

Kyiv metro and urban imageability: a student youth vision

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ABSTRACT

This paper aims to reveal and explain the role of metro stations in a post-socialist metropolis as nodes that determine the perception of the city. By means of Lynch-type mental maps, we sought to find whether metro stations really function as perceptual nodes concentrating urban functions and traffic, and how recent changes of urban built environment and functions induced by neoliberal policy are reflected in the public perception. The results are discussed in relation to transit-oriented development that considers public transport stations and spaces around them as community hubs. The study has confirmed the expectation that the metro system constitutes an important part of the urban image and often functions as a skeleton that is used to arrange and frame the mental map of the city. Most of the metro stations function as perceptual nodes concentrating a particular urban function (monofunctional nodes) or combination of different functions (multifunctional nodes). The current perception of nodal areas around the metro stations reflects the recent transformation of urban built environment and functions, including intense and sometimes aggressive commercialization, as well as deindustrialization, although the role of open green public spaces and waterfronts continues to be important. To promote economic development and produce a more comfortable living environment, the metro-related nodal areas need to balance different functions, resisting abusive commercialization and promoting, keeping, and creating open public spaces, green areas and heritage protections.

KEYWORDS

metro stations; city nodal areas; mental maps; urban structure; Kyiv

Received: 30 August 2022

Accepted: 7 February 2022

Published online: 14 February 2022

Gnatiuk, O., Kononenko, O., Mezentsev, K. (2022): Kyiv metro and urban imageability: a student youth vision.

AUC Geographica 57(1), 16–30

<https://doi.org/10.14712/23361980.2022.2>

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1. Introduction

Whatever the specific concept of urban development is used, the idea of nodes invariably plays an essential role in it. Playing the leading role in the urban planning structure, nodal areas concentrate processes crucial to the life of the city and related city functions (Dronova and Brunn 2018). A system of nodes together with linking paths constitutes a network that unites a city into a single organism and provides access in between its different parts (Cheng et al. 2013). At the same time, they belong to the key elements shaping the urban image and thus largely determine the public perception of the entire city and its individual parts, influencing the behaviour of urban development actors (Cheng et al. 2013). The complex urban forms are stored in our memory in the form of a linked-node configuration, and the process of acquiring spatial knowledge involves continuously adding new nodes to the existing node-link framework (King and Golledge 1978; Yoshimura et al. 2020).

Nowadays, the cities are recognized main foci and drivers of development on different spatial scales, from local to global (Hall 1993; Sassen 2016), and urban nodal areas usually first are facing and mirroring social, economical and cultural challenges, in particular those related to globalization and pervasive neoliberalism. Especially this is true for post-communist cities that during the last decades are being adapted and remodelled to new conditions shaped by the political, economic, and cultural transition to capitalism (Sýkora 2009; Sýkora and Bouzarovski 2012), while neoliberalism is acknowledged as the dominant ideology driving post-communism (Sailer-Fliege 1999; Birch and Mykhnenko 2010; Stenning et al. 2010). Therefore, understanding the processes of functional and morphological transformation of urban nodal areas and their perception gives a clue to understanding the whole transition of the post-communist cities to the market economy.

Among the various types of nodes that may be encountered in the city, specific place belongs to the stations of rapid transit transport, in particular subway/metro stations. In particular, this is true for the largest post-Soviet cities, where the metro was more than just a transport but also an imposing monument to the communist state, a “church of Soviet civilization” (Jenks 2000). Metro stations provide the surroundings with access to places of employment and other social activity, but at the same time they form new points of growth and intense transformation, changing the local built environment, as well as labour and real estate markets (e.g. Cervero and Duncan 2002; Duncan 2011; Roukoni et al. 2012; Forouhar 2016; Li 2019). The role of metro stations as local growth poles is especially important in the framework of transit-oriented development (TOD) and urban polycentricity concepts aimed at urban sustainable development (cf. Bertolini 1999; Dittmar

and Ohland 2004). Centralisation of activities and developments around metro station areas is a key TOD policy to encourage more public transport travel through providing maximum access to passengers, thereby enhancing economic efficiency, health, well-being and social inclusion (Zhang et al. 2019).

In this paper, using mental map technique (Lynch 1960), we seek principally to find out to what extent the metro system contributes to the urban imageability (and, consequently, urban identity) of Kyiv, the capital of Ukraine and third of the largest post-Soviet metropolises. In other words, we want to know a role of the metro system in shaping the residents’ representations on the city: how significant is its impact on the image of the city in the whole and its individual parts? If this role is significant, which can be supposed from the literature, the individual mental maps of Kyiv should be structured around metro lines and stations, including individual objects and places in the city tied to individual metro stations as urban nodal areas. It can be expected also that some vernacular urban districts will be shaped around metro stations (node-based districts) rather than based on historical urban areas (uniform districts). The question posed is all the more interesting keeping in mind the recent trend of expanding ridesharing taxi services (e.g., Uber, Bolt, Uklon) and the network of bicycle paths. However, it should be mentioned that the bicycle path networks in Kyiv often are starting from the metro stations, and the stop of the metro during the Covid-19 pandemic restrictions in the spring 2020 actually resulted, according to the author’s personal experiences, in the collapse of transport communications in the city). On the other hand, if Kyiv metro stations really function as perceptual nodes, it would be yielding to look at their identities in order to access the reflections of recent transformation of urban built environment and functions in the conditions of neoliberal policies.

Thus, starting from the general assessment of the importance of metro system for building the image of the city, we shift to the images (identities) of particular metro stations and access whether they really function as perceptual nodes concentrating urban functions and traffic. After that, the perceptual portraits of the metro stations are examined in order to understand whether and how the recent changes of urban built environment and functions are reflected in the perception of the informants. Finally, we compare our results with the findings of previous study using different methodology (Dronova and Brunn 2018) to evaluate the correspondence between the subjective perceptions and the fact-based evaluation of Kyiv nodal areas.

2. Theoretical background

Kevin Lynch, discussing spatial elements of the mental map of the city in his seminal work (Lynch 1960),

defined a node in two ways. The first types of nodes are junctions of paths, and thus they are points where a decision on the further direction of movement takes place. Lynch argues that “the junction, or place of a break in transportation, has compelling importance for the city observer. Because decisions must be made at junctions, people heighten their attention at such places and perceive nearby elements with more than normal clarity”. The second type of nodes includes places of concentration of some special properties (e.g. typical space, planting, activity, etc.). These condensation points can, by radiation, organize large areas around themselves if their presence is somehow signaled in the surroundings. Consequently, some of these concentration nodes are the foci and epitomes of perceptual districts, over which their influence radiates, and of which they stand as symbols. Some nodes may be both junctions and concentrations at the same time. The distinction between these two types of nodes is questioned as it may not be especially informative and somewhat ambiguous (Dalton and Bafna 2003).

Nodes, together with paths and edges, describe the fundamental topological structure of space in relation to movement and visibility; they are “places of heightened awareness and decision-making where people slow down or stop and make choices about what they will do next and where they are going”, and thus the functional and aesthetic environments of nodes play a significant role in creating a sense of place (Stevens 2006). They are not merely cognitive, but also behavioural elements, shaping fundamental topological structure of urban space in relation to movement and visibility (Norberg-Schulz 1971, 1980). Urban networks can morphologically be described as major nodes or concentrations of activities and physical and/or functional connections between nodes (Cheng et al. 2012). Like the other elements of a mental map, nodes may have high imageability not only because of their visual stimulus, but due to certain historical or cultural meaning or playing a role of urban spiritual centre (Mumford 1961; Appleyard 1969; Golledge et al. 1978; Hospers 2010; Jiang 2012). Nodes are not only strengthened by the presence of landmarks but provide a setting which almost guarantees attention for any of the latter. At the same time, nodes are more remarkable if provided with one or two objects which are foci of attention. In any event, Lynch argues, the most successful node seemed both to be unique in some way and at the same time to intensify some surrounding characteristic. Also, names and meanings are non-physical characteristics that may enhance the imageability of a node element; names, for example, are important in crystallizing identity (Lynch 1960).

Following Lynch’s definition of nodes, Dronova and Brunn (2018) consider them as places or strategic points (foci) of the city that (1) have free access, (2) are mainly located at the crossroads of important transport routes, (3) have a large concentration

of urban functions, and (4) are characterized by both centripetal and centrifugal flows. The emergence of these “intersections of processes” leads to a concentration of transport, cultural, economic, social, administrative, communication, and service functions. They implicitly distinguish between a node and a surrounding “nodal area”, which is experiencing the influence of the node and is perceived together with it as a single spatial entity.

The original experience of Lynch (1960) showed that subway stations, strung along their invisible path systems, often play the role of strategic junction nodes. In particular, in the case of Boston, some respondents organized the rest of the city around them while making the sketch. Most of the key stations were associated with some key surface feature, had distinct individual characteristics and thus easy to recognize. Simultaneously, some other stations had not so prominent identities, probably due lack of visual interest and the disassociation of the subway node from the street crossing. In view of this, Lynch suggested that a detailed analysis of the imageability of subway systems, as a kind of transit systems in general, would be both useful and fascinating.

More recent analysis of hand-annotated maps showing the locations of prominent places of Boston also suggests that subway stops play an important role in framing a person’s mental map (Look and Shrobe 2007). In particular, it was shown that all of the prominent places, marked by the respondents, were extremely close to subway stops (all within 280 meters, with many places located at a subway stop). Conversely, a large majority of the subway stops were within 50 meters of prominent places. It is suggested that, on the one hand, subway stations themselves may be use for structuring mental maps, but on the other, subway stations are often located near important places and these places or features bring to the importance of subway stations.

The role of metro stations as nodes in Moscow, the largest post-socialist metropolis, has been revealed by James Schrader (The Village 2014; Urban Look 2014). Schrader emphasizes the uniqueness of the role of metro in Moscow, opposing the Russian capital to Western metropolises like New York or Los Angeles, where the metro network determines both urban development and the perception of the city to a much lesser extent. He argues that the metro has drastically changed the way people move around the city and thus affected their perception of the city. Metro stations become spatially isolated access points to the surface areas in their immediate vicinity (up to 500 meters). A circle of this diameter is a nodal area shaped around the station. At the same time, it is more difficult for a person to get to the area outside such nodal areas. Furthermore, while traveling, metro passenger usually cannot observe the city space located between the stations. Consequently, the metro turns into something like a horizontal elevator

or a teleportation device that transports people from one point to another through “nowhere” between the beginning and end of the journey. In this way, the city, perceived by a regular metro user, is divided into numerous small nodal areas around the stations, which in turn become a kind of magnet for a variety of functions: residential and commercial real estate, public spaces, and stops for land-based public transport. The adaptation of the urban structure to the configuration of metro stations, turning them into hubs of economic and social activity, has become especially pronounced in the last two decades. The city is being transformed into a set of nodal areas with a metro station in the centre; each of them provides the locals with the entire infrastructure for a comfortable life.

The idea of transforming the city into a set of relatively independent neighbourhoods around metro stations resonates with the concept of transit-oriented development. Among other things, TOD traits include public and civic spaces near public transport stations as community hubs. A multimodal TOD neighbourhood is built around a public transport station or stop, surrounded by relatively high density development with progressively lower-density development spreading outward from the centre. Typical radius of such neighbourhood is 400 to 800 metres – this is considered to be an acceptable walking distance at the start or end of a journey by transit (ITDP 2017). Although it has been shown that the TOD, by improving transportation accessibility, can promote economic development, as well as produce more comfortable living environment (Cervero and Duncan 2002; Gibbons and Machin 2005; Ahlfeldt and Wendland 2009; Duncan 2011; Roukoni et al. 2012), the concept is criticized, as it has raised concerns about gentrification, displacement, re-segregation, and more polarization (Jones and Ley 2016; Renne et al. 2016; Dong 2016, 2017; Derakhti and Baeten 2020). In view of this, the issue of metro stations as foci of urban nodal areas, including their perceptual characteristics, is important not only for urban theory, but for practitioners as well. While cities without a metro usually show a decrease in the density of all functions from the centre to the periphery, with the advent of rapid transit, the density of functions is differentiated based upon the distance from the stations (Osietrin and Omelchuk 2008). Therefore, urban areas around the metro stations possess a high value in terms of urban planning and require a special approach to functional zoning and transport planning solutions aimed at intensifying all urban functions (Osietrin and Omelchuk 2008; Avdiejeva and Bila 2016).

3. Case study area

Kyiv, the capital and largest city of Ukraine, with current registered population of ca. 2,970,000, has experienced intensive socio-economic and spatial

transformations in recent decades. New developments typically are associated with deindustrialization, commercialization, especially construction of shopping malls, and housing, which leads to the growing functional diversification of the urban space, its increasing patchiness. Transformation of urban public spaces consists in their commercialization, sacralization (de-sacralization), and domestication; the role of malls as public spaces is increasing with simultaneous significant reduction of the role of squares and parks (Mezentseva and Mezentsev 2017). According to Dronova and Brunn (2018), most of 45 existing and potential nodal areas of Kyiv are experiencing replacement of the cultural, aesthetic, representative, and communication functions by commercial, service, and transport land uses. The development of city and the transformation of urban space largely depend on the private investors, their interests and visions (Mezentseva and Mezentsev 2017). The city gradually loses its original appearance and becomes a cosmopolitan place associated with all kinds of investment projects (Maruniak 2013; Dronova and Maruniak 2019), while modernization, being the positive side of neoliberal development, goes together with replication of monotonous urban landscapes and creation of monstrous forms (Cybrivsky 2014).

The Kyiv Metro is the third among both oldest and largest metro systems in the former Soviet Union, after Moscow and St. Petersburg. It has three lines, having proper names but publicly known by colour designations as “red”, “blue” and “green”, and 52 stations. In the whole, the red line is the oldest one, while the green line is the newest. In the recent years, the system accounts approximately for a half of Kyiv’s public transport load. Three existing lines, intersecting in the city centre, connect the peripheral areas located in opposite directions and basically follow the key surface roads and city-planning axes, serving the areas with high densities of population, jobs and services. However, some vast and densely populated areas of the city are still not covered with the metro network. In particular, this refers to large mass housing neighbourhoods in the north-eastern (Troieshchyna), north-western (Vynohradar) and south-western (Borshchahivka) sectors of the city (Osietrin and Omelchuk 2008). The construction of the fourth “grey” metro line, which is to connect Zhuliany Airport in the southwest of the city and Troieshchyna neighbourhood with more than 400,000 inhabitants in the northeast, was started in 1993 but has been repeatedly postponed and become the subject of jokes (e.g. “man will land on Mars sooner than build a metro to Troieshchyna”).

In most cases, metro stations in Kyiv function as urban planning centres (nodal areas). However, there are problematic issues related to the planning and functions of the urban areas around the metro stations. With the transition to a market economy, the territory of high-speed transport has become

attractive for the implementation of various investment projects, including shopping malls and business centres (Osietrin and Omelchuk 2008). Some key nodal areas around the metro stations in the city centre have undergone complex reconstruction, e.g. Maidan Nezalezhnosti, the main square of Kyiv, a venue for political and cultural events of national scale (including construction of underground shopping mall Globus), and Kontraktova Square, the urban public centre of Podil neighbourhood, concentrating business centres and the main offices of the largest banking institutions (Dronova and Polieshko 2017; Bondar 2018).

4. Data and methods

The research is based on the analysis of Lynch-type mental maps (Lynch 1960) drawn by the 2–3 year bachelor geography students in 2018–2019. Each student was asked “to make a sketch map of Kyiv from his/her perspective marking the most prominent and important places, including streets, squares, neighbourhoods, buildings, public places and other landmarks, etc.” without receiving additional suggestions from the researchers. This is extremely important because the research is very susceptible to the occurrence of the so-called “interviewer effect”, which may influence the resulting sketch substantially (Nawrocki 2017). A total of 31 maps were selected for further processing; the remaining 9 sketches were considered to be unsuitable for analysis (e.g. depicting the contours of the city only). The respondents had approximately one hour to perform a task. Among the students, whose sketches were selected for the research, 25 (80.6%) came from different Ukrainian regions and lived in campus dormitory, while the rest 6 (19.4%) were native Kyivans. Since mental maps were created by geography students, they may be artistically expressive more than it could be expected in case of ordinary people, but this fact is unlikely to affect the list of places and objects depicted on the maps, and therefore cannot have a significant impact on the conclusions.

The first part of the analysis involved general assessment of the importance of metro system for building the image of the city. To perform this task, we (1) classified mental maps according to the role of metro system in the total graphic structure of the individual sketches, (2) examined the spatial distribution of landmarks, marked on the sketches, in relation to the metro lines and individual metro stations, (3) counted the number/percentage of maps on which each metro station was a) denoted and b) labelled, and (4) counted cases when the metro station or other location was marked as a crossroads of transport routes, i.e. as a transport node (including transfer to the other metro line).

The second part of the analysis was focused on the identities of nodal areas shaped around the individual

metro stations. For this purpose, we counted associations and mentions of linked landmarks for each station. If a certain landmark is marked on the mental map in the immediate vicinity of the metro station, or otherwise compositionally tied to it by the respondent, such a landmark is defined as an association with the given metro station. Each single recording of an association is considered as a mention. This implies that the number of mentions for each particular metro station can be greater than or equal to the number of associations recorded for this station. Having collected the data on associations and mentions, we characterized the place identity of each metro station in terms of scope, intensity, polarization and semantic content.

The scope of place identity is defined as a number of independent associations to the given metro station. In this way, a large number of associations mean a broad place identity, and vice versa, few associations point at narrow place identity. The intensity of place identity is defined as a frequency of mentions of the most frequently mentioned association (or key association). In other words, this is an imageability of a key association. If a key association is mentioned frequently (i.e. appears on many mental maps), it contributes to the higher intensity of the place identity, and vice versa. The polarization of place identity is an indicator that aims to estimate the balance of representation of associations. It was measured as a coefficient of variation for the numbers of mentions of each association. If mentions are equally distributed between the associations, there is zero polarization. Otherwise, if some associations are more frequent than the others, the coefficient of variation deviates from zero, indicating a certain level of polarization. The polarization is possible to estimate only for places with more than one association. To investigate the semantic content of place identity, we divided associations between semantic categories and then defined the structure of mentions by semantic categories for each metro station.

5. Results and discussion

The analyzed mental maps were divided into 4 categories depending on the role of the metro system in their total graphic structure.

The first category (9 sketches; 29.0%) may be described as totally metro-centric maps. The metro lines play the dominant role and constitute the so called “good figure” of the mental map, structuring the whole image (Figure 1a). The second category (7 sketches; 22.6%) includes maps that are also metro-centric; however, they represent additional paths and nodes beyond the metro system (e.g. rapid tram lines, urban train, some important streets) (Figure 1b). The third category (7 sketches; 22.6%) enclose maps where the metro lines and stations are

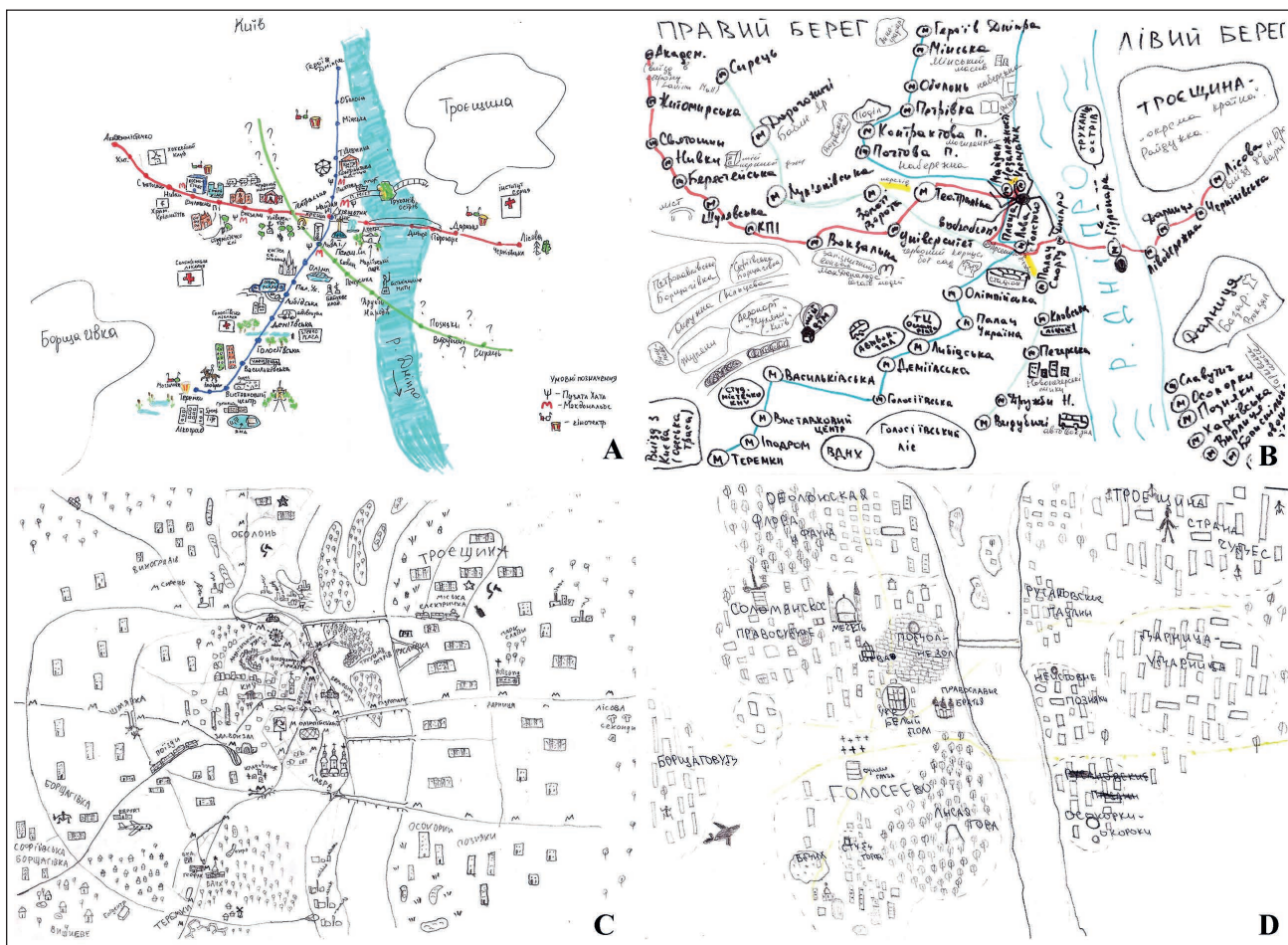


Fig. 1 Examples of mental maps made by participants.
Source: students' work.

marked but they do not dominate the entire mental map. The landmarks on such sketches are more or less evenly filling the urban space and are not strongly linked to the individual metro stations or lines (Figure 1c). The fourth category (8 sketches; 25.8%) represents maps where metro system is almost completely absent. Most commonly such maps represent a system of districts with minimum of paths (Figure 1d).

Although there are certain exceptions, the sketches from first and second categories generally fall into the sequential-type maps dominated by linear elements and the links between them, while the sketches from the third and fourth categories were mostly spatial-type maps with well-elaborated network of districts, according to the typology by Appleyard (1973).

The distribution of the maps between these categories convinces that the metro system constitutes an important part of the image of the city for the absolute majority of the respondents, and for approximately half of them it posturizes a skeleton that is used to arrange and structurize the other elements of the image of the city, and is used to navigate around the city (Kuipers et al. 2003). In this way, the form of transportation around the city has a significant impact

on the image of the city, and the mental map of Kyiv is significantly different from the mental maps of cities without subway/metro system like Szczecin, where the most prominent nodes are squares as transport hubs and public spaces (Osóch and Czaplińska 2019), or Konya, where tram stops were marked by the students as nodes (Topcu and Topcu 2021). At the same time, in the case of Kazan, the role of metro system seems to be not so brilliant feature of the mental maps comparing to Kyiv, although some stations do play a role of most prominent nodes (Latypova et al. 2021).

Another observation, pointing out the importance of the Kyiv metro for urban imageability, is the role of metro stations as nodes for urban perceptual districts. In particular, in the part of Kyiv with a dense network of metro stations, most of perceptual districts are shaped around the metro stations, and it is often difficult to determine unambiguously whether an inscription on a map refers to a metro station or the surrounding homonymous district (e.g. metro station Pozniaky and the adjacent residential neighbourhood Pozniaky). The maps of the fourth category, with completely absent metro lines and stations, also often depict perceptual districts with names derived from the names of the metro stations. On the other hand,

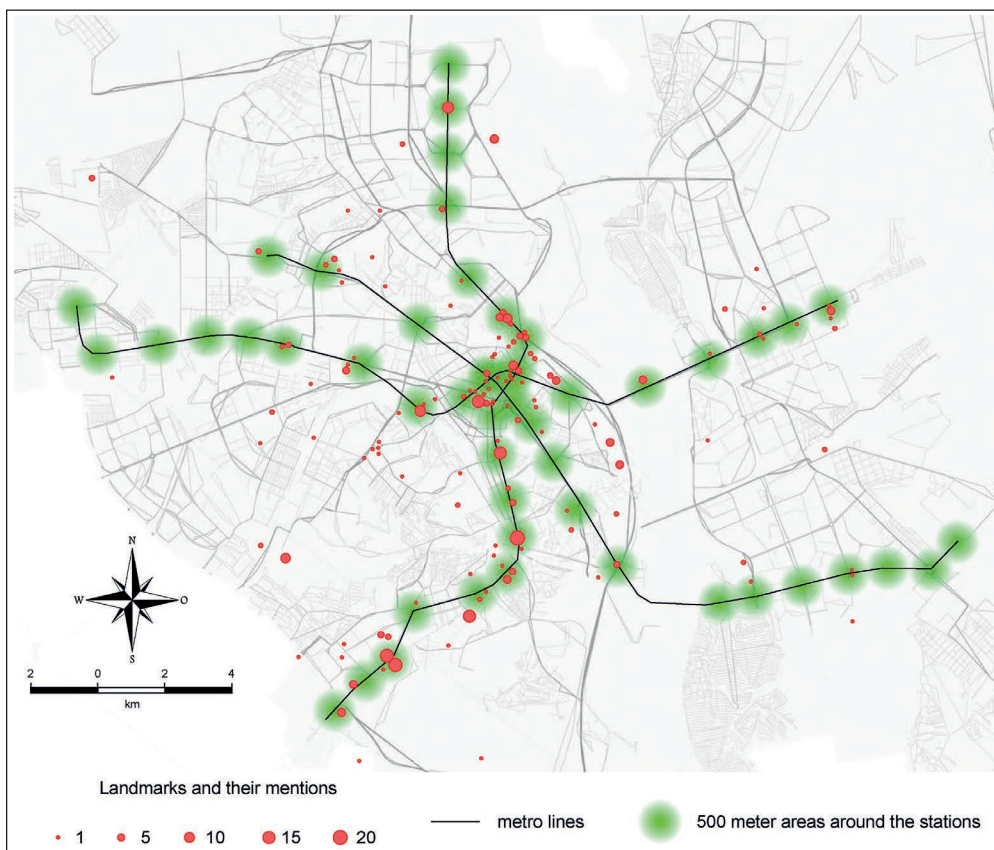


Fig. 2 Distribution of landmarks on mental maps in relation to the metro system.

Source: elaborated by the authors.

the most frequent and clearly represented districts on the mental maps are Troieshchyna and Borshchahivka – exactly those two large neighbourhoods where there is no metro. This means that the rapid transit may significantly restructure traditional perception of urban space, destroying the traditional system of vernacular districts based on historical urban areas and bringing to birth the network system of smaller vernacular districts centred on the stations.

Regarding the differences between the mental maps of Kyiv permanent dwellers and students from outside the capital, the total number of maps is not sufficient for detailed analysis and strong conclusions. However, native Kyivans tend to create more detailed representation of one certain (native and the most familiar) neighbourhood and less rely on the metro scheme when locating other places and objects in the city. In particular, none of the totally metro-centric maps was produced by the permanent dwellers. This means that the importance of the metro for mobility and perception is highest in the early stages of acquaintance with the city. Meanwhile, according to a study by Research & Branding Group (2014), approximately 55% of Kyiv residents were non-natives, and this figure is likely to have just increased, not least due to the inflow of the externally displaced persons from the Eastern Ukraine. Hence, we can assume that nowadays the metro system plays a key role in the urban

imageability for most residents of the Ukrainian capital.

The importance of the metro system as a spatial backbone of the city is further strengthened by the spatial distribution of landmarks marked on the sketches. As can be seen from the map (Figure 2), the absolute majority of landmarks are located within the spatial belts along the metro lines. In particular, 59.7% of landmarks and 74.5% of their mentions are concentrated within 500 meters from metro stations. Moreover, practically all frequently mentioned landmarks are located in the vicinity of the metro stations, and vice versa, the landmarks located far from the metro are mentioned rarely. Exceptions are Zhuliany and Boryspil airports, Obolon Embankment, Kyiv-Pechersk Lavra, and the Motherland Monument; the last three objects are stretched along the Dnieper waterfront, and the last two are important landmarks forming the skyline of the right bank Kyiv when seen from the left bank. The only one significant cluster of landmarks beyond the metro line belts is observed around Sevastopolska Ploshcha. On the other hand, among the metro stations, 40 (76.9%) have at least one landmark in the vicinity of 500 meters.

All 52 metro stations have been found on analysed mental maps. They are not only marked but also labelled in the majority of cases. This is another confirmation of the importance of the metro system

as a spatial skeleton of the city. However, some differences in representation are observed for both individual metro stations and entire metro lines: blue line stations are best represented, while green line stations are worst represented, especially this refers to the left bank part of the line (Figure 3). These disparities should be attributed to the specificity of the respondents (university students), whose places of study and residence (university campuses) are mostly located along the blue line course, and thus not surprisingly this line (together with important transport hubs and other places important for the students' life on the other metro lines) is best represented on mental maps. Maidan Nezalezhnosti (located in the city centre on the homonymous square) was the most frequently marked station (27 sketches; 87.1%), while Vyrllytsia (located in the peripheral left-bank residential neighbourhood) was the least mentioned station (2 sketches; 6.5%).

Among all metro stations, 34 (65.4%) have been marked as transport nodes by the respondents. This figure includes six stations used for transfer to another metro line, and they were marked as transport nodes most frequently (38–48% of sketches). The list of the other stations, mentioned as transport nodes by more than 10% of the respondents, includes Teremky, Demiivska, Vydubychi, Darnytsia and Pochaina; all

these stations are really located near the important surface crossroads. At the same time, approximately third part of all metro stations have not been marked as transport nodes; in some cases this may be justified, but some of these stations in reality are located near the important transport junctions, e.g. Nyvky or Druzhby Narodiv. Nevertheless, we identified 12 transport nodes different from the metro stations, and all of them were mentioned by less than 10% of the respondents. This means that although not all metro stations are perceived to be important transport nodes, some of them belong to the most recognizable transport nodes in the Ukrainian capital.

Typically the associated landmark is located in the vicinity of metro station. However, in many cases, the distance from the metro station to the associated landmark is large enough, although it is drawn quite near the metro station. Some extreme examples of this kind are the following: Darnytsa railway station is linked to Darnytsia metro station (distance 3.7 km); Lavina Mall is linked to Akademmistechko metro station (distance 3.4 km); Motherland Monument is linked to Druzhby Narodiv metro station (distance 1.8 km); Obolon Embankment is linked to Obolon metro station (distance 1.1 km). This confirms the point that metro stations sometimes may act as nodes not only for the immediate vicinity, but also

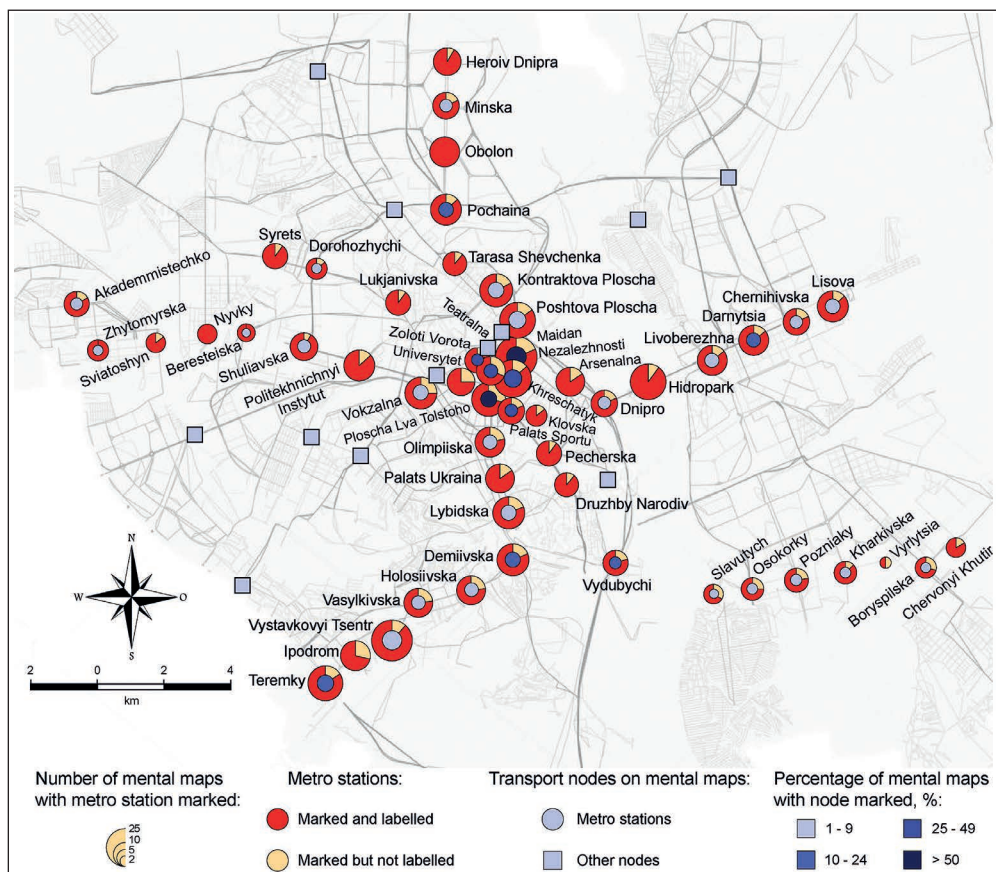


Fig. 3 Metro stations and transport nodes on mental maps. Source: elaborated by the authors.

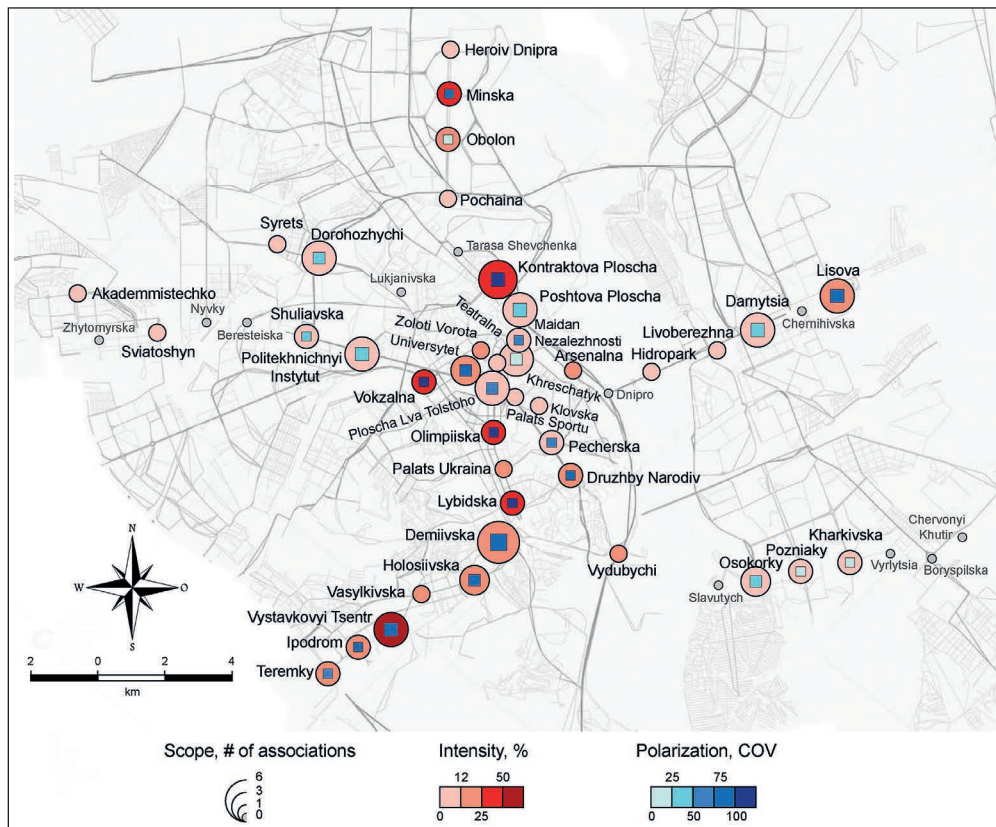


Fig. 4 Metro stations: scope, intensity and polarization of identity. Source: elaborated by the authors.

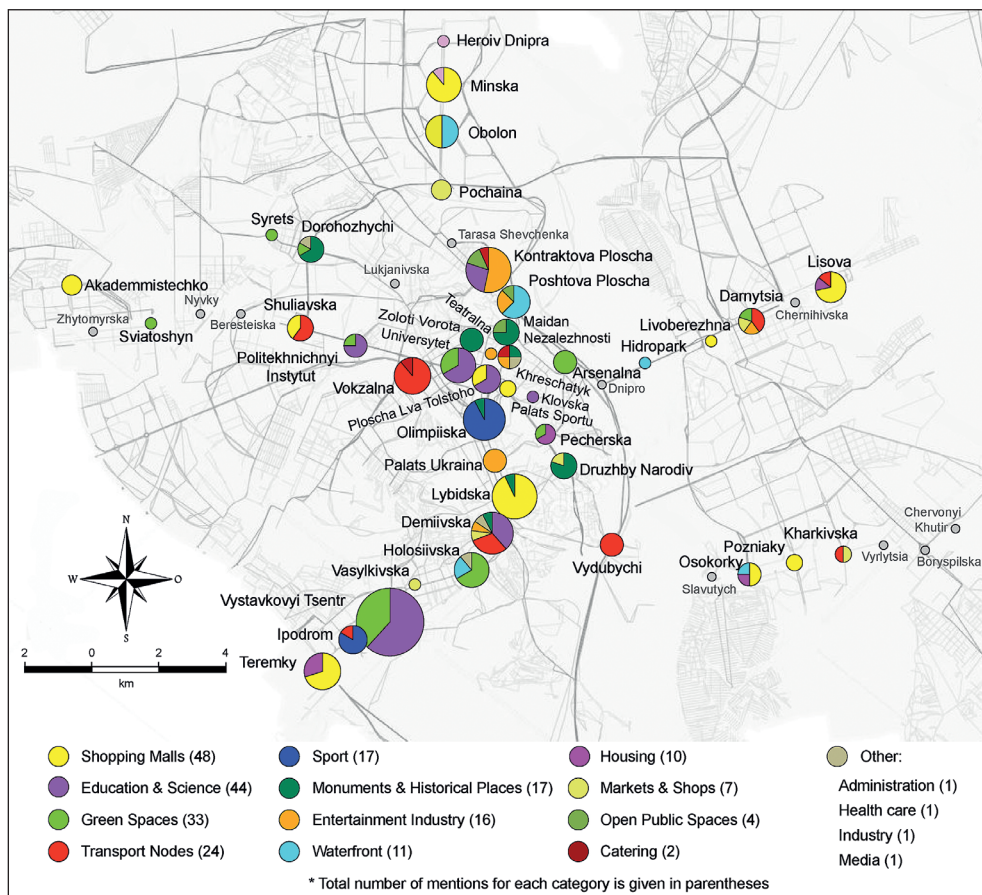


Fig. 5 Metro stations: semantic categories of associations (number of mentions). Source: elaborated by the authors.

for large areas closest to (or best accessible from) the given station. The toponymic factor may also play a role (e.g. common attributes like Obolon and Darnytsia).

Differences between both the lines and individual stations become more pronounced when focusing on their identities (Figures 4, 5). First of all, the scope of identity varies substantially. There are 11 stations without any association: one on the blue line, five on the red line and another five on the green line. These stations are located mostly in peripheral and semi-peripheral areas of mass housing, industrial development, or green spaces. On the contrary, the broadest identities were recorded for Demiiivska (6 landmarks), Kontraktova Ploshcha, Poshtova Ploshcha, Vystavkovyi Tsentri stations of the blue line (4 landmarks per each station), Politechnichniy Institut, Darnytsia and Lisova stations of the red line (4 landmarks per each station). The green line, joining mass housing areas in the south-east and the north-west of the city, rarely visited by the students, is the worst represented on the mental maps.

The most common semantic categories of associations (and the most common key associations) are the following:

- 1) Shopping malls (48 mentions; 8 key associations) that have sprouted up on Kyiv streets and squares over the past two decades: Ocean Plaza (Lybidska), Dream Town (Minska and Obolon), Magellan (Teremky), Cosmopolite (Shuliavska), Lavina Mall (Akademistechko), Gulliver (Ploshcha Lva Tolstoho and Palats Sportu), Darynok (Darnytsia), River Mall (Osokorky). It is worth noting that if a shopping mall is located near the metro station, it will most likely be displayed on mental maps.
- 2) Institutions of education and science (44 mentions; 6 key associations), including three leading universities: Taras Shevchenko National University of Kyiv (Ploshcha Lva Tolstoho, Universytet and Vystavkovyi Tsentri), Kyiv-Mohyla Academy (Kontraktova Ploshcha), Igor Sikorsky Kyiv Polytechnic Institute (Politechnichniy Instytut).
- 3) Green spaces (33 mentions; 4 key associations): Holiiv Park and Forest (Holiivska), Mariivsky Park (Arsenalna), Syrets Park (Syrets), Sviatoshyn urban forest (Sviatoshyn). Also, important second-order, but extremely frequent association was the Expocentre of Ukraine located on the outskirts of the Holiiv Forest (Vystavkovyi Tsentri).
- 4) Transport hubs (24 mentions; 5 key associations): passenger stations like Central Railway Station (Vokzalna), Central Bus Station (Demiiivska), Darnytsia Bus Station (Darnytsia and Lisova), Vydubychi Bus Station (Vydubychi), Pivdenna Bus Station (Ipodrom), Kharkivska Bus Station (Kharkivska). All these are important for students arriving to Kyiv and going back to their homes on weekends or vacations. Another key association is Shuliavka Bridge, the infamous “tired bridge” on the transport junction near Shuliavka station that collapsed in February 2017.
- 5) Monuments and historical places (17 mentions; 4 key associations), including the Golden Gate (Zoloti Vorota), Motherland Monument (Druzhby Narodiv), the Independence Monument and Square (Maidan Nezalezhnosti), Babyn Yar (Dorohozhychi).
- 6) Sports facilities (17 mentions; 2 key associations): Olimpiivskyi Stadium, the main sports arena of the country (Olimpiiska), and Hippodrome (Ipodrom).

The other semantic categories are much less frequent although may be important for individual stations. For example, entertainment facilities shaped the image of Palats Ukraina station (homonymous concert hall), Soviet mass housing appears to be essential for some peripheral stations like Teremky, Heroiv Dnipra, Minska, Osokorky, Pozniaky, Lisova, while the images of Postova Ploshcha, Obolon, Hidropark, Osokorky and Holiivska stations benefit from location near waterfronts (embankments and beaches).

Based on the relationship between the scope, intensity and polarization of identity, four groups of stations may be distinguished:

- 1) Stations with broad and intense identities: Kontraktova Ploshcha, Vystavkovyi Tsentri, Lisova and Demiiivska stations. Each of these stations evokes numerous associations, but one of them is stronger than the others and very frequent, causing sufficiently high polarization. Key associations may be different depending on the station and vary from the observation wheel (entertainment industry) to the education and science (Faculty of Geography; National Library) and shopping mall (Darynok). Also, all these stations function as important cross-sections. Such metro stations can be considered well-developed perceptual nodes that not only concentrate some function, but combine various functions in one place and serve different needs of different groups of people at the same time (multifunctional nodes). Thus, we may expand the original description by Lynch (1960) and add a third type of nodes: places where different special properties are in close contact (e.g. the junction of several urban districts or functional zones) may be perceived as nodes as well.
- 2) Stations with narrow but intense identities: Minska, Vokzalna, Olimpiiska, Druzhby Narodiv, Obolon, Ipodrom, Teremky, Palats Ukraina, Zoloti Vorota, Arsenalna, Vydubychi. Usually there is one strong association, mentioned by the absolute majority of the respondents, and one or two less frequent associations. Common key associations are shopping malls, transport hubs, sports facilities, monuments and historical places; less common are waterfronts and entertainment industry facilities. Polarization is typically extremely high due to the strong dominance of the key association. These stations are places of concentration of some special properties

and functions, and this makes them recognizable perceptual nodes (monofunctional nodes). The only exception with two equivalent associations is Obolon station (Dream Town Mall and Obolon Embankment), which is rather multifunctional node.

- 3) Stations with broad but subtle identities with polarization from low to moderate: Dorohozhychi, Politechnichniy Instytut, Poshtova Ploshcha, Darnytsia, Khreshchatyk, Ploshcha Lva Tolstoho. Their identity is not firmly established: most people draw some associations, but they are different and depend on a respondent. Such stations lack a powerful perceptual dominant to be well-imageable. However, they may be considered as potential multifunctional nodes.
- 4) Stations with narrow and subtle identities. This group includes all other 31 stations, including 11 stations with the absent associations. As for the other stations from this group, typically, there are one or two associations with each station, and each of these associations is mentioned only once. Such associations may be given incidentally, depending on the individual experience of each particular respondent. Given the scarcity of associations, their low frequency and obviously random nature, these stations have no clear and stable identity and cannot be defined as perceptual nodes nowadays. However, they may be considered as potential monofunctional nodes, although some of them, if strengthen the identity through the medium of some (re)construction in the vicinity, may totally change it comparing to the present-day situation.

It should be noted that this classification is reliable only for selected sample of the respondents (students of the Faculty of Geography) and can be extended to the general population of Kyiv only in the part concerning the southern part of the blue metro line and the central part of the city. Metro stations beyond the specified area are less frequently visited by the respondents, and thus they are expected to evoke less variety of associations, and recorded images have less frequency. For example, we may suppose that if our respondents were students of the Institute of International Relations, located near Lukianivska station of the green line, the north-west part of the line would have been much better represented. Nevertheless, even given the limitations of this particular study, it can be concluded that some metro stations definitely play the role of important perceptual nodes. In particular, this refers to all stations that fall into the first and second categories of our classification. With the larger and more representative sample of respondents, we expect many stations from the third and fourth groups to move to the first and second groups. In other words, the results of this study rather underestimate than overestimate the value of a particular metro station as a perceptual node.

The results suggest that some metro stations had to undergo radical changes in their identity over the past decade. In particular, this refers to all metro stations with shopping malls as key associations. Nodal areas, like the other public spaces, seem to actively commercialize, and the role of shopping malls, extending or substituting the existing open public spaces, becomes extremely important (cf. Mezentsev and Mezentseva 2017). Prior to the construction of shopping malls in 2010s, the respective metro stations (or areas where the stations has been constructed) should have had fundamentally different perceptual dominants if any (for example, Soviet mass housing for Minska and Teremky, transport hubs for Lybidska and Lisova, etc). Nowadays, identities of such places often combine old and new associations, reflecting the development of so called hybrid spatialities (Golubchikov et al. 2013), for example, Soviet modernist building known as 'Tarilka' (*The Plate*) and shopping mall 'Ocean Plaza' at Lybidska station. On the one hand, this testifies to the powerful role of shopping malls as perceptual dominants of the modern Ukrainian capital: they produce difference between previously monotonous locations making them recognizable (and attended) places. Therefore, we can only partially agree with the statement that "the main phenomena that are changing urban processes and functions and that are deforming the nodal areas' spatial structures are commercialization (...) spatial unification, and homogenization" (Dronova and Brunn 2018, p. 101). On the other hand, construction of the shopping malls, as well as office centres etc. often leads to the replacement of the other associations with a place (the association with a shopping mall, once emerging, tends to dominate), endangering the authentic image of the city and oversimplifying it (cf. Dronova and Brunn 2018, p. 96).

Dronova and Brunn (2018) distinguished several types of existing and potential nodal areas in Kyiv, assessing them according to the predefined criteria. The comparison of their assessment with the results of this study, performed with completely different methodology, shows strong or partial correspondence for the majority of metro stations covered by the both studies (Table 1). At the same time, we found weak correspondence for some stations, which may indicate that subjective perceptions of respective places are different from those expectations based on the fact-based evaluation.

At the same time, some metro stations were underestimated by Dronova and Brann (2018) and even not included in their list of nodal areas, which is questioned by our results. For example, Holosiivska station, due to vast parks, forests and ponds in the vicinity, seems to be well-shaped nodal area with a function of a green public space used for socializing, recreation and relaxation; Lisova and Teremky stations are nodes of the surrounding mass housing neighbourhoods with prominent commercial and transport function; Dorohozhychi station functions as

Tab. 1 Comparison of the assessment of metro stations as nodal areas in two studies.

Metro station	Assessment by Dronova and Brunn (2018)	Assessment in this study	Correspondence
Arsenalna	Areas in Kyiv's centre (highest score for 'political gatherings', high score for 'parks, squares, elements of unique natural landscapes')	Monofunctional node (key association – Mariinsky Park)	Partial
Demiivska	Reconstructed areas with transport as the predominant function	Multifunctional node (with Central Bus Station among the 2 key associations)	Strong
Khreshatyk	Areas in Kyiv's centre (almost balanced but low scores)	Potential multifunctional node (catering; entertainment industry; monuments and historical places; administrative buildings)	Strong
Kontraktova Ploshcha	Public spaces of special social significance	Multifunctional node (entertainment industry; education and science; public spaces)	Strong
Livoberezhna	Areas with transport function that require reconstruction	Potential monofunctional node (key association – shopping mall 'Komod')	Weak
Lukianivska	Areas with transport function that require reconstruction	No associations	Weak
Lybidska	Areas significantly transformed due to the shopping malls	Monofunctional node (key association – shopping mall 'Ocean Plaza')	Strong
Maidan Nezalezhnosti	Public spaces of special social significance	Multifunctional node (monuments and historical places; public space)	Strong
Minska	Areas significantly transformed due to the shopping malls	Monofunctional node (key association – shopping mall 'Dream Town')	Strong
Obolon	Territories that have potential features of nodal areas	Multifunctional node (shopping malls; waterfronts)	Weak
Palats Sportu	Areas significantly transformed due to the shopping malls	Potential monofunctional node (key association – shopping mall 'Gulliver')	Strong
Pecherska	Areas in Kyiv's centre (all scores equal to zero except for high transport accessibility)	No associations	Partial
Ploshcha Lva Tolstoho & Universytet	Areas in Kyiv's centre; Public spaces of special social significance	Multifunctional node (education and science; green spaces; shopping malls)	Strong
Pochaina	Areas with transport functions, including intercity, national, and international routes	Potential monofunctional node (key association – book market)	Weak
Poshtova Ploshcha	Reconstructed areas with transport as the predominant function (highest score for 'parks, squares, elements of unique natural landscapes')	Potential multifunctional node (waterfronts; entertainment industry; public spaces)	Partial
Shuliavska	Areas with transport function that require reconstruction	Potential multifunctional node (key association – Shuliavka bridge)	Strong
Teatralna	Areas in Kyiv's centre (almost balanced but low scores)	Potential monofunctional node (key association – National Opera House)	Partial
Vasylkivska	Territories that have potential features of nodal areas	Potential monofunctional node (key association – chain store 'Varus')	Strong
Vokzalna	Areas with transport functions, including intercity, national, and international routes	Monofunctional node (key association – Central Railway Station)	Strong
Vydubychi	Areas with transport functions, including intercity, national, and international routes	Monofunctional node (key association – Vydubychi Bus Station)	Strong
Zoloti Vorota	Areas in Kyiv's centre (high score for 'cultural, historical, sacred, or aesthetic monuments and artefacts')	Monofunctional node (key association – historical monument 'Golden Gate')	Strong

a recognizable historical place (with Babi Yar, a site of massacres carried out by Nazis in 1941, as a key association); Olimpiiska station (and the adjacent square) is strongly associated with the Olimpiyskyi Stadium, a place for sports competition, as well as the other festive events, etc. This means that it is advisable to combine quantitative and qualitative methods for in-depth study of urban nodal areas, especially when they are understood as perceptual nodes structuring a mental map of the city.

6. Conclusions

Although the sample of informants imposes some limitations on our research, some conclusions can be drawn:

1. The Kyiv Metro seems to have significant impact on the image of the city. Approximately for the half of the informants, it constitutes a "good figure" of a mental map and a "skeleton" that is used to structure the other paths and landmarks and to navigate

the city. Areas that are not covered by the metro and are not either way involved into the everyday activity of the informants, represent *terrae incognitae* for the most informants. Conversely, metro lines and stations typically are the only details marked in parts of Kyiv not familiar to respondents from personal activity. Having the previous results on Moscow (The Village 2014; Urban Look 2014), these findings can be extended to other large cities in the post-Soviet space. However, the peculiarities of the city-planning structure may make difference in the each individual case.

2. Most of the metro stations do function as perceptual nodes of the image of the city. Some stations are primarily junctions of pathways, but most of them concentrate some urban functions (monofunctional nodes) or even show combination of different functions (multifunctional nodes); the latter are among the nodes with the highest imageability. The most common landmarks associated with metro stations are malls, universities, parks, passenger stations and other kinds of transport hubs, monuments and historical places, stadiums and concert halls.
3. Perception of nodal areas around the metro stations reflects recent transformation of urban built environment and functions under the neoliberal policy regime. Only one recorded association with industrial facility mirrors deindustrialization process. On the contrary, shopping malls, being the most visible product of recent commercialization, are the most frequent associations with metro stations and often tend to replace previously existing associations cardinaly changing the place identity. However, the role of open green public spaces, as well as embankments, in shaping the place identities for metro-related nodal areas is also very important. Monuments and historical places keep the role of perceptual dominants but only in the areas not touched by aggressive commercialization, and their imageability seems to be lower comparing with the aforementioned landmarks.
4. The study of nodal areas should combine both quantitative and qualitative approaches to achieve the best results, since the subjective perceptions resulting from the mental maps does not always coincide with the fact-based evaluation.

To summarize, metro system in post-Soviet city, apart from performing basic function of transportation, constitutes an important element of urban identity and imageability, both in the city-wide dimension and the dimension of individual neighbourhoods. In view of this, much attention should be paid by urban planners to the layout of new metro lines and the land use planning in the vicinity of already existing and intended stations. It is recommended to use TOD for development of the nodal areas in order to reduce car use and create multimodal transport opportunities.

It is important to mix residential, commercial, retail, office, green zones and public civic spaces within walking distance of metro stations. According to the results of the study, in order to improving urban sustainability, the metro-related nodal areas of Kyiv need to balance functions with an emphasis on their compactness and safety, convenience of public transport use, keeping/creation of the open public spaces and heritage protection.

Acknowledgements

We are thankful to the students for their work on mental maps. Also, we would like to thank two anonymous reviewers for their constructive and helpful comments.

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