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POST-COMMUNIST URBAN LANDSCAPE AT RISK – CHALLENGE AND INNOVATION

Abstract
The paper aims to present aspects regarding the relation between the urban environmental metabolism and the formation of urban heat islands in Romanian residential areas, as well as the specific contextual problems including the socio-cultural behaviour within local communities, in the sense of urban landscape performance design.
Our study analyses the risks of extreme heat and cold, the response of the building performance envelope, taking into consideration the resilient design principles regarding typical use scenarios, common points of stress due to normal use, as well as the vulnerabilities to the environmental disruption situations of normal life that could challenge the building integrity and/or endanger its occupants. In this context there clearly appears the necessity to develop more holistic strategies for climate change adaptation that support a planning thinking process, seeking to re-construct broken connections and entities between architecture, landscape and cities.

Keywords: post-communist urbanscape regeneration, resilience, urban heat islands, holistic systemic approach

Introduction
Today, global climate change is impacting Europe in many ways, including changes in average and extreme temperature and precipitation, desertification, rising sea level, which have influenced ecosystems, socioeconomic sectors and human health. Nowadays local and global environmental changes can be associated with the issue of residential areas, since this sector is an important receiver and amplifier of their effects, being, at the same time, the component most affected by these changes within the human settlement systems and specially within the most vulnerable areas, in which the population is exposed to their impact for a longer time. The important contribution of residential areas and their vulnerability to current environmental changes require the need to identify applicable short- and medium-term solutions to reduce their impact on the environment. They would also improve the possibilities of adapting the residential areas to satisfactorily ensure the specific functions in the new conditions, as the outcome will be determined by "our common response to interconnected problems that are already combining to create a perfect storm which threatens the human prospect"[1].
The vulnerability of the city as perceived through the landscape by its setting should be tackled by designing innovative social, economic, and environmental responses that allow it to endure and form the basis for new urbanscapes. This means configuring and connecting fragments of the city, without nostalgic unitary visions or the fear of overwriting, all this in order to understand natural processes. It also means using new technologies to reorganize the pieces, re-interpreting their connection to the context, eventually re-creating new places.
The present paper refers to the challenge the apartment buildings, often called boxes of matches, pose to architects and urban planners, not only as problem generators, but at the same time as opportunity providers, considering their huge urban potential for new regeneration projects, from the technical and the urban landscape points of view; it is a phenomenon on a big scale, as almost 75% of Bucharest population lives in these communist quarters.

Context. Potential of Neglected Residual Landscapes
As regards its traditions and climate and in order to preserve its identity and prevent the phenomenon of urban heat islands, following remarkable urban theories from the beginning of the 20th century (Fig. 1), Bucharest should become a real *urbs in horto* and not only just a *hortus in urbe* [2]. Unfortunately, this principle has been neglected since 1986, when the very aggressive demolishing operation affected part of the centre of Bucharest. Moreover, after 1990, there has been an explosive growth of incorrectly structured and poorly managed real estate developments which have led to complex problems as the surface of urban parks decreased by 34,5% [3].

Fig. 1. Green belt proposal - The master plan for Bucharest, 1934 [4].

These new urban inserts ignored criteria regarding orientation and meteorological issues caused by climate change; therefore various types of conflicts have appeared, all with dramatic consequences on human comfort.
The blocks of flats located in the centre of Bucharest on the Unirii Boulevard give the measure of a particular context inherited after 1989, of control on the relation between the buildings and the public space: no porticos and very small balconies. In an area defined by an excessive temperate continental climate, the porticos had their purpose as transition spaces with a protective role, and the balconies, at such dimensions, lost their functionality. At urban level, a completely new system has been induced, defined by a formal and functional self-referential axis (Fig. 2), causing a fracture between the new apartment buildings and the old urban structure, and resulting in huge residual areas.
Unfortunately, the situation has remained like this until today, even if the residual areas have big potential to be designed as green and public spaces.

Methodology
A pioneering topic in our country (2014) and relatively recently addressed in the EU, the phenomenon of UHI caused by climate change requires the urgency of finalizing the regulatory and legislative framework on the behaviour of urban complexes, landscaping and buildings, analyzed both individually and in interdependence. This analysis has to take into account the anthropogenic urban factors identified as elements of an urban residential area whose effect is manifested on the zonal microclimate by increasing the outside temperature and generating the urban heat island.

Fig. 2. Unirii Boulevard, former Victoria Socialismului Boulevard, fracture and residual spaces between new buildings and old urban structure.

The issue of heat stress cannot be ignored in situations where heat island intensity is maximum because of its negative effect on energy balance (Tab. 1)[5], and because heat stress does not only involve discomfort, but it also leads to the reduction of mental and physical performance and to psychological and behavioural changes [6].
Our research has applied the unconventional creative research method for detecting problems and dysfunctions, as well as for grouping various factors according to certain criteria by relating the urban heat islands to the Urban Anthropic Factors UAF_i and to the architectural features of the envelope.
At the urban and landscape level, the following urban criteria have been considered:

a. location of the estate within the city;
b. spatial tipology of the considered residential area;
c. location related to the main traffic route/strongly anthropized landscape, mainly mineral;
d. the presence of natural or artificial water in the proximity of the urban estate (natural, decorative fountains, water mirrors with a role in evaporation);
e. location in the urban context related to the direction of the dominant winds;
f. specific urban altimetry and urban "silhouette" (gaps in the overall dimensions of urban complexes that can cause specific local air currents);
g. location in relation to community spaces and related green spaces;
h. location in relation to local sunlight or exposure (number of hours of sunshine per day in each season, orientation of the flat within the residential area relative to the cardinal points);
i. the ratio between the mineral and the vegetal surface - territorial balances and surface indicators, including the Percentage of Land Occupation and Land Use Coefficient;
j. location in relation to topography and relief;
k. the percentage of green space - tall vegetation with increased ecological capacity.

The score of 0 to 5 is assigned to each factor according to measurable characteristics that are included in the matrix for assigning the values of the factor. These values change only as a result of interventions aimed at reconfiguring the urban area from a geometric point of view and the characteristics that have an impact on the zonal microclimate [7].
At the level of the architectural design plan, it will be necessary to study the following criteria: form and typology of construction elements of the building, thus the details and architectural features of the studied apartment: level where the residential unit is located, number of floors, orientation of façades, joinery type, the presence of the balconies, the constructive structure, number of rooms, number of residents, age groups of inhabitants, features of immediate surroundings, presence of air conditioners and other air conditioning systems, the exposure to sunlight of the apartment etc.
The parameters used for the envelope in terms of solar heat input are:

a. a.materials;
b. b.envelope opaque elements / glazed elements;
c. shading strategies;
d. compactness of the building;
e. colour;
f. orientation of the building.

Each characteristic of these parameters has been considered individually thus concluding that some of them could have reciprocal effects. Consequently, the integrated design is needed in order that it benefits from all possible solutions. Certain interactions between the effects of these features are significant, so the quantitative effect on a feature (eg orientation) may largely depend on the design details of other features (in this case, window shading, wall and roof colour and their geometry, and urban geometry).
Thermal insulation can combine two physical processes, namely: reducing the thermal transmittance of the envelope and maximizing long-wave radiation [8]. Usually only the first process is considered, but both can be researched into the concept of radiant barriers. When properly installed, radiant barriers can reduce the cooling load by up to 10%. On the other hand, a low transmittance can be obtained by using high-performance thermal insulation materials. The performance of 15 kWh/m^2, a energy consumption for heating, the standard of the passive house, implies that the construction elements meet certain requirements.

Tab. 1. Urban heat islands influence on human comfort.

Characteristics that contribute to the formation of UHI in urban areas	Effect on energy balance
Lack of vegetation	Reduction of evaporation
Extended waterproof surfaces	Reduction of evaporation
Increasing the thermal diffusivity of construction materials used in urban areas	Increasing stored heat
Reduced solar reflectance of construction materials used in urban areas	Increased net radiation
Urban geometry that captures heat	Increase in net radiation
Urban geometry that reduces wind speed	Reduced convection
Increasing the level of air pollution	Increasing net radiation
Increasing energy consumption	Increasing anthropogenic heat

Mitigation of Urban Heat Islands Effects
The presence of buildings and their functioning in the built environment requires a large amount of material and energy resources. One of the strategies to reduce the effects of climate change by reducing greenhouse gas emissions and the effects of heat waves and UHI is to renovate the existing buildings.
The most common residential areas, built during the late 1960s and early 1980s, are confronting with some specific situations about the urban heat islands (UHI). Although the master plan for Drumul Taberei residential quarter followed the theories of Landscape Urbanism of the early 1960s (Fig. 3), having the advantage of a good ratio between the built space and the free space (Fig. 4a), it is also facing the UHI phenomenon, due to the increase of net radiation, the reduction of convection, densification (Fig. 4b) and pollution. The intetrvention aimed improving the envelope performance (Tab. 2) and reducing the UAF average value through designing public spaces as gardens and other specific solutions for the green buildings such as green roofs (Fig. 5).

Optimizing Envelope Thermal Performance and feedback from local people
Urban regeneration process also includes specific technical improvement of the envelope performances, as a more comprehensive maintenance cost reduction. The rehabilitation project for the residential quarter *Prietenia* in Brasov, (Fig. 6a), developed by the Ministry of Regional Development and Public Administration in cooperation with Sfantul Gheorghe local authorities, used continuous insulation where possible to avoid thermal bridges and replaced uncoated glazing with insulated low-e glazing, (Fig. 6b).

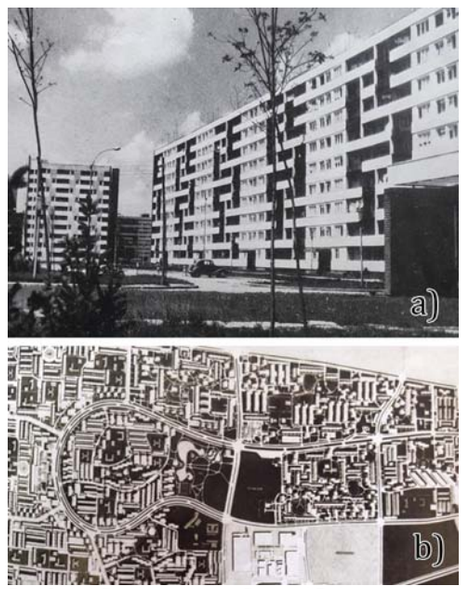

Fig. 3. (a) Public space - Drumul Taberei residential quarter; (b) Drumul Taberei - Landscape Urbanism vision of the early 1960s.

Tab. 2. Main building characteristics before and after rehabilitation.

	Before intervention	After intervention
Standard Building	Insufficient thermal insulation	Low energy building
Building Elements	Typical U value for a certain thickness of thermal insulation material	
Exterior walls (Precast concrete slab of 25cm) Thermal insulation thickness	0,40 W/(m^{2}K) 6 cm	0,20 W/(m^{2}K) 16 cm
Floor above basement	1,00W/(m^{2}K) 0 cm	0,25W/(m^{2}K) 10 cm
Terraced roof	0,90 W/(m^{2}K) 15 cm autoclaved aerated concrete	0,15 W/(m^{2}K) 30 cm
Average desity of heat flow from outside to interior space q	6,134 W/m^2 Standard terrase	1,06 W/m^2 Green roof, dry soil, with vegetation, with insulation additional
Window frames	2,80 W/(m^{2}K) Double glazing with air	1,10 W/(m^{2}K) Double glazing, insulating glass
CO_2 emissions	30 kg/m^{2}a	10 kg/m^{2}a
Energy needed for heating for a typical appartment	kWh/m^{2}a 150 - 100	kWh/m^{2}a 30 - 40
Energy needed for cooling for a typical appartment	4,2	1,5

Fig. 4. (a) Drumul Taberei – Ratio between built space and free space; (b) Densification in the late 1970s.

Fig. 5. (a) Tall vegetation with increased ecological capacity; (b) Green roofs mitigating UHI effect.

Fig. 6. (a) Prietenia residential quarter after rehabilitation; (b) Prietenia residential quarter - Insulation and balconies to avoid thermal bridges.

In addition to all this, it involved an alternative approach for the open spaces, including aspects regarding the green areas, public/semi-public spaces, parking places, household waste management etc.
Referring to the rehabilitation strategy, beside the design project, the building materials and the climate factors, human behaviour plays a key role. The effect of the local urban heat islands, the required energy for cooling and heating and the vulnerabilities identified in the people's feedback have to be considered within the adaptation strategy of the urban population to the new climatic conditions.
Behavioural patterns contribute to the significant ratio growth of the factors influencing indoor air quality. The thermal insulation of the apartments has considerably improved the thermal inner comfort and has determined some changes in the behaviour patterns of the inhabitants. The tendency to remove the centralized ventilation systems during the interior design works led to reduced natural ventilation in the interior (more than 75% of the apartments have undergone renovations).
In these circumstances, as mentioned above, there have been behavioural changes such as: decreased interest in individual additional heating using the cooker, the use of only one extra-heated room by several family members, drying the laundry in living spaces, but, at the same time, increasing preference for the classic ventilation system through windows, the only efficient solution for optimal ventilation in all the analyzed houses that underwent the thermal insulation with very economical budgets. The ventilation is done exclusively through windows as it is simpler and less expensive than other systems, the average frequency being of 3 openings per dwelling a day.
The last case study took into consideration Ferentari quarter, situated in the southern part of Bucharest, built in the late 1960s for the refugees of Chile, and later inhabited by poor workers and the Roma. It has been definitely/ affected by poverty and hidden criminality that nowadays it appears as a ghetto improvisation which resulted from enlarging the living areas, as the apartments are mostly one-room studios, and the families count more than five members, with a rural lifestyle(Fig. 7).
Our proposal considered to improve the space quality, the inner comfort, the structure system and the urban image. It also allowed autonomy for inhabitants to intervene as they need. A light structure was proposed within our research in 2018 to increase the space of the flats in a safer and beter configured way. The balconies can be enclosed as greenhouses, the spaces within the grid can be used for plants, natural shading systems and technologies (Fig. 8).

Conclusions

The research highlights the following ideas on the post-communist urban residential quarters, in order to boost resilience:

a. Urban and architectural solutions in the process of urban landscape regeneration must be an answer to climate change effect, but also to specific demands concerning public spaces, esthetic urban qualities, visual continuity and identity;
b. Regarding its effect on the microclimate, the vegetation included in the envelope as green roofs and continued by the trees alignments along the roads will mitigate the impact of urban heat islands in cities and urban residential areas, and other natural factors such as wind or rain.
c. The energy performance response of each material used in an envelope assembly is determined by physical characteristics and proximity environmental factors (interior/exterior).

The paper attempts to take a global but not exhaustive look at the post-communist residential urbanscape in Romania, and proposes, by an integrated approach, a methodology for a possible response to urban, architectural, technical and social issues in order to enhance comfort quality. No action or even worse, abusive or wrong actions mean a process of deterioration along time, which will irreparably affect various aspects.

Fig. 7. (a)- Ferentari residential area –nowadays statement; (b) Irregular cantilever enlargements; (c) Public space appropriated in a rural manner.

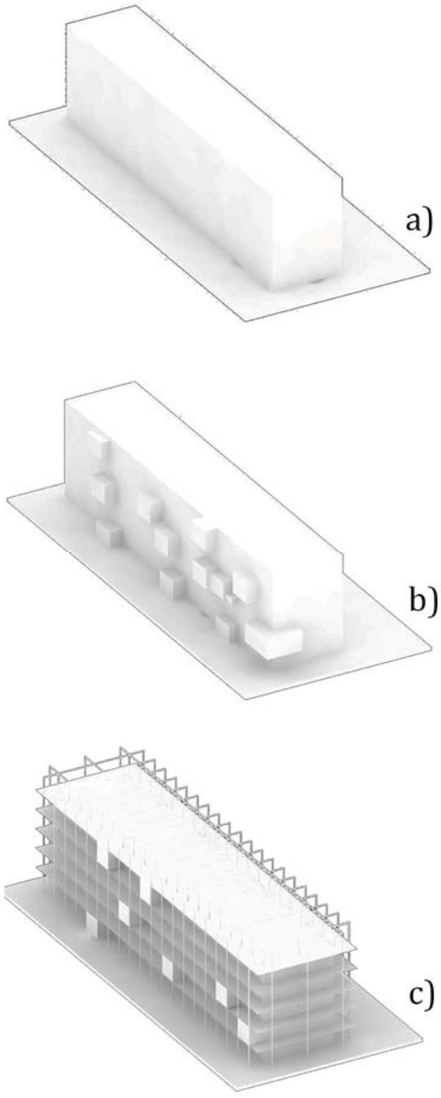

Fig. 8. (a) - Socialist building model, 1968; (b) Irregular cantilever spaces, 1990s; (c) Light structure including the irregular enlargements.

"It is becoming increasingly clear that the twenty-first century marks a turning point in human history" [9] and more than ever, the crisis we are all experiencing nowadays shows the absolute necessity to build in a more comprehensive perspective. It would integrate technical rehabilitation envelope aspects in the frame of complex urban regeneration with the purpose of adjusting the new perspective to vulnerabilities challenge, identifying and exploiting the real potential by recycling this urban heritage with all its cultural and physical components.

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