Science and Urban Planning In Times of Climate Crises

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Curated by Skender Luarasi and Valerio Perna, the *Tirana week on Science and the City*, *in the Era of Paradigm Shifts* was among the most significant events of 2020, as I believe it anticipated a pivotal research trend of the next few years.

Science, understood as a manifestation of transdisciplinarity, will result in architecture, traditionally enclosed in its own disciplinary niche, opening up to a variety of possibilities for the benefit of community resilience, understood as the capacity of urban settlements to respond positively to the challenges of environmental crises (Melis & Medas, 2021).

Considering that the architecture "puritanism", as described by Richard Sennett (1970), has favoured design determinism and, consequently, transformed our cities into unstoppable climate change engines, a new taxonomy, based on resilience and corroborated by science, will arouse the interest of many, even outside the field of architecture.

Promoted by Polis University, and fuelled by TAW's lectures, the debate regarding science's contribution in fostering urban planning in times of global crises is obviously vast.

Thus, this text focuses on TAW's contribution to the discourse on the extension of the current architecture taxonomy, supported by up-to-date transdisciplinary knowledge, towards more ecological urban planning forms, consistent with the idea of community resilience. Recent research in the biology of evolution, and physics, shows that taxonomic revolutions become necessary when aspects described as marginal, and even exceptional, take on a value both qualitatively and quantitatively relevant (Gould & Vrba, 1982). This need becomes even more urgent when environmental, social

and economic conditions change very quickly and dramatically.

However, the authors of the aforementioned researches may encounter resistance, both from their more orthodox colleagues and from society, given that the abstractions of reality, such as taxonomies, are often the object of reification and, therefore, considered immanent and immutable (Gould, 2011). In architecture, the cultural inertia of tradition can be even more evident, despite the fact that the environmental crisis has now abundantly demonstrated the inadequacy of our city paradigms (Melis & Medas, 2021). If, therefore, we were to consider today the heuristic value of sciences, such as the biology of evolution and physics, we should pay more attention to the marginal phenomena of architecture, which today have assumed qualitative and quantitative dimensions such that they can no longer be underestimated (Gould, 1996, 2011). These marginalisation components surely include the peripheral phenomena of the cities understood in an urban, geographical and also a design sense (Melis, 2021).

The paper will also highlights how design biases depend on the reification of architectural taxonomies, from classicism to the present day, and that this reification can be overcome through the up-to-date scientific knowledge, especially focusing on evolutionary biology.

So does dark matter also exist in architecture?

The peripheries are the result of a cultural bias, or reification, to which the puritan reading of architecture has accustomed us. Transdisciplinarity can contribute (heuristically) to draw a parallelism among the periphery of the known universe, be-

fore the discovery of dark matter, the centrality of Mankind, before the publication of Charles Darwin's *Origin of Species,* and the marginalisation of several architectural phenomena within architecture history and criticism books, which, perhaps, still awaits a taxonomic revolution in the scope of the events mentioned in the physics and biology of evolution (Melis et al., 2021). The hypothesis of the periphery of architecture is not a novelty. On November 9, 1964, Bernard Rudofsky inaugurated the memorable *Architecture without Architects* exhibition*,* at the MoMA in New York, and stated that "The history of architecture, as written and taught in the Western world, has concerned only a few selected cultures." In the same year, physicists Arno Penzias and Robert Wilson proved the existence of the Big Bang, which corroborated the shift of the then cosmos model, year after year, towards the periphery of the universe dominated, today, at 85.3%, by a hitherto invisible dark matter (Melis et al., 2021).

So does dark matter also exist in architecture? According to the United Nations, in 2018, 23.5% of the population lived in slums (slums) or informal settlements (https://unstats.un.org/sdgs/report/2019/goal-11/). Slums are settlements in an urban area devoid of one or more of the following components:

- Durable dwellings of a permanent nature that protect against extreme climatic conditions.
- Sufficient living space (i.e. that no more than three people share the same room).
- Easy access to drinking water in sufficient quantities at an affordable price.
- Access to adequate sanitation in the form of private or pub lic toilets shared by a reasonable number of people.
- Security of property. (UN Habitat Report, State of Cities of the World, 2006-2007).

However, the phenomena of informality and slums are not always superimposable. A research from the Martin School of the University of Oxford shows that informal cities operate outside the common legal and regulatory framework and yet are closely intertwined with the functioning of the city. This informal sector covers all the social and economic conditions of places such as the Brazilian favelas or townships of South Africa. Globally, the informal sector is estimated to account for over 60% of urban-city activities, with the vast majority of jobs in many of the world's emerging economies considered informal (http: //www.oxfordmartin .ox.ac.uk / about /). This last observation, corroborated by recent studies on the temporary appropriation of public spaces (Khemri & Melis, 2020; Lara Hernandez et al., 2020), implies that a large portion of urban settlements does not respond to the planned city logic and does not fall within the definition of slum. Thus, some form of dark, quantitatively and qualitatively significant, architecture exists. This is clearly the object of marginalisation, due to the prejudices and reifications enunciated by Rudofsky regarding the centrality of the Western perspective, and by Sennett on urban puritanism. In addition to the global environmental crisis, therefore, the evidence of the marginalisation of relevant phenomena, which could instead contribute to the resilience of cities, also confirms the initial hypothesis of the need, today, of an extension of an architectural taxonomy able to read more adhering to the dynamic reality that surrounds us.

Non-deterministic planning as a paradigm shift

The search for dark matter in architecture is not a purely intellectual and theoretical fact. The data on the environmental crisis show that most of the emissions that we attribute to the city and to buildings concern the formal city designed in a deterministic way. This consideration raises the doubt that the 'dark' architecture might, instead, be intrinsically ecological. Cultural bias, therefore, prevents us from hearing the background noise that diachronically and synchronously comes from a large part of the urban fabric that we really inhabit. As in physics, even in architecture the dark part, although marginalised by a dominant thought, is quantitatively greater than the known one and can be found anywhere: in the most distant regions; in the informal settlements of the southern hemisphere; and in the suburbs of western cities; The periphery of the world, therefore, does not belong to a specific region or city, but essentially concerns the prejudice towards non-deterministic design processes and the marginalization of diverse architectural manifestations. The images of "Architecture without Architects", El Houma of Algiers, the historic centre of Mexico City, and Shibam, Yemen, are just some of the infinite possible cases which demonstrate that indeterminism is a phenomenon that extends far beyond the informal urban fabric, and does not end with the phenomenology of the vernacular (Khemri & Melis, 2020; Lara Hernandez et al., 2020). Underestimation and disinterest in non-deterministic design are perhaps due to a reification of linear progress and human intelligence as a product of rationalism, both of which are fuelled by the 'mismeasure of man' (Gould, 1996). This bias has much deeper roots than the history of architecture and periodically emerges as a critique of philosophical structuralism. We could, therefore, imagine rewriting a history of architecture beyond reification. This alternative history could include, perhaps, intrinsically ecological works in distant places and times. In the Global South, the bias is oriented to slums, often described as a degenerative form of (deterministically) designed urban fabric despite the environmental crisis is mainly due to the formal city. The slums instead suffer (and will suffer) the negative effects on health due to the tropicalisation of the climate, for example in the transmission of Dengue fever, the reduction of rainfall, which favours the spread of the West Nile Virus, and the urban pressure exerted on reservoir animals, as in the cases of Ebola and COVID19 (Melis, 2020). The inhabitants of informal settlements will also be the main victims of the impact of climate change on air quality, drinking water and food supply, which will cause, between 2030 and 2050, about 250,000 more yearly deaths worldwide from malnutrition, malaria, dysentery and heat island stress (IPCC Report, 2014; UN Human Settlement Program, 2014; WHO, 2018), in addition to having to review the victim-executioner relationship between formal and informal cities, architectural scholars could instead consider informal settlements as case studies on the survival strategies (with low environmental impact and in the absence of infrastructure) of its inhabitants (Melis, 2020). Even the suburbs of Western cities are victims of determin-

ist prejudice, albeit from the opposite perspective. Post-war planning, based on the modernism principles of specialisation and homologation, tried in vain to regiment, in a mechanistic form, the organic nature of communities. The monofunctionalism and reductionism of the zoned suburbs have contributed considerably to the environmental crisis, and to its feedback phenomena like the urban heat island and the limited resilience of marginalised communities in the dormitory neighbourhoods.

Architectural exaptation as a possibility for the construction of a resilient city

To understand the reasons for the reification of design determinism, it is necessary to consider again the transdisciplinary research. Determinism implies: a design capable of describing a future scenario, at least probable; uses and functions of the city which reflect that particular scenario both qualitatively and quantitatively; spaces, forms and (architectural) structures that derive from these two starting conditions.

Although historians and architecture critics love to squirm over the type of scenario and the methods of attribution of uses, functions and structures, the discussion on this sequence, net of the sophisms and fashions of the moment, is almost non-existent. This does not mean that tectonic manifestations of habitat modification without intention have never been observed. These manifestations have simply been relegated to the margins of architecture and, from time to time, catalogued as artistic expression, mannerism, conservation, informal or in any way that does not compromise the uniqueness of deterministic design (although equally varied). The dichotomy between the apparent unity of determinism, the only one worthy of the prefix 'arche', and the fragmentation of all the rest, is an involuntary and *ante litteram divide et impera* of the architect who keeps intact a shaky taxonomy of architecture as old as Aristotle (Melis et al., 2021).

Between the 1960s and 2000s, a similar argument in the field of biology concerning the definition of evolutionary mechanisms of adaptation led to the publication of a fundamental article by US palaeontologists Stephen Jay Gould and Elisabeth Vrba (1982). With this text, the authors intended to challenge and extend the traditional taxonomy on adaptation by highlighting that it referred exclusively to that process through which the form (i.e. the morphology of a trait or the pattern of a behaviour in nature) follows a certain function.

Many scholars, and even Darwin in his second edition of the *Origin of the Species,* had been able to observe cases of functional co-optation of structures that had a different function or that had none at all. Exaptation is the term coined by Gould and Vrba for functional co-optation (Melis & Foerster, 2021). Before Gould and Vrba, in fact, a taxonomic definition was lacking, which would underline the relevance of the mechanism described, in contrast to the determinist prejudice of the most orthodox evolutionary biologists, who, up to that moment, had fuelled the marginalisation of functional cooptation.

The deterministic position, in biology, had, therefore, led to the exclusion, from the evolutionary process, of all those cases in which pre-existing structures (evolved in other ecological contexts, with other functions or none) were subsequently co-opted by natural selection. In this description, we can observe an extraordinary similarity with architectural design, as described, genotypically, in the literature of the discipline.

Equally extraordinary is the similarity between exaptation and non-deterministic tectonic transformations, described above. This reflection, if shared, could have a heuristic implication. The structures capable of acquiring new functions and the spandrels, structures without functions, constitute an indispensable resilience reservoir when environmental conditions change rapidly and unpredictably. During the current environmental crisis, therefore, the same criteria of diversity, variability and redundancy of the structures intended for functional co-option (exaptation), would guarantee levels of resilience that, evidently, the intentionalism of conventional planning was not able to do.

Conclusion

Almost forty years after the 1982 publication of Gould and Vrba's essay on exaptation, the reactionary rigour of a part of architectural criticism raises a question: if diversity has now been acquired as a social value to be promoted as opposed to homologation, why is it that, in urban planning, one is forced to propose the opposite? Yet many, in the most diverse research fields, have described the limits of dexterity homologation, with respect to unpredictability, uncontrollability and the scale of events, such as environmental crises. The question of the opposition between order and disorder is still open, in architecture, precisely because it reflects a political relationship, difficult to unhinge, between order, hierarchy and authority, which pervades the entire organisation of society. When the reifications crystallise into prejudice, what is culture, etymologically understood as the cultivation of knowledge, risks becoming a cult, and the discussion on order, from abstraction, takes on a dogmatic dimension on the part of those who hold authority and control.

According to Lebbeus Woods (1994), authority resides in the hierarchies and static balances of rational determinism to which it is necessary to contrast a fluid dynamic reality. Already in 1970, Richard Sennett had sensed that the confusion, between the use of the machine as a tool for the city with the vision of the city as a machine, would have convinced planners to create the conditions to intensify the impulses towards purity and, in this way, they would have promoted the voluntary abandonment of social participation and the desire to use violence as a final solution (Sennett, 1970, p. 86). For Sennett, therefore, "The growth of technological complexity in modern society and the decrease in the complexity of its social forms have proceeded on entirely separate levels" (Sennett, 1970, 85). Sennett concludes that a new urban anarchy, which includes creative disorder, could be the alternative to the puritanical, rigid and violent city. In this context, it is less surprising that the design and thoughts of many architects who work on the margins of the taxonomy of order are still described today as an individual and solitary journey, albeit relevant to a limited range of enthusiasts.

Although they use different definitions and have even distant cultural and philosophical references, in the work of

these 'solitary' architects there are expressions that can be superimposed on the mechanisms of exaptation and the concept of spandrel. Woods, for example, argues that radical architecture is that in which one does not yet know how to behave (Woods, 1997). Maximalism is, for him, a 'wonderful complexity', as opposed to the rhetoric of reductivism and modernist mechanism. As for Gould, therefore, also in this case, order, Platonic idealism and the binary vision of the Cartesian reality are at the origin of the reifications, which we carry with us like millennial burdens. They are counterpointed by the creative possibilities of indeterministic, antihierarchical and fluid dynamics networks and relationships.

Reflecting today, in an organic way, and with a historical perspective, on the apparently distant works and ideas of Woods, Fredeick Kiesler, Raimund Abraham, Haus Rucker Co., Gunther Domenig, Vittorio Giorgini, Giovanni Michelucci, Emilio Ambasz, and many others, would allow to place their thinking in the right perspective, as a contribution in favour of a more articulated and complex reading of reality. The re-emergence, in their texts, and in the projects, of themes that describe in advance the impact of global crises, and that expose pioneering proposals regarding possible architectural strategies, in response to the crises, instead confirm the inability of at least two generations of architectural historians and critics to keep pace with paradigm shifting and to recognise the continuity and coherence of research. The dominant reading of architecture, as order, and of planning, as determinism, is, therefore, at the origin of the marginalisation of those who have instead promoted alternative ideas, perhaps perceived as subversive.

In addition to having a responsibility on the effects of environmental crises and on the marginalisation of those who could have contributed to their mitigation, architectural determinism has also helped to increase forms of cultural exclusivity that have prevented a historical, organic and coherent reading of the work of those who have promoted the extension of the taxonomy of architecture towards non-deterministic forms of design. Although unconsciously (in most cases), the 'divide et impera' action of ordered, autonomous, homogeneous and rational architecture, which promoted postmodern historicism as the only form of antagonism, favoured a reading of alternative tendencies, as fragmentary, incoherent, formalistic (in the sense of the orientation to the geometric form) and informal, at the same time, always assigning a negative meaning to each of these categories.

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