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THE CITY CHALLENGES AND EXTERNAL AGENTS.
METHODS, TOOLS AND BEST PRACTICES

THE CITY CHALLENGES AND EXTERNAL AGENTS. METHODS, TOOLS AND BEST PRACTICES

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The cover image shows the building of Kharkiv National University of Civil Engineering and Architecture, destroyed as a result of a missile and bomb attack. March 2022 (Source: STRINGER/Reuters/Forum. <https://www.pism.pl/publications/sweden-on-the-russian-aggression-against-ukraine>)

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Urban space at the time of the war. Configuration and visual image of Kharkiv (Ukraine)

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Abstract

This paper is devoted to consider the changes in the surrounding artificially created environment under the influence of the tragic circumstances of the Russian military invasion in Ukraine and the peculiarities in the perception of the urban environment, resulting from the interaction between it and the people.

The war has changed the usual visual image of Ukrainian cities: many cities suffer from shelling, many objects of architectural and cultural value have been destroyed. The ruins of Mariupol, Kharkiv, Mykolaiv, Izium will represent the new view of these cities for a long time, as a reminder of the terrible events and suffering of individuals and communities. A lot of visual-informational forms have appeared, accompanying on the mental, content and emotional levels the resistance of Ukrainians.

Visual forms capturing the destruction of streets and houses, household activities, suffering and pain of residents are shown focusing on the case study of Kharkiv, whose inner geography is considered within a configurational framework. The article, written under the storm that is still ravaging Ukraine, also displays a variety of "pictures" of people's living in the Kharkiv metro, whose intended use is transformed into a shelter. Fragments and knowledge elements that ought to be recollected and put together while discussing strategies and choices for reconstructing Kharkiv when the weapons are finally laid down.

Keywords

City image; Configuration analysis; Visual perception; Metro station; Bomb shelter; Destruction; Reconstruction.

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1. Introduction

The purpose of this paper is twofold. On the one side, it aims at reflecting on the genesis of the configurational state of Kharkiv throughout its modern development, briefly discussing the way the morphologic pattern of the urban grid matches and reproduces the inner geography and the socio-spatial logic of the settlement, as observed in the different phases of its growth as well as in its present form: so as to comprehend the context where the current war events are currently taking place. On the other hand, and in the light of this overall picture, the paper is devoted to consider the changes in the surrounding artificially created environment under the influence of the tragic circumstances of the Russian military invasion in Ukraine and the peculiarities in the perception of the urban environment, resulting from the interaction between it and the people.

The two issues are closely linked by the conceptual framework of space syntax, that assumes a city as a socio-spatial mechanism aimed at favouring social interaction in space:

"Space syntax is built on two formal ideas (...) The first is that we should think of space not as the background to human activity, as we think of it as the background to objects, but as an intrinsic aspect of everything human beings do. (...) The second idea is that human space is not just about the properties of individual spaces, but about the inter-relations between the many spaces that make up the spatial layout of a building or a city" (Hillier & Vaughan, 2007).

It is the assumption of a city as a socio-spatial system that suggested to analyse spatial grids using methods, computational tools and parameters that had long been used in social network analysis, and that sociologists had borrowed from graphs theory and network analysis when a relational mode of thought was introduced into social studies. And it is precisely the integration and complementarity of spatial and social issues in urban systems what allows observing in Kharkiv the social effects of war destructions on spatial perception and individual and collective behaviour.

It should also be observed that in a configurational view the spatial grid of a settlement, primary element of the phenomena that occur along the paths, was acknowledged (Rabino & Cutini, 2012; Cutini, 2022) as the material depository of its urban resilience, intended as its capacity to sustain perturbations, disruptions and local alterations under disasters or unpredictable events: and hardly there are disruptions more devastating and unpredictable than those caused by war and missiles.

Some cautions are needed, to be preliminary underlined in the current circumstances, so very difficult and sensitive. A first caution is practical and patently obvious: given the sensitive nature of the topics, no detailed information on the local situations and spatial circumstances of places affected by the current war events will here be provided. All the mentioned spatial references are taken from historic sources, or extracted from open access data, freely available in the web.

Another issue is the unavoidable temporariness of findings and observations. Today, at the very moment of writing these contribute, under the war that is still ravaging Ukraine, it is not possible to know the forthcoming events and when the weapons will be laid down, putting a definite end to the traumatic transformation of urban space, perception and behaviours. At this time of uncertainty, we can only detect and discuss aspects that cannot but be marked by temporariness and transience, as well as destined to be overtaken by unforeseeable events. Nevertheless, precisely in this time of war it appears important to give witness to the current spatial and social devastations while they are underway.

A further caution is more general, and far less obvious: it is out of the purpose of this paper to grasp for some correlation between tragic war events and configurational issues, what would not be allowed by the available information and, even if possible, would be unacceptably disrespectful to individuals and communities suffering from such a tragedy. On the contrary, it is aimed at opening a window to discreetly observe perceptions and behaviours within the devastated urban environment of Kharkiv, sketching fragments that ought to be recollected and put together, once this tragedy is finally all over.

2. The city of Kharkiv and its configuration

Grief and destructions seem to be written in the destiny of Kharkiv, as the city - like other cities of Sloboda Ukraine, such as Sumy, Akhtyrka, Ostroh - was founded in the XVII century as a fortress, built in a troubled period of disorder and conflicts due to persisting clashes between Cossacks, Crimean Tatars and the Polish-Lithuanian Commonwealth.

The fortress was built on the slopes of the hills that converge on the confluence of the rivers Kharkiv and Lopan, where the original urban area was enclosed within the triangular perimeter of the town-walls, roughly corresponding to the outline composed of the present Kvitky-Osnovianenka Street, Maidan Konstytutsii (Constitution Square), Pavlivsky Maidan, Serhiivskyi Maidan and Bursatskyi Uzviz. In the nineteenth century the first growth direction was addressed northward by the location of the new government centre, corresponding to the junction of the two radial roadways reaching the fortress, Klochkivska (from north-west) and Sumska (from north-east), imprinting on the growing settlement the pronounced Y pattern that for decades was to characterize the spatial development of the northern part of Kharkiv.

A strong impetus for urban growth was given early in the nineteenth century, when Kharkiv, under a process of intense industrialization, was appointed – from December 1919 to January 1934 - as the first capital of the Ukrainian Soviet Socialist Republic, position that enhanced the pivot spatial role of the government centre, central node in Viktor Trotsenko's masterplan: here the government centre (hinging on what was later named Dzerzhynskyi Square and presently Freedom Square ('Maidan Svobody' in Ukrainian)) is shaped as a composition of two open spaces, a circular plaza and a rectangular square, geometrically arranged so as to enclose what at the time was claimed to be, with its 11.5 hectares, the largest open space in Europe. Five radial streets were drawn departing from the centre of the circular plaza, crossing Derzhprom architectural complex (see Fig.7) and addressing the external radial development of the city according to the overall urban scheme that was worked out by I. F. Voitkevych in 1924 (Hewryk, 1992).

In the years preceding the II world war the strong population growth and the housing problem were tackled by the construction of massive residential neighborhoods so as to make Kharkiv a living laboratory for proposing new housing and spatial patterns for the socialist city: the garden city concept, with mass low-rise housing construction, was initially implemented, soon replaced by the house-commune pattern and residential combines typologies (Didenko et al., 2016). The neighborhoods were located all around the inner core, along the streets departing from the original fortress site, so as to give rise to a powerful model of radiocentric growth.

In the Twenties and Thirties, the development of Kharkiv was under the influence of utopian ideas formed within the Soviet system, and revolved around reconstruction of the way of life, cultivation of the new socialist education, and improvement of cultural and consumer services. These ideas made a great impact on architectural and urban planning activity. The industrial district "New Kharkiv" and the new administrative center "Kharkiv-City" are city-forming structures that were innovative and soon became integral parts of the 20th century urban heritage (Shpara, 1967).

The post-war decades, with the increasing growth of the population up to the present 1,400,000 inhabitants, further fostered the scattering of neighborhoods in the suburban territory, located all over the wide area included within the highways ring-road, with a particularly high density in its north-eastern and south-eastern parts, along the present Akademika Pavlova Street and Heroes of Kharkiv Avenue (Heroiv Kharkova Avenue). This is obviously not the place to enter the wide debate on Soviet urbanism or discussing the contribute that on such regard may arise from Kharkiv. A comprehensive overview on urban development and planning of Kharkiv in 1950s-1970s is provided by Alforov (1972) and Liubarskyi (1960), while the urban planning of Kharkiv residential areas is described by Tiulpa (1964). More in general, the volume "Soviet modernism, brutalism, post-modernism: buildings and structures in Ukraine 1955–1991" presents a comprehensive study of post-war Soviet architecture and a key for understanding the historical and political context of the

multifaceted modernist architectural movement in Ukraine (Gubkina, 2019), while an overview of the Kharkiv architectural heritage can be found in a collective monograph by Shkodovsky et al. (2002).

The recent post-Soviet years are characterized by unsystematic urban growth, with the progressive saturation of the urban spaces left unused in the previous general plans, gradually bought out by investors and built up, mostly with commercial massive activities.

As a key for interpreting the genesis of Kharkiv spatial layout a configurational approach will be assumed, using the theoretical concepts and the analysis tools that, under the name of Space Syntax, were introduced at the end of the twentieth century by Bill Hillier (1984, 1996). The approach is based on the fundamental role of the urban grid as a primary element in the making of the phenomena occurring along its paths, in particular the distribution of movement flows and the location of economic activities. In order to appraise such role, several indices were introduced, depending on the topologic relationships between the spatial elements that form the grid (Hillier, 1996).

By means of these relations, the configurational state of the system – as well as the configurational value of each of its elements - can be defined (Hillier, Hanson, 1984) through the use of several selected indices, namely the connectivity value, the choice value and the integration value. We call these parameters configurational, meaning that they do not refer to the intrinsic features of a spatial element, but depend on the relations mutually connecting it to all the elements in the rest of the system. The connectivity value measures the number of elements directly connected with the observed one, the choice value measures the frequency an element is on the shortest paths connecting all the other couples of elements, and the integration value measures the mean depth of an element with respect to all the other elements in the system. Those three parameters are suitable for reproducing different kinds of centrality: connectivity reproduces the capability of an element to work as a hub, focal point of local connections, choice reproduces the capability of an element to work as an intermediate location, intercepting through movements, and integration, by far the most important configurational parameter, reproduces the capability of an element to work as a terminal, easily accessible from any other place in the settlement (Cutini, 2001).

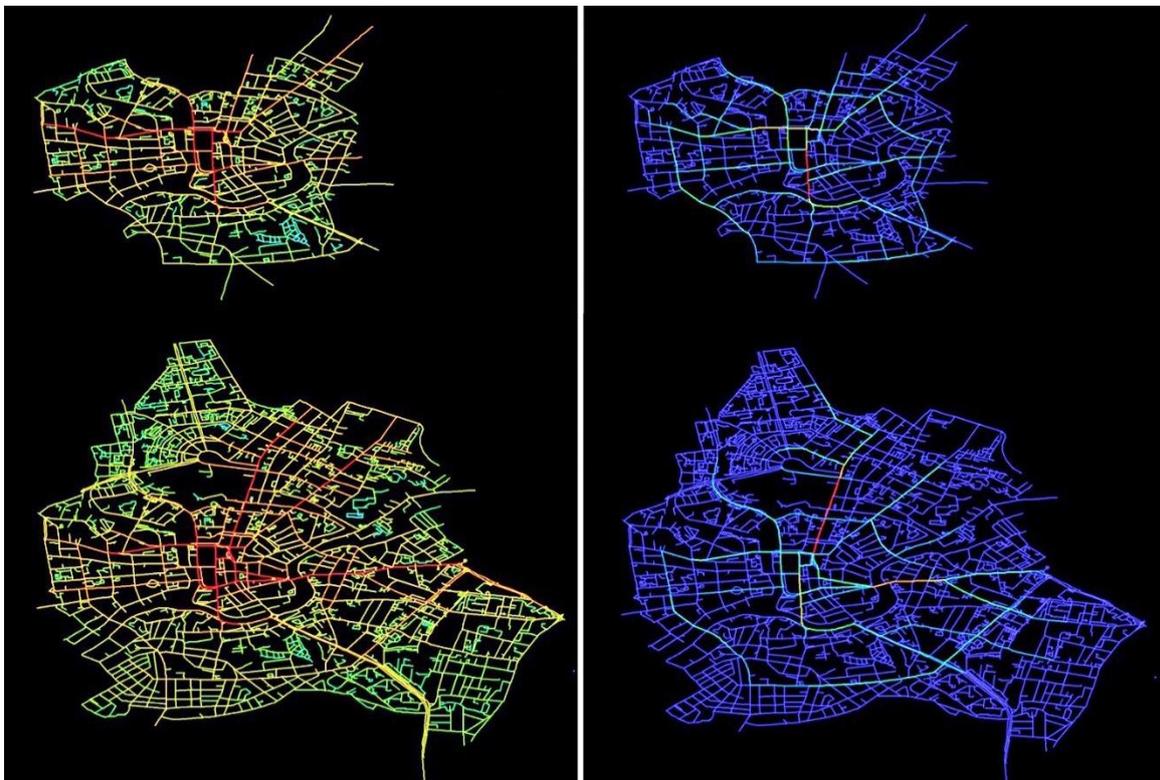


Fig.1 Global integration (left) and choice (right) values in the segment map of Kharkiv, at the end of nineteenth century (top) and in the '30s (below)

In order to analyse a grid configuration, several operational techniques have been so far introduced, distinguishing from one another for the different way to reduce the spatial grid into a system. In order to diachronically analyse the configuration of Kharkiv the so-called Angular Segment Analysis will here be used, "one of the most fundamental analyses in space syntax practice that helps understand movement, land-use and other socio-economic patterns" (Kolovou et al., 2017, p. 1); the system to analyse is the segment map of Kharkiv at different times, composed of the segments that result from the intersection of the lines of its axial map, that is the longest and fewest lines suitable for connecting all the spaces of the urban grid (Turner, 2000).

The angular segment analysis of Kharkiv was then carried out considering a sequence of five systems, corresponding to the urban grid at significant historical phases: the end of nineteenth century, the beginning of the '30s, the end of the '70s, the end of the twentieth century and the current date. The main results, referred to the centrality indices of integration and choice, are summarized in Figg.1-3.

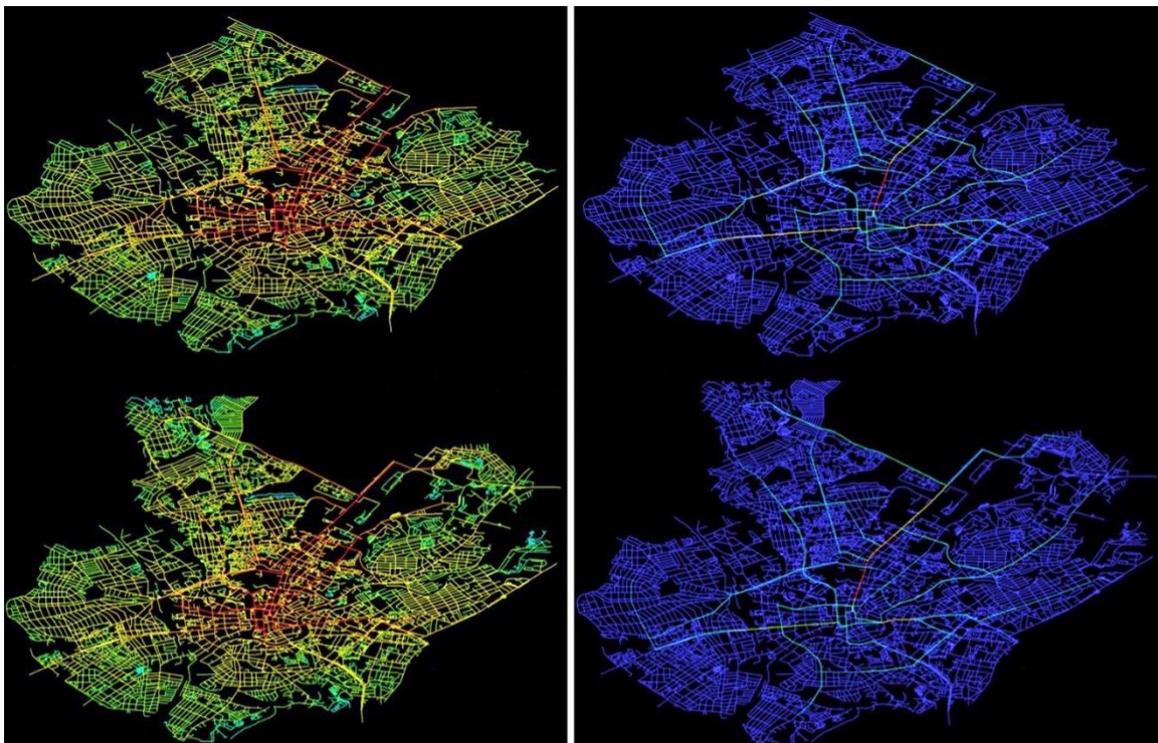


Fig.2 Global integration (left) and choice (right) values in the segment map of Kharkiv, in the '70s (top) and in the '90s (below)

Several information can be easily drawn out of these results. First, the layouts in Fig.1 (top left) point out the original integration core of the grid, clearly located within the meander of the river Kharkiv close to the confluence of Lopan. The bridges that respectively cross the two rivers also correspond (Fig.1, top right) to the two segments with highest choice values, pointing out them as the basic elements in the distribution of movement flows all over the inner core of the settlement. The two maps below show the effects of the first urban growth in the early 20th century, with the making of the northbound Y pattern centred in the government centre and the arising Sumska as a strong integrator (Fig.1, bottom left) as well as provided with the highest choice value (Fig.1, bottom right), what highlights it as the arising axis in the modern development of the city.

The images in Fig.2 represent the configurational effects of the growth of Kharkiv in the twentieth century, that can be summarized in a shifting of centrality heading north-east and in a clockwise rotation of its backbone axis, which appears completed in the current configurational state (Fig.3): here the integration core of the whole grid is oriented towards east, and the highest centrality levels pertain to the two radial axes of

Akademika Pavlova Street and Heroiv Kharkova Avenue and to the north-eastern sections of the highways ring road surrounding Kharkiv.

Figs. 2 and 3 allow to detect the making of the skeleton of the distribution of movement flows, characterized by the main roads radiating from the inner core of the settlement, provided with particularly high values of choice in their eastern sections. Indeed, it is a recurrent configurational pattern, that typically characterizes the cities that have experienced a similar mode of growth: as it was shown with reference to other contexts (Cutini, 2016; Cutini et al., 2020), a radial development around a compact inner core is likely to determine a strong polarization effect, with the radial arteries and the outer ring roads gaining the highest choice values all over the grid, at the expense of all the minor roads structuring the urban fabric.

In addition, it is also interesting to observe in Fig.4 the configurational features of the residential neighborhoods that were built in the course of the twentieth century, scattered all over the grid and highlighted by the attribution of remarkable values of local integration.

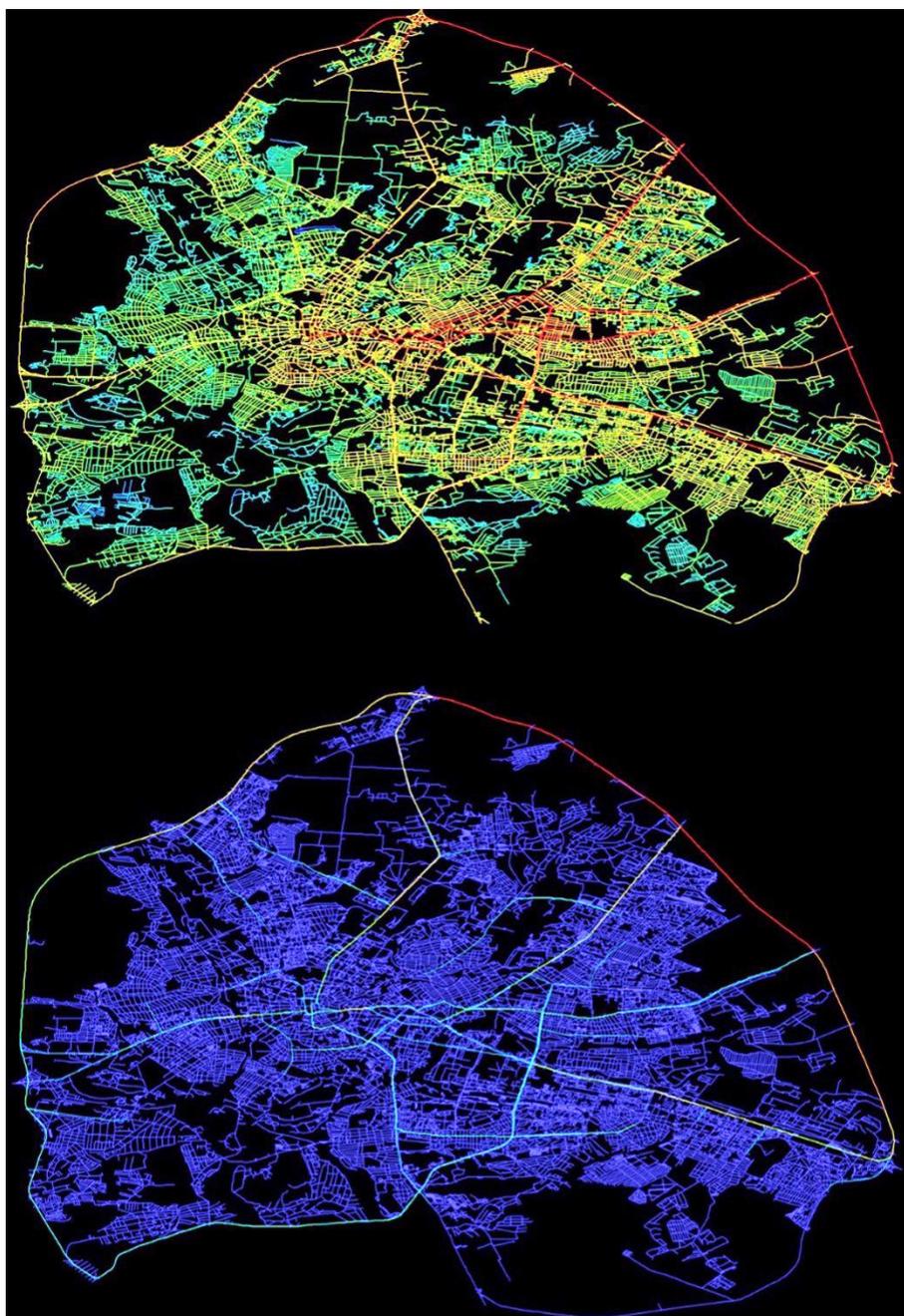


Fig.3 Global integration (top) and choice (below) values in the present segment map of Kharkiv

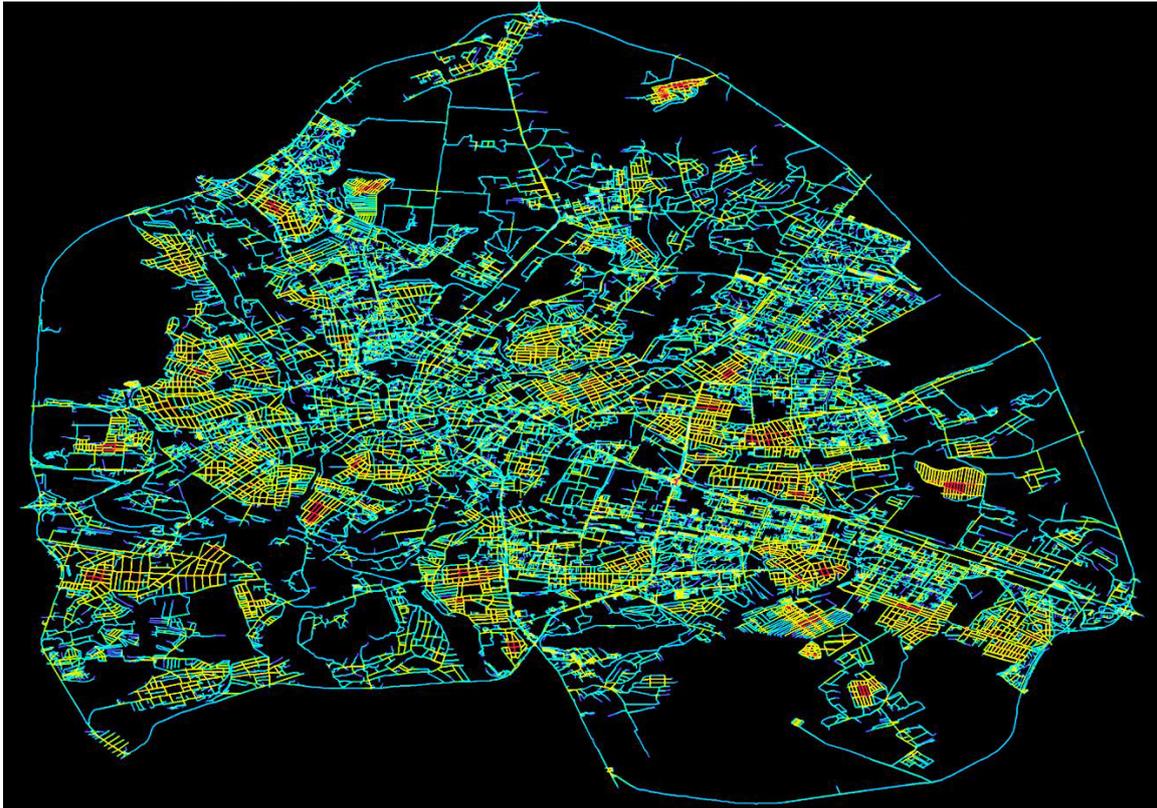


Fig.4 Local integration values in the segment map of Kharkiv

3. At the time of the war

At dawn on February 24, 2022, explosions were fired in many cities of Ukraine. Russia launched missile and air strikes on radars and air defense missile systems, air bases, ammunition depots of Army Field Forces brigades. Kharkiv is the city from which the Russia's full-scale war in Ukraine began, when the first explosions thundered there around five in the morning.

According to the Mayor of the city, during the six months of the war, as a result of shelling, more than 4 thousand residential buildings, 110 schools, more than 100 kindergartens, more than 50 healthcare institutions and hundreds of other administrative and non-residential buildings have been destroyed to various extents. A number of universities are among them, in particular those that train specialists in the field of civil engineering and architecture. Also, the invader purposefully destroys the energy supply system, transport and engineering infrastructure facilities (Mayor's Office, 2022).

The very first hours of the war radically transformed the image of a peaceful, colourful, cheerful city.

To protect against fragments, windows of the above-ground floors were scotch taped, as if they were crossed out, and windows of semi-basement floors and basements were covered with sandbags for protection. A few days later, as a result of bombing and missile attacks, many window openings were left gaping with ominous holes, and some of them were covered with hastily boarded-up plywood.

The city statues were protected with the same bags. The monument to Taras Shevchenko, the outstanding Ukrainian poet, writer, artist and thinker, one of the main national symbols of Ukraine, a multifaceted sculptural composition in the style of socialist realism with elements of the Stalinist empire style and art deco, a monument that was created in the '30s, when Kharkiv was the capital of Soviet Ukraine and is the most known monument to Shevchenko, was enclosed within a special structure with a protective net.

In Kharkiv and elsewhere, the image of monuments, the main symbols of cities (Kyiv, Odesa, Dnipro, Zaporizhzhia, etc.), covered with sandbags for protection, is becoming a common, branded artistic technique for posters and patriotic leaflets.



Fig.5 The building of Kharkiv National University of Civil Engineering and Architecture, destroyed as a result of a missile and bomb attack. March 2022
(Source: STRINGER/Reuters/Forum. <https://www.pism.pl/publications/sweden-on-the-russian-aggression-against-ukraine>)

All over the city, signs of bomb shelters and protective constructions appeared on walls of buildings. Concrete block barriers were erected at many points along major highways and access roads to slow down passways and to control traffic, as well as checkpoints, structures for protection and the ability to fire. Road signs in all directions were dismantled or pasted all over in order to make wayfinding difficult to the invading army. But billboards and all kinds of posters with patriotic content appeared, they were addressed to defenders and residents, and, conversely, with reproaches and curses towards invaders.

Anton Gerashchenko, advisor to the Ukraine's Minister of Internal Affairs, made an appeal to owners of outdoor advertising objects (billboards, light boxes, advertising structures on walls of buildings) to place the appropriate inscriptions on their own, without any approval, without embarrassment in expressions.

The most common were signs explicitly addressed to the Russian troops. The most popular destination is the meme expression "Russian warship, go fuck yourself" from the defenders of Snake Island.

On other billboards, Ukrainians offer the occupiers to leave their lands, disobeying orders: "Russian soldier, stop! How will you be able to look your kids in the eyes? Go away! Stay human", "Russian soldiers are not welcome here. Instead of flowers, bullets are waiting for you. Go away, return to your family", "Ivan, has your mother already known that you are killing Ukrainians?", "Putin lost. The whole world stands with Ukraine". Most messages to Russian soldiers in Ukraine were urging them to leave "without blood on your hands" etc. War has changed the face of the city. Photo and video reports on the life of cities, tourist posters, advertising banners on websites, in addition to architectural sights and natural landscapes, always show their inhabitants (laughing, joyfully walking or skipping, or lying on green grass, or inhaling the smell of flowers, squinting in the sun, breathing aroma of coffee).

Now the faces, captured by photojournalists, have become grim visaged, gloomy, tired, showing pain, horror, despair. People fuss, hurry, carry belongings in their backpacks and in their hands, drag children behind them. Silent queues stretched to those shops and pharmacies that were not closed. The fear of being under shelling has not yet appeared and strengthened, and people do not scatter even under the sounds of shell explosions rumbling in the distance.

A view of city streets packed with cars, slowly flowing and stretching towards the exit out of the city, should be added to these shots. As it was shown above, Kharkiv has a radial planning structure with elements of a ring structure. From the very first days, the city was caught in a semicircle of encircling.

The northern (Oleksiiivka, Piatykhvatky), north-eastern and eastern (Saltivka, the largest residential district of the country, with population as Mariupol, about half a million), southeastern (industrial territories, districts of Kharkiv Tractor Plant and Rogan residential area) radial roads were under the control of advancing troops. There was only one free evacuation vector – the western one, the direction to Poltava – Kremenchuk – Kropyvnytskyi – Vinnytsia and further to the western Ukraine or abroad to Poland, Slovakia, Hungary. This radial road corresponds to the Poltavskyi Shliakh highway, on which all streets and avenues merge and converge. Behind the city exit, other cars try to join this stream, moving from two sides along the external ring road.

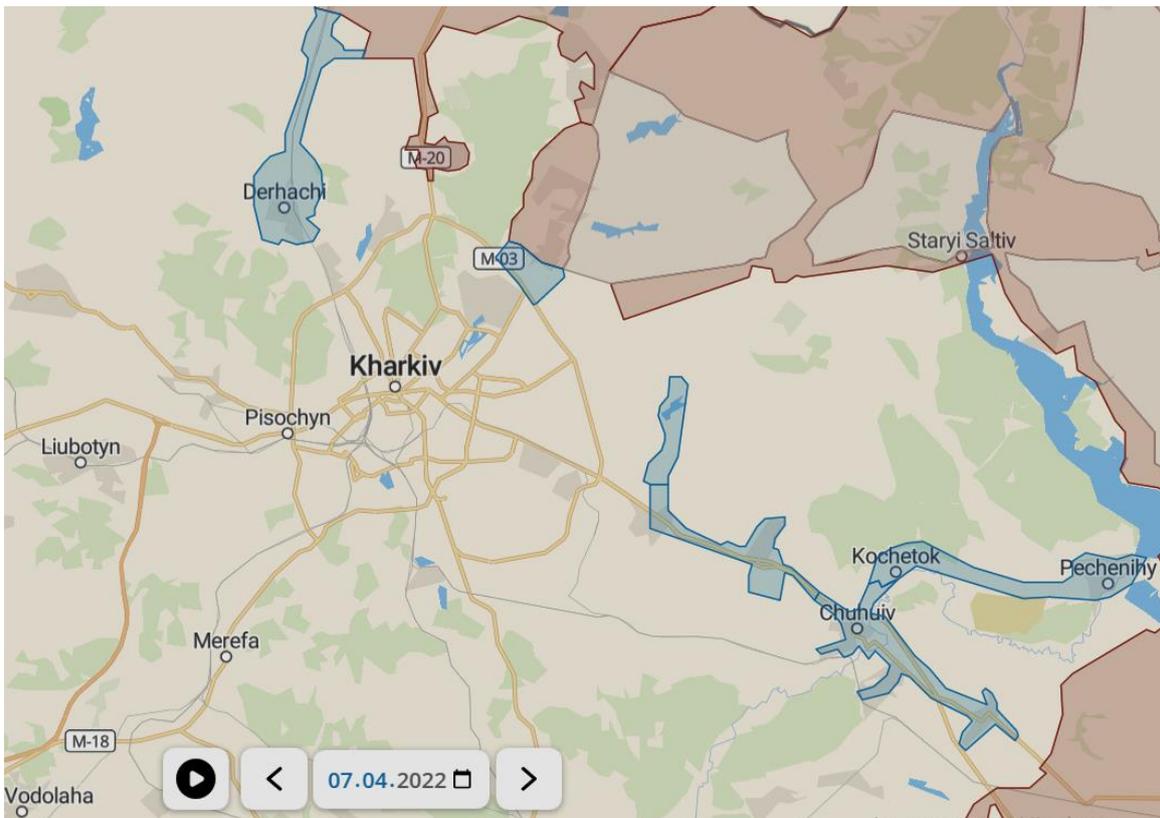


Fig.6 Map of the Kharkiv encirclement by Russian troops at 07/04/2022
(Source: <https://deepstatemap.live/en#9.75/49.9346/36.1983>)

The evacuation of Kharkiv and the region inhabitants had an unprecedented, never before experienced scale. Some data: in 2020 the population of the Kharkiv region was 2.6 million people. Since then, almost half of the inhabitants were forced to leave because of the war: at September 2022, 672 thousand people left the Kharkiv region abandoning their destroyed dwelling or the combat zone, while almost 300 thousand people left their homes, still remaining in the region.

From 7,000 to 8,000 people are registered as migrants every week in the Kharkiv region; only in Kharkiv more than 150 thousand residents lost their homes.

Many people were evacuated from the northern part of the Kharkiv region, which was substantially destroyed by the occupiers (Kharkiv Today, 2022). Property damages affecting only multi-storey buildings are estimated 103 billion hryvnias.

In order to consider the scope and effects of war destructions on the inner geography of Kharkiv, it can be interesting to compare (Fig.7) the distribution of global integration values all over its grid (suitable for

reproducing the levels of urban centrality) with a building damage assessment based on satellite imagery collected on June 15th, 2022.

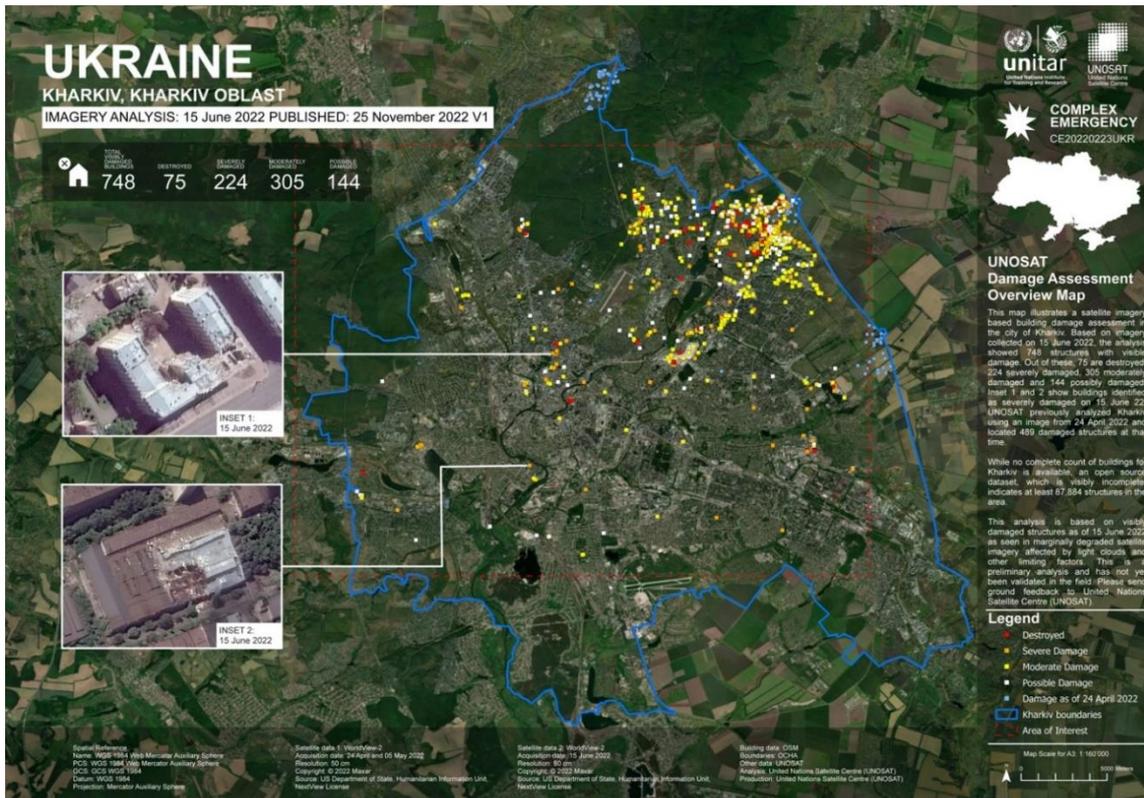


Fig.7 Satellite imagery, at June 15th 2022¹, based building war damage assessment (above) and global integration values

¹ Source: <https://reliefweb.int/updates?view=maps>

The image, published by Reliefweb, a service provided by the United Nations Office for the Coordination of Humanitarian Affairs, shows 748 structures visibly damaged in the city of Kharkiv (Reliefweb, 2022).

It is noticeable in Fig.7 that the location of a large proportion of the damaged structures (at June 15th, 2022) corresponds to some of the most integrated segments all over the grid, both in the inner core and in the outskirts, in particular the north-eastern, along Akademika Pavlova Street, where high values of urban attractiveness stand for a remarkable concentration of economic activities and interaction places.

If this correspondence is anything but surprising, since major economic activities are usually targeted objectives of any war bombing, yet researches so far (Cutini, 2013) attest the heavy effects of disruptions on the whole settlement when they affect its integration core.

It is also to be pointed out that the radial structure of the city, described and discussed above, actually represents a vulnerability element in the global system configuration, due to the marked polarization in the distribution of movement flows, channelled into a limited number of spatial elements, as reproduced by the distribution of choice values and confirmed by the high value of the frequency index (Cutini, 2013).

The few segments that are provided with the highest choice values (namely, as it was said, the main arteries radiating from the inner core and the outer ring road) (Fig.3), represent Achilles' heels of the settlement, as their disruption could easily determine the breaking of the system (Rabino & Cutini, 2012).

Even if the issue of massive war damage sadly runs throughout millennia of history, from Chartago and Jerusalem to Mosul, as it was to be expected the current tragic events have recently drawn the attention of the scientific debate on the issues regarding the matter post-war planning of destroyed cities (Alvanides, Ludwig, 2023), mostly based on the re-interpretation of the reconstruction processes after World War II (Knauer, 2023; Szczepańska, 2023; West, 2023) and discussing the legacies of planning decisions on the social and urban fabric of today's cities.

Moreover, even before the present war space syntax methods and techniques have been used to analyse spatial dynamics in case of war events (Wang et al., 2019); and the above reflections on the poor network resilience of the whole grid of Kharkiv should be taken into account when considering the effects of war destruction on the working of the settlement.

Furthermore, the role of configuration and visual image in the interpretation of the urban landscape in post-war reconstruction was acknowledged and discussed (Czarnecki, Chodorowski, 2021), showing a decrease in the number of spatial elements of the urban grid as a frequent result of post-war reconstructions, actually impoverishing the imageability of the city and the complexity of its whole configurational state: all the more reason to give very careful consideration to visual and configurational issues while discussing strategies and choices for reconstructing Kharkiv when the war comes to an end.

In fact, it has to be said that, as early as in the first months of the war, Ukrainian architects in close cooperation with the team of Norman Foster started discussing the Kharkiv masterplan in a context of post-war reconstruction, so as to seize the chance for a fundamental revision of the entire urban structure of the city.

4. The image of Kharkiv through the eyes of students

The findings resulting from the configuration analysis ought to be complemented by the exploration of the perceived vision of urban space. Lynch's (1960) concepts of imageability and readability, the idea of the relevance of how people see and interpret the city, create their own image of it, their own mental maps, through the elements and signs of the urban landscape on the behaviour within it, as well as Robert Venturi's reflections (Venturi et al., 1972) on the importance of signs and symbols in sensing the urban landscape suggest to consider the effects of the change in the perception of the physical elements of the city (signs, posts, lighting, parks, stores etc.). And the eyes of students provide a prominent point of view on Kharkiv.

Pre-war Kharkiv was in fact considered the "student capital" of Ukraine: 69 higher educational establishments of various forms of ownership and accreditation levels, including 17 universities and 9 academies, trained

specialists in Kharkiv. The specializations of universities are very different: from technical to agricultural, from military to creative, from medical to economic. Three Nobel laureates lived and worked in Kharkiv. More than 160,000 students, including about 12,000 foreign students, have studied (and are studying now, but remotely) at the universities of Kharkiv (Kharkiv City Council, 2021).

In 2020, a survey was conducted among students of the Historical and Philological Faculties and the Faculty of Mathematics and Information of V.N. Karazin Kharkiv National University within the framework of the inter-university project for the exploration and rethinking of the symbolic space of several key cities in eastern and southern Ukraine including Kharkiv "CityFace: Practices of the Self-Representation of Multinational Cities in the Industrial and Post-Industrial Era". Respondents' answers made it possible to identify the architectural dominants, attractive places and locations of the urban space, which, according to students' opinion, are significant for the city. The survey materials show the peculiarities of interaction / mutual influence of residents and urban space. The results interpretation was based on the lifestyle concept of the French sociologist P. Bourdieu (Bourdieu, 1998) and the lifestyles theory of the German historian M. Dinges (Dinges, 2000).

Without any doubt, the students' perception of the city is influenced by their daily route through the urban space: their housing - university buildings (educational buildings, laboratories, the Central Scientific Library, a sports complex, etc.) - places of recreation in the city (parks, food services areas, cultural and educational institutions or cultural and entertainment centres) - place of work / another option - their own housing. In fact, this route determines that for the vast majority of the interviewed students (more than 83%) Kharkiv is the "centre", first of all. Among the mentioned objects that characterize the city, such buildings as Derzhprom (House of State Industry), V. N. Karazin Kharkiv National University and Kharkiv National Academic Opera and Ballet Theatre named after M. V. Lysenko, the "Mirror Stream" fountain, Maxim Gorky Central Park of Culture and Leisure, and Freedom Square are of high priority. An interesting fact is that young people do not pay much attention to the historic and cultural objects, which were chosen in the contest «Seven Wonders of Kharkiv» in July 2008 (Kharkiv guide, 2008), primarily religious buildings - the Pokrovsky and Annunciation Cathedrals, the Cathedral of the Assumption of the Blessed Virgin Mary. Students are more unanimous in choosing a monument - the "face" of Kharkiv. In particular, more than 120 respondents give preference to the monument to the Ukrainian Kobzar Taras Shevchenko in the City Garden.



Fig.8 Derzhprom (House of State Industry), the first Soviet skyscraper, built in 1925-1928, the main architectural landmark of Kharkiv (Source: Photo by Vasily Golosny)

It should be noted that a number of other buildings and architectural monuments of Kharkiv, mostly (but not only) located in its central part, making up the "postcard" representations of the city, as traditionally placed in photo albums and guidebooks, remain unnoticed or not understood: among them, for instance, the building of the Mechnikov Institute of Microbiology and Immunology of the early twentieth century, which is one of the most striking buildings in the neoclassical style of the most eminent Kharkiv architect Oleksii Beketov, or the building of Kharkiv State Academic Puppet Theatre named after V. A. Afanasiev in the Art Nouveau style, also designed by O. Beketov, as well as the Centre for Science and Technology and the Kharkiv State Automobile Transport College. All those three buildings are located in one row in the historical part of Kharkiv, on the central and the oldest square of the city - the Constitution square. The two last-named buildings were badly damaged during the war of 1941-1945, and now they are again with broken windows.

The students did not mention the architectural monuments of other famous Kharkiv architects of the beginning of the last century - Volodymyr Pokrovskiy and Viktor Velychko (a residential building in the Art Nouveau style with elements of English Gothic), Oleksandr Ginzburg (a residential building on Pushkinska Street and a commercial apartment building on Sumska Street, both in the Art Nouveau style, or one of the first modernist buildings in the city on the same street). It is surprising that, in the survey, students have ignored the Commercial and Manufactory building in the constructive modernist style of Oleksandr Rzhepishevskiy and Oleksandr Ginzburg, to say nothing of the constructivist era monuments of the 1930s such as the Central Post Office (architect Arkadii Mordvinov), and the Palace of Culture for the Railway Workers (architect Oleksandr Dmitriev) (in August 2022, this building was almost completely destroyed by a missile that directly hit it). Generally speaking, it is understandable, because students of architectural faculties didn't participate in the survey.

It can be considered as the important observation that in the minds of its inhabitants, Kharkiv was not a "border" city. In any case, the survey results showed that this fact was not perceived as its main characteristic (Krasko, 2020).

During the war, the same team of professors and students from V. N. Karazin Kharkiv National University, Kharkiv State Academy of Culture, Kharkiv National Medical University and other Ukrainian higher educational institutions has launched a project "City and War: Destruction, Preservation and Rethinking of the Urban Cultural Heritage of Large Cities in Eastern and Southern Ukraine within the Russia's Military Aggression". The project "City and War" focuses on the issues of preservation, investigation, and mediatization of various urban cultural heritage (tangible heritage - architectural monuments, urban area development, industrial heritage, monuments, memorials, landmarks, as well as museum, archival, and library objects; intangible heritage - urban celebrations, festivals, customs, urban language, street painting, cuisine, etc.), transformations of collective cultural memory and interpretation of cultural heritage by urban communities as well.

Tangible sites and intangible cultural values belonging to the cultural heritage of large cities in eastern and southern Ukraine are in the limelight of the project. As a complex, they create a unique historical and cultural urban landscape, which is embodied and at the same time influences the formation of cultural values and the collective identity of the urban communities (CityFace, 2022).

Among the specified topics of research, which is based mainly on the survey of respondents among student youth, are the following: "Mechanisms for creating a mental image of the city", "Self-representation of Kharkiv in coins, stamps and envelopes", "Reflection of the history of Kharkiv in guide books, religious images of Kharkiv", "Consumer goods in the symbolic space of the city", "Visual image of the city in the industrial and post-industrial era", "The Influence of Street Art on a City's Image".

5. A new image of the Kharkiv metro as a reflection of its new functions

Many objects have changed their usual functions out of necessity. The most illustrative change of the nominal function, formation and solution of new urgent tasks, brought by time, and, as a result, the change in the

perception of the visual and mental image of the urban space, can be traced on the example of the Kharkiv metro. This is understandable, since the underground is the safest place for citizens to stay. The Kharkiv metro is the fourth largest metro in the former USSR states. It is the second by the number of stations (30) and the length of the lines (39.3 km) in Ukraine after Kyiv.

From the first hours of the war, all metro stations have been transformed into shelters. Hundreds of people, fleeing the shelling, settled down inside the stations, on platforms, in lobbies and in train carriages. On February 24 at 15:00, trains of the Kharkiv metro were stopped to accommodate as many people as possible. Initially, the city dwellers went down into the subway to wait out the bombing, over time, the bulk of the people remained. As it turned out later, they remained for a long time. These are those who are fleeing the shelling, those who are forced to leave their homes and those whose homes have been destroyed. People organized their life: put up tents, arranged sleeping places. Metro workers equipped fountains with drinking water on the platforms and installed electric kettles.

Most live on mattresses on the small patches of platform space they have staked as theirs, beside their most treasured belongings and pets. Many on the platform are transfixed by their phones, their only contact with the outside world, other than a few minutes above ground each day for fresh air and some quiet, until it's punctured by the heart-stopping roars of shelling. The lucky few live in tiny tents for privacy or inside the subway cars, where blankets hang as walls from railings, which double as drying racks for clothes (Rubinsztein-Dunlop, 2022).

The director of Caritas-Spes reports on her visit to one of Kharkiv metro stations: "An underground network of train carriages and tunnels where people sleep, cook, study and where babies continue to be born despite the bombs. The metro station is a city within a city for a lot of people. The entire metro system has become a shelter housing approximately 60 to 70 people per station. The person in charge is responsible, among other things, for keeping a register of arrivals and departures so as to avoid overcrowding or vacancies. Once inside, we find a kitchen to our right. A form is displayed indicating the shifts and the number of people entitled to eat breakfast, lunch and dinner. A first-aid station on the left offers medical advice and medication. The trains – which once brought residents back and forth between the city – are no longer running. Each carriage has three entrances and a room has been created in each compartment for each family or group" (Biagioni, 2022). TV reporters, photographers, bloggers began to fill the media space with video materials, where they recorded how people live, sleep, cook and eat, give birth, get sick and recover, play with children, walk dogs, how teachers try to engage schoolchildren and pre-schoolers in their studies and keep them busy as far as possible under the current conditions. The visual image of the underground life of Ukraine's second-largest city was supplemented by pictures of a hairdressing and nail salon organized in the centre of the railway platform. Some reports give publicity to the work of volunteers performing a wide range of medical services: from cold symptoms treatment and dressings, bandages for the wounded and injured inhabitants during shelling of residential buildings to managing pregnancy and the coronavirus busting. Since the beginning of the Russian invasion, more than 100,000 Kharkiv residents live or have lived in the metro. Many of them have been living underground for several months, they experience panic attacks when undertaking attempts to go outside. Traumatized, some still refuse to leave these tunnels, which have been transformed into cavernous cities.

To ensure the vital activity of underground residents, the metro staff from the first days of the war remained at their posts to maintain technical units of the station in good order. This includes electricity, technical water, toilet facilities and so on. In addition, subway workers guided refugees through tunnels between stations to evacuate city residents to safer places. The Department of Civil Protection of Kharkiv Regional Military Administration, together with the Main Directorate of the State Emergency Service in the Kharkiv region, took actions to inform and educate the population regarding the necessary measures and rules of conduct under shelling. They were told how to behave correctly during shellfire, how to distinguish "outgoing", "incoming" strikes, and what to do in such situations, and how to provide first aid.



Fig.9 Fleeing shelling people live in the metro. Kharkiv, Heroiv Pratsi Station (meaning: Heroes of Labor), March 2022 (Source: <https://www.reuters.com/world/kharkiv-metro-is-city-where-hundreds-shelter-bombardment-2022-03-11/>)

The subway is the safest disaster shelter during bombing and even nuclear strikes. The Kharkiv metro, like many subways in the USSR, was built as a dual-use facility - both as a transport facility and as a shelter for civil protection of the population. Therefore, its entire infrastructure is intended for civil defence in case of armed hostilities. Consequently, the metro infrastructure is maintained in good condition in peacetime. Exercises are held on a scheduled basis for employees of the metro and related services. Therefore, the subway was ready to perform this function. However, before the war, the concept of organizing the stay of population in the shelter was somewhat different. It was considered that modern military operations are conducted differently than during the Second World War or other large-scale military operations of the past. They are more targeted, mass bombing with striking the civilian population is almost nowhere used. So all shelters were designed for temporary staying there for 1-2 hours with a capacity of 1-1.5 square meters per person.

In Soviet times, there was the concept of a bomb shelter. However, in accordance with the Legislation of Ukraine "Code of Civil Protection of Ukraine", such a concept didn't exist. As amended and supplemented in 2022, there are civil protection facilities, i.e. engineering facilities designed to protect people against exposure to hazard resulting in emergency, military operation or terrorist attack (shelters, antiradiation shelters, prefabricated civil protection structures), dual-use structures and simple design structures which can also be used to protect people against some hazards arising from an emergency in peacetime and munition impact during the special period. A dual-use structure is defined as a land or underground structure that can be used for its primary function and people protection (Verkhovna Rada of Ukraine, 2022).

On February 23, 2022, the day before the beginning of the invasion, Kharkiv Mayor Ihor Terekhov assured that, according to the regulatory standards, 154,000 people would be able to take shelter in the Kharkiv metro if necessary. All systems and conditions were prepared there: a ventilation system, an air supply system, food, medical care, water, both technical and drinking. All regulations and all requirements were absolutely met (Terekhov, 2022).

However, the doctrine of the civil protection did not assume the massive destruction of residential areas and, consequently, the constant stay of a large number of people in the metro space for a long time. Moreover, all conventions, regulations and customs of modern war did not let expect the bombing of civilian buildings, residential areas, cultural sites, places of people concentration such as shopping centres, train stations, markets. Furthermore, on June 20, after four months of the war, the depot building was destroyed as a result of a ballistic missile strike on the infrastructure of the Kharkiv metro. The roof was damaged, walls were partially destroyed, the explosion smashed in windows and several train carriages were also damaged.

According to Maslow's pyramid, the physiological needs are the most important, as they include those that are vital for survival. If physiological needs (e.g. air, water, food, shelter, clothing) are not satisfied the human body cannot function optimally. At the second level of Maslow's hierarchy, the needs for security and safety become primary. The long stay made it necessary to meet more complex needs of higher levels in the hierarchy. Educational classes were provided for schoolchildren daily at the metro stations "Students'ka" (meaning: Students' station), "Akademika Pavlova" (meaning: Academician Pavlov station) and "Zakhysnykiv Ukrainy" (meaning: Defenders of Ukraine station). A team of caring teachers was organized who volunteered to conduct classes in the metro.

To brighten up the joyless days of the war for the underground temporary residents, various activities were often organized there. Within the framework of the "Funk The Police" project, children from the Kharkiv metro were taught breakdance. The initiators of the idea, who for more than 20 years, together with the police, have been dealing with the problems of children in difficult life circumstances, tried to return children to normal life through dancing.

There were also other cultural and entertainment programs for underground residents. Artists of Kharkiv Academic Theater of Musical Comedy performed at different metro stations with concerts. Puppets and poetry also went underground to entertain Ukrainians sheltering in the Kharkiv metro. They exchanged emotions and it lifted their spirits. The children had the possibility to play with the puppets (Stenson, 2022).



Fig.10 Station "Istorychnyi Muzei" (meaning: Historical Museum) of the Kharkiv metro. Children's drawings are printed on top of advertising posters (Source: Photo by Mykhaylo Averbakh, August 2022)

An exhibition of art works created by children and teenagers with the support of a teacher from the Kharkiv art studio took place at the "Istorychnyi Muzei" metro station. Over the period of two weeks, young artists were reflecting on the topic of modern superheroes. They were drawing, cutting out paper figures, painting. As a result, four monumental sculptures of a Warrior, a Medical professional, a Volunteer and a Mother with Children appeared. Classes for children were initiated by the Aza Nizi Maza art studio with the "Together. Meeting Points" project, which was created by the non-governmental organization "Professional Development of Kharkiv" with support from UNICEF Ukraine. According to the founder of the art studio Mykola Kolomiitsev, the project about modern superheroes is an act of gratitude to all those who hold on and defend Ukraine.

Drawing is the most common activity for children in the underground city. Kharkiv Mayor Ihor Terekhov said that when he was at the first wedding in the subway, he noticed many children's drawings. "Children live there, and they draw their family, their car, their house, mom and dad with holding hands. After the war, I will display these huge children's drawings in place of advertising in the metro," said Terekhov (Terekhov, 2022).

The advertising in the Kharkiv metro mentioned by the Mayor was investigated by the authors of this article some time ago. The research was carried out in the context of the problem of contamination of the city's visual environment by the dominance of outdoor advertising (Averbakh, Demydiuk, 2017). Advertising in the city, being an integral attribute of the modern economy, and therefore practically not subject to regulation, distorts the architectural intent, violates the visual harmony created by authors-architects, artists, designers, based on verified compositional solutions, colour and light combinations, plasticity, architectural forms, careful selection of finishing materials and decor. Intrusive advertising, which claims to become almost the main factor in creating the visual environment of the modern city, has also penetrated underground. Substantially all free surfaces and spaces of the Kharkiv metro were sold for advertising. Everything is used, where a passenger is located: entrance lobbies, passages, stations, underground rolling stock outside and inside.

Successful underground spaces should be multifunctional, with well-planned and safe spaces for the public, but there is again a little bit more to it than that. Art and culture should also be included within underground spaces (Besner, 2017).

We can only hope that the post-war restoration of Kharkiv, whenever it may be, will give impetus to reconceptualize or develop a new concept for the making of the city's spatial environment, including the subway.

6. Conclusions

Each city has a spatial configuration, that keeps the keys for understanding its intimate *raison d'être* and its working as a socio-spatial mechanism for social encounter and interaction. And a city contains places, where people live and interact; the places that the war is massively destroying in Ukrainian cities. But "places are not local things. They are moments in large-scale things, the large-scale things we call cities. We cannot make places without understanding cities" (Hillier, 1996, p. 112).

Each city has its own face, its own image. This image is a mosaic, a combination of those sensations and visualizations that are formed by its inhabitants, guests of the city, and even those who have never been in it, but know something about it. For people temporarily residing in the city, these are mainly experiences that are associated with the places of stay (work, study, recreation, excursions, travels). For city-dwellers, these visualizations are more stable, because the accumulated impressions from childhood, myths and stories are added to them.

In the era of globalization, digitalization, informatization, virtualization and other "zations", any stories are brought into world on the web-pages, telemedia screens and social network channels. This is the place where the face, the image of the city is formed. The most attractive plots, facts, stories are published, and if we talk about the visual imagery, then these are camera angles, perspectives, plans, panoramas, fragments, details, and so on.

Since the beginning of the war, the city and its places were devastated. All mass media and social networks began to post pictures of destroyed buildings, broken military equipment, military heroes and captured invaders, people crushed by the war, bloodied, homeless and sitting in shelters. The pictures were reprinted, multiplied and dispersed by information channels around the world, imprinting to millions of people an overwhelming visual image of a wounded and bleeding city. The destroyed buildings of the Kharkiv region state administration, the V.N. Karazin Kharkiv National University and the "Palace of Labor", North Saltivka,

the largest residential district in the city, which has been turned into ruins, have become for the whole world a symbol of the horrors of war, suffering, deprivations, but also resistance to violence.

The image of a fighting city is formed not only by the chronicles of hostilities, shots of destruction, stories about the life of citizens living in the subway. It is complemented by people of creativity - artists, graphic artists, poster artists. They create their own cultural battlefield, expressing their attitude to what is happening in a visual form.

Architects, designers, urbanists create concepts for the future city, offer options for reconstruction, renovation, revival. Professionals and not only express their vision of the prospects for the restoration of Kharkiv. It is clear that the problems are much deeper, not only regarding the rebuilding of the destroyed buildings, but involving a fundamental revision of the city's resilience and security strategies and concepts of its development as a whole. It remains to express hope, moreover, confidence that in the near future it will be possible to investigate a rebuilt, renovated Kharkiv and to complete a chapter with the research of its new, changed image, well aware that the forthcoming planning strategies and choices will be called to define the urban and social conditions for future generations.

References

- Alforov, I. (1972). The present and the future of socialist Kharkiv, *Construction and Architecture*, 12, 28-33 [in Ukrainian].
- Alvanides, S., Ludwig, C. (2023). Bombed Cities: Legacies of Post-War Planning on the Contemporary Urban and Social Fabric, *Urban Planning*, 8 (1), 165-168.
- Averbakh, M., Demydiuk, O. (2017). *Sign of Visual Communication in Architectural Environment*. LAP Lambert Academic Publishing.
- Besner, J. (2017). Cities think underground—Underground space (also) for people. *Procedia engineering*, 209, 49-55. <https://doi.org/10.1016/j.proeng.2017.11.129>
- Biagioni, C. (2022). Kharkiv: the bombed city that lives in underground metro stations. Official website of S.I.R. Agenzia d'Informazione. Retrieved from: <https://www.agensir.it/europa/2022/05/06/kharkiv-the-bombed-city-that-lives-in-underground-metro-stations/>
- Bourdieu, P. (2018). Structures, habitus, practices. In *Rethinking the Subject* (pp. 31-45). Routledge.
- CityFace (2022). City and War. Website of the project. Retrieved from: <https://en.cityface.org.ua/projectheritage.html> [in Ukrainian and English]
- Cutini, V. (2001). Centrality and Land Use: Three Case Studies on the Configurational Hypothesis, *CYBERGEO – Revue Européenne de Géographie*, vol. 188. <https://doi.org/10.4000/cybergeo.3936>
- Cutini, V. (2013). The city, when it trembles. Earthquake destructions, post-earthquake reconstructions and grid configuration. In: Y O., Park H.T., Seo K.W. (eds.) *9thSSS Proceedings, Space Syntax 9th International Symposium*, Seoul (South Korea), 30.10.2013–04.11.2013
- Cutini, V. (2016) Motorways in Metropolitan Areas: The Northwestern Growth of Florence and the Urban Use of Motorway A1, *IJGI International Journal of Geo-Information*, 5 (77), 1-18. <https://doi.org/10.3390/ijgi5060077>
- Cutini, V. (2022). Cities at risk: spatial matrices of resilience and security, *Territorio*, vol. 97, 77-84.
- Cutini, V., Farese, D., & Rabino, G. (2020). Configuration and resilience: some remarks from the cases of Florence and Milan. *Plurimondi*, (18), 35-51.
- Czarnecki, B., & Chodorowski, M. P. (2021). Urban Environment during Post-War Reconstruction: Architectural Dominants and Nodal Points as Measures of Changes in an Urban Landscape. *Land*, 10(10), 1083. <https://doi.org/10.3390/land10101083>
- Didenko, C., Bouryak, A., & Antonenko, N. (2016). Residential Housing in Kharkov (Ukraine) 1920–1935. *ZARCH Journal of interdisciplinary studies in architecture and Urbanism*, 5.
- Dinges, M. (2000). Historical anthropology and social history: through the theory of "style of life" to the "cultural history of everyday life", In: *Odyseus. Man in history*, 96-124 [in Russian].
- Gubkina, I., Bykov, A. (2019). *Soviet modernism, brutalism, post-modernism : buildings and structures in Ukraine 1955–1991*. Kyiv, Berlin: Osnovy DOM.
- Hewryk, T. D. (1992). Planning of the Capital in Kharkiv. *Harvard Ukrainian Studies*, 16(3/4), 325-359.

- Hillier, B. (2007). *Space is the machine: a configurational theory of architecture*. Space Syntax.
- Hillier, B., & Hanson, J. (1984). *The social logic of space*. Cambridge university press.
- Hillier, B., & Vaughan, L. (2007). The city as one thing. *Progress in planning*, 67(3), 205-230. <https://doi.org/10.1016/j.progress.2007.03.001>
- Kharkiv City Council (2021). Kharkiv is a student capital. Official website of the Kharkiv City Council, mayor, executive committee. Retrieved from: <https://www.city.kharkov.ua/ru/o-xarkove/xarkov-studencheskaya-stolicza.html> [in Russian]
- Kharkiv guide (2008). Seven wonders of Kharkiv. Official website of the Kharkiv City Council, mayor, executive committee Retrieved from: <https://www.city.kharkov.ua/uk/dovdnyk/putevoditel-po-xarkovu.html> [in Ukrainian].
- Kharkiv Today (2022). Displaced residents of Kharkiv. How many of them are scattered across Ukraine? Official website of Kharkiv information and analytical portal "Kharkiv Today". Retrieved from: <https://2day.kh.ua/ua/kharkow/kharkivski-pereselentsi-skilky-yikh-rozkydano-po-ukrayini> [in Ukrainian]
- Knauer, B. (2023). From Reconstruction to Urban Preservation: Negotiating Built Heritage After the Second World War. *Urban Planning*, 8(1), 196-210. <https://doi.org/10.17645/up.v8i1.6133>
- Kolovou, I., Gil, J., Karimi, K., Law, S., Versluis, L. (2017). Road Centre Line Simplification Principles for Angular Segment Analysis. In: Heitor T., Serra M., Pinelo Silva J., Bacharel M., Cannas da Silva L. (Eds.) *Proceedings of the 11th Space Syntax Symposium*, 11. 2017, Lisboa: Instituto Superior Técnico.
- Krasko O. (2020). Features of perception of the city of Kharkiv by student youth (by survey materials), The Journal of V. N. Karazin Kharkiv National University. Series: History, 57, 106-119 [in Ukrainian].
- Liubarskyi, R. (1960). Unloading the center of Kharkiv from motor vehicles, *Construction and Architecture*, 7, 6-8 [in Ukrainian].
- Lynch K. (1960). *The Image of the City*. Cambridge, MA: MIT Press.
- Mayor's Office (2022). More than 4000 buildings are destroyed and damaged in Kharkiv. Official website of Media Group "Obektiv". Retrieved from: <https://www.objectiv.tv/objectively/2022/08/17/v-harkove-razrusheny-i-povrezhdeny-bolshe-4000-domov-meriya/> [in Russian]
- Rabino, G., & Cutini, V. (2012). Searching for Ariadne's thread. Some remarks on urban resilience and orientation. *TeMA-Journal of Land Use, Mobility and Environment*, 5(2), 7-22. <https://doi.org/10.6092/1970-9870/889>
- Reliefweb (2022). UNOSAT Damage Assessment Overview Map - Ukraine: Kharkiv, Kharkiv Oblast, Imagery Analysis: 15 June 2022 Published: 25 November 2022 V1. Retrieved from: <https://reliefweb.int/map/ukraine/unosat-damage-assessment-overview-map-ukraine-kharkiv-kharkiv-oblast-imagery-analysis-15-june-2022-published-25-november-2022-v1>
- Rubinsztein-Dunlop S. (2022). Inside Ukraine's underground city: No showers, no sunlight and no peace from Putin's rockets. Official website of ABC News, Sydney. Retrieved from: <https://www.abc.net.au/news/2022-04-22/kharkiv-a-new-secret-ukrainian-city-has-emerged-underground/101000764>
- Shkodovskyi, Y., Lavrentiev, I., Leibfreid, O., Poliakova, Y. (2002). *Kharkiv. Yesterday, today, tomorrow*. Kharkiv: Folio [in Ukrainian].
- Shpara, P. (1967). Kharkiv in the present and in the future. [The city development and improvement masterplan]. *Construction and Architecture*, 6, 8-11 [in Ukrainian].
- Stenson, J. (2022). Puppets, poetry go underground to entertain Ukrainians sheltering in Kharkiv metro. Official website of the online newspaper "The Times of Israel" Retrieved from: <https://www.timesofisrael.com/puppets-poetry-go-underground-to-entertain-ukrainians-sheltering-in-kharkiv-metro/>
- Szczepańska, B. (2023). Post-War Architecture and Urban Planning as Means of Reinventing Opole's Past and Identity. *Urban Planning*, 8(1), 266-278. <https://doi.org/10.17645/up.v8i1.6079>
- Terekhov, I. (2022). Advertisements in the metro will be replaced by children's drawings about the war. Official website of Kharkiv information and analytical portal "Kharkiv Today" Retrieved from: <https://2day.kh.ua/ua/kharkow/pislya-viyny-ukharkivskomu-metro-rozvisyat-dytyachi-malyunky> [in Ukrainian]
- Terekhov, I. (2022). Kharkiv metro will be able to shelter 154,000 people. Official website of Kharkiv information and analytical portal "Kharkiv Today" Retrieved from: <https://2day.kh.ua/ru/kharkow/kharkovskiy-metropoliten-smozhet-prinyat-154-000-chelovek> [in Russian].
- Tiulpa, L. (1964). Planning of the Saltiv residential area. *Construction and Architecture*, 3, 6-8 [in Ukrainian].
- Turner, A. (2000). *Angular analysis a method for the quantification of space*, paper 23, CASA working paper series.
- Venturi, R., Scott Brown, D., Izenour, S., (1972). *Learning From Las Vegas*. MIT Press.
- Verkhovna Rada of Ukraine (2022). Code of Civil Protection of Ukraine. Official web-portal of the Parliament of Ukraine. Legislation of Ukraine. Retrieved from: <https://zakon.rada.gov.ua/laws/show/en/5403-17?lang=en#Text>

Wang, H., Newman, G., & Wang, Z. (2019). Urban Planning as an Extension of War Planning: The Case of Shenyang, China, 1898-1966. *Journal Of Contemporary Urban Affairs*, 3(1), 1-12. <https://doi.org/10.25034/ijcua.2018.4677>

West, R. L. (2023). Dockers in Poplar: The Legacy of the London County Council's Replanning of Poplar, East London. *Urban Planning*, 8(1). <https://doi.org/10.17645/up.v8i1.6075>

Image Sources

Fig.1-4: Authors;

Fig.5: STRINGER/Reuters/Forum. <https://www.pism.pl/publications/sweden-on-the-russian-aggression-against-ukraine;>

Fig.6: <https://deepstatemap.live/en#9.75/49.9346/36.1983;>

Fig.7: <https://reliefweb.int/map/ukraine/unosat-damage-assessment-overview-map-ukraine-kharkiv-kharkiv-oblast-imagery-analysis-15-june-2022-published-25-november-2022-v1;>

Fig.8: Photo by Vasily Golosny;

Fig.9: [https://www.reuters.com/world/kharkiv-metro-is-city-where-hundreds-shelter-bombardment-2022-03-11/;](https://www.reuters.com/world/kharkiv-metro-is-city-where-hundreds-shelter-bombardment-2022-03-11/)

Fig.10: Photo by Mykhaylo Averbakh, August 2022.

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