

Proceeding Paper

Urban Environment and Human Health. The Motivations for Urban Regeneration to Adapt

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Abstract: Urban regeneration is not only an opportunity for the city to adapt according to criteria of resilience to climate change; it is also a significant opportunity to build a city based on an approach to health that places the human person at the center of the whole system. According to the World Health Organization, health is not only the absence of disease but the broader well-being understood as a complex of socio-economic, biological, and environmental relationships. We want to present some results of applying this human-centered approach where the urban fabric's shape, texture, and materials are essential to building the boundary conditions for developing a healthy city.

Keywords: Urban Climate; Urban population health; Urban regeneration; Urban adaptation.

1. Introduction

Talking fully about cities is the work of entire manuals of urban planning and architecture; exposing the reasons for their existence would require historical and social analyzes that transcend our exposition's due limitation. Thus, let's limit ourselves to thinking of the city as where we live and remember that the city is not neutral. The non-neutrality of the city is based on the very form and structure of its conformation, and the specific architectural features are not neutral in their interactions with human beings in terms of direct and indirect impacts. The city is made up of forms, materials, and uses, which directly affect the quality of life and the health of its population [1-3]. Thus, the city's evolution marks a series of different, and sometimes divergent, relationships with the living aspirations of its inhabitants.

Historically, all the cities of the world have suffered from this discrepancy between people's expectations and the conformation that the policies wanted to give to their structures, and it often occurred as a function of the specific typology of government: an example is that of "foundation cities" characteristic of authoritarian regimes [4,5]. Suppose these chauvinistic impulses have gradually diminished in Western countries, but it cannot be said that they have completely disappeared. In that case a further discrepancy interaction between city and population has come to assert itself through overlapping two phenomena that we can define as epochal: the push for urbanization and climate change. The push towards urbanization is considered unstoppable because the driving force is determined precisely by people's aspirations to live a better and more comfortable life. However, these aspirations collide with the new climatic situations, which can transform the city into a trap for the weakest segments of the population by reducing not

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only the quality of life but also its duration expectations [6].

History, urban planning, and architecture have taught us that it is very difficult, if not impossible, to define a model of a city; it is therefore necessary to apply a new paradigm capable of breaking the non-neutrality of urban processes to reaffirm the centrality of the human being and to adequately protect the most socially fragile groups in terms of quality and health: a human-centered approach which moves towards the construction of a healthy city, overcoming the limitations of what is now defined as a smart city, but which ultimately could be less smart than one would like for these social groups.

2. Toward a Healthy City

Modern town planning tends to reject the idea that the city can follow pre-established development models. Starting from the early 1900s, a group of intellectuals and architects started research to modify the settlement model of the industrial city both from the point of view of urban planning and from the economic, political, social, and cultural. Le Corbusier, Gropius, Mies, and others analyze the functions in the city, defining minimal elements for each of the urban functions, and the city begins to be perceived according to a functional framework. This new definition of elements still does not significantly change the modeling approach. However, it introduces a higher level of complexity where the functions become the fundamental structure of the urban plan.

We owe Le Corbusier the cultural passage, perhaps rediscovering the Vitruvian concepts, which clearly introduces the relationship of the city with its materials and the climate [7]: "*Les matériaux de l'urbanisme sont le soleil, les arbres, le ciel, l'acier, le ciment, dans cette ordre hiérarchique...*", almost a premonition of what would become the fundamental elements of the microclimatic study of the urban environment.

Precisely with the worldwide attention on the climate problem, the study of cities becomes multi-sectoral, and different disciplines begin to contribute to the formulation of methodologies, techniques, and policies that increase the resilience of this specific fabric using the watchwords: mitigation and adaptation.

The qualitative leap in approaches is due to the United Nations with the development of the SDGs, or rather the sustainable development goals [8]. Specifically, goal number 11, "Make cities and human settlements inclusive, safe, resilient and sustainable," is perfectly suited to respond to the new challenge posed by climate change. The specific targets are indicated in the 2023 Report [9]:

- *Over half of the global population currently resides in urban areas, a rate projected to reach 70 percent by 2050. Approximately 1.1 billion people currently live in slums or slum-like conditions in cities, with 2 billion more expected in the next 30 years.*
- *In 2022, only half of the world's urban population had convenient access to public transportation. Urban sprawl, air pollution, and limited open public spaces persist in cities.*
- *Since 2015, the number of countries with national and local disaster risk reduction strategies have doubled.*
- *To achieve Goal 11, efforts must focus on implementing inclusive, resilient and sustainable urban development policies and practices that prioritize access to basic services, affordable housing, efficient transportation, and green spaces for all.*

It is, therefore, extremely clear, from the words of the Report, that in the priorities of the construction of resilient cities and communities, the founding act of the new paradigm is the centrality of the human person, in his entirety of aspirations and rights.

It must be extremely clear that when we consider the legitimate aspirations and rights of people, we cannot fail to centralize the definition of Health principles as defined by the Constitution of the World Health Organization [10].

We have, thus, defined the paradigmatic framework within which the techniques and tools must now be inserted to obtain the desired targets. Some recent attempts, which are under development, have tried to identify the correct techniques to pursue the objectives of SDG #11. These are: the development of the SMART City concept and the 15-minute city. One of the main criticisms leveled at SMART Cities is that, while taking into account the accessibility of services, its driving force is essentially based on the digitization of processes, which can be enormously complex if a digital infrastructural network is capable of driving the transformation [11]. On the other hand, the most sustained criticism of the 15-minute city is that that time frame refers to a group of the population to be considered in good physical condition, while for the weaker groups who appear to have good functional conditions, the average values are around 300 m. These values drop below 300 meters for the weakest groups with poor functional capacity, conditions very far from the 15-minute philosophy [12–15].

For the development of a human-centered approach, the reference baseline must be the construction of a healthy city where the primary objective is the protection of the vulnerable and, above all, from climatic risks. The "healthy city" creates and improves the opportunities of the physical and social context and allows all citizens to remain physically active in everyday life [16].

3. Distributed Nature based Solutions and New Building Materials

The first fundamental proposition for the construction of a healthy city is of an educational nature, i.e., preparing the Public Administrations to understand that the climate problem and the impacts on the population do not derive exclusively from conditions generated on a large scale, such as heat waves, that they are indeed the engine of these impacts, but that there is a direct responsibility of the policy-makers on the intensity of the effects to which the population will be subjected. Considering that for the next few years to come, even by applying robust mitigation policies, the inertia of the climate system will still produce impacts on cities, the only option for municipalities to protect the well-being of citizens will be to proceed with adaptation measures to increase urban resilience [17].

3.1. Distributed Nature-Based Solutions

It has been known for a long time that the dominant factor within the urban system that determines a low or high level of comfort for people is what is defined as the surface energy balance. Said balance is the result of the partition of solar energy to the surface in which the term sensible heat is that which, exceeding certain limits, produces distress [18–20]. The fastest option in physical terms to promote well-being, but often less rapid in urban planning terms, is the application of Nature-Based Solutions or solutions that can distribute solar radiation in processes such as evaporation and evapotranspiration. The main candidate to provide this beneficial effect is urban vegetation.

However, placing trees at random within the urban system can be a cost without obtaining a reasonable adaptive response. Urban vegetation must respond to three fundamental criteria: 1. which trees to put; 2. how many trees to put; 3. where to put these trees.

If in the past it was very complex to respond to these criteria, today the problem is extremely simplified using special fluid-dynamics software that is able to propose and select the best option to distribute the vegetable resource correctly and with maximum optimization. Obviously, this requires close collaboration between public administrations, atmospheric physicists, agronomists, and urban planners.

The concept of a distributed Nature-based Solution is particularly important for promoting virtuous attitudes on the part of the population. Think of the problems of urban pollution and the need for a transition to sustainable mobility, such as the massive use of bicycles. We cannot think of encouraging the use of slow mobility without having

equipped the city with places to stop and recover physically for elderly people who need to access urban services, go shopping, or even just socialize with each other. For this reason, the hypothesis of distributed pocket parks represents a relatively low-complexity solution, having, however, the caveat of taking into due account also the needs of the vegetation for its need for water for its survival. Even more important in a distributed system of these solutions is the fact that there will be no parts of the city with a high endowment of these resources and others with low or no availability, this avoids the creation of phenomena of gentrification or the expulsion of weaker social groups towards the peripheral areas, that phenomenon which in the greater Paris gives birth to a specific culture called the "Bourgeois-Bohème", those who can afford to live in the center, a private paradise for the rich people.

3.2. *New Building Materials*

From a physical point of view, the interaction of solar radiation with the urban fabric does not end with the surface energy balance, but another factor which is called surface radiation balance, must also be taken into the utmost consideration.

Apart from the application of Nature-Based Solutions (NBS) in cities, new building materials or surface treatments of old and historical materials can strongly contribute to reducing the thermal regime of the cities and, consequently, reduce the energy consumption due to the conditioning of the buildings.

The primary levels of intervention within the urban system in terms of materials are flooring, facades, and roofs. For consolidated urban structures, where the cultural heritage covers an essential percentage of the buildings, regeneration with new materials is often impossible not only due to the costliness of the potential interventions but also because this collides with the urban regulations to safeguard the historical and traditional heritage. In fact, even urban areas are subject to landscape protection regulations in terms of perception by the population [21]. Obviously, this should not be seen as a limitation, as a protection of fundamental tangible and intangible assets, but rather as a push to seek new technological solutions that reconcile the preservation of cultural heritage and the challenge of climate change. In this context, the use of cool materials has been widely acknowledged as a promising passive UHI mitigation solution. However, the light-colored cool solutions cannot be applied in historical districts, since regulations on such protected areas are strict [22]. Results in high reflective facades showed a decrease in temperature greater than 10 °C.

Mainly for the newly built city, it is possible to work with new materials, while for the consolidated city, subject to landscape and historical constraints, it is necessary to find solutions that allow the use of traditional materials but which respond to the useful reflectance characteristics the reduction of the enthalpy load (i.e., coating). One of the critical points in regeneration remains that of costs and, therefore, the market penetrability of these new technologies. Another important point concerns the national production landscape and its ability to innovate to remain competitive in the market. Therefore, a continuous dialogue between the research and industrial sectors becomes necessary to face both the challenges caused by climate change and the challenges of international competitiveness.

4. **Conclusions**

The strongest motivations for urban regeneration have been briefly described since the effects of climate change pose serious problems for the resident population in terms of impact risk. From a physical point of view, there are currently no limitations to being able to define the best interventions to preserve the health of citizens. The main problem is to bring scientific and technological advances to the knowledge of the municipalities in order to be able to make that fundamental transition in our urban agglomerations.

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