reflect the capacity of humans to lucidly adapt their local conditions in order to rationally sustain primitive needs, thus metaphorically valid to both nomadism and construction. Such inherent understandings constitute crucial steps in order to attempt to reposition human behaviors onto the natural and nominal trajectory of spaceship Earth.

3D Vierendeel truss from forks' inherent tectonics - EPFL, Switzerland - 2020

Maxence Grangeot

Structural salt – Salar de Uyuni, Bolivia – 2019

Maxence Grangeot

Hybridizing craftmanship with inherent geometries - Cusco, Chile – 2019

Maxence Grangeot

Optimum hybrids

While problem-solving is defined by specific conditions and potential solutions, aiming towards extreme rationality provides an inherent elegance to the process itself, but more significantly to the best solution identified as optimum. The wide knowledge conferred to nomads through their experiences in diverse conditions particularly unveils rapid understanding and adaptability, efficiently reaching optimum situations for a given environment through relevant hybridizations, notably of technology, mobility, sourcing and physics laws. Construction as a process metaphorically reflect such hybridity of technics to fittingly sustain human needs, therefore requiring intensive use of energy and matter. The built environment consequent forms a gigantic bank of such valuable resources able to straightforwardly supply subsequent constructions in order to reduce the need of supplementary allocations, thus aiming for a circular economy through hybridity of reused and newly sourced. Therefore, beyond the growing hybridity of sedentary and nomadic lifestyles, hybrids in construction appear as most environmentally suitable,[331] and more importantly as optimal conditions to perpetually upgrade the existing building stock while limiting the amount of novel procurements. This shifting hybridity markedly exceeds the environmental benefits of novel improved constructions, but most predominantly surpasses the relevance of pure reuse, consequently referred as optimum due to the appropriate rationality and the attractive vision it carries. Moreover, since pure reuse principles induce form to follow availability,[332] the hybridity with novel and ad hoc inputs enables architecture to

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331 Brütting, "Optimum Design of Low Environmental Impact Structures through Component Reuse."

332 Brütting, Senatore, and Fivet, "Form Follows Availability – Designing Structures Through Reuse."

overcome the hypersensitivity to the stock. Indeed, elements of reuse, even derived from standardized productions, result into singular geometries with distinctives material properties, therefore composing a stock lacking the availability of identical elements. The conception and the construction therefore incorporate bespoke elements or must integrate sufficient tolerances to resorb differences.[333] In case of failure, the specificity of elements imposes their bespoke re-manufacturing preferably with local resources, thus marginally decreasing the environmental and conceptual relevance of circular economy.
Hence, improvisation and adaptation as the core of human and nomadic values seamlessly apply for architecture through site analysis, intervention planification, construction phasing, and technical rationality of developed solutions.[334]

As consistency is not primordial in reuse, optimums are not necessarily the best solutions, but the best solutions are inherently optimum in light of the outlined diversity of criteria. The optimization of construction, for example through the amount of material for the scaffolding of the Salginatobel bridge or inversely of the Rolex Learning Center, are traditionally external to the considerations of architectural rationalities, yet they play a fundamental role in the overall qualification of optimum hybrids. Complex situations are equally subjected to potential optimizations through the acknowledgement of assumptions to simplify the problems through discretization and heuristic algorithms.

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333 In the "Woodland Cabin." project by master students of the Architectural Association in Hooke Park, such tolerance for construction with round wood forks is adequately incorporated in standardized beams as an interface with the roof.

334 Yona Friedman advocated for improvisation as an essential part of architecture and notably his vision of mobile architecture and urbanism, detailed in Friedman and Orazi, *The Dilution of Architecture*. p.48

In order to perpetuate the supply of existing resource to be hybridized with novel materials, waste becomes an essential consequence of constructions to be maintained and augmented from their early production into elements to be ultimately reused, therefore overtaking the notion of waste. In France from 2021, the *réglementation environnementale* (environmental regulation) include compulsory strategies of circular economy for new buildings while the *réglementation thermique* (thermal regulation) impose positive energy balance, thus requiring to diversify local production through hybrid solutions.

The ideal solutions for thermal and structural efficiencies, like geodesic domes offering a maximum volume for minimum surface and materials, must therefore be conceived in light of optimum hybrids, especially considering the complexity of layers separation of building envelops, in order to seek for overall efficiencies. To be fully achieved, optimization must also occur all the way down to material composition, without falling into the unsustainable errors of composite materials. This is notably made possible through the relevant hybridity of fibers orientation in LVL products for example, where 20% of fibers with perpendicular orientation allows a decupled resistance in transversal tension.

Tackling the optimization of hybrids, the strategies of conception and fabrication ought to equally employ hybrid methodologies in order to draw informed potentialities notably offered by digital technologies and analogic processes. For example, the use of Augmented Reality (AR) enables to take advantage of human adaptability and local expertise,[335] especially for digitally planned geometries.[336]

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335 "Fologram." is a technology exploiting Augmented Reality headsets to assist construction workers on site.

336 See the use of a custom AR smartphone application for the referencing of cutting location of forks in Allner, "Branch Formations."

Humans are particularly virtuous at recognizing and combining carefully selected processes, practices and elements into meaningful functioning hybrids. In the contrary, machines, robots and algorithms are particularly worthy for executing specific or repetitive assignments.

Adequate combinations remarkably reveal unexpected potentialities through the wise usage of available tools,[337] or requiring to adapt existing tools in order to perform more specific and relevant actions.[338] Such hybrid solutions often benefit a separation of low-tech elements from complex and digitally crafted connections allowing their rapid fabrication, and ultimately simple manual assemblies for a kit of parts.[339]

The prospective applications for intricate collaborations between humans and non-humans, in particular with robots,[340] defines a new age able to tackle pressing concerns of contemporary crisis.

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337 For the "Free Form Steambending." project, master student of the Architectural Association in Hooke Park developed numerous hybrid tools and processes, such as laserscanning a physical model and to scaling it up and superimposing target geometries over a live video stream to manually adjust lathes into the correct geometry.

338 For a MIT course, Gil Sunshine, developed a "Basket Buddy 2.0." machine to automatically measure, mark and cut sticks to be manually assembled by hand, therefore adequately splitting tasks for more rational and entertaining construction.

339 The "Digital Bamboo." project from master students in the MAS DFAB program at ETHZ combined 3D printed metallic connections with bamboo linear elements.

340 The thesis of Stefana Parascho, entitled "Cooperative Robotic Assembly." and her derived researches at Princeton University successfully embrace human robots collaboration to foster novel architectures

Hybrids notably bring a balance between adaptability to the context and vice-versa, particularly ensuring the preservation of existing infrastructures for transport, while lowering their stress, and adequately cope with the increase of mobilities. In fact, hybridization is the most essential quality of adaptability, as it can allow the collapse of constituent parts, while mono-oriented lifestyles, specific material sourcing, single-purpose technologies, etc. are more sensitive and prone to breakdowns.

Historic, tectonic, and polytechnic hybrids – Athens, Greece – 2018

Maxence Grangeot

Sourcing locally and hybridizing adequately – Arvouin, France – 2020

Maxence Grangeot

Synergetic externalities - Ecublens, Switzerland - 2020

Maxence Grangeot

Construction as choreography

The ephemeral nature of construction sites composes particular nomadic architectures as a unveiling scenography of hybridizations. The eminent philosopher Martin Heidegger reminds the gathering force of building as an action giving shape to constructions and infrastructures, but also to the bordering landscapes and environments.[341] Construction is therefore encompassing various actors, technics, materials, and tools persistently performing through hybrid conditions and thus establishing construction choreographies. Such dance of matter in perpetual motion prominently reflect the vibrant operations of extraction sites, from forestry to quarries and mines.

However, while construction apparatuses are principally mono-functional, there are little academic studies on the overall efficiency of construction sites and the potentialities of versatile tools, in contrast to numerous designs of ever more specific and advanced machinery and tools. Moreover, construction site sheds negatively stand out as the lowest architectural objects despite their modularity and efficiency, reflecting a functional yet unpleasant architecture of engineers. Similarly, construction machineries have persistently and exclusively been designed by engineers, leaving architects alienated from the reality and rationality of construction choreographies. The careful planning and design of the construction process as a project for architects could induce novel tools benefiting relevant hybridizations and potential versatilities in light of local and recurring conditions.

The academic trend of research in architectural fabrication and construction carried principally by engineers or architect-

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341 Heidegger, *Building Dwelling Thinking*.

engineers devotedly focuses on digitalization and automation gradually migrating onsite. The experimentations and the required interdisciplinarities are primarily permissible in academic environments but yield insufficient applicability for economically viable in situ construction works. Moreover, the required adaptation of such research to tangible applications ought to adequately consider materials and labor costs.

There are however a trivial number of researches tackling human-robot collaborations,[342] presumptively leading the way for more researches in relevant hybrids process seamlessly integrating digital and analog methods. The mere presence of construction sites in the 21st century is notably questioned as more and more fabrications occur off-site and the in-situ assembly in progressively replaced by non-stationary lifting machineries, including drones,[343] or self-building modules.[344]

However, mono-purpose endeavors require improvised adaptability and relevant hybridizations solely obtainable with human interactions through trials and errors on site at real scale. The value of the construction workers therefore surpasses the mere hourly rate of productive procedures, but designs must originally convey robust strategies for easy handling of elements require no specialist's expertise in order to autonomously correct errors and re-adapt to

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342 Notably Parascho, "Cooperative Robotic Assembly." And Larsson, Yoshida, and Igarashi, "Human-in-the-Loop Fabrication of 3D Surfaces with Natural Tree Branches."

343 Rogeau and De Beusscher, "Conception Paramétrique de Structures Architecturales En Bois Drone-Compatibles."

344 Retsin, "Discrete Timber Assembly."

changing contexts.[345] However, the temporal adaptability of modular systems under the systematic argument of un-wise static solution rarely yields successful re-establishment in other locations. Hence, adaptability of the building site is to be developed in deeper and often intangible characteristics, notably in the inclusion of sufficient tolerances as dimensions are inherently inaccurate, both in their physical realization an in between the surveying tools. The nature of tools also determines the precision of the final execution, as digital sensitivities can occasionally be supplanted by analogic principles resting upon laws of physics in remarkable maneuverings.

345 Particularly defended through the disassembly and re-construction of mobile architecture in : Friedman and Orazi, *The Dilution of Architecture*. "Architecture as Improvisation", p.29-33

Hybrid orchestra of relentless adaptations – Sion, Switzerland – 2020

Maxence Grangeot

Versatility upon reversibility

Reflecting on past and present construction strategies, flexibility is considered as fundamental to establish programmatic robustness over time, and notably by enabling adaptability not only from existing conditions, but also in subsequent times. The incumbent lessons on egoism from the lack of long-term projections strikingly remind the importance of humility and self-restrain to establish prosperous civilizations and ecosystems. Thus, the labile conditions on the surface of Earth beg for the careful planning based on a dynamic evolution of perpetual changes rather than based on a static condition of a specific state. Hence, the necessity of versatility generates learnings simultaneously applicable to both nomadism and architecture.

VERSATILITY

In comparison to the prominent versatility found in nature through inherent performances, most of designed artefacts are monofunctional as versatility and especially since the emergence of standardization and mass production. Versatility is particularly challenging to achieve from a human brain despite its invaluable reflexive capacity and its ability to “change of mind" therefore to adapt with light of additional inputs. Such deficiencies of synthetic thinking, resulting in specializations, are ubiquitously observable through most industrialized artefacts, and notably through the multi-layer composition of building envelopes as most explicit example in the field of construction. Moreover, the difficulty to achieve versatility equally defines a limited field of applications as separated artefacts deemed to be combined must satisfy the decisive condition of having no plural nor simultaneous use. While the concept of mobile architecture conveys visions of versatile usages through potential

modifications,[346] versatility is more prominently noticeable in nomadic habitats, whether as vehicles of versatile externalizations like tools, or as a tool itself changing of behavior with each context.

REVERSIBILITY

The malleable nature of nomads in rapidly changing conditions reflects their ability to generate and exploit versatilities while praising the merits of freedom.[347] The reciprocity of actions employed by nomadism through time markedly invalidates the appraised benefits of modularity, notably through simple yet efficient principles of reversibility, and regardless of any common "module". Moreover, advances in reversibility are yet to be developed as recycling and reuse have not fully tackled design from reuse and for reuse coextensively. The versatility of building components notably rests upon their reversibility of assembly, therefore emphasizing dry connections over cast-in or welded connections. In turns, the acquirable freedom might overcome the delusions of modularity while retaining potentialities of novel space configurations through time, notably for unpredicted architectures.[348]

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346 Friedman, *L'architecture mobile*.

347 D'Andrea, "Neo-Nomadism."

348 The arguments leading to the advocation of no preconceived plan are particularly developed in : Friedman and Orazi, *The Dilution of Architecture*.

Flexible activities within reversible structures – EPFL, Switzerland – 2019

Maxence Grangeot

Robustness through tolerance – EPFL, Switzerland – 2019

Maxence Grangeot

VIII. On adaptability and hybridity in eras of lability

FREEDOM IN A LABILE WORLD

Construction and nomadism intrinsically relate to time. Their respective importance lies in the notion of temporary passage, not solely on territories but within active environments. Such interventions on dynamic conditions repeatedly reminds humans of their responsibility towards a context unfit for anthropological appropriation and towards each other. The value of spaceship Earth consequently ought to be shared and preserved over time, by means of inherent performances in order to allow a perpetuity of cycles. Thus, the notion of mobility encompassing both physical and temporal units reflects the predominance of labile conditions as a persisting paradigm to be fully integrated for human alterations. The variability of environmental, social, political, technological and economic conditions defines a complex scene required to be addressed accordingly, while embracing the potentialities of associated risks and outcomes. Sedentism therefore unveils significant limitations to address the labile state of such fluids, especially in comparison to the aspiration for individual emancipations. Consequently, freedom represent more than a mere countercultural aspiration, but equally integrates the mutation of evolving lifestyles as well as the malleable condition of perpetual reuse, thus interrogating the lifespan of human alterations. While the long-lasting presence of the geo-infrastructure provides a worldwide domesticated surface for humans to explore, the lifetime of buildings raises numerous distinctive interrogations balancing absolute and relative relevance in accelerating societies.

Moreover, the development of posthuman architectures and invisible structures enabled the dissociation between aspirations for freedom and values of localities, therefore augmenting the perception of nomads as evolving unrestrained within a labile world.

NOMADIC ADAPTABILITY

Facing chronic changes, adaptability is prominently acknowledged as a relevant strategy and is notably associated with nomadic behaviors. Beyond localized alterations such as agriculture or other encampments for prosperity generating accumulative sedentism, the mobility of nomads provides an efficient adaptability to contexts thus allowing to successfully interact within such labile conditions. Therefore, the architectures of in-situ use and reuse can learn valuable lessons on adaptability to local conditions from the primitive conditions of hunter-gatherers, from the circular business models of Roma people or even from the freelance working scheme of global nomads embracing specificity. Inversely, the standardization of architecture gradually suppressed humans' ability to adapt and self-restrain through the accumulation domestic, tectonic, climatic and energetic irrationalities for the sake of comfort. However, the adaptability of nomads in accordance to economic, political and climatic changes represent a valuable example for localized construction through relevant tools. While nomadism inherently integrates adaptability and remains the best method for surviving in changing contexts,[349] the related "costs" are not yet accepted in order to face climate change and the housing crisis,[350] thus threatening to transition into a fatalist adaptability rather depicting acclimatization. However, unpredictability must be distinguished from improvisation as relevant adaptability appears critical to get humanity back on a

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349 Ginat and Khazanov, *Changing Nomads in a Changing World*.

350 Le Marchand, "Travail intermittent et production de la ville post-fordiste."

trajectory matching with the one of spaceship Earth. Therefore, the primary importance of adaptability to localized and globalized contexts is simultaneously reflected in the metaphoric relationship between in-situ reuse and neo-nomadic principles.

ROBUSTNESS THROUGH HYBRIDITY

However, adaptability as an independent strategy isn't always sufficient to provide a robustness facing the potential collapse of entire systems. In order to avoid sensitivity to specific conditions and the subsequent volatility, the adequate hybridity of distinctive systems provide more robust behaviors overall by allowing the individual collapse of constituent part. This is notably applicable to the hybridity of lifestyles, such as hypermobility and proxymobility, therefore offering infrastructures able to withstand localized or partial failures, but more important allowing permutations in lifestyles despite their interdependence.[351] Therefore, robustness is obtained by multiplication of sources, and equally applies to material procurement, fabrication processes, territorial establishment, energy production, collective cogitation, and more. Consequently, the benefits of hybridizing the needs of nomadic and sedentary populations is equally reflected in the necessary hybridization of cities with the countryside for the reciprocal supply of goods and services. Such robustness can notably be extended to more input sources in order to increase the robustness of the overall system, for example by unifying the production of wind, hydroelectric and solar energy under one network to relevantly generate renewable energy, therefore mutually supporting the respective unpredictability of natural conditions. Likewise, socially and environmentally robust architectures are neither defined by

[351] Forum Vies Mobiles and Observatoire Société et Consommation, "Enquête Nationale Mobilité et Modes de vie."

addition nor by subtraction alone with a context,[352] but rather by precise transformations and hybridizations of technologies and materials. The existing value embodied within existing structures notably offer valuable opportunities for the building construction, to hybridize reused and recycled materials fostering novel appeals. The persistent hybridity of historic adaptations with upgraded alterations constitute a valuable storage of energy, metaphorically reflecting a carbon sequestration, and notably eases subsequent adaptations, including from nomads. The accumulation of all previous hybrids therefore augments the holistic capabilities of humans beyond the mere sum of individual significances.

Moreover, building construction is particularly suitable for relevant hybrids of performative functions between humans and tools, and especially between analog craftsmanship and digital machines, which would undoubtably perform with limited efficiency in their respective individuality. Intensive collaborations during design phases equally compile tremendous assets to generate architectures simultaneously responding to architects' visions and user expectations, notably reflected in the reciprocal enrichment and total interdependence of form and force diagrams within the field of graphic statics.

Within the labile conditions of cultivated complexity, cross-discipline collaboration compose the most opportune endeavor to tackle the urgency of contemporary crises. Such situations require synthetic and analytical thinkers, to collaboratively solve problems through intensive hybridizations of experiences and knowledge,[353]

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352 For more tangible example in building construction, see the potential applications of circular economy to structures in : Fivet and Brütting, "Nothing Is Lost, Nothing Is Created, Everything Is Reused."

353 Ochsendorf et al., "The Edward and Mary Allen Lecture in Structural Design."

thus mutually elevating each other by embracing primordial accomplishment in hybrid teams. Reflecting the mutual requirement of hybrifs, the composition of this *énoncé,* through the interrelation of social and constructive learnings literally constitutes an engaging hybrid in itself.

Nomadic versatility through hybridity and adaptability - Pucon, Chile – 2019

Maxence Grangeot

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