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Matej NIKŠIČ
Alenka FIKFAK
Christine MADY

Editorial Changing streets in changing cities: Providing streets for all?

City streets are the most enduring urban components accompanying changes through time. They are mirrors of cities' histories and everyday social practices. Streets are mnemonic spaces (Hebbert, 2005), capturing the interaction between space, people, and social practices, and accompanying and imprinting our everyday lives (de Certeau, 1998). They are the type of public open spaces that have been studied from various perspectives, including their cultural, social, economic, and legal dimensions (Vernez Moudon, 1991; Fyfe, 1998; Loukaitou-Sideris & Ehrenfeucht, 2009). However, although streets have been a common topic of research and implemented projects across the globe and across disciplines, their socio-spatial complexities call for on-going and continuous endeavours towards their further exploration (Sharifi, 2019; Bertolini, 2020).

In light of present-day challenges affecting cities, there is a rising concern about transformations streets must undergo in order to address new realities and needs. This special issue proposes to address the following questions: Which conceptual frameworks are useful to examine the relationship between city streets and other urban systems that constitute the city? What are the methodological challenges of studying urban streets as an explanatory framework of urban phenomena? What are the rules of the game and who are the main players in shaping contemporary streets? How are behaviours, needs, and aspirations of the contemporary street users reflected in streetscapes? Which are the tendencies and drivers of change that may influence the conceptual and practical approaches to street (re)design in the near and distant futures?

The idea for this special issue stems from the international interdisciplinary virtual conference City Street[4] "Streets for 2030: Proposing streets for integrated and universal mobility" (Fikfak et al., 2020), held in Ljubljana and specifically focused on transformations for universal mobility as understood in the broader term of the mobility turn (Urry & Sheller, 2006), and in relation to the UN-Habitat SDGs for 2030. This fourth conference in the series of City Street conferences offered a rich overview of scholarly and practical work in the field and provided a platform for discussions on the roles and issues that streets and their makers as well as users have been recently facing. The aim of this special issue is to provide the basis for further reflections, research, and discussions on the selected themes.

The seven contributions in the special issue respond to one or more of the posed questions. Their topics range from accessibility and mobility, public spaces within housing projects, methodologies of studying public space transformations and walkability, and the environmental performance of pedestrian zones. Marchigiani et al. address spatial accessibility as a right and catalyst for urban inclusion. Accessibility allows for active living and participation in urban life. The paper investigates the locations of public spaces, their role in active living, and the

role of accessibility in urban regeneration. In a broader sense, it touches upon mobility and social justice, wellbeing, and the role of public spaces. Two papers shed light on informal mobility in Beirut, Lebanon. In the first, Mady provides an overview of the public transportation system in Beirut, the challenges it has faced under perpetual political instabilities, and the consequent birth of the informal bus system. It focuses on understanding the impact of spatial divides on people's mobility patterns and experiences, hence reflecting embedded conditions affecting everyday mobility in Beirut. The second paper, a case study using the lens of participatory research, charts the development of the Beirut grassroots initiative (later NGO) "Bus Map Project" / "Riders' Rights" and its fight for spatial justice in the context of all-pervasive consociational "democracy". The paper by Petrovič Krajnik et al. aims to demonstrate how the spatial, morphological, and functional transformation of public space contributes to the aspects of sustainability in relation to traffic, landscape, facilities, and urban equipment issues, and thus positively impacts wellbeing. The two-level methodology considers the urban structure within the wider spatial context first and then focuses on the selected public area in the city centre. Žnidaršič and Juvančič explore walkability issues through the multidimensionality approach. The overarching walkability themes derive from research and theoretical contributions of various authors and are structured into operational walkability principles. These are developed further into implementable interventions and items with the focus on residential environments. Tasheva-Petrova et al. present the case-study of Sofia in order to illustrate the complexity of interests and interactions in the public space of prefabricated housing estates inherited from the socialist period. The capacity of the planning system to address them, and the rationale and limitations of participatory planning approaches in conceptualizing conflicts and providing solutions, is discussed, offering a concept of "public" life and space in contemporary urban development of Modernist heritage. Finally, Martínez Mansilla examines the environmental performance of pedestrian zones in Tarija, Bolivia, with the purpose of enhancing urban social life by improved accessibility and increased mobility under specific climatic conditions. The proposed scheme with simulation modelling could provide a template for implementation in other urban places all over the globe.

In line with the goals of Urbani izziv, this issue as a whole aspires to open and address the relevant and meaningful questions of the past, present, and future of streets in order to contribute to the establishment of the conceptual frameworks and methodological approaches to the challenges ahead of us. As the cases presented in the authors' contributions illustrate, streets in diverse spatial and social contexts face different challenges and require tailored approaches. At the same time, certain common challenges can be identified, such as the role of streets regarding growing social disparities, environmental issues, new technology-driven developments, etc. We wish you an enjoyable reading and a fruitful reflection!

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Spatial accessibility as a driver to build an inclusive and proactive city

Abstract
Providing the largest number of persons the possibility to actively move and contribute to their own well-being also depends on the spatial accessibility to urban environment. From this perspective, the present article addresses two main questions: to what extent can the physical arrangement of public spaces play a key role in enabling individuals' capabilities to lead a healthy life, and how can accessibility affect urban regeneration. Accessibility is here understood as a fundamental right of citizenship and as a prompt to set the reflection on sensorial/cognitive/motor disabilities within a broader frame, covering many fields of urban agendas: social justice and health, sustainable mobility and Universal Design, and nature-based solutions. COVID-19 distancing measures have further emphasized the importance of these issues, stressing the need to make urban spaces walkable and usable for the most vulnerable citizens. The research Proactive City, developed at the University of Trieste (IT), offers input into this debate. The outcomes of design workshops in the Italian region Friuli Venezia Giulia, as well as of collaboration activities with the Regional Administration, provide technical and methodological recommendations to rethink "accessibility for all", not as synonymous with special solutions addressed to persons with disabilities but as an overall approach to envisaging any urban transformation and policy.

Keywords: inclusion, accessibility for all, Proactive City, urban regeneration, COVID-19 pandemic

1 Introduction: accessibility for all as a strategic urban issue

Moving across urban spaces in an autonomous and sustainable way (on foot, by bicycle, by public transport) is becoming an increasingly difficult task for everyone, especially for the most fragile citizens (the elderly, children, persons with disabilities). Many physical obstacles preclude an extensive use of streets and squares, parks and gardens, schools, social and health care services, and cultural equipment. The material configuration of public spaces is less and less "democratic" and open to welcoming different social practices, bodies, and capabilities (Francis, 1987), thus contributing to severe *social and spatial inequalities*. Although accessibility is currently recognized as a request of building and planning regulations across Europe, their focus is often on the removal of single barriers to mobility of disabled persons. Instead of fostering real inclusion, this sectoral approach tends to justify a "functionally accessible social and spatial discrimination" (Accolla, 2009). The risk of solutions solely designed to meet a defined user group's needs is to recreate discriminatory situations for the individuals they aim to include. According to Universal Design (UD) philosophy, urban environment should be "usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (United Nations, 2006, art. 2), whereas the physical configuration of cities should accommodate individuals with diverse motor, cognitive, and sensory capabilities. In the light of these considerations, *accessibility for all* is here understood as the material arrangement of infrastructures, public spaces, and facilities, allowing their use by the largest number of persons through soft mobility: by walking as well as using a wheelchair or carrying a baby stroller. The focus is on the spatial connection and comfort of the routes that

a person covers daily (from their home to collective places and welfare equipment), and on the overall quality of urban environment that can support social interaction. The assumption is that taking accessibility as an *urban and social capital* can address deep rethinking of cities as more inclusive contexts (Brain, 2019), according to the aim to "leave no one behind" (Cities for All, 2019). Specifically, the present article discusses how urban spaces can prevent or enable access, participation, and social inclusion, depending on how they are planned and built.

Since 2020, the effects of the measures against COVID-19 pandemic have further highlighted the impact of reduced autonomous mobility on the well-being of large parts of the urban population. Although with differences in national contexts, social/physical distancing and limitation in the use of public spaces and services are producing serious effects on the psycho-physical health of those already suffering from major vulnerabilities (due to age, loneliness, and illnesses, lack of economic and social resources, poor housing conditions, etc.). The situation is often worsened by the prior inadequacy of the spatial configuration and accessibility of the places where education, social facilities, and health care are provided. However, the need for soft mobility connecting public spaces and essential services has been brought to the fore well before the pandemic, both in Europe and elsewhere, by the growing variety of lifestyles, worsening of social and economic disparities, and increase in the age of urban dwellers. These requests and trends have combined with the just claims by people with disabilities, leading to the assumption of *UD principles* by international policies (World Health Organization, 2001; European Commission, 2010; United Nations, 2016; Bencini et al., 2018). In parallel, the topic of *walkability* has gained momentum within a broader reflection on urban well-being and equity (Speck, 2018; Blečić et al., 2020), and a number of international city networks and design experiences have focused on the issues of *healthy*, *active*, and *inclusive cities* (Nike, 2015; Shah et al., 2015; Tsouros, 2015), showing the capacity of mobility to combine with environmental sustainability, health, and inclusion within innovative approaches to city planning and design. Presently, accessibility for all can be understood as a strategic issue of *urban agendas* and as a viewpoint from which many fields covered by the recent addresses and funding for a green transition (the *European Green Deal*, the post-COVID *Recovery and Resilience Plans* of *Next generation EU*, and the *New European Bauhaus*) can be co-ordinately tackled: social justice, physical and digital access to health and care services, people-centred spatial planning and design, sustainable and nature-based solutions (European Commission, 2020, 2021). The perspective urban policies are prompted to take on is that of a "preventive urbanism" (Dorato, 2020), in which the issues of *taking care* in advance of both environmental and people's health are joined with a deep rethinking of welfare services, their spatial layout, and urban setting (Marchigiani, 2022). In this frame, by integrating pedestrian and bicycle mobility, public transport, the provision of green areas and facilities, making city spaces accessible contributes to health and well-being precisely because it allows to deal with many challenges: from limiting the impacts of urbanization processes and vehicular traffic on environment and climate, to encouraging physical activity to help reduce the onset of chronic illnesses due to sedentary lifestyles and ageing. In terms of economic sustainability, the relations among preventive actions to improve the quality and use of welfare services, the rationalization of public spending on social and health care, the reduction of costs borne by individuals and families when resorting to market-provided facilities are evident.

In fact, the attention given these issues is strong and recurring. However, the coordination of the variety of skills and tools dealing with accessibility, as well as their assumption as constitutive elements of urban policies and design, are still far from being taken for granted in the upgrading of city spaces. It is precisely with the aim to develop instruments and strategies helping overcome the gap between innovative approaches and current public administrations'

and professionals' routines that the group Trieste Inclusion & Accessibility Lab (TRIAL) has been working at the University of Trieste since 2019, in the frame of the research *Proactive City: The city as a gym for active design*. The hypothesis is that the physical configuration of places can play an enabling role in supporting social interaction, stimulating healthy and dynamic behaviours, and reactivating a person's "capabilities" to autonomously contribute to their own well-being, according to their different needs, functionalities, and potentials (Sen, 1987). Moreover, taking on a "proactive perspective" can help transform technical and cultural approaches to urban regeneration towards more comprehensive and people-centred solutions. The article investigates how this perspective can work in practice, when integrating urban design and planning. The second chapter provides an overview of the "action and by design" methodology and objectives of the research *Proactive City*. The third chapter draws practical inputs from the results of pilot experiences developed in the Italian region Friuli Venezia Giulia, namely design workshops and activities in collaboration with the Regional Administration addressed to build spatial solutions, planning guidelines, and Information and Communication Technology (ICT) tools supporting accessibility-oriented urban interventions and policymaking. In the fourth chapter, the article further discusses the technical and cultural dimensions of accessibility as the outcome of a proactive approach to the renewal of public spaces and equipment, organization of participatory design processes, and integration of a variety of strategies, scales, fields, and instruments of urban regeneration. Finally, from a post-COVID perspective, the conclusions reflect on the relevance of the issues of inclusive, soft, and healthy mobility in fostering – in collaboration with universities – a deep rethinking of urban planning and design.

2 Proactive City: objective and methodology

In the frame of urban transformations and policies, accessibility for all to collective spatial assets can be translated into many operational fields: the material refurbishment of public spaces as usable by people with different abilities; the combined implementation of mobility, green and healthy infrastructures, and equipment for outdoor activities; the arrangement of the spatial location and organization of social, educational, and health care facilities. To investigate these issues, the research *Proactive City* focuses on the enabling potential of urban space. Going beyond the simple removal or mitigation of the impacts of physical barriers in urban contexts, the research understands *cities as gyms for active design*. The main objective is to rethink urban contexts as places where the configuration of public spaces, the location of services, and green and sports areas are part of strategies aimed at reactivating people's capabilities to move independently (mainly by walking) while preventing the worsening of spatial, social, and health imbalances.

Relevant to the present discussion, the concept of "motility" has been used by Vincent Kaufmann (2011: 37–46) to describe the many forms of interaction between urban spaces and social practices. Talking about *motility* means reflecting on the active role urban populations can perform in the city in relation to the material configuration of their living and working contexts. Motility is referred to as a *conditioned*, *conditioning*, and *enabling capital*, taking force when a person's specific physical capabilities match with adequate levels of accessibility to urban assets. In turn, the degree of expression of motility affects the development of additional capabilities, aimed at adjusting one's lifestyle to contextual conditions. Moreover, going beyond mere adaptation, the presence of spaces that stimulate these abilities can eventually lead to new social practices; this is an important aspect when rethinking urban welfare through citizens' involvement (Marchigiani, 2020). In other words, if the link between

healthy places and *healthy people* is understood as inseparable (Commission on Social Determinants of Health, 2008), disability has to be interpreted not so much as the condition of single individuals, but as the outcome of the daily interaction with a living environment that is more or less able to enhance their motor, sensory, and cognitive potentials. In a stable or permanent way, these potentials change *for everyone*, in the different phases of their existence. A fundamental factor in making cities proactive is, therefore, joining actions on *places* and *people*: on the physical configuration of urban space; on the ways public services are delivered; and on the active role and involvement of citizens, meant not only as city users but also as providers of knowledge and experience when conceiving physical transformations and services reorganization.

The research *Proactive City* addresses these topics by taking on an *interdisciplinary approach* and by linking different expertise: from planning and inclusive spatial design to healthcare and rehabilitative therapy. In addition, *Proactive City* is an "action and by design" research, oriented towards a strong interaction between theory and practice, according to a "reflective practitioner's" attitude (Schön, 1984). Its methodology is based on empirical activities, with the aim to develop two intertwined paths: the exemplification of spatial solutions through design experiences involving citizens, local stakeholders, and administrations; the definition of tools and approaches to innovate public policies.

3 Results from pilot cases

Below, the aims and results of three different and complementary case studies are presented. The first one focuses on the importance of the citizens' participation in the renewal of urban spaces through public discussion, multicriteria analysis, and digital tools as devices in support of people's engagement. The second one shows how the issues of accessibility foster innovation in the ways soft mobility in between facilities is planned and designed. Finally, the third case refers to the development of guidelines and policies meant to help public administrations accept accessibility as a fundamental component of urban planning and spatial upgrading. The outcomes of these experiences support the proposal of a methodological path towards the transformation of urban environments into proactive cities.

3.1 Sant'Antonio Square (Trieste): public discussion

The first case study was offered by the upgrading of Sant'Antonio Square, promoted by the Municipality of Trieste as one of the latest steps of a long-standing regeneration process of the city historical centre, begun in the 1990s. A participatory design experience was developed in spring 2019 by experts from TRIAL in collaboration with members of Progettiamo Trieste (a local association of young activists). The general aim was to raise wider public awareness of the importance of providing public spaces that are accessible for all. This scope was addressed through the definition and testing of tools used to *listen to vulnerable groups' requests* from the initial phase of the design process onwards. During a one-week workshop, students from the University of Trieste had the opportunity to debate with the Administration technical staff, the architect in charge of the preliminary plan of the square (Maurizio Bradaschia), and different stakeholders (Regional Board of Disabled People's associations, Italian Blind Persons' Union, and Pro Senectute association). The main objective was to assess – in a shared way by students and expert designers, the elderly and persons with motor and visual disabilities – which of the four proposals defined by the architect (Comune di Trieste, 2019) could best meet a number of identified fundamental requirements.

The participatory process was supported by the use of decision-making tools to help match and evaluate different solutions, and improve the quality of the final project. Specifically, the listening process was started from on-site mapping and filling in of qualitative questionnaires that had already been tested by TRIAL and the Municipality in the prior project *Accessibility Laboratory – Labac* (2011–2016), promoted by the Province of Trieste to map urban itineraries according to their degree of accessibility by the most fragile city users (Garofolo et al., 2018). First, *practicability*, *safety*, *environmental quality*, *usability*, and *reachability* were identified as the main requirements for the square. Then, in order to choose among the project proposals, a general grid was defined, linking the types of stakeholders to more detailed design criteria (Table 1).

Table 1: Trieste. The multi-criteria assessment grid.

Stakeholders	Requirements	Criteria
Physically disabled Visually impaired The elderly Experts	Practicability	Readability of spatial elements
		Path continuity
		Path width
		Path inclination
		Sound aspects
	Safety	Discontinuity detectability
		Readability of obstacles
		Horizontal surface uniformity
		Materials invariability
		Sound aspects
	Environmental quality	Perception
		Well-being
		Microclimate
		Illumination
	Usability	Ergonomics
		Material properties
		Reflexivity
	Reachability	Public transport proximity
		Availability of dedicated car parks

Source: Chiarelli (2020).

By adopting a *multi-criteria assessment model*, each participant was asked which requirement weighed more, with the aim to recognize the design alternative that could offer the highest level of accessibility in relation to the preferences of the majority of stakeholders. This approach helped understand how the importance given to accessibility issues varies according to the stakeholders' needs and capabilities. For example, for the elderly, the most important requirement was safety; for the visually impaired, practicability, usability, and safety were equally fundamental; for physically disabled persons, not only the practicability of the space but also its reachability were defined as priorities. Finally, a computer software was used to analyse the answers by equally considering the different points of view. The outcome was the choice of one proposal (number 4), that however revealed certain critical issues (Figure 1). The workshop therefore developed a second listening phase in order to allow the participants to suggest measures to overcome the identified problems and review the project during its further steps. In addition, the Administration also considered feedback from citizens by delivering a public on-line questionnaire. The overall set of collected suggestions prompted the Municipality technical staff to ask the architect for a new version of the project, considering the

needs expressed by the citizens during the entire process. The Administration is currently working on that version of the proposal in order to develop the final design phase.

This experience clearly demonstrates that *participation counts*. Knowing the needs of citizens allows designers to calibrate their choices and come up with solutions that are better tailored to people's requests. The challenge is to not only consider the design and quantitative criteria on accessibility that are formally dictated by the law (in Italy, major references are the Ministry Decrees no. 239/1989 and no. 503/1996), and that predominantly focus both on the removal of single obstacles to motor/sensory disabilities and on the definition of minimum dimensions of open areas and buildings. The aim is also to give voice to the performance requests that are expressed by the actual users of public space. The assumption is that, in order to be more effective, spatial strategies and solutions should be ordinarily built through processes of *designing with people*, open to the contribution of the *common knowledge* of persons with different vulnerabilities, capabilities and needs, whose daily struggles are also the result of disabling environments.

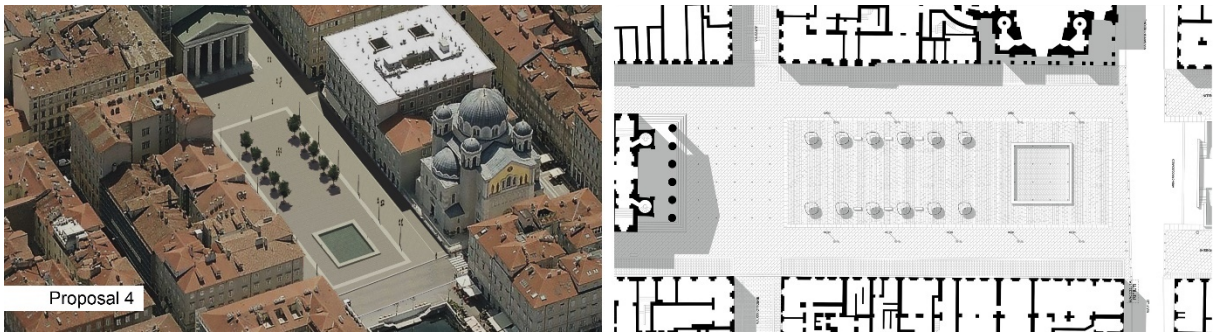

Figure 1: Trieste: the fourth proposal for the renewal of Sant'Antonio Square (source: Studio Bradaschia, Municipality of Trieste, 2019).

3.2 Grado: healthy and green routes

Grado was the location of a second design workshop, held in summer 2019. The choice of the place was motivated by the complexity and dynamism of this small city in Friuli Venezia Giulia, and by the interest to further question the interactions between planning and design issues dealing with accessibility. Grado is an important tourist destination in the region, with an intense seasonal change of habits and population (8,000 inhabitants in winter, 80,000 in summer). The local administration is implementing innovative projects for public spaces, with specific attention given to green networks, walkability, and cycling. The two most relevant planning initiatives concern the Plan for the Removal of Architectural Barriers within public buildings and open spaces (PEBA; established by the Italian Laws no. 41/1986 and 104/1992), and the Sustainable Urban Mobility Plan (PUMS; Decree of the Italian Ministry of Infrastructures and Transports, 04 Aug. 2017; see also Rupprecht Consult, 2019). However, further work is needed towards their integration into overall urban strategies. Again, the workshop approach was based on the direct practice of the city. For two weeks professors and students walked across urban spaces, met technicians from the Municipality and the Region, and took part in surveys with disabled people's associations. The organization of training seminars on accessible cities, given by experts engaged in national planning and design experiences, aimed to provide inputs both to the Administration and to professionals and citizens. Meanwhile, design work focused on proposals for *healthy and green routes*, namely itineraries connecting residential urban districts to the green and pedestrian areas at the back of the beach. The challenge was to imagine Grado as a small capital of active life, where everyone can move safely all year long; as a city where collective spaces and equipment work in an

integrated manner, offering the largest number of people the opportunity to perform outdoor activities; and as a place where tourism can become a lever both to develop economies and to upgrade the quality of everyday life.

The selection of the streets and paths to refurbish was oriented by considerations made on a larger, urban scale. Design work took the public facilities already available in the residential neighbourhood – schools, parks, sports areas, and healthcare facilities for the elderly – *as keystones of the new urban route* and of the entire soft mobility system. On a more detailed scale, the proposals focused on *opening up the fences of public buildings and plots*, and on redrawing their intermediate spaces with the streets, in order to multiply their services and offer them to a larger variety of users (Figure 2a). The solutions consisted of the design of *adaptable collective spaces*, where casual encounters and interactions can take place, and where inclusive playgrounds and equipment for outdoor activities are not conceived as intrusive furniture but as an integral part of multitasking, continually changing, and interlinked urban spaces, inviting to freely act in the city. In all projects, green materials and nature-based solutions for making urban soil permeable and resilient to climate change were among the main elements, showing how *accessibility, health, and environmental issues can be jointly addressed* in ordinary interventions on public spaces. Wherever possible, the students' proposals converged on the increase of pedestrian areas and of lanes specifically dedicated to bicycles (separation of walking and cycling was recognized as necessary and welcome by all the users), combined with the reorganization of parking facilities and public transport services. In line with the *EU Road Safety Policy Framework 2021–2030* (Adminaité-Fodor & Jost, 2020), when the co-presence of different mobility modes in the same space could not be avoided, the solution was to design *30 km/h streets* as public spaces meant to protect the most vulnerable road users by hosting cars in reduced vehicular areas, adding chicanes and trees to articulate the street section, and lowering car speed limits (Figure 2b). A common component of all the interventions was the creation of a *continuous system of pedestrian crossing platforms and pavements*, where the choice of *surface materials* and the location of *street furniture* would help orientation and avoid obstacles not only to persons with motor and sensory disabilities but to everyone else (Marchigiani, 2022).

The workshop strengthened the awareness that *inclusive design is not synonymous with special solutions and devices*. The challenge is to imagine spaces that are without barriers and walkable by everyone, trying to negotiate in advance the conflicts among different persons and ways/capabilities to move (pedestrians vs. cyclists, motor vs. visual or cognitive abilities). Indeed, one of the outcomes was the awareness that the main obstacles to a proactive city are not to be found in the lack of detailed technical solutions (in fact, to a large extent already developed by urban planning, regulations, and design), but in the difficulty in combining them as regular and interconnected components of a different (and multiscale) way of transforming urban contexts into people-centred and environmentally sustainable habitats.

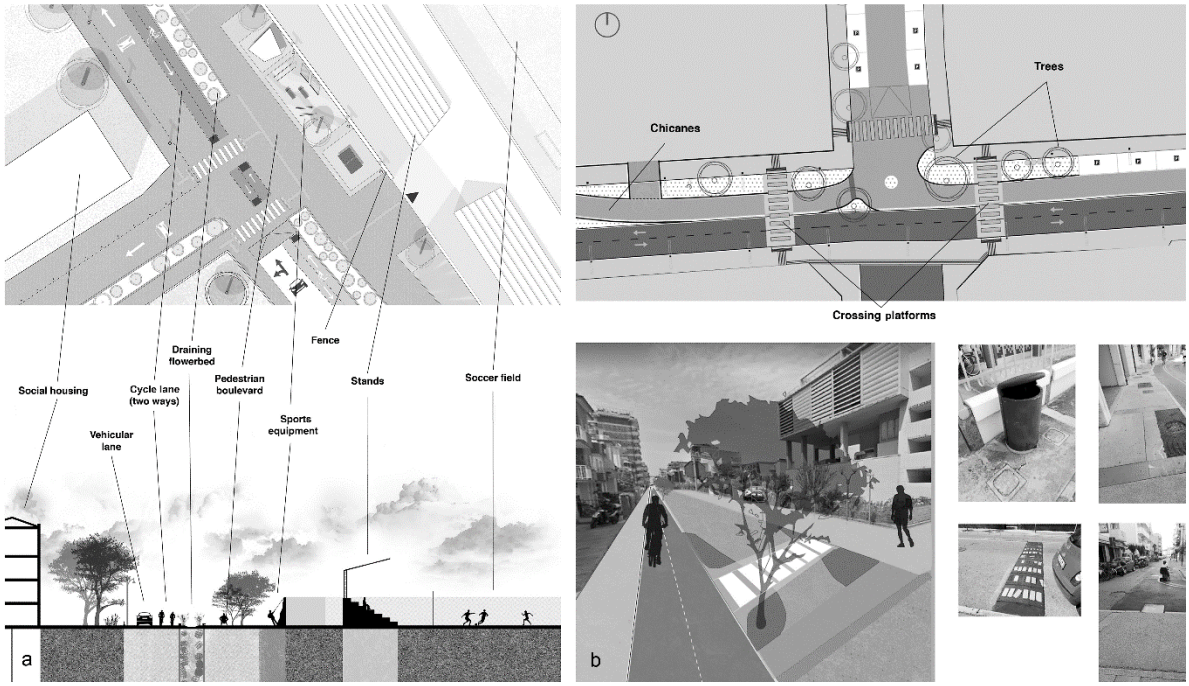

Figure 2. Grado: a) the redesign of spaces in between sports equipment and the streets; b) 30 km/h streets (source: research documentation of *Proactive City*, University of Trieste, 2019).

3.3 Region Friuli Venezia Giulia: change in urban policymaking

Further operational fields for conceiving a proactive city have opened up thanks to an agreement signed in 2020 by the Universities of Trieste and Udine with the Region Friuli Venezia Giulia. The request is to support the enactment of the regional Law no. 1/2018, *General Principles and Implementation Provisions on Accessibility*. By taking UD perspective, the aim is to activate a laboratory for innovating public policies, in which the Region and the local administrations work together to revise the contents of planning tools. The starting point consists of providing municipalities with public incentives both to draw Plans for the Removal of Architectural Barriers (PEBAs), and to address their integration into general town plans and public works. In fact, in spite of being established by national laws, up until now the compulsory nature of PEBAs has been nullified by the lack of sanction measures, and the number of the approved ones is still limited. The final output of the agreement signed with the Universities is the realization of a georeferenced (GIS) mapping of accessibility to public buildings, and urban and extra-urban paths in the region.

The first collaboration phase consisted in the delivery of *planning guidelines* (AA.VV., 2020). Their purpose is to help city administrations use the regional funds for the PEBAs, innovate their contents, and show the strategic role they can play in urban regeneration. The text is not only a practical step-by-step guide. It also proposes a new approach to planning and design, providing both methods and solutions, with regard to: i) setting the construction of PEBAs within a stronger coordination of municipal sectors and offices (town planning, traffic and mobility, public works, etc.); ii) organizing continuous interaction with citizens, in order to consider and provide answers to their needs; iii) taking existing public facilities as the origins and destinations of the accessible itineraries defined by the PEBAs; iv) substituting solutions to single criticalities with more complex spatial upgrading processes, where the interventions on the surfaces of pedestrian paths and pavements, and on their connections, combine with those on urban furniture, lighting, and on the outdoor and indoor accessibility to public buildings. The prompt is to avoid the use of standardized spatial devices and to stimulate

administrations to take on a more contextual and project-oriented attitude, not only towards the removal of specific obstacles but also towards the overall redesign of public spaces. The work is now proceeding with the construction of a *software platform* the Region will make available to local municipalities and professionals in order both to facilitate the construction of the PEBAs, and to collect and harmonize information on accessibility on a regional scale. The software will combine the visualization of regional and municipal data on the location and use of existing welfare services with georeferenced mapping tools and integrated electronic sheets. These latter will allow real-time organization of the information gathered during the on-site survey activities PEBAs are based on – from the technical analysis of the places to the matching of critical issues (environmental obstacles and individuals' perceptions).

This experience shows that the improvement of accessibility cannot rely on the implementation of *sectoral tools*. In fact, the mapping of the physical obstacles to people's movement – although extensive, accurate, and based on participation – tends to reduce the complex theme of accessibility to a *punctual and remedial approach*. Another important issue refers to the use of ICT devices. The identification and selection of the interventions that are supposed to ensure the effective functioning of collective spaces, equipment, and services is often oriented more by emergencies than by careful planning. A further relevant question therefore concerns how to support municipalities in the construction – as agile and automatic as possible – of *knowledge helping decision-making* (Chiarelli & Marchigiani, 2018; Marchigiani, 2020).

3.4 Recommendations on design and planning solutions

As a result of *Proactive City* pilot cases, recommendations to build comprehensive regeneration projects based on accessibility issues can be highlighted. They provide a methodological path and some key steps, addressing further development of the software platform in collaboration with the Region Friuli Venezia Giulia (Figure 3). The first step refers to the *selection of the places that plans and projects for accessibility should primarily focus on*. As the workshop organized in Grado showed, a preliminary analysis is needed, taking the entire urban context as a reference and deriving information from regional and municipal data sets. The analysis should start from the cartographic mapping of the main public spaces and facilities, their location, and existing/potential physical connections (e.g., schools and cultural equipment, green and open spaces, civic, health, and social care centres, social housing districts, public transport services and hubs, commercial activities). The collection of information about the actual users of this equipment, their places of residence, and movements can further enrich the analytical frame. Moreover, the work of setting action priorities should consider the outcomes from the organization of participatory opening events, and the building of an atlas of the plans and projects the local administration is defining and implementing (e.g., urban plans, mobility plans, public works).

Once the specific intervention area (e.g., a spatial system including walking itineraries, public spaces, built facilities) has been chosen, the second step consists of *detailed and contextualized technical and participatory surveys*. In this part of the process, the assessment of criticalities and barriers to accessibility should focus not only on quantitative criteria and their actual respondence to normative standards but also on those qualitative and performance aspects (e.g., practicability, safety, environmental quality, usability, and reachability) that the co-assessment process with actual users, tested in the workshop in Trieste, well put into evidence.
Finally, the third step refers to the *definition of spatial design solutions* and their integration with both overall planning and regeneration strategies, and urban policies dealing with different topics of city governance (from mobility to housing, social and health welfare). Here again, the

pilot project developed in Grado provided valuable inputs to go beyond sectoral interventions. A proactive city is not just “barrier-free”. It is a city where the material reorganization of spaces and facilities is conceived by taking the most vulnerable users' perspective: from the choice of the surface of streets and pavements, to the retrofitting of public buildings, to the conception of new types of equipment (e.g., those freely dedicated to sports and open-air healthy activities).

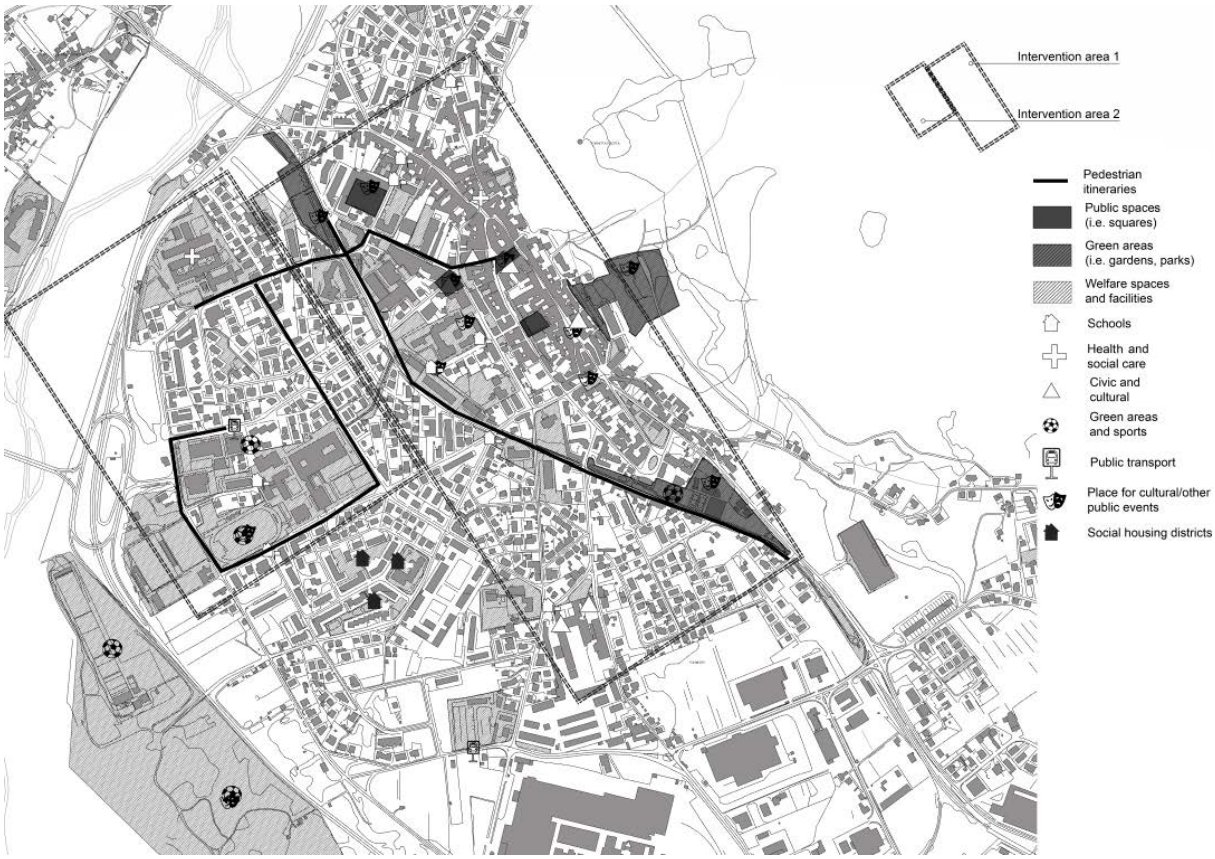

Figure 3: Regional software platform: map of intervention areas, with reference to existing public spaces and facilities, and their potential connections (source: research documentation developed by the Universities of Trieste and Udine, and the Region Friuli Venezia Giulia, 2021).

4 Discussion: accessibility as a component of ordinary urban regeneration

The results of the research *Proactive City* offer inputs to review urban policies, design, and planning tools, confirming the hypothesis that accessibility can be a powerful driver towards comprehensive and people-centred urban regeneration. However, the research outcomes clearly also demonstrate the need of a deeper cultural change in technical approaches. If many solutions to make our cities more accessible are already available, what is often lacking is the attitude to concretely integrate them into the conception of ordinary urban transformations.

4.1. Public spaces as an enabling infrastructure

Wearing the lenses of accessibility means assigning a pivotal role both to the direct analysis of the spatial contexts (of their specific constraints against soft and autonomous mobility) and to the acknowledgment of the actual needs of those who daily practice them. The *perceived usability* of a place goes well beyond the absence of single sensory and architectural barriers. Instead, it refers to a large set of physical and behavioural variables, whose impacts differ according to individuals' capabilities/disabilities, and which profoundly affect the propensity to

freely move across urban space. Public spaces should be designed for the largest extent of the urban population – starting from those most fragile – with the aim to guarantee inclusive access to collective equipment, while taking into consideration different functioning of individuals. In fact, talking about accessibility for all means providing a high-quality urban environment in which different social practices and bodies can comfortably take place and interact (Bianchetti, 2020). It means assuming a combination of the issues of fruition with those of soft mobility as a prompt to reconceive the *material and accessible connection of public spaces and facilities as a welfare service itself*. Namely as a service that both plays a strategic prevention and therapeutic role in enabling healthier conditions (for the urban environment and its inhabitants) and helps fight against the exclusion of growing numbers of at-risk urban populations (persons with disabilities, citizens who are transportation disadvantaged for social and economic reasons, as well as the elderly, children, etc.) (DIAUD, 2016). The mere application of quantitative and functional building and planning standards – which currently still regulate accessibility – has frequently led to the conception of separate and disconnected plots and buildings, difficult to access not only for people with disabilities but for everyone. Evidently, to overcome this situation, well-designed routes in between public spaces and facilities are needed.

4.2 Participation as a continuous co-design process

In this view, *participatory surveys and mapping* help understand the often-conflicting effects of enabling/disenabling spaces and negotiate towards more inclusive solutions. In Italy as elsewhere in Europe, the adoption of participatory approaches in urban regeneration (and, specifically, in placemaking processes and projects for inclusive public spaces) is currently recognized as fundamental, and highly recommended by EU initiatives (e.g., URBACT; Bandenhorst, 2019). However, when such approaches are not made compulsory by national and regional laws, they are often ignored. In the Italian national legislation, *public debate* – which comes closest to the concept of participation in design – is formally required only for large-scale infrastructural and architectural works of social relevance. In addition, public debate can be activated for other types and scales of interventions but only if requested by a sufficient number of citizens (*Codice dei Contratti Pubblici*, Legislative Decree for Public Contracts no. 50, 18 Apr. 2016), in spite of the evident value that understanding of the end users' needs can add to the effectiveness of urban regeneration projects. Indeed, the right to creativity of a designer should be carefully negotiated with the judgment expressed by a variety of stakeholders. Relevant actors and citizens should be invited to co-build and co-validate all the different steps of a design process, and not only during formalized events meant to present and discuss already developed proposals, as is customarily the case when it comes to “ordinary” public urban transformations.

4.3 Crosscutting the fields of urban policies

Trying to match and co-ordinately address a variety of conflicting issues (prioritization of traffic flows and parking, safety and comfort of pedestrian and cycling mobility, needs of persons with different disabilities) concretely proves to be a *wicked problem* (Rittel & Webber, 1973). That is a problem with many reverberations on *spatial justice* (Sorkin, 1999) which largely remain underestimated by urban policies. A further important field of innovation thus refers to the systematization and integration of the urban policies and tools that more or less directly deal with accessibility but are often managed by local administrations in a sectoral way (e.g., town plans; traffic, mobility, and parking plans; public works; permissions for commercial occupation). In this sense, the assumption of accessibility (and of PEBAs) as a *structural*

component of ordinary and general town plans can help build a reference vision, able to more effectively coordinate the timing and contents of the many public and private interventions that materially affect the use of collective spaces. When talking about healthy and active cities, overcoming the persistent misalignments between planning instruments and housing, social, and health care programs that rule the *territorialized organization of welfare services* is no less important. This further highlights the importance to foster a radical change in the routines that guide local administrations; the necessity to break the persistence of a "silo thinking" approach (namely the rigid separation of the fields of public action); and the need to strengthen the coordination among urban policies, expertise, and actors involved in urban transformations.

4.4 Rethinking the role of ICT tools

ICT tools can help administrations fulfil the aforementioned tasks, but a huge amount of work still needs to be done in this direction. A relevant field of experimentation and innovation regards the construction of technological and GIS integrated platforms, able to harmonize the large amount of data that are already available to the many administrations' sectors and levels; integrate them into a spatial vision; and bring to light the connections between the spatial location of equipment and services, their users and uses. The focus is on data describing the intensity and the type of access to public facilities, local transport, and sites of tourist/cultural interest; facts related to the origin/destination of users; and information on the demographic composition of the residents in different neighbourhoods. These data sets are already automatically and periodically updated, mainly refer to public services addressed to vulnerable groups, and can feed *decision support systems*, helping not only define where to intervene but also monitor the effects of interventions and, if necessary, re-address them.

However, accessibility is not only a spatial issue, and the interaction of urban planning with ICT tools opens up further operational fields. The adoption of technological applications shows considerable potential for the improvement of the daily use of urban spaces by a large number of persons. Through the provision of up-to-date information on services and their timetables, the physical accessibility of places (e.g., by means of public transport or dedicated parking spaces), and the presence of supports to overcome motor, perceptive, or cognitive barriers, ICT tools allow an easier use of the city as well as a continuous and direct dialogue with the public administrations. This is especially true if technological devices are *customizable* (adaptable to a person's specific needs) and *interactive* (capable both of gathering information and suggestions from citizens and city users, and of communicating the status of the interventions carried out to meet their requests). In this sense, the same tools can provide information, and collect citizens' needs and advices in a smarter way.

5 Conclusions

The effects of COVID-19 pandemic have dramatically highlighted the strategic role that the usability of fundamental services plays in guaranteeing inclusive and fair urban life conditions. This has helped put accessibility issues at the core of technical and political debate, while stressing the importance of refurbishing urban spaces to make them walkable and enjoyable by the largest extent of the urban population. As sanitary measures have shown, social distancing mainly affects the most fragile persons (the disabled, the elderly, children), preventing or making highly difficult their autonomous access to public spaces and equipment. More careful reflection is thus needed on how to reorganize both welfare facilities (mainly health care and education) and those public spaces that can offer opportunities to reactivate social and health

practices (mainly parks and streets). If in many Italian cities, as well as all over the world, the management of the post-lockdown phases has seen the realization of pop-up cycle lanes and pedestrian areas as tactical responses to a limited use of public transport (Barbarossa, 2020), a structural and stable adaptation of spaces and material connections according to accessible for all criteria cannot be postponed. Otherwise, there is a significant risk to miss the opportunity to take the pandemic as the driver of significant changes in urban space, welfare, and policies. In other words, our choice stands between two extreme scenarios: on the one hand, the worsening of spatial/social/functional disparities by providing only targeted and temporary solutions, on the other hand, the opening up (similarly to past post-pandemic periods) of a new phase, based on the renewal of skills and tools of urban design, planning, and governance (Pineda & Corburn, 2020).

From this viewpoint, one of the main challenges is to overcome the still widespread tendency to adopt "particular" technical solutions that, while focusing on physical specialized supports, confine the movement of persons with disabilities to dedicated spaces, produce spatial stigmatization, and prevent social integration. Therefore, there is a strong need to promote actions aimed at raising awareness of the issues of inclusion and enhancement of diversity. The results of the research *Proactive City* show that taking accessibility as an urban right fosters a radical change in approach, whereas the prompt is to assume detailed spatial devices as ordinary and interconnected components of renovated urban regeneration tools and processes, better addressed to build *care-full cities*. The reference is to cities that allow their inhabitants to freely move and access public spaces and welfare facilities on a daily basis, according to their different bodies and motilities, material and immaterial needs, cultural and social habits and conditions. If we positively take on the perspective of a deep change, the responsibility of education and research in providing technical and cultural inputs is paramount. The experiences described in the present article move precisely in this direction. Being part of the so-called university *public engagement activities* (namely the establishment and strengthening of relations with local contexts, stakeholders, and institutions), they pursue multiple purposes. The dissemination and sharing of good practices – as well as the organization of curricular and/or continuous training programs – feed innovation processes. They provide all actors involved with skills and opportunities to *think out of the box*: the students as future experts can enjoy a different way of learning, based on active and early engagement in the treatment of the complex issues of urban regeneration; the territorial administrations in charge of urban policies can escape routines and emergencies by experimenting with new processes and tools; and the civil society can have voice and offer better knowledge of possible solutions for accessibility through active involvement in co-design processes.

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Christine MADY

Exploring Beirut's instability through its informal mobility

Abstract
The present article addresses the transformations of Beirut, Lebanon's public transport system from its establishment in the 1890s until its disruption during the Lebanese civil war of 1975–1989. The civil war left the country with a weak state, weak planning, and ongoing implications including the emergence of informal mobility. Although informal mobility is a global phenomenon, Beirut provides an opportunity for its study in the context of instability, with implications for riders' spatial experiences. Within the framework of the mobility turn and mobility experiences, the present article explores the impact of the war-time divides on mobility in Beirut and the transition from a system operated under the auspices of the Ministry of Transportation and Public Works to one operated by private entities with politico-sectarian support. The article analyses the contextually embedded informal framework in terms of regulations, operations, negotiations, and Beirut's road infrastructure. To this end, the methodology comprises literature review, analysis of the available bus map, interviews with the Riders Rights NGO, and observations along selected bus routes. The article the basis for further exploring how the spatial experiences of riders in this informal system are affected by Beirut's post-war, divided configuration and securitization. The purpose of the article is to establish a basis for further investigating the system's potential for social integration within Beirut's fragmented and unstable context.

Keywords: Informal mobility, Beirut, spatial divides, securitization, infrastructure

1 Introduction

Lebanon's geopolitical position, alongside internal and external influences, gave rise to intermittent instability throughout its history down to the present. During the civil war of 1975–1989, Beirut was divided into east and west parts, its population segregated along politico-sectarian differences, while the government and urban planning system were weakened. This instability led to disruptions of everyday life, which equally affected mobility (Adey et al., 2014: 11; Adams-Hutcheson, 2017). Such disruptions generated differentiated spatial experiences based on private car or public transport, while adaptations enabled people to continue their much-needed mobility despite instability. One such adaptation was the emergence of the informal bus system. The critical transportation situation in Lebanon, and the difficulty to provide an integrated public transport system, is reflected in reports by the UITP (2019), the World Bank (2016, 2017), UN-Habitat (2018), and the recent proposal to implement Bus Rapid Transit (BRT) without an indication of how the current informal bus system could be integrated (CDR, 2018).

Informal mobility based on informal transport plays a central role in cities worldwide yet remains tangential to academic research (Medeiros et al., 2018: 5). Literature on informal transport generally focuses on the Global South, referring to such forms of mobility as, for example, para-transit, third-world transport, intermediate technologies, or artisanal transport (Cervero, 2000: 3; Godard, 2008). However, empirical studies show that informal transport also exists in the Global North, relating informality to regulation, organization, and the economy (Cervero, 2000; Cervero & Golub, 2007; Adey et al., 2014; Kumar, 2016; Buhr, 2017; Rekhviashvili & Zgibnev, 2020). Further research is required to examine its implications within different urban contexts (Evans et al. 2018). In terms of the current informal mobility debates

related to power relations, culture, and market influence, the scene of informal buses in Beirut is comparable to that in other cities globally. Yet, Beirut's case, with its contextually embedded aspects including its car-dominated, securitized, socially polarised, and unstable context (Nemeth, 2010; Mom et al., 2011; Mom, 2017; Mom & Clarsen, 2017), can make an important contribution to our understanding of implications of instability on mobility. In particular, the present article explores spatial changes caused by the fragmented city, and their impact on the spatial experiences of the informal system's users.

The section that follows provides an overview of the role of mobility in everyday life and urban experiences, building on the mobility turn (Urry & Sheller, 2006), with the purpose of examining mobility under instability. Then the characteristics of informal mobility are presented as a framework for analyzing Beirut's case. The article examines Beirut's public transport in its historical context and focuses on the shift or emergence of informal mobility following the civil war. Methodologically, in addition to the literature review and analysis of the existing bus map, the article builds on interviews with the Riders Rights NGO, conducted with both founders on 14 June 2018 and with one of them on 20 May 2019, 8 August 2019, and 3 March 2021. These interviews provided insights into the informal mobility system, its material and immaterial traits, and operation models. To demonstrate the differentiated spatial experience, the same journey from one location in an eastern suburb to the same destination, Hamra, in the west (Figure 1) is indicated with a car trajectory and by commuting using the available bus lines, with the required route interchanges and an exploration of the experience of getting off the bus at a stop (Mady, 2020).

2 Mobility, informal mobility, and instability

This section explains the importance of mobility and its lived experience, particularly in unstable contexts. It then specifically examines informal mobility and its traits as presented in the literature, with the purpose of framing the case study of Beirut. Regardless of the means of transport, mobility is a constituent of everyday life (de Certeau, 1984). Mobility contributes to spatial connectivity among people, objects and information (Salazar, 2018), and the everyday contextual experiences of "socialities, affinities, knowledge" (Buhr & McGarrigle, 2017, 227–228). Mobility adapts itself to circumstances, and is "something we learn to do and that requires a constant manipulation and re-adjustment of skills and knowledge" (Buhr & McGarrigle, 2017: 232). In unstable contexts and in response to various threats, securitization affects social interaction by secluding streets, and both public and private urban spaces. Instability and securitization often result in the emergence of "militarized landscapes", which either physically or symbolically reduce or obstruct mobility (Nemeth, 2010: 2489; Nemeth & Hollander, 2010). Furthermore, heightened security measures generate feelings of insecurity and fear, which may result in insular behaviour, even in the case of mobility (Nemeth, 2010; Blokland, 2017; Leese & Wittendorp, 2018). Under instability, mobility by car could be favoured over that by public transport, since it allows for flexibility in route choice and dissociation from the public through an insular spatial practice (Alaily-Matar, 2008; Blokland, 2017; Farjalla et al., 2017). Note that simultaneously occupying the same urban space does not imply that people in that space-time engage in the same activities. By isolating themselves in micro-cultures, car users could cluster without interaction (Yip, 2016: 162). For instance, the co-presence of private cars and buses on the same road, in the context of which the bus riders remain unknown to each other, generates different perceptions of riders' profiles. The lack of participation in public transport results in a "public space so imputed with normative understandings of (in)appropriateness that they appear inaccessible to some" (Blokland, 2017: 559). Conversely, shared mobility contributes

to the "co-constitution" of meanings to urban areas through the mode of transport, its subjects, and the public experience embedded in this system (Sheller, 2014: 47). The unfolding spatial experiences of public transport reveal tangible and intangible contextual specificities, including street names, signs, and other space-markers. In a car-thriving context, automobility establishes a system of interaction between driver, car, and infrastructure that influences the commuting experience (Adey et al., 2014: 12). Within such an enduring system, it is difficult to switch ridership to public transport even when alternatives are introduced (Dennis & Urry, 2009, cited in Adey et al., 2014: 13). This reluctance is even stronger when it comes to informal mobility in unstable contexts, although it presents one approach towards social integration and supports diversity in urban life (Buhr & McGarrigle, 2017: 228; Blokland & Schultze, 2017).

Predominant discussions of informal mobility underline its negative perspectives, absence of state endorsement, and response to market demand (e.g. Cervero, 2000; Cervero & Golub, 2007; Kumar et al., 2016). Informal mobility is obfuscated by transport planners and automobile users who perceive it as a nuisance or undesired reality serving a homogeneous, stereotyped user group rather than acknowledging the "multiple identities of users" (Levy, 2013: 49). Car users perceive it as a safety and pollution threat to be eradicated while overlooking its vital role in providing spatial justice (Cervero, 2000: 9; Adams-Hutcheson et al., 2017; Sheller, 2018). In the absence of strategies within a weak state with weak planning, mobility is affected by instability and abrupt events, leading to coping tactics in order to meet this collective need (Andres, 2013). In such a context, the negative outlook on informal mobility is related to several factors. These could include the "laxly enforced" control over its regulation, degrees of laissez-faire approaches, makeshift or situational solutions, the condition of the existing infrastructure, and the inherited socio-cultural structure, including heavy reliance on the automobile (Cervero, 2000: 3; Rekhviashvili & Zgibnev, 2020; Weicker & Sgibnev, 2019).

Organizationally, informal transport is entangled in a power network (Keblowski et al., 2016), which is interconnected vertically to the state and horizontally to informal regulating norms and values (Rekhviashvili & Zgibnev, 2020). Whereas the government provides licenses, the operators distribute routes, sublet vehicles, and involve a "diverse body of transport workers" (Rekhviashvili & Zgibnev, 2020: 7). Informal mobility is then negotiated between riders, drivers, operating companies, and the state, under contextual, socio-political considerations going beyond profit-seeking (Rekhviashvili & Zgibnev, 2020). This negotiation occurs in space and time as an interaction between people, objects, and places. Negotiation is affected by the historically and culturally established system of meanings and values, and it simultaneously generates new meanings and norms (Adey et al., 2014; Salazar, 2018; Rekhviashvili & Zgibnev, 2020). Under instability, informality acquires a fluid state of behaviour, and thus becomes difficult to disentangle from formality (Roy, 2009b; Watson, 2009).

In summary, unstable contexts lead to disrupted urban environments in which mobility adapts to abrupt changes through tactics, one of which is informal mobility. The latter is used by some groups, providing them with opportunities for diverse spatial experiences. While the stereotyping of riders, and generated norms and values of this system cannot be covered within the scope of this article, other aspects of informal mobility, specifically within an unstable context, are explored. These include some of the material features attributed to informal mobility but also the power relations, inherited culture, and negotiations that affect spatial experiences. Under instability, it is important to explore informal mobility, which creates a dichotomy as a nuisance but also a possible medium for social justice for its users.

3 A historical overview of public transportation in Beirut

In Beirut "infrastructure and sectarian communities are reproduced in the present. Yet without a historical perspective none of this makes sense. For this, we need institutional and infrastructural histories" (Nucho, 2016: 9). These can be briefly summarized as following: Beirut's motorized public transport began with the introduction of a tramway in 1890. Its lines were distributed peripherally along the waterfront and covered Beirut's extents from north to south (Figure 1). Even at the time, tram schedules and stops could not be enforced, reflecting people's fluid practices in stopping coaches indiscriminately (Hanssen, 1998). The tramway, in 1905 followed by the railway and the Beirut port station, witnessed Beirut's growth under Ottoman rule as a nexus between the Middle East and Europe (Hanssen, 1998; Kassir, 2003). This also meant Beirut had a diversified and growing society, characterized by "civic and national identities [that] are multivalent and sharply contested" (Reilly, 2016: 111). Beirut maintained its regional role during the French mandate period, and French planning modelled the city's development, including the expansion of the road network. This network mainly served commercial interests and contributed to the formation of suburban and peri-urban residential areas accommodating separate religious and income groups (Salam, 1998; Saliba, 1998).

The Republic of Lebanon, newly constituted in 1943, was founded on the principles of free-market economy and consociational government (Salamey & Tabbar, 2008). A consociational government distributes state roles and power sharing among the various politico-sectarian groups with the purpose of ensuring equity among the multi-sectarian population (Hanf, 1993; Camett, 2011). In reality, "authoritarian inner-state entities", supported by politico-sectarian parties, prevailed and served their own communities rather than a civic society at large (Salam, 1993; El-Khazen, 2000; Salamey & Tabbar, 2008: 240; Roy, 2009a). This applied to various facilities, public spaces, and infrastructure, including public transport (Davie, 2001; Mady & Chettiparamb, 2016; Nucho, 2016; Farjalla et al., 2017). These communities formed "social bonds of cohesion found in tribal, kinship or communitarian solidarities" (Khalaf & Denoueuz, 1998; Larkin, 2012: 42). The intertwining of governance with sectarianism questioned the "sovereignty to one jurisdiction" (Nucho, 2016: 13) and led to "a fragmented sense of urban identity" (Monroe, 2017: 249). Despite these challenges, convivial living characterized Beirut until the eruption of the civil war.

The new Republic followed and implemented western urban planning trends, mainly influenced by French schemes (Salam, 1998); it prioritized road infrastructure and the automobile (Perry, 2000). These were considered as advantageous to urban development and as a "tool for nation-building" (Hass-Klau, 2015; Monroe, 2017: 193). Beirut followed suit and priority was given to expanding the road network at the cost of dismantling the tramway. Particularly in the 1950s and 1960s, the construction of new highways dissected the urban fabric and split neighbourhoods (Tabet, 1996). What followed was an increase in car ownership, neglect of public spaces, and car-driven urban development in and around Beirut (Perry, 2000). Despite the import of buses, the population preferred using shared taxis, or jitneys, called "service". The service's benefit was that it used the existing road network and offered numerous, flexible itineraries. All residential districts were connected by service routes which radiated from the centre, requiring a stop there to change destination (Jouzzy & Nakkash, 1973). This system served "a wide spectrum of the public" (Jouzzy & Nakkash, 1973: 324). Even before the war, the "service business [was] linked to politics and their lobby [was] strong" (Jouzzy & Nakkash, 1973: 325). Meanwhile, controlling the parking, disembarking, and driving behaviour of

services became a difficult problem for the Beirut municipality: a condition that was normalized and persists to the present day (Chidiac, 2008; Monroe, 2017).

3.1 War divisions and post-war impact

In Europe of the 1970s and 1980s, the car-centred approach became contested, and mobility trends were reconsidered. Return to mass-transit became the appropriate solution for urban transport, which could revive urban public spaces and prioritize pedestrians over cars (Hass-Klau, 2015). However, this period in Lebanon coincided with the beginning of the civil war in 1975: the non-planning period or "urbicide" of Beirut (Fregonese, 2000). The outbreak of the war was symbolically marked by the incident in which a bus crossing between East and West Beirut came under gunfire (Chidiac, 2008). Such incidents recurred during the war, causing an aversion towards buses. "All urban mobility was under the control of various factions who defined their territorial boundaries" (Nucho, 2016: 23). Insecurity generated fear, which in turn formed physical and mental barriers limiting mobility (Nucho, 2016). Except for the service, other public transport was interrupted during the war (Perry, 2000), and buses were reintroduced only after 1994 (CDR, 1995). The war caused the evacuation of the city centre and division of Beirut along a north-south demarcation line along Damascus Road (Tabet, 1996) (Figure 1). This demarcation lasted for 15 years and formed a buffer zone from Martyrs Square in the north within the city centre to the Pine Forest in the south at Beirut's administrative limits. This spatial reconfiguration changed mobility in the divided city. Another war impact was the segregation of Beirut's population into predominantly Christian east and Muslim west (Khalaf, 2002). "Familiar spaces of the city soon became strange and alienating" (Nucho, 2016: 23), and included public spaces such as Martyrs Square, transportation terminals, Damascus road, and the Pine Forest south of the city (Khalaf, 2002: 248; Khalaf, 2006; Mady, 2018a). This change in the city's topology was augmented by the formation of multiple centres around Beirut, with their homogenized neighbourhoods controlled by the politico-sectarian communities and characterized by limited mobility across them (CDR, 1995; Genberg, 2002).

3.2 Navigating post-war Beirut

In 1989, the Taif Agreement marked the civil war's end. However, the country continues to undergo intermittent instability. The war led to a publicly mistrusted weak state and the political hegemony of politico-sectarian leaders. The result was a laissez-faire attitude privileging a market-led approach to reconstruction and favouring private interests (Salam, 1998; Khalaf, 2006). On the one hand, the post-war period was marked by the city centre reconstruction under the public-private partnership by the real estate company Solidere . On the other hand, little attention was given to the densification of both East and West Beirut, and to expanding suburbs. One reason for this prioritization was the urgency of reconnecting the war-affected road network with the construction of tunnels and bridges simultaneously connecting and dividing the city (Nucho, 2016). Some examples include the Ring Road circumscribing the reconstructed city centre, the highway along the Beirut River, the Independence Street upgrade to a highway, and the Corniche El Mazraa highway (Figure 1). However, the transportation hub formerly located in Martyrs Square was not reinstated. Instead, two roundabouts respectively in the west and east, Cola and Dora, now served as Greater Beirut's transportation nodes. Everyday mobility of the population was determined by its place of work, residence, and other social practices (Perry, 2000), while Lebanon became the third MENA region country in terms of high car ownership (UITP, 2019). Suburbs and new centres formed part of the Greater Beirut area, with investment and job opportunities located in and around the centre. This pushed the economically disadvantaged population to urban fringes or further outside the city, despite the

absence of public transport, similarly to other cities sometimes resulting in social exclusion (Perry, 2000; Stanley & Stanley, 2017; Bou Akar, 2018).

Already prior to, but specifically following the assassination of the former Prime Minister Hariri in 2005, security for politico-sectarian figures was provided at the expense of people's everyday mobility (Fawaz et al., 2009, 2012). In this system, similarly to that of the informal transport, "each claims an element of the 'public' through connections to and integration within state security apparatus, without ever fully submitting to a public authority" (Fawaz et al., 2009: 189). In Beirut, "securitization may be the reflection of the fragmentation of a political system and society that are increasingly compartmentalizing the respective city into territories, each securitized by its own system" (Fawaz et al., 2009: 189). By fragmenting rather than consolidating public good, security practices threatened public spaces and possibilities for encounter, encouraged insular behaviour, and allowed people to navigate the city rather than consider it a meeting place (Fawaz et al., 2009). Fawaz et al. mapped securitized locations in administrative Beirut, indicating variations according to the "level of perceived threat" (2009: 179). These variations were manifested temporally, with fixed or suddenly emerging checkpoints and barriers, police patrols, road closures, or even complete curfews (Monroe, 2011: 91). Being mobile in a highly securitized context meant that the shortest path or the preferred one is not necessarily followed (Bollens, 2012). Depending on the occasion, one develops a mobility tactic.

On top of security measures that impacted traffic congestion, mobility varied according to people's perceptions of security, their politico-sectarian affiliations, as well as their socio-economic class (Samaha & Mohtar, 2016). While Beirut's residential neighbourhoods are socio-economically mixed (Alaily-Matar, 2008), they are characterized by homogeneity in terms of the politico-sectarian belonging of their populations, traversing some city parts while avoiding others. For car users in these neighbourhoods, mobility choices vary along politico-sectarian differences. Additionally, in Beirut and its suburbs, along with changing demographics, the intersections of "different politico-religious territories" (Fawaz et al., 2009: 181) necessitated divisions with the purpose of securitization. These made the city unequally accessible at any time, depending on one's place of residence (Borell, 2008; Fawaz et al., 2009; Bou Akar, 2012; Deeb & Harb, 2013). This meant that Beirut was "subjected to overlapping, sometimes conflicting security systems that neither report to the same authority nor concur on their identification of what constitutes a threat" (Fawaz et al., 2009: 189). This intertwining of actors and actions over space and time affected infrastructure and "sectarian geographies" in Beirut's urban spaces (Nucho, 2016: 3), and consequently mobility. Therefore, "being mobile in Beirut is a civic practice, one in which different social and territorial boundaries are fashioned" (Monroe, 2011: 107). The effect is differentiation and inequalities depending on one's location and politico-sectarian belonging (Monroe, 2011: 92).

Despite these circumstances, mobility persisted in unstable yet vibrant Beirut. A shared realization for the need to provide mobility was present, as reflected by the requests of some taxi and bus drivers to the government to organize public transport (Baaj, 2008; CDR, 2018). This was also evident in the responses to a BRT survey indicating the population's request for public transport, since it would provide "a chance to meet new people" (CDR, 2018: 236). With this imminent mobility need, the Riders Rights NGO took the initiative to generate a map for the informal bus system and facilitate its use for riders (Mady, 2018b).

4 The infiltration of informal mobility

In 1996, after the end of the war, a bus network was proposed, and the state Office for Railway and Shared Transport (French acronym OCFTC) implemented a plan for reinstating public buses, operating on 22 routes without dedicated lanes and with bus stops that would soon be vandalized (Mady, 2020). In the absence of the Martyrs Square hub, OCFTC buses did not have terminals, and were instead served by city edge terminals at Cola and Dora roundabouts (Chidiac, 2008). With the uncontrolled expansion of the suburbs, Beirut's administrative edges merged with these polycentres, in addition to already polarized east and west neighbourhoods. Cheaper than taxis and services, and for an initial post-war limited demand, bus transport was provided by the OCFTC, with a limited number of operating buses, and amidst traffic congestion in a securitized and car-privileged urban context (Baaj, 2008). Gradually, families with affiliations to politico-sectarian leaderships entered the bus transport system. With the limited OCFTC buses, the newcomers dominated routes, leading to the emergence of what is referred to as unregulated or artisanal transport (Chidiac, 2008; Nucho, 2016; Nakkash, 2017). Providing informal transport required low capital investment for a needed and to some extent lucrative business (CDR, 2018).

4.1 Characteristics and negotiations

This infiltration into the public transport system was enabled by two aspects: the licensing mechanism and the absence of a single transportation authority (Chidiac, 2008). The Parliament issued licenses, or "red plates", to individuals, not vehicles, while the Ministry of Interior registered vehicles and controlled them through the traffic police. The same red plates were used by different taxi companies, services, vans, or buses, including the OCFTC ones. The red plates were distributed by quotas to politico-sectarian leaders, who support their communities rather than the public at large. Van and bus companies with fleets generally manufactured in the early 2000s obtained licences, used the same road infrastructure and routes as OCFTC buses, and operated at minimum cost (CDR, 2018). Buses were serviced by community mechanics and petrol stations, and their operators hired precarious drivers receiving minimal wages.

In terms of operation, the system reflected a blurring of boundaries between formal and informal mobility, in which infrastructure, vehicles, and operations intertwine (Mady, 2018b). The result was an interconnected horizontal and vertical management of the system. This is reflected in licensing red plates, the "laxly enforced" rules of stationing, routes and service zones, and the politico-sectarian supported operators. One example of such company is LCC (Lebanon Commuting Company), which was affiliated to the then-Prime Minister Rafic Hariri (Chidiac, 2008). The system included various operation models: a single vehicle type operation along a route, one operator with a fleet along one or more routes, cooperatives of more than one fleet, or companies (Faraj & Baaklini, interview, June 2018; Faraj, interview, May and August 2019, March 2021). Some buses have tickets, and controllers who check whether passengers have bought them, while others operate without tickets (Faraj, interview, August 2019). These operation criteria enable the competitive presence in the network vis-à-vis OCFTC (Takyi, 1990). Such a state of affairs is not only a response to demand but also reflects embeddedness in the underlying fragmented politico-sectarian community. Within this context, infrastructure "could stretch across 'overlapping jurisdictions' and boundaries", reflecting "entanglement between political actors who operate simultaneously in multiple scales and institutional spaces" (Nucho, 2016: 8).

After the war, the number of red plates both legal and counterfeit increased significantly (Chidiac, 2008), leading to an oversupply of vehicles on some routes (Baaj, 2008). Several syndicates corresponding to different politico-sectarian communities were formed for services, taxis, buses, and later on, vans. The purpose of these multiple syndicates was to redistribute coverage of zones with minimal overlap and conflict across the politico-sectarian operators serving their respective communities (Faraj, interview, August 2019). The fragmentation of the public transport management over several administrations and departments rendered this sector difficult to control, as was the case even before the war (Jouzzy & Nakkash, 1973; Chidiac, 2008). This reflects how divides, whether inherited or emerging, are entrenched in various social practices, including both the operation of the shared transport system and the spatial experience of the system's riders.

4.2 Beirut's street network configuration and informal mobility

For the purposes of the present research, the available bus map – www.busmap.me – served to identify the lines that would cover an itinerary from the original location in north-eastern suburbs to the destination in Beirut city centre in the following sequence: buses 6, 24, 12, 2, and finally 22. In practice, the reality of the journey turned out to diverge from the plan as bus number 6 deviated from its itinerary before arriving to Cola. This necessitated an interchange from its new terminal stop with bus number 15 in order to arrive at Cola Roundabout. Below is a brief description of the routes, while the major stops along them are indicated in Figure 1.

- Bus number 2 connects Antelias, an eastern suburb, to Hamra, a sector in West Beirut with medical, educational, cultural, and administrative services. This bus alternates with number 5, which connects Hamra to Ain Saadeh, another eastern suburb. It does not allow for easy transfers within the southern part of Beirut.
- Bus number 6 connects Nahr el Mot, a major traffic junction in an eastern suburb, to the Kuwait Embassy, which is located at a major traffic node just south of administrative centre of Beirut. This bus does not have a stop that would allow riders to transfer to the south-eastern suburbs.
- Bus number 15 is divided into two lines: one starts from Nahr el Mot, and connects to Dora and then Ain Mreisseh in West Beirut. The other number 15 arrives to Cola, serving areas outside Beirut, including areas to the south-east of the city, Aleyh and Kmetiyeh, passing along the way to Cola by the Kuwaiti Embassy and the Sports City nodes. The two lines meet at Cola, otherwise having different itineraries.
- Bus number 22 connects Dora to Baabda in the south-eastern suburbs. It is operated by both OCFTC and private operators, yet they have different stops at Dora. This line has no connection to Cola or other major nodes in the western part of Beirut.
- Bus number 24 operates within Beirut from Hamra in the west to Badaro in the east, then to Furn el Chebback, an eastern suburb. However, it does not intersect with number 6 to provide a direct connection to Dora or other nodes in the eastern suburbs.

The practical journey served to validate how suburbs are not directly connected to the city centre, especially in the absence of a terminal at Martyrs Square. The available option for riders coming from either the southern or north-eastern suburbs is to exchange at Cola or Dora respectively, in order to arrive at destinations within Beirut (Mady, 2020). As demonstrated in the itinerary, few routes covering the north-eastern suburbs reach the southern suburbs or vice versa (Figure 1). The informal bus system follows OCFTC routes along which some of the OCFTC buses are still in service, such as bus number 22. This often leads to conflicts between drivers racing to pick up passengers. As informed by Faraj (interview, March, 2021), these bus

routes are managed by diverse private operators serving their respective communities. Buses connecting different areas operate along routes when there is a relation between the communities living in both areas; for instance, residing in one area but having commercial activities or job opportunities in the other (Faraj & Baaklini, interview, June 2018; Faraj, interview, March 2021). Examples include bus lines 6 and 15, where the numbers are duplicated and function along separate routes to serve different communities. In order to acquire a more comprehensive understanding of this network, further investigation on other bus lines is required.

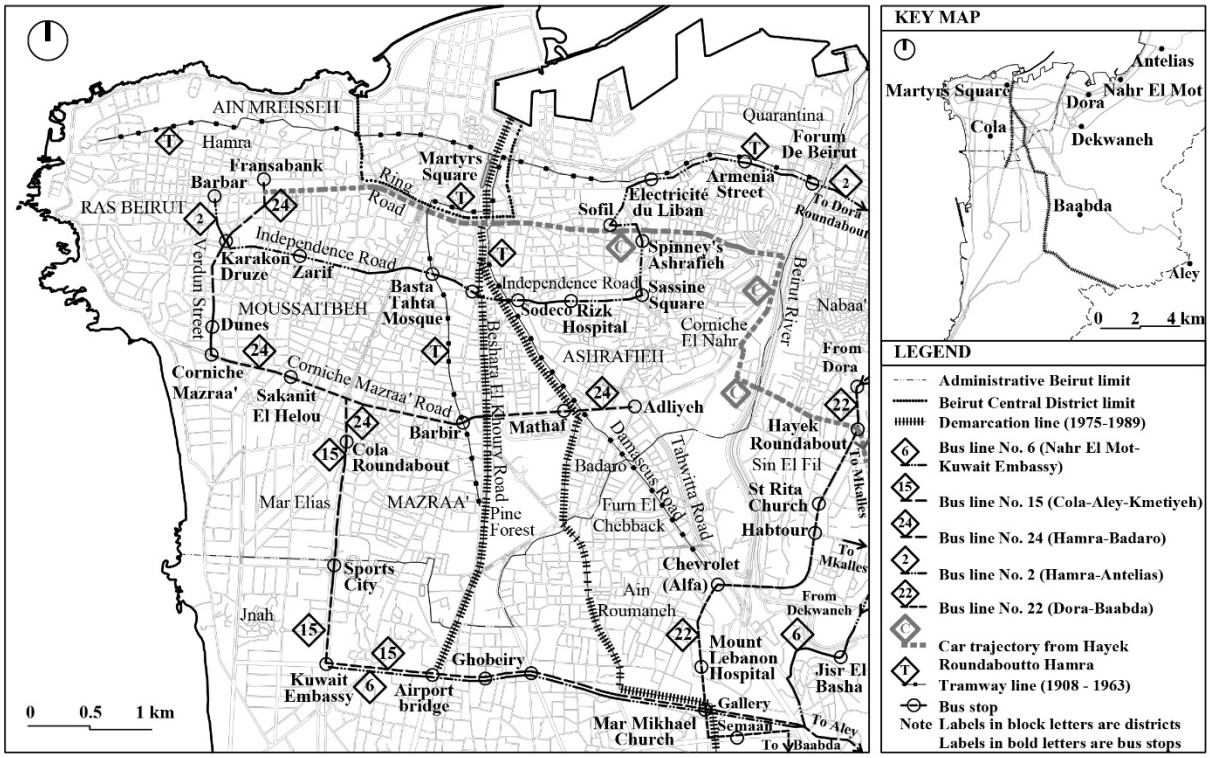

Figure 1: Map indicating the bus routes followed to move across Beirut (illustration: Christine Mady).

4.3 Mobility experiences under instability

Regarding bus stops, as indicated on the Riders Rights' Bus Map (www.busmap.me; Figure 1), it is evident that the marked stops are indicative of locations with affordances which may act as stops (Mady, 2020). Based on observations, this allows riders to request disembarking at any location along the route. Likewise, this flexibility allows the driver to deviate from the mapped route or even alter the terminal stop. Adaptations happen in cases of road repair works, bringing a rider closer to their destination, or avoiding temporary checkpoints, as experienced with bus number 6 (Mady, 2020). Therefore, the system's adaptability to sudden events could change the riders' spatial experience. More empirical work, however, is required for validation.

Navigating Beirut entails "a profoundly social experience" in which people actively learn by asking others (Nucho, 2016: 24). One has to ask to discover which line stops at which location or terminal as only few stops are visually defined or clearly marked (Mady, 2020). A terminal is an empty strip, or even a vacant lot adjacent to the main road, and could be shared by more than one operator, such as lines 2 and 5. Despite expectations that physically reconnecting the post-war city would heal the east–west divide, this process was mentally obstructed and

powered by collective memories (Larkin, 2012), which guided navigation in the city and provided indication of places to avoid (Genberg, 2002; Chidiac, 2008; Saksouk-Sasso, 2015; Nucho, 2016; Mady, 2018a). This emphasizes a context "where national sovereignty is heavily contested" and security privatized (Fawaz et al., 2009: 188). The various fragmented areas or zones are supported by spatial markers, which are not only fixed but also mobile as some buses have religious slogans and symbols displayed at the front of the bus. Also, religious ornaments worn by the driver, controller and riders, or various dress codes pertaining to cultural or religious groups were observed. Therefore, even if a vehicle of the informal bus network operates in another zone, its particular identity is manifested and can be recognized by stickers, slogans, and symbols (Chidiac, 2008). Similarly, as one traverses different divided city parts, one notices politico-sectarian slogans, symbols, and images of leaders, which have both become an integral and yet dynamically changing part of the city, thus affecting communities' comfort zones (Mady, 2020).

In summary, Beirut's informal bus system follows similar trends to its counterparts in other cities. This applies to the vertical and horizontal power relations, the local culture entrenched in serving communities and market interests, and the informal mobility's makeshift solutions. The outlined journey served to show how existing infrastructure, which follows spatial partitioning established after the war, has affected the routes of the informal bus system. Additionally, the spatially defined segregated communities generate part of the demand for this informal mobility and manage only marginally to break war-time divisions. In operating this system, and despite abrupt changes, instability leads to the system's fluidity and adaptability, allowing for mobility of people with a diversity of urban experiences. Although considered as a nuisance, the system is worth exploring further for its possible positive impact on social integration and urban diversity.

5 Conclusion

The present article explored the state of informal mobility within Beirut's unstable context, and its impact on riders' differentiated experiences, especially when commuting between Beirut's formerly divided east and west parts. This exploration was embedded in Beirut's history and the developmental stages of its public transportation from the 19th century to the end of the civil war. Over time, perpetual instability generated new divides and defined new zones within Beirut. These are reflected materially and immaterially across the city in urban spaces, infrastructure, facilities and neighbourhoods, and the relations between various actors. People's propensity to move across divides is guided by security, collective memory, and their individual politico-sectarian affiliations. This mobility could be differentiated for car users or bus riders as demonstrated in the chosen itinerary. The article suggests that informal mobility in Beirut contributes to a differentiated social and spatial experience, while the system's adaptability enables it to respond to the context's intermittent instability. The informal bus system, embedded in contextual specificities and entrenched in the consociational structure, has its limitations. Rather than reverting to the pre-war mobility pattern radiating from the city centre, it perpetuates some of the inherited divides. However, it also allows the fragmented society to collaborate, with encounters and social interactions occurring while commuting. Learning from the riders could contribute to a more integrative mobility system in Beirut, which could in turn affect its spatial practices. The present article sets the basis for further empirical work covering all of the bus routes, with the purpose of reinforcing the system's potential positive contribution.

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Transformation towards sustainability: public space in the city centres of Varaždin and Ivanić-grad

Abstract
The aim of the present article is to show how spatial, morphological, and functional transformation of public space contributes to aspects of sustainability. Research methodology encompasses two levels of urban structure consideration. The first level refers to the area of the city centre, and the second level refers to selected public area in the city centre. Criteria and indicators for the evaluation of planned interventions in public spaces were set and divided into topics of traffic, landscape, facilities, and urban equipment. The relationship between the research project results and the principles of sustainability stated in the *Basque Declaration* was analysed in order to confirm the hypothesis and possible impact of interventions in the context of achieving sustainability and sustainable development on the local level. It can be concluded that planned activities of transformation and contemporary design of public spaces on the local level have multiple positive effects and add to well-being in the wider spatial context of the city, thus also contributing to the global issue of sustainability.

Key words: spatial activation, hybrid features, public space system, sustainable development

1 Introduction

The topic of sustainability and sustainable development has been relevant in scientific and professional domain for more than three decades and still represents the basis of numerous spatial planning documents at all levels. By establishing relation between visions and actions, and their contribution to sustainability, we want to emphasize the importance of the local level in the planning of cities and towns, relying on the adopted documents. The European Conferences on Sustainable Cities and Places have produced three documents highlighting the main guidelines and activities that European cities and towns should follow and implement on their path to sustainability: Aalborg Charter (1994), Aalborg Commitments (2004), and Basque Declaration: New pathways for European cities and towns (2016). Based on the Aalborg Charter as a basic document explaining why local authorities should pursue sustainable development, the Aalborg Commitments were adopted, with their ten topics explaining what needs to be done to achieve sustainable development on the local level. The Basque Declaration clarifies how these transformations can be implemented with the aim of achieving productive, sustainable, and resilient cities for a liveable and inclusive Europe. The document is set to support and accelerate socio-cultural, socio-economic, and technological transformations to ensure decent quality of life while respecting the constraints of local and global ecosystems and available natural resources. The declaration acknowledges the need for transformation to decarbonize energy systems, create sustainable urban mobility patterns, protect and enhance biodiversity and ecosystem services, reduce the use of greenfield land and natural space, protect water resources and air quality, adapt to climate change, improve public space, provide adequate housing, guarantee social inclusion, and strengthen local economies. The topic of public spaces of the city centre opens numerous different themes and problems that we need to

refer to in this research when considering public space in the context of the social, economic, and environmental aspects of sustainability.

The city centre has always been of great importance to the city. Despite efforts to stimulate diffuse polynuclear development of the city, Maretić (1996) points out that the main city centre remains a superior focus, the bearer of tradition, representation, and prestige. In the sociological, psychological, and functional sense, it is a place where man as a social being confirms himself, realizing numerous activities and making numerous social contacts. The city centre enables the dynamics of various activities due to numerous facilities and public spaces that represent the connective tissue of the centre, places of socialization, and integration of residents and visitors, thus achieving social dynamics. Therefore, these spaces represent great potential for the city, and carefully designed interventions can often encourage their liveability and transformation of the surrounding space (Petrović Krajnik et al., 2013). Apart from a special role for the wider city area, urban centres also possess a symbolic meaning with emphasized historical significance. Approaches to planning in protected areas such as city centres are particularly sensitive and require subtle sensibility of architects and urban planners, while community engagement must be an integral part of planning and urban design as Polat and Tümer Yildiz (2019) point out.

One of the significant problems in the city centre, and thus in its public spaces, is traffic. Increasing use of private motorized transport has led to congestion in the city centre and numerous negative impacts on the quality of urban life. In order to meet urban sustainability standards, many European cities are conceiving and developing strategies to reduce or eliminate private motorized transport in the centre. New urban mobility plans in cities are focused on improving public transport, encouraging non-motorized modes, creating pedestrian zones, limiting the use of private cars, and otherwise trying to undo the transformation of cities caused by automobile dominance (European Commission, 2004; Pojani & Stead, 2015).

The public spaces of the centre can be viewed multidimensionally, dealing with different aspects that overlap on different scales. They can be viewed as a specific area, i.e. a location in the city, or as a system of public spaces that connect the urban fabric of the centre. Each part of the system has its own specifics, significance and function, and the system must be considered in a broader spatial context. As Farr (2008) points out, one of the most promising signs for the practice of sustainable urbanism is the diversity of project scales. During the 20th century, public spaces, especially streets, were designed on the principle of car domination, whereas nowadays they have acquired a completely different character, becoming places of multiple modes of transport. In the very centre they become exclusively pedestrian zones, conceived on the idea of liveability in order to contribute to the overall quality of life in the city (Miller et al., 2013; Pojani & Stead, 2015). Aman et al. (2019) point out that to introduce the concept of living streets in a city is to make the city lively and accessible for its inhabitants, thus encouraging transformation of public spaces. This concept also enables the promotion of healthy communities, better quality of life, improvement of neighbourhood conditions, and the encouragement to use public space (Carmona, 2010; Gehl, 2011; Gehl, 2013). Architects and urban planners strive to design public spaces in a pedestrian attractive way. Here, setting up urban equipment that is not merely attractive but also enables and encourages urban dynamics can play an important role. In addition to equipment, urban landscape is also significant for the compound well-being of citizens and the overall quality of life in the centre. In this research we especially want to point out the importance of public spaces in cities and towns as the optimal elements of urban structure on which the contribution and the suitability of interventions affecting aspects of sustainability can be studied and evaluated. It is hypothesized that the

transformation of the public space of the city centre can contribute to sustainability and sustainable development. The aim of the present article is to show how spatial, morphological, and functional transformation of public space contributes to the aspects of sustainability.

2 Research methodology

As a basis for evaluation of planned public space transformation in the context of sustainability, a review of analysis of selected case studies with general data and historical features of cities, spatial planning documentation of city centres, problems of public spaces, and proposals for their transformation and activation is given. In order to connect scientific research and teaching for the purpose of this research, the city of Varaždin and the town of Ivanić-Grad were selected. Each of the two urban centres was the subject of a master's thesis (on urban planning and architectural proposal for public spaces in Varaždin city centre and on urban planning and architectural proposal for public spaces in the centre of Ivanić-Grad). For the purpose of the present article, research methodology encompassing two levels of consideration of urban structure has been set up. The first level refers to the area of the city centre, and the second level refers to a selected public area in the city centre. By considering the importance of public spaces of the city centre in the context of sustainability and by dividing their physical appearance into formative elements, criteria and indicators for the evaluation of planned interventions in public spaces for each consideration level were set, divided into topics of traffic, landscape, facilities, and urban equipment. The set of criteria and indicators is considered in the period before and after the proposed spatial interventions. For research purposes, quantitative and qualitative methods are used to evaluate proposed interventions and place them in the context of sustainability.

Since the research analyses the physical structure of public spaces, quantitative evaluation methods of planned interventions and their contribution to sustainability aspects are primarily used. Quantitative indicator features are indirectly manifested qualitatively through comparison of existing situations and planned interventions in observed areas. Since these are projects that have not been implemented, contribution to social aspects of sustainability has been considered consequently through the contribution of the physical structure to social aspects of sustainability. For the purpose of the comparison given in the discussion, the results of the evaluation analysis of intervention proposals in two reference periods are presented graphically and with tables. In conclusion, the relationship between the research project results (on different topics of the two considered levels) and the principles of sustainability stated in the Basque Declaration was analysed to confirm the hypothesis and possible impact of interventions in the context of achieving sustainability and sustainable development on the local level (Table 6).

3 Case Studies – Varaždin and Ivanić-Grad

This chapter is a review of the analysis of selected case studies with general data and historical features of cities, spatial planning documentation of city centres, problems of public spaces, and proposals for their transformation and activation. The analysed data represents the basis for evaluation of planned interventions in the context of sustainability in two time periods at two considered levels in two selected examples of cities. The results are presented in Chapter 4.

Table 1: Comparative presentation of general indicators of the considered case studies.

	VARAŽDIN	IVANIĆ-GRAD
City area (ha)	5,945	17,357
Area of urban settlement (ha)	2,772	2,320
Population of the city (inhab.)	46,946	14,548
Number of inhabitants of the urban settlement (inhab.)	39, 839	9,379
Area of city centre (ha) – first level of consideration	38	12
Area of analysed public space (ha) – second level of consideration	1.4	1.2

Source: Prostorni plan uređenja grada Varaždina (2005); Prostorni plan uređenja grada Ivanić-Grada (2017).

3.1 Varaždin

The city of Varaždin is located in the northwestern part of continental Croatia. The total area of the city is 5,945 ha and consists of 10 settlements with a total population of 46,946. The central settlement of Varaždin with 39,839 inhabitants is a significant political, cultural, and economic centre of northwestern Croatia. The city centre covers an area of 38 ha (Table 1).

3.1.1 Historical features

The area of formerly fortified town, the present urban centre, has a particular importance in the urban structure of the city. During the 12th and 13th centuries, a civic settlement developed as a suburb south of the aristocratic town, which received its first fortifications in the middle of the 15th century. The transformation of Varaždin's medieval fortifications according to Italian Renaissance fortification style began in the middle of the 16th century due to its newly significant strategic role. The subsequent modernization of Varaždin's fortifications was the first example of the emergence of a bastion-type fortification in Croatia. The modernized fort retained its shape and size until its demolition after 1807. Dismantling Varaždin's fortifications at the beginning of the 19th century enabled the creation of public urban spaces and construction of predominantly public buildings on the site of former fortifications, similar to numerous examples of urban transformation in European cities (Žmegač, 2000; Krajnik, 2007; Krajnik & Šćitaroci, 2007). Transformation of fortifications opened the possibility of design and arrangement of new public spaces. These newly designed places were located on the site of former bastion fortifications, and have a representative character and special significance in the urban fabric (Figure 1a).

Figure 1: a) Varaždin on first military survey of the Habsburg Monarchy (1764–1784) (source: https://mapire.eu/en/); b) Urban Development Plan of the historic core of the city of Varaždin (2006) (source: Urbanistički plan uređenja povijesne jezgre grada Varaždina, 2019).

3.1.2 Spatial planning documentation

The Urban Development Plan of the historic core of the city of Varaždin (2006) and its amendments (2013 and 2019) show that the analysed area is mainly planned for public and social use, with mixed use being predominantly devoted to economic/business purposes, while a significant part of the area is intended for public parks. Courtyards next to public buildings are planned as public green areas, enabling the addition of the existing system of landscaped areas of the city centre. Two underground garages are planned in the centre area, one in the north and the other one in the southwest along the ring road. Additionally, there would be a parking lot for residents of the urban insula in the eastern part of the centre. Parking lots are also provided in the profile of the perimeter roads. Through construction of the already mentioned underground garages, the plan envisages the expansion of the existing pedestrian zone and the abolition of parking lots (Figure 1b). The city centre of Varaždin is one of the most important Baroque–Rococo–Classicist historical architectural and urban sites in Croatia, with preserved architectural heritage that has been enlisted in the Register of Immovable Cultural Monuments of Republic of Croatia.

3.1.3 Problems of public space in the city centre

The analysis of the current traffic infrastructure indicates that the city centre is overloaded with cars, especially during peak hours. The existing parking spaces in the profile of the centre's roads, the public parking lot in the northwestern part of the centre, and the newly built public garage in the southeastern part of the centre do not have the capacity to meet the needs for parking space of residents and visitors. The analysis of public spaces in the centre indicates that the city has a clearly defined pedestrian zone, with the possibility of expansion to the contact area. Perimeter squares (Ban Josip Jelačić Square and the Freedom Square) represent a potential for integration into the pedestrian zone which would significantly reduce the carload on the centre and enable more space for pedestrian use. Some of the streets that are an integral part of the pedestrian zone are without urban equipment and have a transit function only. Courtyards next to public buildings that are currently neglected and not in use also represent the potential to become new public spaces. The analysis shows that apart from the landscaped areas of the

northern and southern part of the centre, which are the result of the transformation of bastion fortification system, the centre itself does not have areas with high vegetation, except for the Freedom Square, Gaj Street, Paulines Street, and Franciscan Square. The city centre is active throughout the year with different occasions depending on public areas, while emphasized social activity is noticed during various public events periodically taking place in the city. The analysis of present situation of the centre of Varaždin pointed out the need for redefinition of public spaces and interventions aiming to create a better, more complete and diverse system of public spaces, thus generating a quality atmosphere suitable for residents and visitors to the city alike.

3.1.4 Proposed solution for the transformation and activation of the public spaces of the city centre

The concept for public spaces in the centre of Varaždin is based on the principle of different subsystems whose completeness enchances the quality of life of both residents and visitors. In the centre of the city, 12 locations were detected (3 squares, 6 streets, and 3 courtyards), each with its own specifics, with proposed interventions that would mainly improve the public space of the city by applying “soft” measures. Specific interventions proposed for each location contribute to integration of public areas into the system and activate public spaces of the centre. The following interventions are planned: arrangement of “new” squares in the urban fabric and redistribution of square functions; arrangment of a new pedestrian street and installation of urban equipment in existing streets; introduction of “new” courtyards open for public use in the system of existing courtyards; redefinition of the existing park on the northeastern edge of the historic urban core; arrangement of a new children's playground; arrangement of new bicycle paths and construction of new bicycle pavilions; construction of a new underground public garage and removal of parking lots on the northern edge of the city centre; and new traffic regulation. Planned interventions in transport infrastructure can directly or indirectly contribute to sustainable urban mobility patterns, reduce total energy consumption, protect biodiversity, water resources and air quality, reduce the risk of disasters, improve the overall quality of public space forming convivial and safe environments, provide more comfortable housing, and guarantee the social inclusion and integration by using different transport subsystems. Additional landscape elements can contribute to enhanced biodiversity, improved air quality, and easier adaptation to climate changes. In addition, they can further creation of convivial environments, provide a peaceful environment for adequate housing, and encourage social integration.

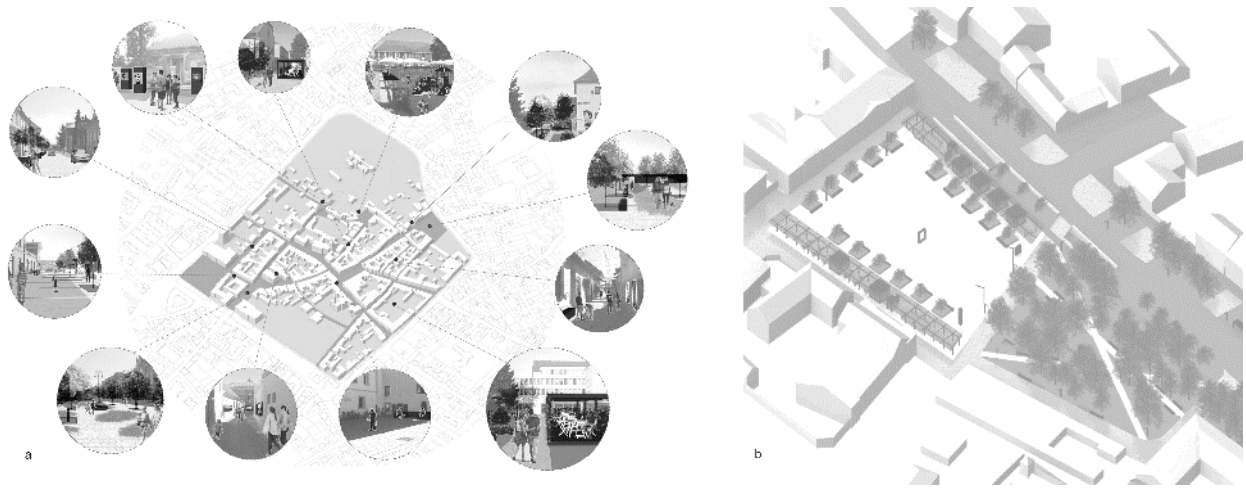

Figure 2: a) Interventions in the subsystems of the public spaces of the centre towards creation of a complete system; b) Ban Josip Jelačić Square and Park project (source: Marić, 2019).

Special emphasis is given to the northeastern edge of the former historic fortifications, which has been recognized as a strong potential but also an area in need of extensive interventions. Ban Josip Jelačić Square and Park are conceived as a unique space of dual character. In the context of mobility, the proposal envisages construction of a two-floor underground garage in order to free the area of the square from the existing parking lot. The project envisages induction of the square area into the pedestrian zone of the centre and creation of new pedestrian paths, respecting historical routes. Two stretches of various facilities (flower shops, terraces, and pavilions for rent) were planned as a supplement to existing facilities to further activate public space. The pavilions with facilities on the perimeter of the square use PV panels to generate electricity. In the summer, the cooling of the pavilions is enabled by natural ventilation, the canopy, while the existing structure and the surrounding high vegetation serve as protection from excessive insolation. During the winter, the glass facade of the pavilions allows the passage of sunlight and thus contributes to heating of the interior. The proposal of new facilities in the city centre enables improvement of the public space through creating vibrant environments, enabling social integration, opening the opportunities for local employment, and deterring expansion of construction to greenfield areas, while the use of PV panels would additionally enable reduction of total energy consumption. In addition to the horticultural enrichment of the existing park and the preservation of the existing landscape elements, the perimeter of the square is planned with additional tree lines. In the northwestern part of the park, a children's playground and additional urban equipment is proposed, designed for the needs of the public space system of the centre of Varaždin. Installation of new urban equipment (benches, plant pots, flowerpots, refuse receptacles, info boards, sculptures, clocks) is planned to enhance social interaction and integration of different users. Additionally, it can contribute to the creation of a convivial, safe, and vibrant environment, and the accessibility of public space for different age groups, while use of plant pots contributes to protection and enhancement of biodiversity.

3.2 Ivanić-Grad

The town of Ivanić-Grad is located in the southeast of Zagreb County. The total area of the city is 17,357 ha, with 19 settlements with a total of 14,548 inhabitants. The central settlement of Ivanić-Grad with 9,379 inhabitants is a significant economic and cultural centre of the southeastern part of Zagreb County. The centre of the city covers the area of 12 ha (Table 1).

3.2.1 Historical features

Analysis of contemporary urban structure shows that the city centre has developed throughout history as two separate spatial units, namely the site of a former fortress and its suburb. Historical sources state that a wooden castle was built in the early 13th century, while in the middle of the 16th century a "*novum fortalicium Iwanychensi*" is mentioned. Towards the end of the 16th century, a new bastion fortress was built on the site of the previous atypical square fortress. The fort was completed in 1606, and its construction was led by Viatana, Francesco Marmaro, and Alessandro Pasqualini (Žmegač, 1998; Žmegač, 2000). The compact structure of the *suburbium* (nowadays the Old Town) was formed nearby in the middle of a swamp on an artificial island on the extension of the Lonja River, south of the former fortress (nowadays a park). Historical sources mention that the settlement was fortified in 1570, with an earthen embankment, a water-filled moat, palisades, and a wooden bridge as a connection with the fortress. *Suburbium* was a trade and craft settlement, and to this day the urban matrix has almost completely preserved the historical layout of streets and squares created before the mid-19th century, and, to a lesser extent, the scale of construction (Mavar & Tusun, 2011).

As a result of changes in the geopolitical situation, the fortress lost its purpose; the army abandoned it in 1776, and the area of former bastion fortification was gradually transformed. In the first part of the 19th century, bastions and the moat were levelled, and during the rest of the century public buildings were gradually built in their place, while in 1910 the city park was arranged in neoclassical and natural style by the Czech landscape architect Viteslav Durchanek. The transformation of bastion fortifications resulted in well-designed extension of the city core with new public spaces, which created a new urban quality, while the *suburbium* preserved its urban matrix and the possibility of new representative public spaces on its periphery (Figure 3a).

Figure 3: a) Ivanić-Grad on Habsburg Empire cadastral map from 19th century (source: https://mapire.eu/en/); b) Urban Development Plan UPU – 4 for the area Ivanić-Grad, Donji Šarampov, and Jalševec Breški (2008) (source: Urbanistički plan uređenja UPU – 4 za područje Ivanić-Grad, Donji Šarampov i Jalševec Breški, 2018).

3.2.2 Spatial planning documentation

The cultural and historical ensemble of Ivanić-Grad has been enlisted in the Register of Cultural Assets, and according to the Urban Development Plan UPU - 4 for Ivanić-Grad, Donji Šarampov and Jalševec Breški area (2008) and its amendments (2009, 2012, 2014/2015, 2016, 2018), divided into two sub-units: *the Zone of partial protection of historical structures* (Zone B), which includes the southern area, and *the Buffer zone* (Zone C), which refers to a part of the northern area. The entire city centre is included in protection zone of archaeological area, while only the *suburbium* is defined as historical urban core.

In the spatial planning documentation, the northern part of the subject area is intended mainly for public use, and in the southern part there is a public area categorized as *a particularly valuable area – cultivated landscape*. The southern part of the area, the former *suburbium*, is predominantly planned as mixed use. The transport infrastructure on the northern part of the area is planned for combined transport systems, while public spaces on the southern part are

planned as car–pedestrian or exclusively pedestrian area (the main town square). Pedestrian promenades are planned along the Lonja River on both banks. Adjacent to King Tomislav Street, a public parking area with optional public multi-storey garage under the main square is planned (Figure 3b). In order to protect cultural and historical values, the plan proposes recultivation and integration of city squares, and integration of former fortress and Lonja River landscape with the park of Croatian Veterans.

3.2.3 Problems of public space in the city centre

The analysis of traffic infrastructure in the centre of Ivanić-Grad shows domination of automobile traffic over pedestrians. King Tomislav Street is a spatial barrier which divides central city area into two parts: the northern area of the former fortress and the southern area of the former *suburbium*. The historic structure of narrow streets without sidewalks in the Old Town (former *suburbium*) results in questionable safety of pedestrians. The main town square, east of *suburbium*, is separated from perimeter structure on the eastern part by a street and a stretch of parking area, creating a barrier to public facilities located in the square. The southern part of the square is subordinated to car traffic and is not suitable for pedestrians. In the city centre, parking lots are provided alongside roads in the northern part, while a large number of illegal parking lots alongside narrow streets of the former *suburbium* represent a further burden on the traffic system. South of the Park of Croatian Veterans, along King Tomislav Street, there is a stretch of parking lots preventing spatial connection of the park and the southern part of the centre.

The analysis of public spaces of the city centre shows intensive activities in articulation of public areas during past few years, especially the areas around public buildings and the promenade along the Lonja River which has not yet been connected with other public areas of the city centre. The analysis shows that the city centre has a landscaped area, namely a park on the north side of the scope, while the urban structure of the former *suburbium* with traditional buildings in a dilapidated condition lacks vegetation as well as city centre facilities. The city centre is active only a few days each year during public events, among which the *Bučijada* ("Pumpkin Fair") stands out. The analysis of the current situation of Ivanić-Grad centre underlines the need for planning public space of the city centre with priority given to pedestrian traffic, which would contribute to integration of historically divergent parts of the centre and creation of an environment that would enable stronger activation of the centre.

3.2.4 Proposed solution for the transformation and activation of the public spaces of the city centre

The concept of public spaces in the city centre is based on revival of its culture and history, and integration of public spaces. The project proposed that certain locations become info points, i.e. open-air museum stations. While walking through the centre, the pedestrian would learn about the history of the city and the importance of each location. The main town square is planned as the starting and ending point of the open-air museum where the visitor can recognize the importance of local events for the city through public space design. Traditional buildings in the former *suburbium* offer insight into the local way of life, while the site of former fair in the centre of Old Town is conceived as theme area dedicated to craftsmen and merchants. Public buildings located in the city park form a site where visitors can learn about the formation of the Ivanić fortress and its gradual destruction, the very event which resulted in the creation of the park itself. Recent history data can be found in Public Open University, the INA building, and the atomic shelter. Locations are connected by a pedestrian promenade with distinctive paving directing visitors through different ambiences. The Museum path is linked to new promenade along the Lonja River, thus connecting urban structure with landscape. The offer of various

facilities in the city centre contributes to improvement of public space by creating vibrant environments, enabling social integration, opening the opportunities for local employment, and discouraging further expansion into greenfield areas.

In order to reduce traffic through the centre and to enable integration of the northern and southern parts, circular traffic scheme was proposed on the northern part, turning portion of King Tomislav Street into a *car–pedestrian* area. Streets of former *suburbium* are predominantly planned as *car–pedestrian* with pedestrian priority over private motorized traffic. Planned interventions in transport infrastructure can directly or indirectly contribute to sustainable urban mobility; reduction of total energy consumption; protection of biodiversity, water resources, and air quality; reduction of disaster risk; improvement of overall quality of public space forming convivial and safe environments; provision of more comfortable housing; and social inclusion by different transport subsystems usage.

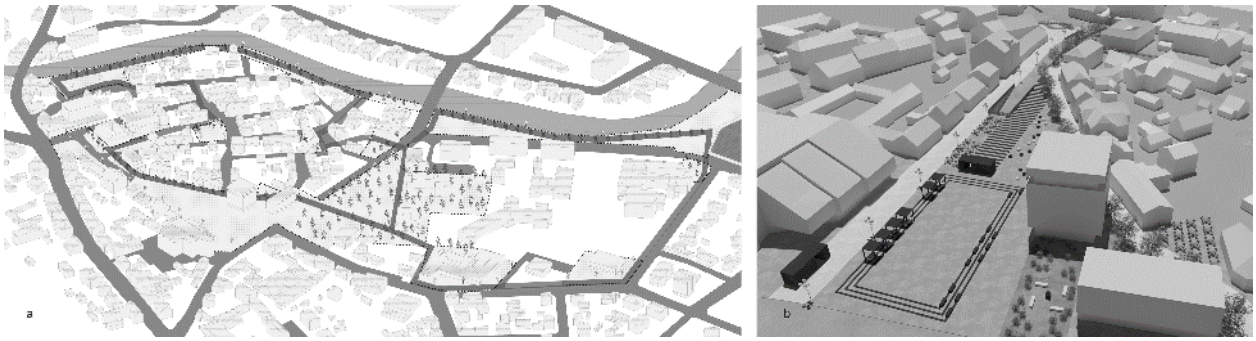

Figure 4: a) Integration of public spaces of the centre based on the concept of open-air museum; b) Vladimir Nazor Square project (source: Kunek, 2020).

Special attention is paid to irregular funnel-shaped main town square located in the southeastern part of the centre, due to its position in the urban matrix recognized as possible starting location for public space problem solving. Design concept of the main town square is based on two promenades placed circumferentially to the main north–south communication axis providing supply and connection of facilities and public areas. The square is divided into three zones: a large *concert* square in the north, a *social* square in the central zone planned for exhibitions and sales, and a *small* square in the south planned as a summer cinema. The abolition of the road on the east side of the square enables the integration of square and perimeter facilities. A pedestrian zone connected to public spaces of the former *suburbium* is also provided for. The problem of parking and traffic congestion of the centre is solved by an underground garage under the main square, with access from the south in order to free up as much space as possible for pedestrian use.

The project envisions green surface of the northwestern part of the square, and the western promenade with children's playground providing peaceful environment near the throng of the main town square. Landscaping can contribute to biodiversity enhancement, air quality improvement, easier adaptation to climate change, and to creation of convivial environments with provision of a peaceful setting for adequate housing and social integration. Each zone of the square has urban equipment (benches, refuse receptacles, display stands, sculpture) providing different use scenarios, social interaction, and user integration. Implementation of planned urban equipment can also contribute to creation of a convivial, safe and vibrant environment, and accessibility of public space for different age groups.

4 Research results and discussion

The area of the central settlement of Varaždin occupies 46.62% of total city area. The considered centre of Varaždin covers 1.37% of the central settlement, while the central settlement is home to 85% of total population of Varaždin. Ratio of number of inhabitants and the area of the city centre shows 9.54 m^2 of the centre per one inhabitant of the central settlement and 8.89 m^2 of the centre per one inhabitant of the city of Varaždin. The area of the central settlement of Ivanić-Grad occupies 13% of total city area. The centre of Ivanić-Grad covers 0.52% of the central settlement, while 64% of total population of Ivanić-Grad live in the central settlement. Ratio of number of inhabitants and the area of the city centre shows 12.79 m^2 of the centre per one inhabitant of the central settlement and 8.25 m^2 of the centre per one inhabitant of the city of Ivanić-Grad.

4.1 First level of consideration – city centre

The analysis shows that the project envisages reduction of total road length in the centre of Varaždin by 10.25%. The organization of stationary traffic in the city centre has been changed by abolition of 25.18% of parking lots (located along roads or as separate areas) and construction of new underground garage with 161 parking spaces on the northeastern edge of the centre. The length of bicycle paths in the city centre has increased by 400.65%. One new bicycle rack and 3 new bicycle pavilions are planned. The analysis shows that pedestrian zone in the city centre has been expanded by 25.36% and makes up 12.12% of total area of the centre (Table 2 and Figure 5).

Table 2: Comparative overview of first level consideration indicators – traffic.

First level consideration	Varaždin		Ivanić-grad	
Traffic	Before	After	Before	After
Road (m)	4,066.48	3,649.38	2,703.39	1,917.09
Parking (m^2)	13,524.04	10,118.59	7,316.84	3,742.22
Public underground garage (number and total capacity)	1 (446)	2 (607)	-	1 (200)
Car–pedestrian area (m)	-	-	87.30	977.43
Pedestrian zone (m^2)	36,728.54	46,044.78	4,109.03	9,409.34
Pedestrian path (m)	-	-	689.55	2,624.45
Bicycle path (m)	655.85	3,283.57	689.55	1,063.26
Bicycle rack (BR) / Bicycle pavilion (BP)	7 SB	8 SB + 3 PB	9 SB	11 SB

Green public areas in the centre were increased by 0.44% due to green courtyards opening for public. The total tree line length in the city centre has been increased by 64.92%. Total of 48.92% of newly planned pedestrian zone (squares, streets, and public courtyards) is activated by installation of new urban equipment (Table 3 and Figure 5) Proposed solution offers new facilities in public spaces of the centre of Varaždin, distributed over area of the first level of analysis. Arrangement of new children's playground and renovation of existing one is planned, thus providing social interaction for the youngest. New areas for catering facilities (cafe terraces) are opened, aiming at further activation of the space of the city centre, as well as installation of small new pavilions for florists and cafes, bicycle storage, etc. (Table 4 and Figure 5).

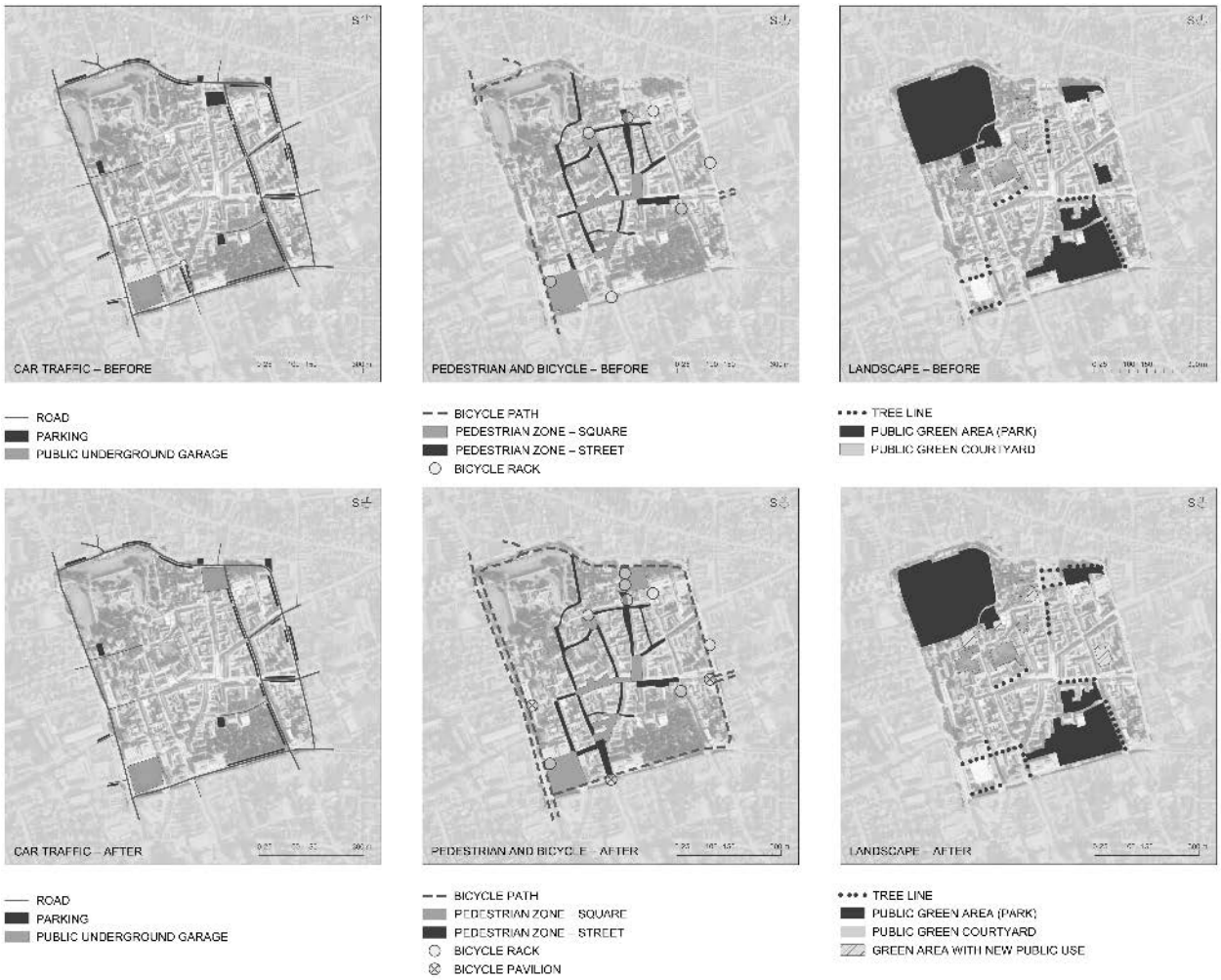

Figure 5: Varaždin – first level consideration indicators (illustration: authors).

Table 3: Comparative overview of first level consideration indicators – landscape.

First level consideration	Varaždin		Ivanić-grad	
Landscape	Before	After	Before	After
Public green areas (i.e., park) of the city centre (m^2)	93,634.73	89,445.25	19,119.49	20,120.03
Green courtyards in public use (m^2)	10,362.38	15,009.48	-	2,045.89
Tree line (m)	639.77	1,055.09	282.95	406.09

The analysis shows that proposed solution reduces total road length in the centre of Ivanić-Grad by 29.08%. The share of areas intended for *car–pedestrian* traffic in the city centre is increased by 1019.62%. The organization of stationary traffic in the city centre has been changed in a way that 48.85% of parking lots (alongside roads or as separate parking areas) have been abolished, and the construction of an underground garage with 200 parking spaces on the edge of the centre has been proposed. The length of bicycle paths in the town centre has increased by 54.19%. Two new parking lots for cyclists are planned, an increase of 22.22%. The analysis shows that the main pedestrian area in the town centre has been increased by 128.99%, with total length of 2,624.45 m of pedestrian path through the centre, which enables activation of existing facilities and landscape area as well as opening new green areas for public use (Table 2 and Figure 6).

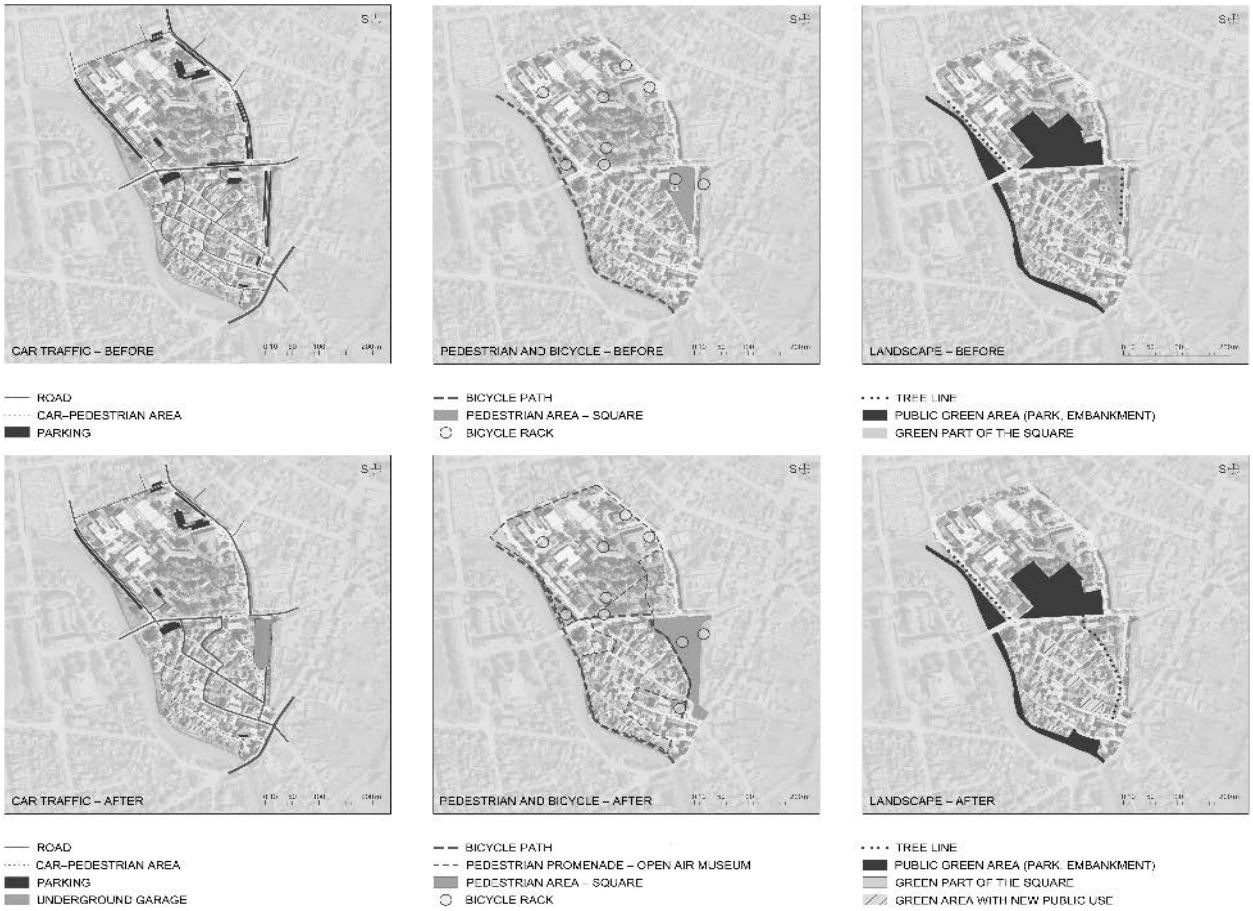

Figure 6: Ivanić-Grad – first level consideration indicators (illustration: authors).

Total green area of the centre in public use (which, in addition to parks and embankments, includes green courtyards in public use) has been increased by 15.93%, while total tree line length has increased by 43.52% (Table 3 and Figure 6), New facilities in public spaces planned in the centre of the town are distributed over the area of the first level of analysis, with new children's playground next to the pedestrian zone, new catering facilities area (cafe terraces), an amphitheatre in the southern part of the town square, as well as installation of educational info panels in open-air museum stations throughout the centre (Table 4 and Figure 6).

Table 4: Comparative overview of first level consideration indicators – facilities.

First level consideration	Varaždin		Ivanić-grad	
Facilities	Before	After	Before	After
Children's playground	+	+ Larger and newly arranged	+	+ Newly arranged
Terraces of cafes on the streets and squares	+	+	+	+
Florists and pavilions	+	+	-	-
Bicycle pavilion	-	+	-	-
Amphitheatre	-	-	+	+ Newly built

The results of analysis in both case studies at the first level show significant reductions of areas used by motor vehicles (roads and parking lots), increase of exclusively pedestrian area, as well as significant increase of area for cyclists. In both cases underground garages are planned to free up space for pedestrian use. Results show an increase in percentage of green public areas

in both cases (achieved by opening courtyards for public use) and significant increase of tree line length. At the first level, in both cases various facilities that contribute to quality of life of residents and enable social interaction are planned. Implementation of new facilities for public use and installation of urban equipment has led to activation of significant areas in city centre. Activation of city centre in Varaždin is achieved by installation of urban equipment in public space (streets, squares, and courtyards), while in Ivanić-Grad vibrancy of the centre and dynamic of use is achieved by public facilities implemented in the peripheral suprastructure and ecostructure.

4.2 Second level of consideration – selected public area

Ban Josip Jelačić Square and Park, located in the northeastern part of the centre of Varaždin, cover 3.68% of the analysed centre area. The analysis shows reduction of parking area by 83.13% and reduction of area intended exclusively for motor traffic by 51.94%. An underground public garage with 161 parking spaces, bicycle path in the length of 227.47m, and new bicycle pavilion are planned in the square. Pedestrian area of the square is increased by 85.01%, the share of green area is reduced by 4.64%, and significant new tree lines were planned with an increase of 322.64%. Public facilities (trade, service, and leisure) occupy a significant share of the square and park (30.13%) in which new urban equipment is also installed (Figure 7 and Table 5).

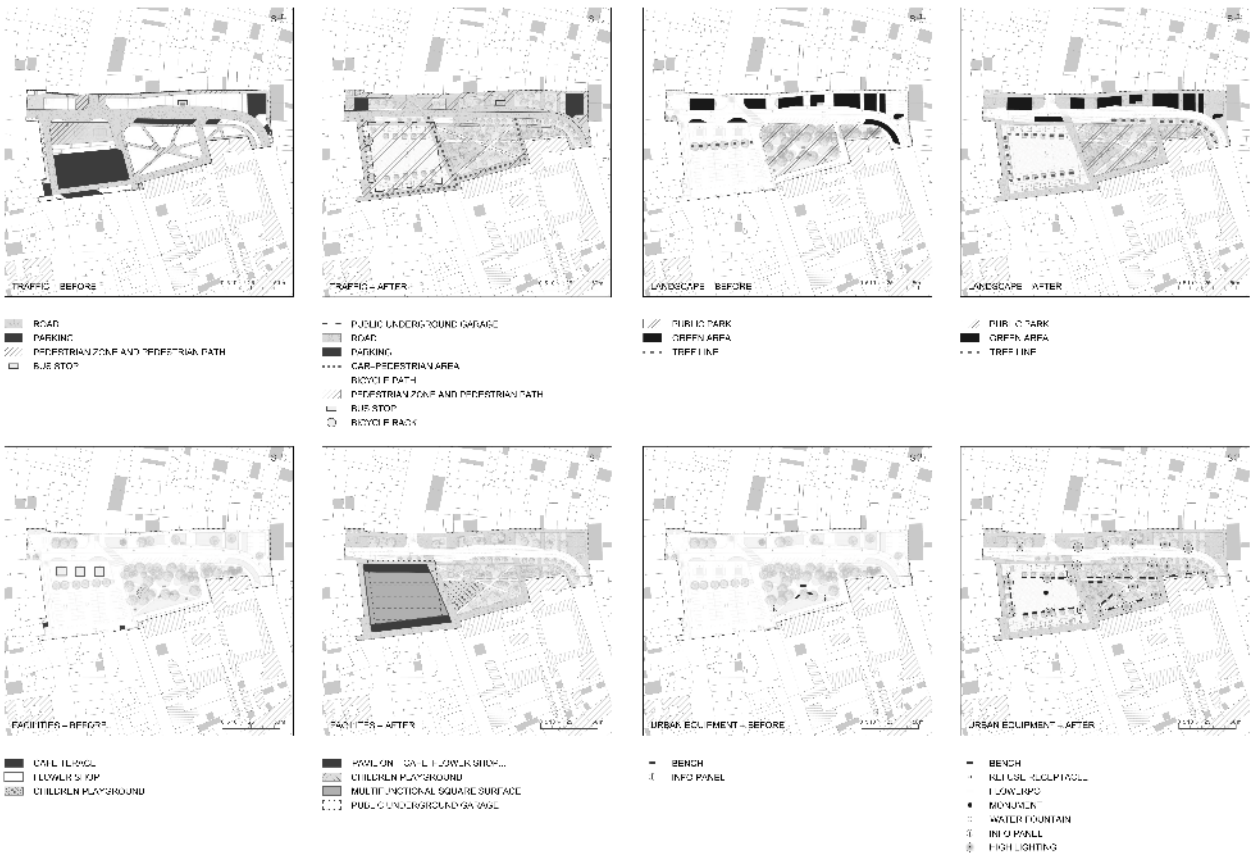

Figure 7: Varaždin, Ban Josip Jelačić Square and Park – second level consideration (illustration: authors).

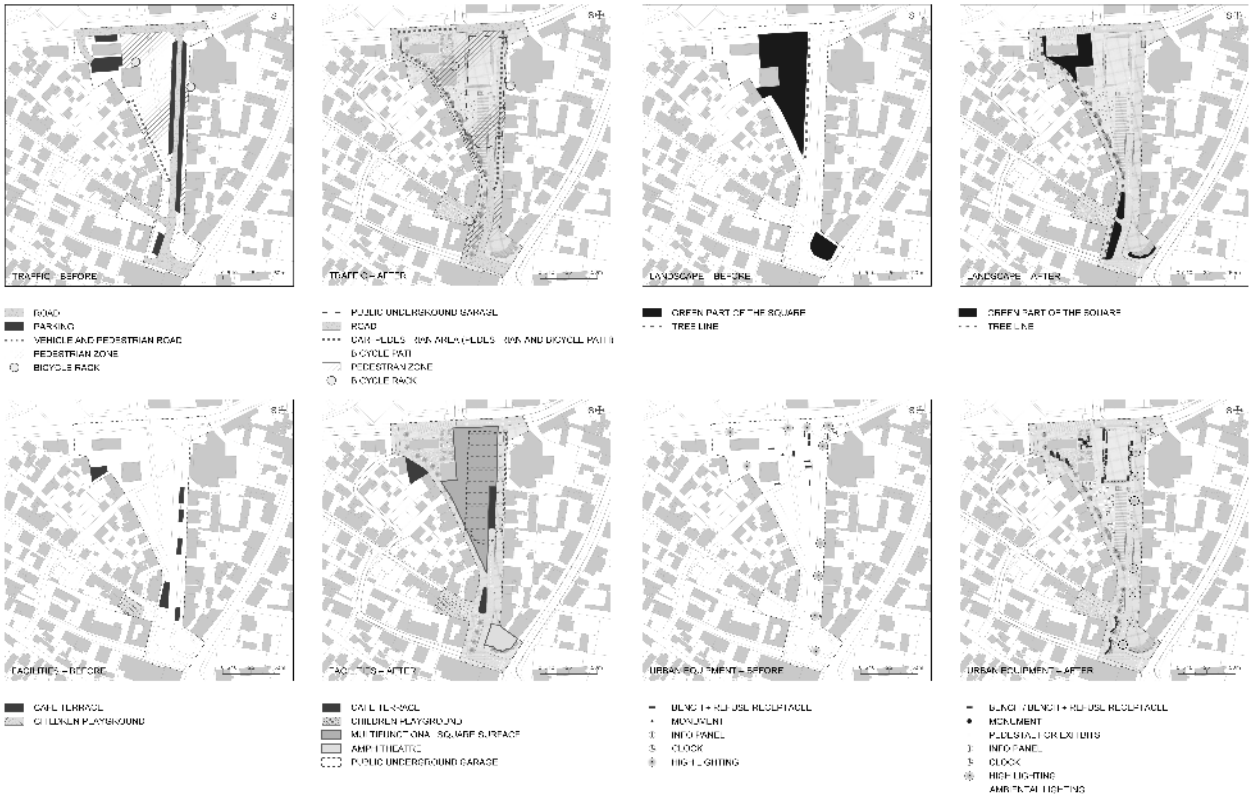

Figure 8: Ivanić-Grad, Vladimir Nazor Square – second level consideration (illustration: authors).

Vladimir Nazor Square is located on the eastern edge of the centre of Ivanić-Grad, covering 10% of centre area. The analysis shows planned reduction of the area intended for parking on the subject area by 100% and reduction of area intended exclusively for motor traffic by 38.92%. An underground public garage with 200 parking spaces is planned, and the share of pedestrian areas of the square is increased by 73.63%. The project envisages a green promenade with 231.99 m long bicycle path along the edge of the square as connection of central square with bicycle path along the Lonja River. The project reduced the share of green part of the square by 96.31%, but new tree lines were planned which represents an increase of 110.65%. Facilities (trade and service) occupy 39.66% of total square surface on which installation of new urban equipment and multifunctional pedestals for various public events is planned (Figure 8 and Table 5).

Table 5: Comparative overview of indicators on the second level consideration.

Second level of consideration	Varaždin		Ivanić-grad	
Traffic	Before	After	Before	After
Parking (m^2)	2,609.29	439.97	1,596.00	0
Road (m^2)	3,996.28	1,920.44	2,761.31	1,686.58
Capacity of public underground garage (PS)	-	161	-	200
Car–pedestrian area (m^2)	-	310.21	84.9	335.51
Pedestrian zone + pedestrian path (m^2)	3,238.77	5,992.05	5,305.94	9,212.81
Bicycle path (m)	-	227.47	-	231.99
Bicycle rack (BR) / Bicycle pavilion (BP)	-	2	2	3
LANDSCAPE				
Public green areas (i.e. park) (m^2)	2,941.68	2,941.68	-	-
Green area of the square (m^2)	1,307.25	1,246.59	3,191.83	117.69
Tree line (m)	54.01	228.27	107.15	225.72
Facilities				

Public underground garage (m^2)	-	3,357.77 (per floor)	-	3,080.16 (per floor)
Multifunctional square surface (m^2)	-	2,669.02	-	3,487.53
Amphitheatre	-	-	-	433.22
Pavilion (flower shop, cafe, etc.)	184.77	866.41	-	-
Cafe terrace (m^2)	31.62	-	495.26	573.17
Children's playground (m^2)	76.09	550.24	265.77	265.77
Urban equipment				
Bench (pcs.)	3	30	8	33
Refuse receptacle (pcs.)	10	11	11	15
Monument (pcs.)	-	1	1	1
Pedestal for exhibits (pcs.)	-	-	-	37
Flowerpot (pcs.)	-	6	-	-
Water fountain (pcs.)	-	1	-	-
Info panel (pcs.)	2	1	2	1
Clock (pcs.)	-	1	1	1
High lighting (pcs.)	19+6	24+6	10	9
Ambient lighting (m)	-	-	-	305,66

The results of both case studies analysis at the second level, the selected public area, show significant reductions of area used by motor vehicles and almost complete abolition of parking areas. Furthermore, in selected public areas, there is a significant increase of areas used exclusively by pedestrians. In addition, the introduction of bicycle paths on subject areas as connection with wider spatial context is emphasized. In both cases, underground garages were planned to free up the square area for introduction of new facilities. The results show decrease in green areas of public space in both selected examples (especially in Ivanić-Grad) and increase of tree line length (especially in Varaždin – over 320%). In both examples, the construction and arrangement of various facilities and installation of urban equipment is planned, which provides for spatial activation, enables social interaction, and contributes to overall quality of life in the city.

5 Conclusion

The historical significance of the town or city and urban structure morphology significantly conditioned proposed interventions and influenced the concept of public space design, encouraging its liveability. The planned transformation of public spaces in selected city centres takes into account current spatial planning documentation in which various sustainability elements were recognized (for instance mixed use, garages on the outskirts of city centres, destimulation or restriction of car traffic by introducing car–pedestrian or exclusively pedestrian areas, adding horticultural elements in public spaces, etc.). Therefore the plans propose new solutions which emphasize the importance and characteristics of sustainability in order to solve existing problems of the centre. Owing to the large number of different public areas of pedestrian zone (streets, squares, courtyards, parks, etc.), the system of public spaces in Varaždin enables the emphasis on specific features of individual elements of the system and their complementarity in the wider spatial context. The central public space in the smaller town of Ivanić-Grad combines different spatial and functional components of public space arrangement, thus giving the public space hybrid features. Combined elements of the square, street, and courtyard create multifunctional spatial features, daily, weekly, monthly, and yearly enhancing its liveliness which significantly contributes to social integration and quality of life. Two approaches to public space activation were detected during research. The first approach uses elements of urban equipment in the public area as activators of dynamics, and the second approach uses the implementation of public facilities in the peripheral suprastructure and

ecostructure of public space to dynamize the use of the city centre. The reasons for different approaches are different scale of public space in the urban structure and the possibilities provided by the peripheral suprastructure and ecostructure (Figure 9a and 9b).

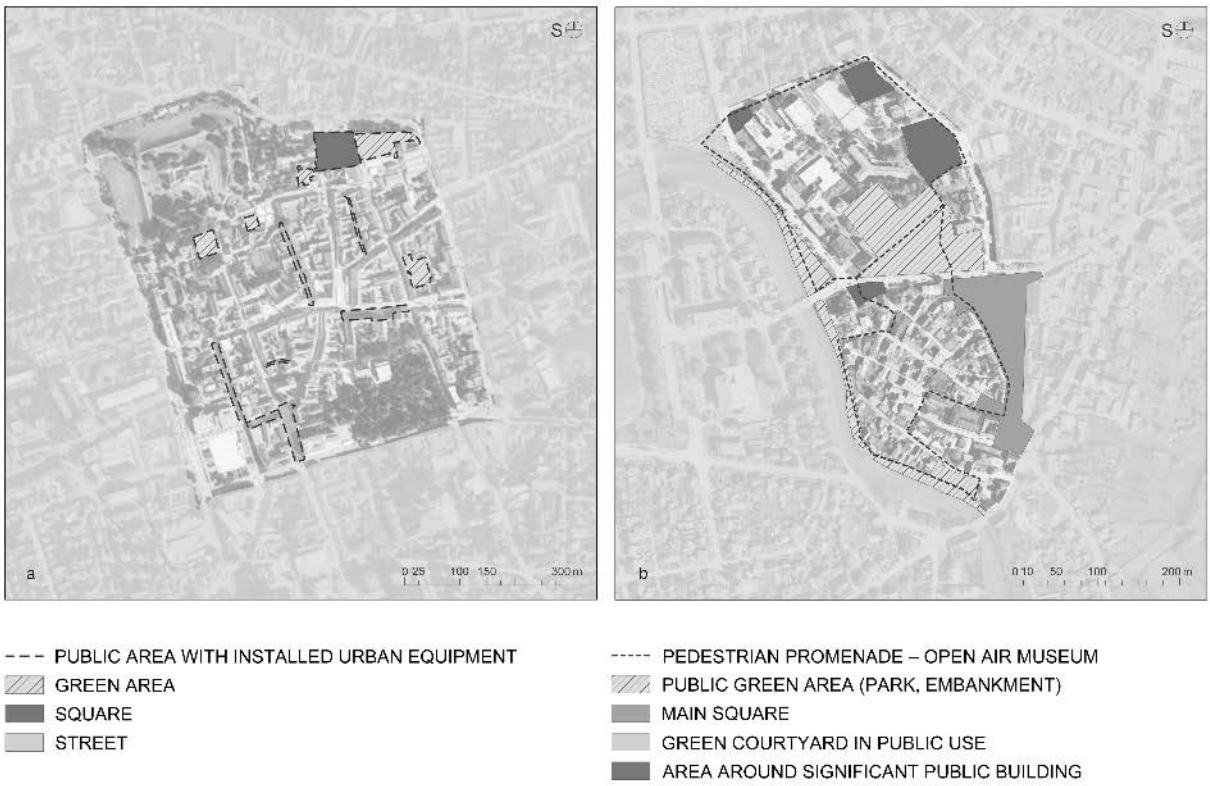

Figure 9: Comparative overview of the activation of public spaces in the centre of Varaždin and Ivanić-Grad: a) Varaždin; b) Ivanić-Grad (illustration: authors).

Table 6: Relation between analysed topics on both consideration levels and principles of sustainable development from the *Basque Declaration*.

Principles of sustainable development from the *Basque Declaration*	Varaždin				Ivanić-grad			
	Traffic	Landscape	Facilities	Urban equipment	Traffic	Landscape	Facilities	Urban equipment
Decarbonize our energy systems and reduce total energy consumption	+		+		+			
Create sustainable urban mobility patterns and accessibility for all	+			+	+			+
Protect and enhance biodiversity and ecosystem services	+	+		+	+	+		
Reduce the use of greenfield land and natural space			+				+	
Protect water resources, water, and air quality	+	+			+	+		
Adapt to climate change and reduce the risk of disasters	+	+			+	+		
Improve public space to create convivial, safe, and vibrant environments	+	+	+	+	+	+	+	+

Provide sufficient and adequate housing for all	+	+			+	+		
Guarantee social inclusion and integration of all parts of society	+	+	+	+	+	+	+	+
Strengthen local economies and local employment opportunities			+				+	

Regarding the projects of public space transformation in the centre of Varaždin and Ivanić-Grad in the context of sustainability and sustainable development, we conclude that they contribute to sustainability on the local level because both projects are in accord with all ten principles of sustainable development. Each of the topics covered contributes to at least three principles of sustainability (facilities), and the topic of traffic stands out since it contributes to as many as eight of ten principles of sustainability set out in the *Basque Declaration* (Table 6).

The research shows that all four topics covered (traffic, landscape, facilities, and urban equipment) contribute to the principle of *Improving public spaces and creating a hospitable, safe, and vibrant environment* and the principle of *Ensuring social inclusion and integration of all parts of society*.
We can conclude that planned activities of transformation and contemporary design of public spaces on the local level have multiple positive effects in the wider spatial context of the city, thus positively contributing to the global issue of sustainability.

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Kaja ŽNIDARŠIČ
Matevž JUVANČIČ

Walkability in residential neighbourhoods: Themes and principles revisited

Abstract
The article sets to examine broader theoretical scope of walkability, and research efforts dealing with measurement of walkable environments, with a specific aim to distil and translate walkability as a measure to walkability as a design principles toolbox of interventions and items. Overarching walkability themes are in due course branched out into more operational walkability principles and broken into further constituents of implementable interventions and items, derived from research and theoretical contributions of numerous authors. The focus lies on newly designed residential neighbourhoods, which we also demonstrate and extensively illustrate on an example of a proposed neighbourhood. Emphasis is placed on an integrative approach, where the holistic aspects of walkability – dealing with all of them at once – and its multidimensionality – intertwinement and co-dependency – are integral parts and built into the design, implementation, and use.

Keywords: walkability principles, key walkability themes, urban design, urban planning, residential neighbourhood, interventions, walkable urban environments

1 Introduction

Walkability has been present in debates and practices ever since it was popularized and firmly established by 2010, and for much longer described by other notions and descriptors, such as walkable, pedestrian friendly, pedestrian-oriented, and others. By 2020, one would expect we have thoroughly exhausted the scope and depth of walkability; however, returning to, dissecting, and interpreting definitions anew, we still can expand, debate, and rethink themes and principles of walkability, and apply them with new insights and clarity to our everyday living urban environments. Lately, the term has often been used to denote a measure of how walkable places are. In the present article, we would like to turn the optics around: from the walkability as a measuring tool to its potential role as a set of operational principles that can be used in urban planning and design practices to achieve more liveable and pleasant neighbourhoods.

One of the focuses of efforts towards pedestrian and cycling friendly cities is aimed at residential neighbourhoods, where we spend the majority of our time aside from work (and even those habits and attitudes have changed during the COVID-19 pandemic, as established by Rubin et al, 2020). There are two typical conditions in neighbourhoods where walkability can be observed, studied, measured, and improved, with the third as blended and proportionally various model of the first two:
a) *existing residential neighbourhood*s that predate explicit notions of walkability (and even sustainability), where we strive to retrofit, change, and implement the principles into an existing built environment;
b) *newly designed residential neighbourhoods* and city districts, where walkability principles are integrated into the initial design from the start;

c) *mixed building stock age residential districts*, where existing urban fabric interchanges with newly designed building blocks in various proportions.

The present article focuses predominantly on the second – newly designed neighbourhoods – and showcases themes and principles on the example of Južne Fužine neighbourhood of Ljubljana. It strives to highlight an integrative approach towards interconnected networks of walkable places, where the overall integrative effect and benefits exceed the walkability benefits of individual places.

For that purpose, the article will first look into the notion of walkability itself, its origins and later derivations, multidisciplinary perspectives, and its respective health, environmental, and economic benefits. The core of the article will then revisit– but also reinterpret – the key themes of walkability, connect them with key walkability principles, and branch them out into different items/interventions in order to make them more operational for the design and planning purposes. The above-mentioned theoretical principles will then be illustrated with envisioned, integrated implementation in a newly proposed residential neighbourhood. In conclusion, the article will sum up the different aspects discussed upon as well as assess the claim that an integrative approach should yield better results and more comprehensive, more walkable neighbourhoods than an application of principles on existing environments or retrofits in individual places.

Instead of clustering illustrations in the section in which they are referred to, the decision has been made to spread them evenly throughout the article, and thus intertwine and support the abstract notions with concrete examples of their implications and implementations on a neighbourhood level from the start. They are showcased on a newly envisioned residential neighbourhood of Južne Fužine, introduced in the second part of the article. This not only adds to the visual appeal but also stimulates the reader to constantly switch between mental and physical space, between general and particular, and between theoretical approaches and everyday life.

2 Walkability and walkable urban environments

The term **walkable** has been present for a long time and has been in use since at least the 18th century (Internet 1, 2020), but the term **walkability** is more recent. It is a noun derived from adjective walkable. While European cities, built long before cars, are inherently walk-friendly (Internet 2, 2020), modernity, fast pace of city growth, and population health issues, combined with sustainability efforts, forced a rethink of how we live and move in our towns and neighbourhoods. The concept thus emerged from the most car-reliant and high obesity rates societies, and began to permeate our way of thinking about urban environments even in more pedestrian and cycling attuned localities.

Walkability is most often referred to as a measure of how favourable an environment is to walking while also providing estimates of predicted human physical activity and active travel (Wang & Yang, 2019). Aside from being a measure, it can also be an attribute or a quality of built environment and an extent to which this environment is friendly to users who walk to their daily activities and access services on foot (Wang & Yang, 2019). Slovenian Institute for Spatial Policies IPoP (Internet 3, 2020) defines it in similar way: walkability as a spatial attribute, the appeal of the space through which pedestrians can move easily and uninterrupted.

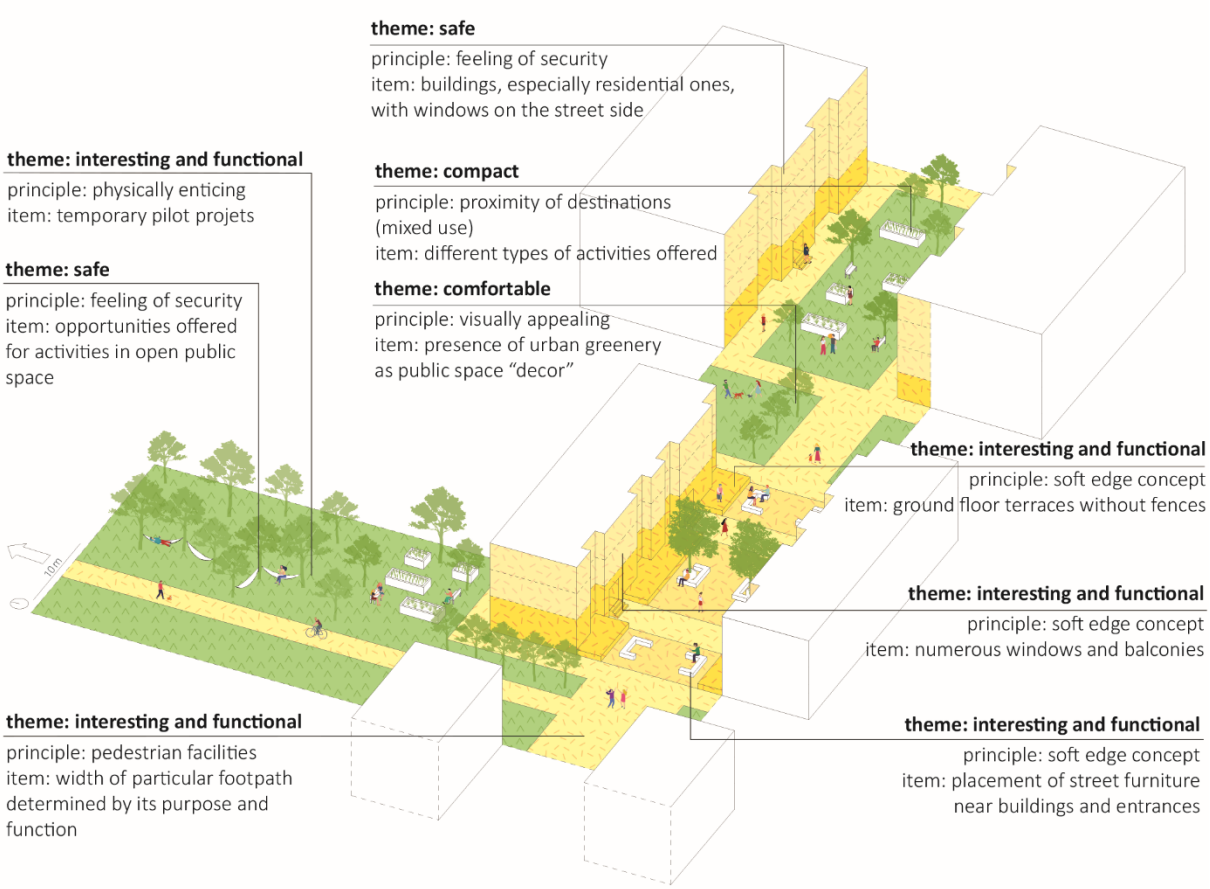

Figure 1: Neighbourhood edge where different paths start or connect the neighbourhood with other places and districts nearby – illustrations depict key walkability themes, principles, items, or interventions on a continuous path. The notions introduced and illustrated here are addressed, elaborated on, and developed throughout the article. They are showcased on a newly envisioned residential neighbourhood of Južne Fužine. (illustration: authors).

Walkability is at the forefront of debates on urban planning and the design of neighbourhoods for several reasons. It has been established that walking substantially contributes to physical and mental health of people by inducing moderate-intensity physical activity (Gebel, Bauman & Bull, 2010). In walkability we have found the formula which re-establishes the link between our built environment and everyday physical activity. This link has been consistently broken during the industrialization age as fast transportation, fast pace of life, and fast traversing of huge distances became essential, culminating in the information age that has affixed us to spending our lives in a predominantly stationary way behind devices facilitating even faster means of communication without requiring movement on our part. As environmental attributes are related to physical activity (Gebel, Bauman & Bull, 2010), urban designers have found additional arguments for claims that design interventions can instigate and maintain higher user activity levels.

The other, no less important reason are the findings that a walkable city promotes balanced development of urban areas and public services, offers residents better places to live, and consequently improves levels of neighbourhood satisfaction (Wang & Yang, 2019). *Walkability is increasingly becoming the measure of liveability and synonymous with good and successful design.* Walkable urban environments are beneficial in many ways, on many different levels, and have a positive impact on environment, society, and economy. Walkability plays a key role in providing vital, lively, healthy, and sustainable cities. It promotes physical activity and thus

has a positive impact on health and wellbeing of city residents. Walkable attributes are therefore not beneficial only in the field of walkability as discussed above, but are also very important for the whole concept of a city life, which is illustrated nicely by Speck (2012): “Get walkability right and much of the rest will follow.”

Figure 2: Green and lively riverbank in the neighbourhood with leisure and sports activities (illustration: authors).

Walkability is deemed essential by Sim (2019) since it is present in every single built relationship, every building where people live, work, and move, and can significantly contribute to sociability. According to Gehl (2010), walking is considered as a prerequisite for a lively city and the majority of social interactions. Walkable city offers people an opportunity to walk and motivates them to choose walking over some of the less sustainable means of transport. Furthermore, walkability plays a huge role in encouraging people to walk regardless of the purpose and motivates them to walk not only because they have to (goal-oriented walks) but also because they want to (walks for the sake of enjoyment and pleasure).

With association of walkable neighbourhoods with health – as well as walkable cities with overall better living conditions – walkability is surpassing its measuring role and becoming more and more a methodology of planning with a variety of design tools and initiatives leading to desired walkability goals. Its transformation from assessment and analytical tool to operational design and implementation toolbox is, however, more complex than mere reverse engineering of variables constituting walkability index.

Research into walkable environments and neighbourhoods is at times controversial, limited, and (too) narrowly focused. Wang and Yang (2019) have pointed out that in measuring of walkability we are lacking variety of other factors, insights into the interactions between different factors, more accurate data, and use of subjective data. Additionally, the interdependence between health and built environment has not been studied across different cultures, regions, and environments, while in applications of interventions attempting to improve walkability proper verification between the intent, design, and actual increase in user's activity is absent. Beyond the objective measures of walkability there are also subjectively perceived walkability attributes among residents (Leslie et al, 2005), where researchers have found that residential density, land-use mix (access and diversity), and street connectivity add to the higher perception of walkability, while traffic safety and safety from crime did not have much impact on that perception.

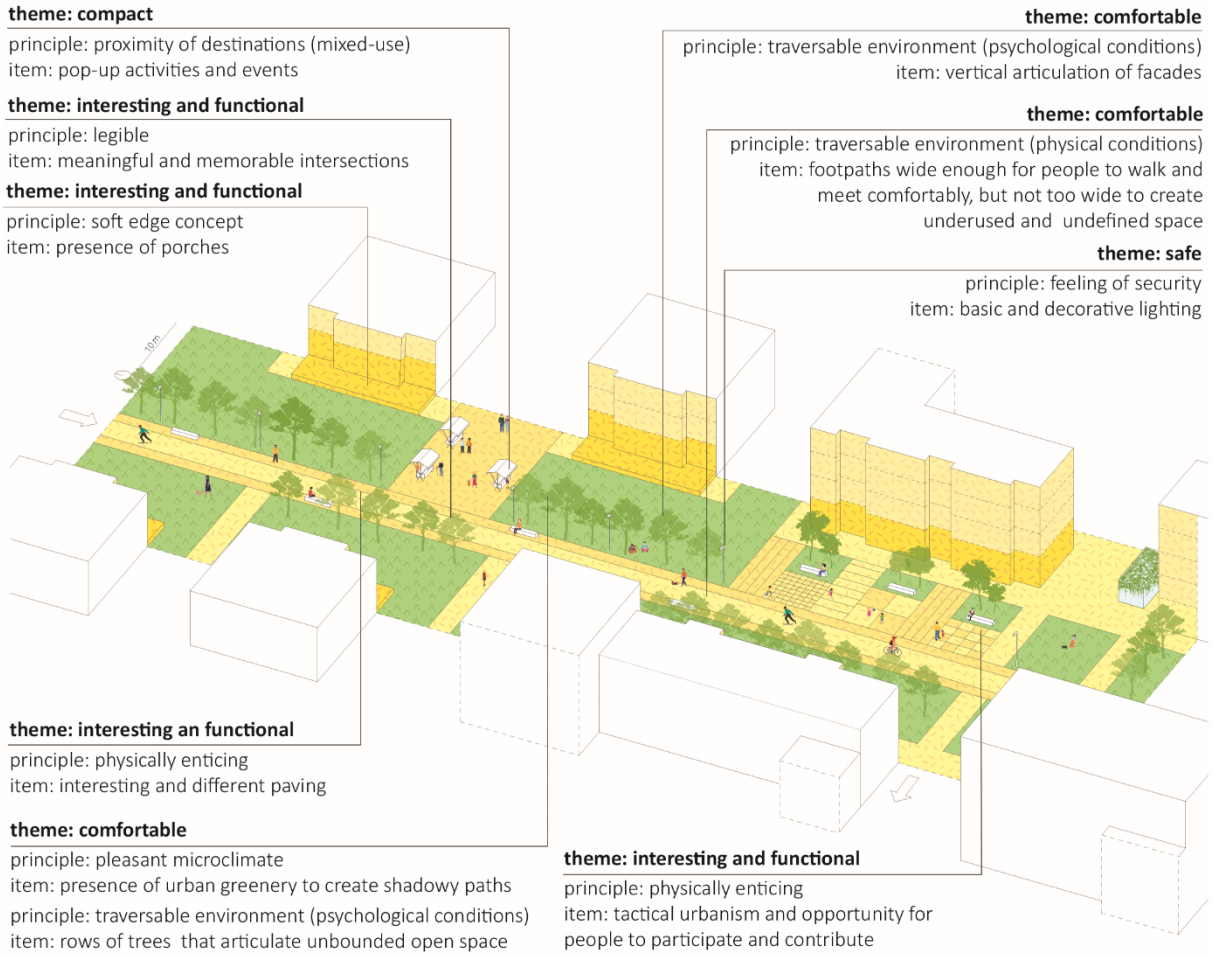

Figure 3: Central pedestrian and cycling path with various activities and interventions (illustration: authors).

Net residential density, intersection density, net retail floor area ratio, and the land use mix, most frequently used in walkability assessment (Wang & Yang, 2019), are all macro level attributes that are not easily controlled and implemented when dealing with existing neighbourhoods and city districts. They are also hard to implement directly and need translation into urban design vocabulary at different scale levels. By adding other attributes, such as traffic conditions, aesthetics, street connectivity, or walkable distances, the problematic begins to traverse into the smaller scale, to pedestrian infrastructure, and the minute and mundane details of urban micro design, such as pavement surfaces, barrier free access, and street furniture.

With this broader concept of walkability in mind, urban planners have found an additional source of inspiration to create environments for pedestrians that are safe, functional, comfortable, and interesting at the same time. The comprehensive notion of walkability covers a broad range and variety of different urban design concepts that can be observed from a new or different perspective of interlinked systems striving towards a common goal: walkable urban environments. *Although there are many walkability concepts related either directly (e.g. curb side parking) or indirectly (e.g. policies discouraging car ownership) to urban design, we will focus on those that address urban planning and physical interventions, namely those described by Leslie et al (2005) as "concepts that address physical attributes of local environments that may influence walking" (and, one might add, other positive effects related to walkability).*

In his book Walkable City (2012), Jeff Speck divides his steps into four main categories titled "The Useful Walk", "The Safe Walk", "The Comfortable Walk", and "The Interesting Walk". Every category of walkable environments includes a number of steps and, within them, many suggestions, principles, and ways to achieve them. We would like to highlight those that are most related to our focus: traffic safety, security, mixed-use, space legibility, suitable distances, green system, diversity, spatial sequences, and soft-edges.

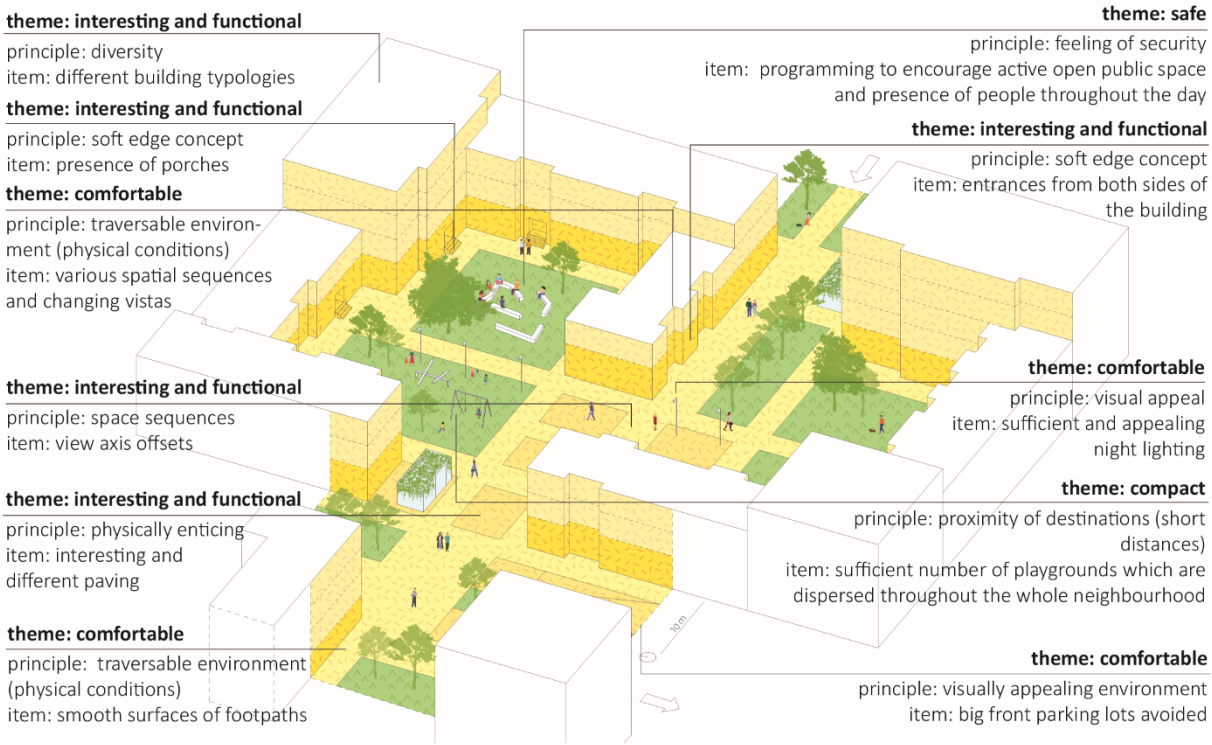

Figure 4: Semi private courtyards crisscrossed with and integrated into the network of public paths (illustration: authors).

Based on Maslow's hierarchy of needs, Mateo-Babiano (2015) derives six main pedestrian needs. The ranking of needs is based on a survey of users and the importance they ascribed to sidewalk environmental attributes. Protection and safety (1) are understandably ranked highest, with ease of use (2) and equitable access to everyone (3) trailing behind, followed by mobility (4) and identity (5), with the need for enjoyment (6) ranked last and deemed only half as important as safety. She also concedes that the ranking is not universal and might change due to demographic, individual expectations, and trip purpose (e.g. mobility would rank higher if

our intention were to traverse the place quickly and efficiently on our way from point A to point B).

Even though we have narrowed our focus on the newly planned neighbourhoods, physical interventions and urban design, and established that users will judge the walkability experience based on their needs and purpose, we insist that there are common attributes which urban planners and designers can have direct influence on. We would like to revisit key walkability themes and principles while also illustrate implementation of principles and ways in their possible appearance in residential neighbourhood design.

While we focus on urban planners and designers, and the scope of their design interventions directly affecting spatial attributes and walkability, we are aware that comprehensive walkability can only be achieved through interdisciplinary efforts and variety of intertwined methods.

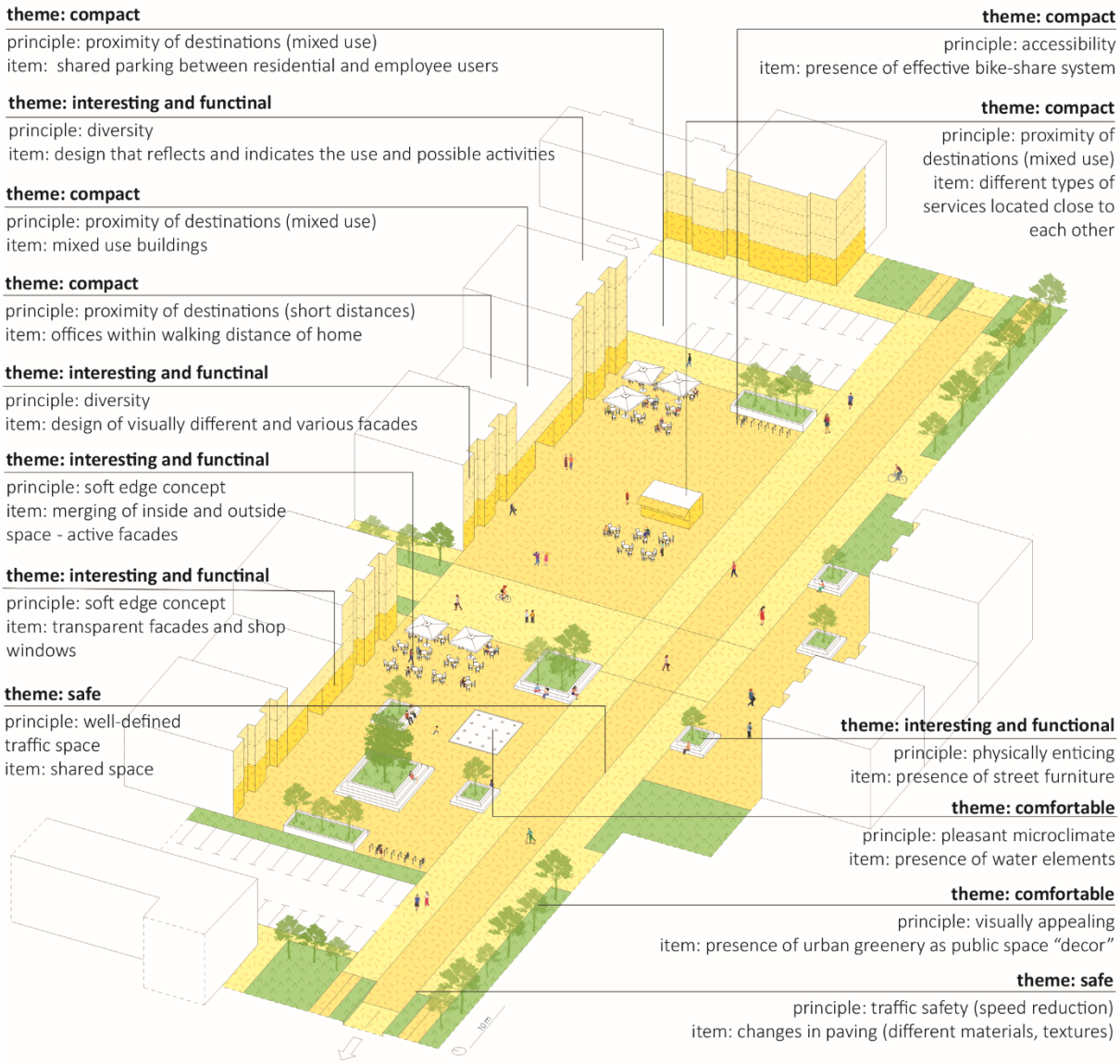

Figure 5: Central space of the neighbourhood with its multipurpose and mixed use open square (illustration: authors).

3 Integrated approaches and holistic walkability

In contemporary urban design and planning field, application of walkability principles differs not only by the selection of principles and ways of their implementation but also whether they are implemented into individual, isolated environments or deliberately incorporated into the whole picture, as a series of interconnected ambiences. Newly designed neighbourhoods, such as the example in this article, lend themselves well to holistic approach, especially when it comes to physical interventions, while existing and retrofitted urban environments are not as flexible but benefit from the root communities and established social networks.

Holistic approach in planning and designing of walkable cities and neighbourhoods is becoming essential since it is the only way urban designers can design open public spaces that are well connected and offer pedestrians unique, continuous, and narrative spatial experience. The integrative approach is extensive and more demanding in nature yet more effective in comparison to individual small-scale projects that are often designed in isolation or with limited possibilities of connecting to already established, built up surrounding places.

While Forsythe (2015) takes holistic solution as one of the proxy definitions for defining better environments that generate investment, are more sustainable, and are in general better places to be in, we would like to take the integrative and holistic design approach further, arguing that it is not only a proxy indicator of walkability, an outcome, but rather a means to an end and a planning instrument towards better walkability outcomes. By planning walkability experiences in integrative fashion, as a series of interconnected and continuous places and space flows, we can achieve better and more holistic results.

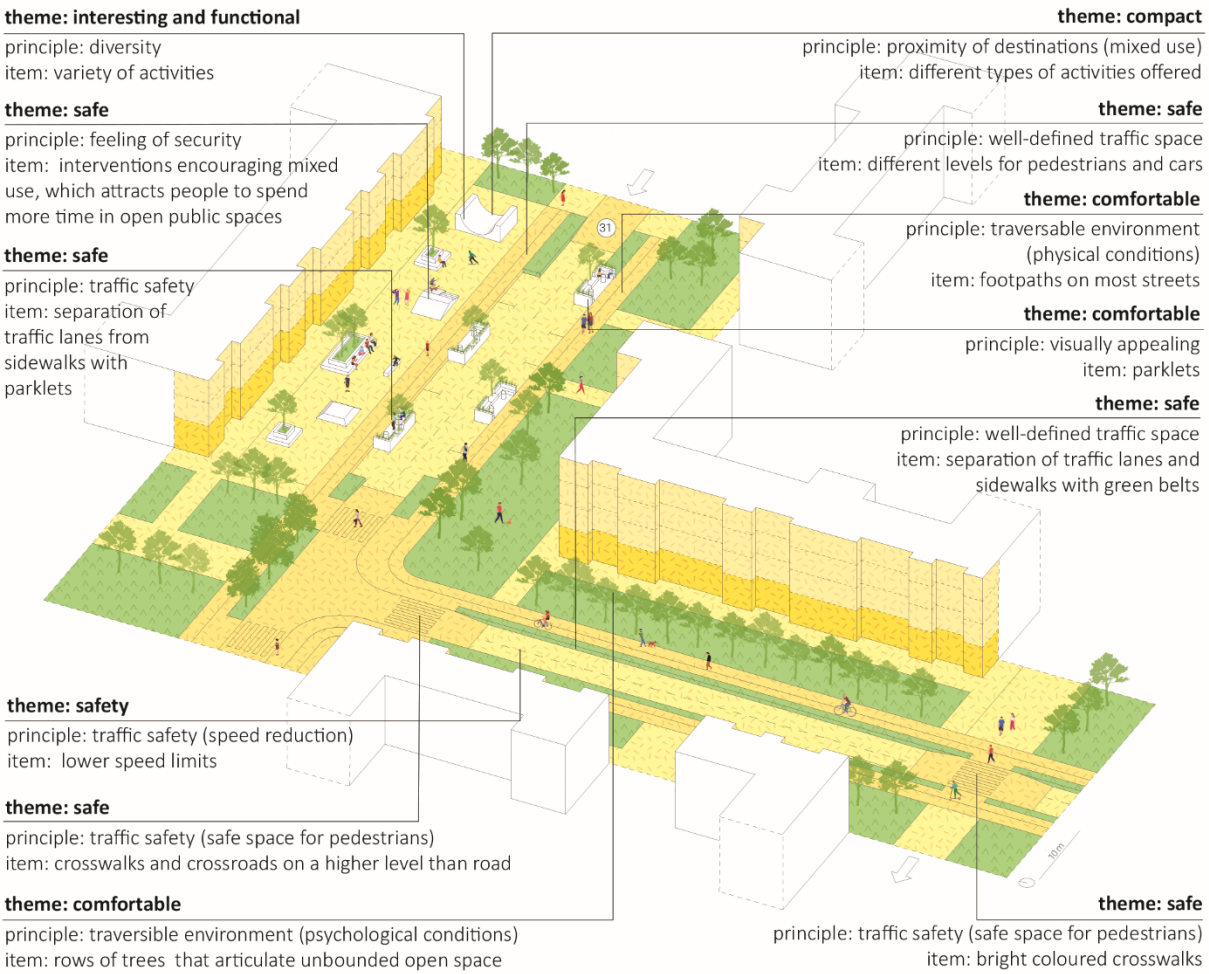

Figure 6: Common streets in residential neighbourhood with walkability principles applied (illustration: authors).

As pedestrians, our interaction with urban environments is predominantly experiential. This is significant because such an experience is common to all of human beings, regardless of age, status, and interests. It is based on our sensory apparatus and perception (and also limited by it, e.g. vision, field of view), on our exploration by moving, relative scales and estimations rather than factual measurements, first person perspective, and intuition. Cullen (1961) sums it up with his notion of serial vision and continues to establish the user's relative positioning in regards to the places she moves through (outside, entering, being in the middle, leaving, etc.). The design of such places has to adapt to these findings; by following them, it is in essence democratizing the experience to all users and user groups.

4 Revisit and reinterpretation of key themes

As introduced above, the notion of walkability consists of many interconnected principles which, when implemented deliberately and consistently, provide safe, useful, comfortable, interesting, and therefore walkable network of open spaces, well integrated into the core of a neighbourhood design. Forsyth (2015) separates *key themes or dimensions of walkability* (from here on referred to as *walkability themes* or *key themes*) into three clusters of attributes: means (traversable, compact, safe, and physically enchanting), outcomes (lively and sociable, sustainable transportation options, exercise including), and proxies (measureable, holistic solution). All of the above-mentioned are interconnected; they all contribute to walkable places,

but not all of them are always present at the same time – or at the same level – and they also differ depending on the specific environment.

For the purpose of our article, we have derived our *walkability principles* and their definitions from Forsyth's (2015) *themes*, modified them, combined them with Speck's (2012) categories of walkability, and diversified them by selected derivations of steps turned into principles from "Walkable city rules" (Speck, 2018). We have also extended them with contributions from other researchers in the field (Leslie et al, 2005; Sulaiman, 2020; Wang & Yang, 2019; Saelens, Sallis & Frank, 2003; Cerin et al, 2006; Leyden, 2003; Gehl, 1971 and 2010; Sim, 2019). By doing so, we have broadened the scope and systematics of notions in order to cover full variety of walkability attributes under urban designer's scope of interventions. Each *key theme of walkability* (Forsyth, 2015) is revisited and examined first, followed by re-think of the implications on urban design practices, and suggestions for widening of particular notions offered as well as renaming of the others for clarity purposes or to introduce new, extended meaning.

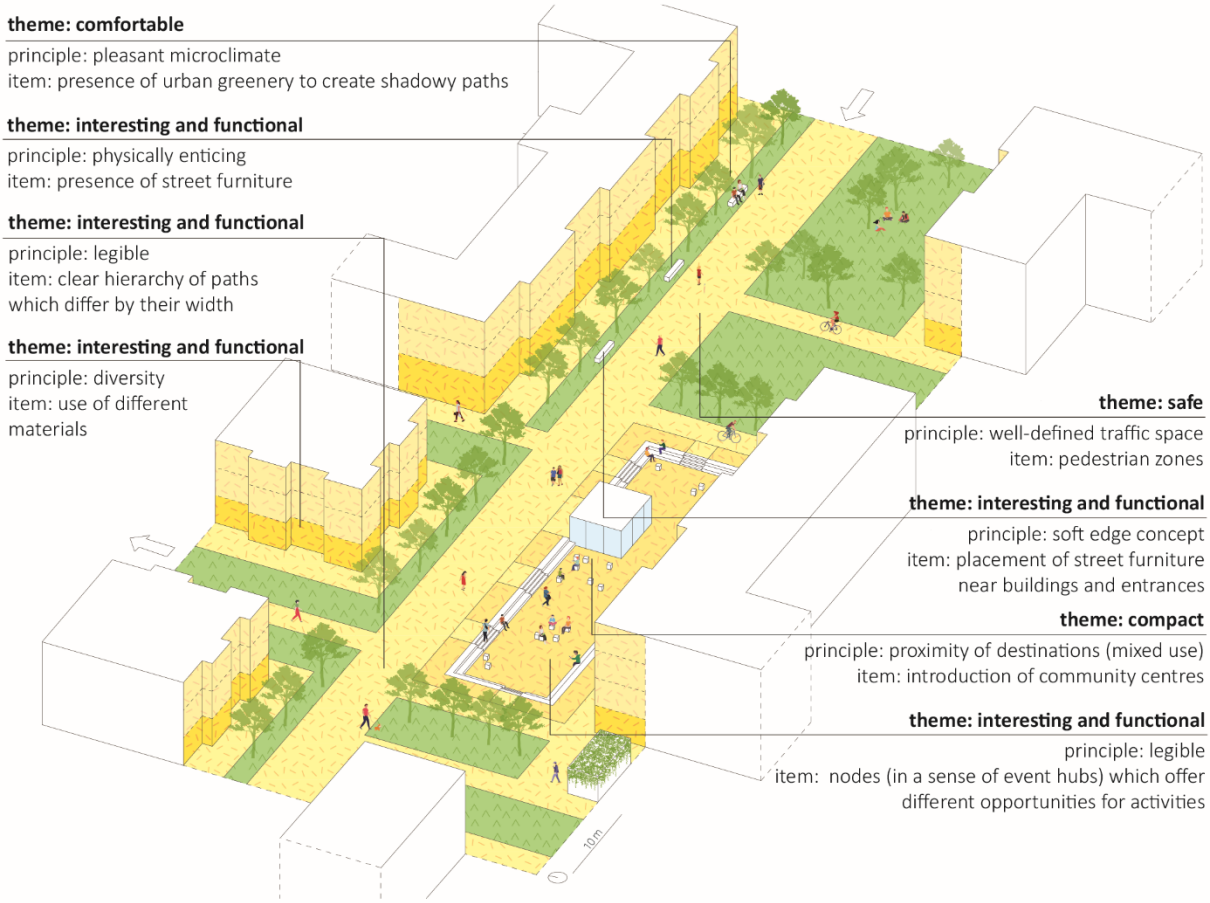

Figure 7: Public square with a distinctive design – open space as a landmark (illustration: authors).

The themes inside the cluster of means will be observed first. According to Forsyth (2015), "traversable environments have the basic physical conditions to allow people to get from one place to another without major impediments, for example, relatively smooth paths". Traversable is a walkability aspect, which falls into a category of comfort, alongside urban greenery and many other design principles that make space appealing and comfortable to walk through. We suggest the term "*comfortable*", because it both covers traversability as introduced by Forsyth and widens its meaning by adding additional qualities beyond mere utilitarian, including different groups and levels of comfortability of traversing.

For Forsyth (2015), compact places provide short distances to destinations for those who are walking for utility. The term compact covers the already introduced principle of proximity and short distances between everyday destinations. This Forsyth's theme therefore falls into the aforementioned category of usefulness of the space but is concrete and intelligible in terms of urban design. In comparison to our term useful, it does not cover the principle of legibility of the space but covers the principle of mixed use. We have kept the term "compact", which will in our case include both proximity and mixed-use but exclude legibility of the space, which we will discuss later on.

Forsyth (2015) states that safe spaces should be understood as "places being safe for walking – perceived and actual crime and perceived and actual traffic safety". The denoted meaning of "safe" is aligned with definitions from our introduction, which include walkability principles for achieving traffic safety and general feeling of security.

For Forsyth (2015), physically-enticing environments "have full pedestrian facilities such as sidewalks or paths, marked pedestrian crossings, appropriate lighting and street furniture, useful signage, and street trees. They may also include interesting architecture, pleasant views, and abundant services attractive to those who have other choices for getting around and getting exercise." Forsyth's definition of the term is very broad; it covers many different aspects of physical qualities of the space. It includes some principles that could easily fall into other themes. For example, sufficient lightning and pedestrian facilities are more suitable for category safe; trees on streets have already been mentioned in category comfortable; and service attractiveness and diversity has already been considered in the compact category.
As many of those principles overlap, and are interconnected and interdependent, we have decided to retain them and change the naming from "physically-enticing" to "***interesting and functional***", which caters to Forsyth's definition and at the same time adds some of the following principles: legibility of the space, variety of built and open space morphology, concept of space sequences and soft-edge principles.

Under the cluster of outcomes dwells the theme lively and sociable (places), which are pleasant, clean, and full of interesting people, according to Forsyth (2015). Likewise, Gehl (2010) emphasizes the importance of walking and describes it as one of the prerequisites for a lively and sociable city. We agree with the poetic definition which denotes these characteristics well and is aligned with our and common understanding of these notions in their broader socio-economic meaning. When it comes to sustainable transportation options, we suggest broader term *sustainable* (in general) that goes beyond Forsyth's (2015) transport focused understanding of walkability "as a way to achieve both the environmental preservation and social equity components of sustainable urban form providing sustainable transportation options". As well as sustainable transportation options, sustainable in general covers some additional outcomes, such as sustainable aspects of microclimate design and control, energy efficiency, sustainable design and maintenance practices, etc.

For Forsyth's (2015) health focused exercise-inducing, where she sees benefits in "higher than average levels of walking either in total or for transportation or exercise", we suggest broader term "*inviting to move on foot*" that covers both the idea of inducing exercise and the concept of choosing walking over some other, less sustainable, transportation options. This theme therefore covers a wide range of health benefits for space users and city residents, but it also alludes to spaces that invite people to walk (and cycle) and encourage them to do so, not only for health benefits but also because it is more practical, less time consuming for short distances, provides more experiences and sensorial inputs, promises more social interaction, is less tedious

and more fun than, for instance, driving a car. Some of these qualities are already reflected through both above-mentioned outcomes (lively, sociable and sustainable); however, we decided that "inviting to move on foot" is a defining quality or outcome that deserves to be singled out.

Forsyth's (2015) proxy definitions are complex and, as she states, draw together elements of prior themes. We agree with the complexity that multidimensionality and holistic solutions bring into the equation of walkability and are thus taking over the proposed definitions. However, due to their broadness and derivative nature of previous themes (notions), we abstain from addressing them in our case study and rather use them for summary of before mentioned topics and principles. Nevertheless, we also single out holistic solutions as a means in an integrative approach, especially in the design of new districts and neighbourhoods, where the holistic integration into the initial design brings many benefits over later retrofits.

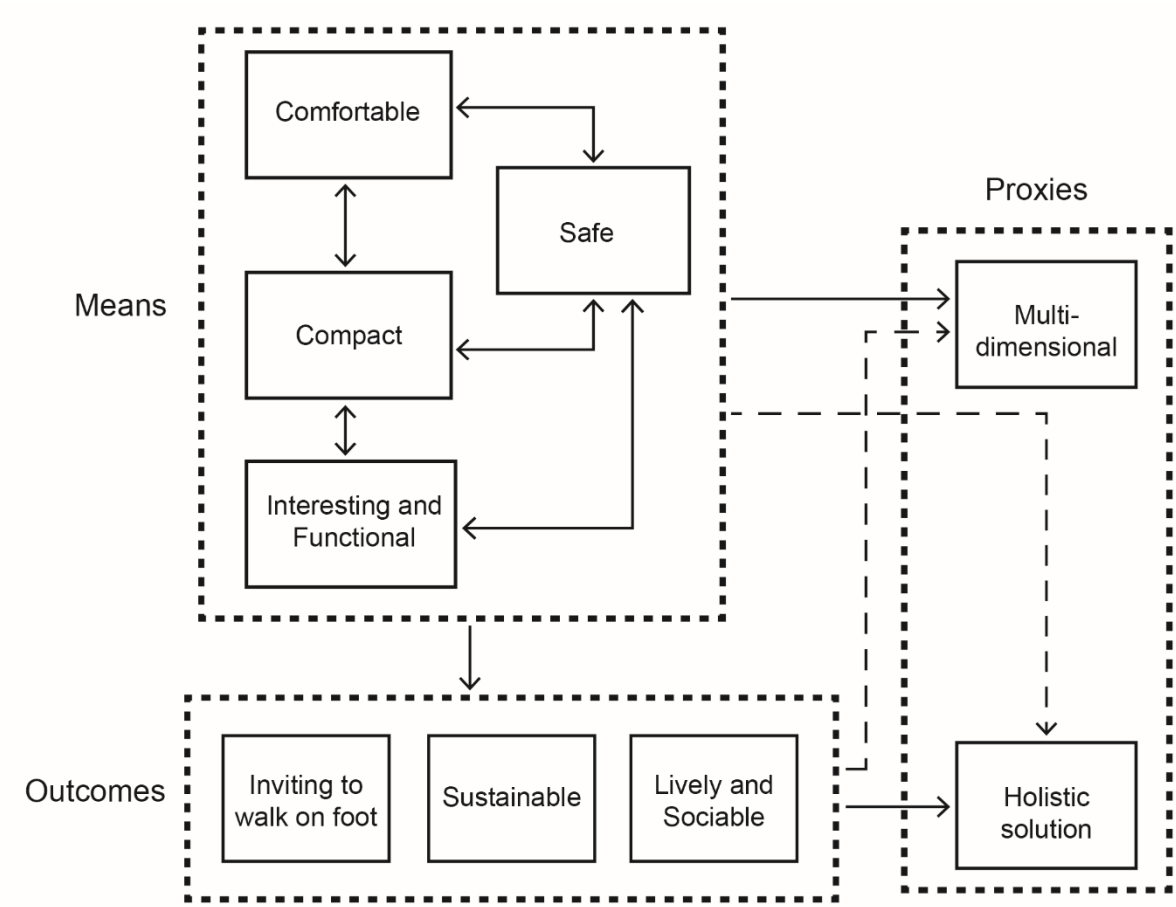

Figure 8: Linking modified key themes of walkability into an existing scheme (initially proposed by Forsyth, 2015; and modified by the authors).

To sum up, we agree with Forsyth's (2015) definitions to a wide extent; however, we felt the need to broaden some of them, include additional aspects which we deemed important, and at some instances rename them in a more obvious fashion.

5 Key Themes Translated into Key Urban Design Principles and Items

To make the *key walkability themes* operational for urban planning and design purposes, we have systematically translated and concretized them in the tables (Table 1–4) and, additionally, visualized them on a neighbourhood scale proposal.

Table 1: Addressing key principles, items, and interventions within the key walkability theme – Comfortable

Walkability principles	Items / interventions
a) traversable environment • physical conditions concerning footpath and road design • psychological conditions concerning interventions that encourage people to walk and make their walking experience more pleasant, especially the concept of actual and perceived distance	regarding physical conditions: - footpaths on most streets - footpaths well maintained - smooth surfaces of footpaths - same level paths or at least minimal interruptions regarding level of paths - unnecessary obstacles cleared out - footpaths wide enough for people to walk and meet comfortably, but not too wide to create underused and undefined space - amount of space dedicated to motorized traffic reduced - limits to motorized traffic lanes width and width reserved for side parking (e.g. MOL, 2012) - optimized driving network in a way that does not have a negative impact on pedestrians - porous driving network instead of branching network - lead pedestrian intervals on semaphorized crossroads
b) visually appealing environment	regarding psychological conditions: - various spatial sequences and changing vistas - tiring one-point perspective avoided where possible - vertical articulation of facades - rows of trees that articulate unbounded open space
c) pleasant microclimate achieved both with urban planning and landscape architecture interventions	regarding visual appeal: - preventing littering with sufficient number of dustbins - presence of urban greenery as public space “decor” - presence of green areas in the neighbourhoods - big front parking lots avoided - sufficient and appealing night lightning - parklets regarding pleasant microclimate: - presence of urban greenery to create shadowy paths - wind and sun conditions taken into consideration during neighbourhood design - presence of water elements - parks and other green areas in the neighbourhoods

Key principles are derived from the themes, and address graspable and physically implementable *walkability principles*, especially in the *means* category, which we see as an urban designer’s intervention toolbox of ideas, solutions, and inspirations. Since research has established correlations between environment characteristics and walkability in the domains of residential density, land use mix–diversity and land use mix–access, street connectivity, walking/cycling facilities, aesthetics, traffic and crime safety, we have examined sample items from Neighbourhood Environment Walkability Scale (Saelens et al, 2003) from the aspect of their intervention “capital”. The items have been used to calculate – or measure through surveys – the walkability index. Looking at them from the designer’s perspective, we see opportunities for deliberate targeting of some of these items with interventions in order to intentionally – and through design – directly influence the walkability outcomes.

Table 2: Addressing key principles, items, and interventions within the key walkability theme – Compact

Walkability principles	Items / interventions
a) proximity of destinations • mixed-use concerning diversity of use both at the neighbourhood level as well as at the single building level • short distances regarding proximity of services and activities	regarding mixed use: - different types of services or facilities located close to each other - mixed use buildings - different types of activities offered - pop-up activities and events - different types of services - single use districts avoided - shared parking between residential and employee users - introduction of community centres regarding short distances: - neighbourhood proximity based design, (re)thinking and (re)designing land use - schools and offices within walking distance of homes - recreational facilities and playgrounds integrated inside neighbourhoods (and not on their edges) - sufficient number of playgrounds dispersed throughout the whole neighbourhood - dense housing
b) accessibility in way of physical accessibility for different users, vulnerable groups, and distances; also on the subject of effective public transport that encourages walking in combination with public transportation	regarding accessibility for different users: - similar to interventions regarding physical conditions - designed for all age groups and groups with different vulnerabilities (e.g. elderly or disabled; with ease of access, social housing, inclusive urban environments, etc.) regarding public transport accessibility: - high public transport frequency - special lanes dedicated to public transport (on main access roads) - efficient public transport lane and route scheme/arrangement/system - affordable, subsidized public transportation - clarity of public transport lanes and accessibility to information regarding public transport lanes, routes, and fares - pleasant and comfortable public transport vehicles - presence of effective bike-share system

Items have thus been selectively derived not only from research (Saelens et al, 2003) but also reformulated from Speck's (2018) rules, Gehl's (2010) principles and amalgamated with other *means* that target design interventions and environmental characteristics established to correlate with walkable environments (from research listed in the previous subchapter). As underlined in the introduction, we are observing newly designed residential neighbourhoods and districts, not retrofits.

Table 3: Addressing key principles, items, and interventions within the key walkability theme – Safe

Walkability principles	Items / interventions
a) traffic safety • motorized traffic speed reduction • safe space for pedestrians in areas where motorized and non-motorized traffic intertwine • well-defined traffic space that can be done in two different – mutually opposite – ways: deliberately merging different traffic spaces into one whole (shared space) or hierarchically dividing them into subcategories of more conventional traffic spaces	regarding motorized traffic speed reduction: - speed bumps/tables - minimized road curb radius - lower speed limits - speed cameras - road axis offsets to create meandering roads - changes in paving (different materials, textures) - mixed traffic zones such as shared space - bright coloured crosswalks and other floor markings regarding safe space for pedestrians: - crosswalks and crossroads on a higher level than road - bulb outs on crosswalks and crossroads - shared space crosswalks - sparse use of curb cuts (for sidewalk car traverses) - pavement on the curb cut the same as sidewalk, not the road - sparse use of roundabouts on neighbourhood streets regarding well-defined traffic space: - pedestrian zones - shared space - separation of traffic lanes and sidewalks with green belts - separation of traffic lanes from sidewalks with parklets - trees planted on road curbs - use of legible and well-visible traffic signalization, both horizontal and vertical - different levels for pedestrians and cars
b) feeling of security that mostly originates from human presence in the space and overall design of open spaces	regarding feeling of security: - buildings, especially residential ones, with windows on the street side - interventions encouraging mixed use, which attracts people to spend more time in open public spaces - opportunities offered for activities in open public space - programming to encourage active open public space and presence of people throughout the day - basic and decorative lighting

Tables 1, 2, 3, and 4 parallel principles and items within each key walkability theme, establishing a hierarchical connection from overarching and more abstract themes through more specific principles to operational physical interventions in the hands of urban planners and designers.

Table 4: Addressing key principles, items, and interventions within the key walkability theme – Interesting and Functional

Walkability principles	Items / interventions
a) present, well-designed, and well-connected pedestrian facilities	regarding pedestrian facilities: - ubiquitous presence of pedestrian infrastructure - well-connected footpaths and pedestrian infrastructure in general - legible network of pedestrian infrastructure
b) overall physically enticing open spaces and buildings	- access to services provided for pedestrians - width of particular footpath determined by its purpose and function - human scale taken into account
c) spaces must be legible to be functional and easy to use	regarding physical enticement: - presence of street furniture - sufficient and ambient lightning - aforementioned well-designed and functional pedestrian path network
d) diversity of design and activities present	- public art programmes (e.g. painting of murals on blank walls, places reserved for public art, etc.) - interesting and different paving
e) space sequences that help users perceive and experience the space differently and dynamically	- tactical urbanism, temporary pilot projects, and opportunity for people to participate and contribute regarding legibility of the space: - clear hierarchy of paths which differ by their width - meaningful and memorable intersections
f) soft-edge concept • commercial use buildings • residential buildings	- nodes (in the sense of event hubs) which offer different opportunities for activities - placement of different types of landmarks throughout the neighbourhoods regarding diversity: - design of visually different and various facades - use of different materials - variety of activities - variety of services - design that reflects and indicates the use and possible activities - inclusion and preservation of architectural and natural heritage - different building typologies regarding space sequences: - tiring one-point perspective needs to be avoided - neighbourhood designed on the principle of serial vision - view axis offsets regarding soft edge principle on commercial use buildings: - transparent facades and shop windows - multiple entrances - big windows - merging of inside and outside space – active facades - different services - narrow units, frequent changes of facades or shop windows regarding soft edge on residential buildings: - entrances from both sides of the building - numerous windows and balconies - ground floor terraces without fences - placement of street furniture near buildings and entrances - presence of porches - well-connected inside and outside space - narrow units

The majority of themes, principles and interventions from Table 1–4 are depicted throughout Figures 1–8 which follow an everyday path from home to school in a newly designed neighbourhood of Južne Fužine. The neighbourhood, which has been envisioned for a bachelor's thesis project (Žnidaršič, 2020), is located on the eastern edge of Ljubljana in the immediate vicinity of the highway ring and the Ljubljanica River at the junction of urban and

rural spatial context. The new residential district covers 35ha and includes residential, educational, commercial, and mixed use buildings, which vary in typology, morphological structure, and height. Four main two-way streets are shared with motorized traffic, while all other paths and areas in the neighbourhood are designed for pedestrians and cyclists only. Among the central features are "green" footpaths connecting larger green spaces adjacent to the district in the south, and the riverbank in the north.

Although out of many possible alternatives a specific path has been selected and illustrated for the reason that it crosses the greatest variety of places, it is representative in terms of a holistic approach and integrated walkability implemented throughout the entire neighbourhood. The illustrations demonstrate opportunities and potential compatibility of interventions and items when they occur in various combinations and where their combined effect is larger than their individual sum. Thematically we are following a sequence of spaces starting at the *neighbourhood edg*e (Figure 1) where we encounter mostly principles and interventions within themes that are interesting and functional as well as comfortable. *Riverbank* (Figure 2) introduces items regarding visual appeal, diversity, and proximity of destinations. *Central pedestrian and cycling path* (Figure 3) with various activities and interventions is one of the backbones of the walkable neighbourhood where principles of traversable environment and overall interesting and functional theme are dominating. Semi-private courtyards crisscrossed with and integrated into the network of public paths (Figure 4) illustrate the theme safe, principles regarding physical enticement, diversity, and soft edge. Central space of the neighbourhood (Figure 5) is the heart of the multipurpose and mixed use demonstrating compactness and other themes. Common street (Figure 6) is a representative of the typical residential and walkable street in the neighbourhood where principles of traffic safety and feeling of security are present. Public square with distinctive design (Figure 7) represents an open space as a landmark approach where items regarding legibility, visual appeal, and physical enticement come into play. Educational facilities in the neighbourhood and their immediate surroundings (Figure 9) illustrate principles regarding items of comfort along with principle instigating interesting and functional places.

6 Discussion and conclusion

The present article set out to examine broader theoretical scope of walkability and research efforts dealing with measurement of walkable environments, with the specific aim to distil and translate walkability as a measure into walkability as a design principles toolbox. The reasoning behind the shift of the perspective is based on the findings of various researchers who found positive correlation between physical attributes of local environment and increase of users walking or cycling and other positive effects related to walkability. By directly influencing – in urban planning and design terms, by deliberately designing and changing our local living environments – we can improve the walkability of our neighbourhoods.

Overarching walkability *themes* which can be clearly divided into three main categories – *how we set to achieve walkable environments* (means); *what we can expect from walkable environments* (outcomes); and *by which other scales we can evaluate or think about them* (proxies) – are excellent starting points. Nonetheless, planners and designers need to translate abstract notions into liveable and tangible urban environments. For this reason, the walkability themes have been branched out into more concrete *walkability principles* and these in turn expanded into physically implementable items and interventions. With this in place, we now have a complete design and examination cycle of interventions leading to more and better

walkable environments, with research efforts able to investigate and provide new insights and new suggestions disseminating back into the design loop at different levels (items/interventions, principles or/and themes).

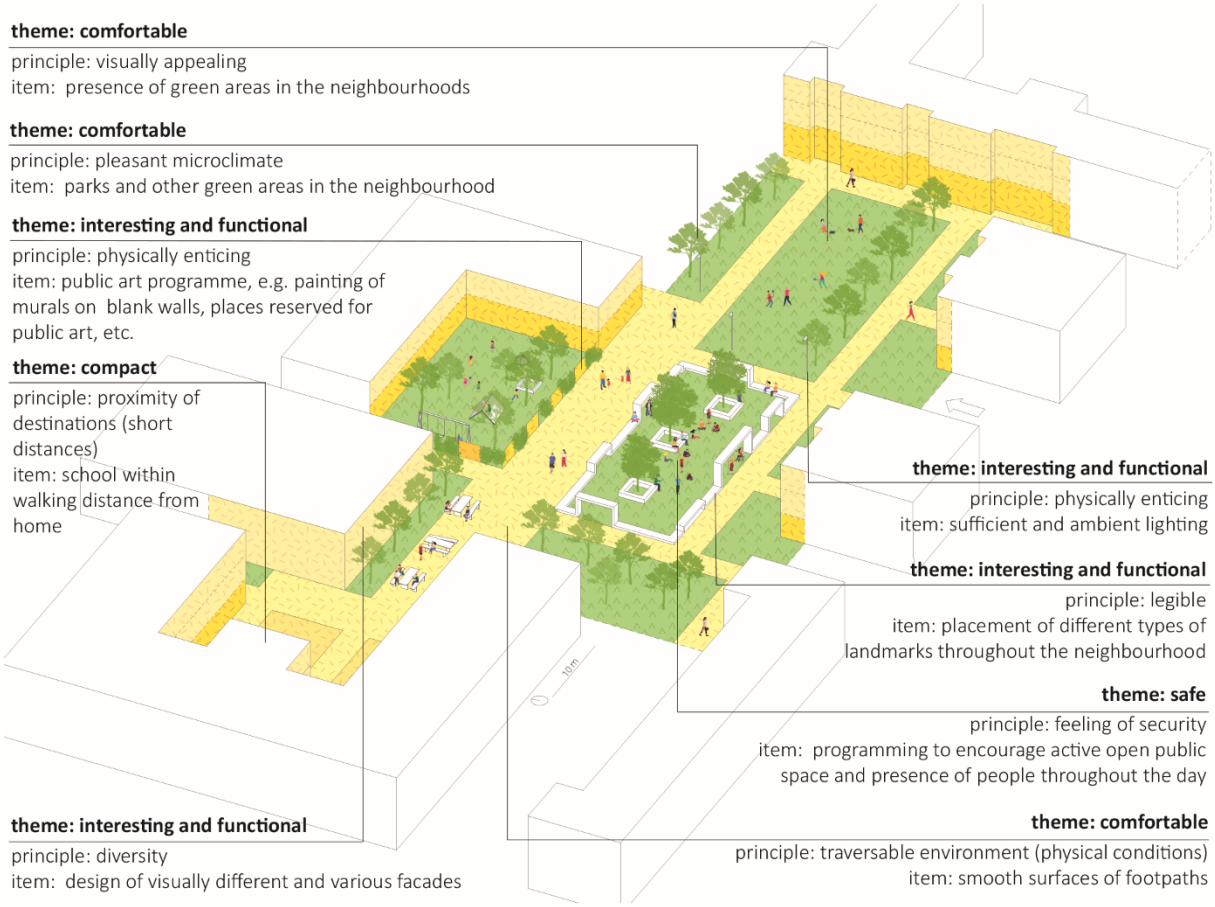

Figure 9: Educational facilities in the neighbourhood and their immediate surroundings

With the idea of broadening and branching out of *themes* towards the bottom-up design interventions in mind, we wanted to address the topic of walkability in general, deepen the understanding of its complexity, and Europeanize it – observe it from the perspective of European urban contexts and realities which are markedly different from cultural and urban contexts on other continents.

We have focused predominantly on physical interventions within reach of urban designers and urban planners – the means category – yet in doing so we have by no means exhausted all other means, such as policy changes strategies, changes of attitudes, changes of habits, economic incentives, and other non-physical, initiative based approaches. They remain powerful means to support and enhance the proposed physical interventions.

While a significant number of items and interventions included could find a place and improve walkability in existing neighbourhoods, we have addressed and highlighted the scope of possibilities in newly designed residential neighbourhoods, leaving out some important interventions and principles that would also benefit walkability in existing urban environments (e.g. renewal and maintenance of cultural and natural heritage, changes in existing traffic networks and flows, etc.).

Equally, the article has an applicable and professional side. Interventions and items in the tables can be understood and used as a palette of tools available to urban designers to achieve walkable, lively environments. They are depicted and shown on site with the descriptors explaining the theme they belong to, principle they address, and interventions themselves in an understandable narrative and integrated fashion. Although the illustrations come from the design of a specific neighbourhood, the spaces depicted are common enough to be used as inspiration for numerous situations with similar opportunities.

As already stated throughout the article, walkability themes – and especially principles – are interconnected, interdependent, and in many ways affect each other. Due to the overlaps, it was therefore sometimes challenging to divide them into groups as some *principles* fit into more than one *theme*.

Speck (2018: 12) claims that "people will not walk unless the walk serves some purpose". Aside from purpose, which provides the reason for walking or cycling activity, they will base their decisions on other factors as well, such as convenience of choosing this mode of transport over others, the appeal of the activity itself, the appeal of the environment they will be moving through, and the amount of effort and time they will need to invest in the activity. The benefits will usually outweigh the investment of effort and time only if the main activity of walking to an errand or a service or for leisure promises the potential of other side benefits and pleasurable activities that might occur during the walk, such as socializing, window shopping, exercising, playing, or moving through pleasant, well maintained, well equipped, convenient, interesting, and engaging environment.

And at this point we return to one of our initial claims that such urban environments will only emerge with holistic and integrated approach and design to walkable neighbourhoods, where such a flow of interconnected interventions, spatial attributes, and incentives has been established as will result in higher walkability, both as perceived among the users as well as objectively measured. The holistic aspects of walkability – dealing with all of them at once – and its multidimensionality – intertwinement and co-dependency – are its integral parts in design, implementation and evaluation. The present article thus not only derives and lists the interventions but also demonstrates them in one of such integrated approaches that illustrates a potential walking path to an everyday errand – such as walking to school or walking to a shop – where the neighbourhood design favours walking and cycling over other means of transport and where these two and other activities promise a more pleasurable, social, and fulfilling experience.

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The main theme was completely refocused and reworked with an emphasis on residential neighbourhood and demonstration of themes, principles, and interventions that are supported by extensive depictions not present in the previous publication.

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Seeds for socio-spatial justice and equitable mobility for all: The "Bus Map Project" as "Riders' Rights" in Beirut

Abstract
The present article discusses the possibilities and limitations of transport-related innovative initiatives in Beirut, Lebanon, through a socio-spatial institutionalist perspective, within a socially divided neoliberal context splintered by sectarianism and political turmoil. The article examines the reach of the grassroots initiative "Bus Map Project", which in 2019 became the NGO "Riders Rights" (BMP–RR), in achieving socio-spatial justice and equitable mobility by recreating and reshaping the debate on Beirut's informal transit system. The latter has various ambivalent features, and an often negative connotation, since it operates in mixed traffic with other vehicles, with no fixed stops, and is not considered as formal transit. However, it is a private–public–civil hybrid system. The empirical data is built on participatory action research (PAR) with BMP–RR since 2018, socio-spatial and ethnographic analysis of the informal transit system, and in-depth interviews with various transport-related agencies. The conclusion emphasizes that the radical ambitions of socially innovative arrangements are possible even in so unstable and divided contexts as Beirut. However, they are limited by the structural problems of a consociational government, which are deeply rooted in the Lebanese history and cannot be easily overcome *by* such initiatives.

Keywords: Beirut informal transit, mobility injustice, participatory action research, social innovation

1 Introduction

After the Lebanese civil war (1975–1990) came to a halt (Salamey & Tabbar, 2008; Nucho, 2016), political divides affected several urban aspects such as the development of urban infrastructure, including users' mobility in certain circuits and circulations entangled within each community's sectarian geography. In other words, the aspects of daily life in Beirut had become the central domain of contest across 18 ethno-religious sects (Mady & Chettiparamb, 2017), and generated a spatio-sectarian mosaic along with politico-sectarian organizations, governments, and profit-seeking developers. The failure of finding a consensual democratic model and a common ground that could embody the country's political cleavages and social divergence gave rise to "authoritarian inner-state entities" (Salamey & Tabbar, 2008: 240). This has resulted in producing an oligarchic political system, which caters to the needs of the various communities (Cammett, 2011). In the context of Lebanon, "community is translated as sect" (Nucho, 2016: 7) that (re)produces sectarian publics. Therefore, the everyday practice of mobility in Beirut cannot be taken for granted, as it depends on Beirut's sectarian territoriality and political differences (Monroe, 2010; Nucho, 2016) embedded in transport infrastructure. The reality of urban transport politics and economy of a dysfunctional elitist post-civil war government is not equally available to all, as it varies according to the socio-economic classes and spatial positionalities (Buhr & McGarrigle, 2017). Injustices were produced and reproduced due to ignoring the different interests of the public, leading to major gaps encountered at the level of public transport service provision. Tammam Nakkash, a transport expert and founder of Managing Partner at TEAM International, explains that "there was no

political will to (re)establish and (re)invest in public transport after the war, even though Beirut was known for its glorious mobility past. The transport problem in Beirut goes beyond the subject itself; it is multifaceted and not easy to solve. Particularly the state failed to adopt wise and long-term strategies for transport policies" (interview, 1 Mar. 2018). In the wake of the destruction of Beirut, the state failed to see a possibility to reinstate public transport. Such decisions eventually resulted in the insurgence of an informal transit system.

The informal transit has become a gap-filler, a self-managed practice to provide socio-spatial justice (Cervero et al., 2017; Sheller, 2018) after a wartime divided city (Cammett, 2011) and to show resilience (Scott, 1989; Bayat 1997) to the apparent chaos in transport and the absence of adequate public transit (Baaj, 2008) within a "laisser-faire" milieu. However, "the politics of everyday mobility have trapped this system as quasi-inaccessible, unsafe, and irregular for non-habituated riders and non-transparent for riders and operators" (Nakkash, interview, 1 Mar. 2018). Within such a fractious politico-sectarian milieu, fuelled by informal practices, civil societies found strategies from below to achieve (mobility) justice in the contested city of Beirut. "Riders' Rights" (RR) grew from a grassroots *initiative* known as the "Bus Map Project" (BMP), with the aim to achieve a better mobility plan by bringing to light through documentation the availability of the Beirut informal transit system, unknown to many, and to achieve bottom-linked governance transformations. The latter implies restructuring the middle ground for new forms of democratic governance collaboratively built between socially innovative initiatives, their scalar dynamic networks, institutions, and agencies (Moulaert & McCallum, 2019). Such a form of governance is helpful to understand and reshape the historic genesis for more inclusiveness at the local level.

The present article aims to investigate whether and how the status of BMP–RR as NGO has produced innovative societal responses with respect to resolving the socio-spatial and political problems in the transport sector, recreating a solidarity-based transit community, and producing changes in social and power relations by bridging different organizations and their collaborative mechanisms. As a methodology with which to combine various strands and explore details about the initiative's work, the researchers have deployed a reflective participatory action research (PAR). PAR allowed the first and second author to participate in experiencing the work of BMP at a grassroots level, through mapping the informal transit, and, with BMP having become an NGO, in challenging Beirut's politico-sectarian divisions while creating partnerships in the city. Given that social innovations possess inherent force towards such change, the article sets the ground for PAR by cross-fertilizing literature of social innovation (SI) by Moulaert et al., addressing social and human needs, solidarity and building participatory governance, with socio-spatial transport and mobility studies. Based on this, the article then discusses the PAR process in different stages regarding BMP–RR's upscaling trajectory. The article concludes by arguing that the radical ambitions of socially innovative arrangements are not utopian or geopolitically marked (Moulaert & MacCallum, 2019), and yet they remain limited in unstable contexts such as Beirut.

2 Combining social innovation and mobility injustice in a framework for building heterogeneous transit communities

Social innovation (SI) is defined in relation to human development and social emancipation. It is characterized by three interconnected features: the satisfaction of human needs that are not answered in the current state of affairs; the capacity to change established social and power relations among the civil society, state, and market actors; and the empowerment of excluded groups via collective (re)construction of identities, capabilities, and cultural emancipation

(Moulaert et al., 2013). Hence, local capabilities and social cohesion are enhanced through bottom-up approaches.

According to Moulaert et al. (2013), working at the community scale provides the nexus between the redefinition of everyday social life in the community and the broader struggle for democracy and rights. Therefore, SI at the local level is an entry point, a window of opportunity into a broader multi-scalar context. However, the possibilities of structural change can only be conceptualized through dialectic processes between community and society building as *s*olidarity-based community-building and the transforming institutional configurations through the redefinition of state–civil society relations. It will be well to recall that the process of SI at the local level is networked and institutionalized, and is not only the outcome of collective actions (Swyngedouw, 2005). SI research "has to be seen as a deeply institutional endeavour" (De Blust & Van den Broeck, 2019: 100), using a multi-actor approach that integrates the possible multiplicity of engagement to build a shared collective ontology (ibid). Such perspective opens up potentialities for SI and multi-actors, perceived as agents of innovative actions (Van den Broeck, 2011), to join transformative practices that (re)shape history while assessing how socio-territorial innovation capacities are differentially embedded in institutional frames and mobilized. Such structural change is created when the actors involved start coproducing innovative solutions which could reinstate socio-spatial justices (Albrechts, 2005: 2012). Bridging different groups is fundamental to the knowledge coproduction process, and they can be reached through a transdisciplinary approach (Moulaert & McCallum, 2019; Van Dyck et al., 2019).
What then does social innovation contribute to mobility justice? In some ways, it seems like a sedentary idea, tying people to place-based communities and finding alternatives for mobility injustice situations. SI revolves around transforming and (re)creating social relations (Moulaert & McCallum; Van den Broeck et al., 2019), and provides a lens to analyse counter-actions in the transport field and ways in which these empower dispossessed public transit users. According to Sheller (2018), the word mobility has been used to simply replace the word transport (i.e. mobility services and alike), but it goes beyond the existing transport and spatial justices to develop epistemic alternatives, as both did not develop a mobile ontology. It could be understood through practice and experience in reference to the "mobilities turn or paradigm" (see Cresswell, 2006; Sheller & Urry, 2006; Adey et al., 2018). In that sense, mobility is not synonymous with transport, as it implies access to necessary healthy lifestyles and generates context-dependent experiences of "socialities, affinities and knowledge" (Buhr & McGarrigle, 2017: 227–228), which users learn by practice and according to circumstances. Mobility is having equal access to transit options with good quality time, affordability, and safety (see Banister, 2017; Sheller, 2018). Without mobility, transport is meaningless. Therefore, transport is the basic infrastructure that provides mobility, which revolves around transforming and (re)creating social relations and cultures within a space. Accordingly, (re)instating a social turn by putting social innovation at the heart of the transport paradigm implies questioning socio-spatial injustices produced by various actors and paving the way to profound socio-political transitions in cities that affect users' mobilities. This perspective places transport planning in a field of actors and institutions, dialectically expressed in terms of each other. It analyses how institutions as social patterns affect the structural dynamics and mechanisms of actors (Toro et al., 2020). Accordingly, the socio-spatial injustices produced by the politics of transport have the ability to (re)create (in)justices depending on users' capabilities to access transport services (Pereira et al., 2017).

The question then is whether and how socially innovative initiatives are mobilized to negotiate socio-spatial and institutional dynamics of mobility (in)justice and create an inclusive transit

system. Mobility justice seems to be advocated by bottom-up (collective) initiatives as "informal or formal arrangements engaging in the act of governing outside, and beyond-the-state" (Swyngedouw, 2005: 1991–1992), foregrounded by citizens separate from ruling technocrats and formal planning institutions, characterized as self-managed, as activists, or as social entrepreneurs. Such initiatives appear to show in a dramatic fashion how the socio-spatial transit (in)justice tenet needs to be (re)thought in more dynamic and creative manners (Sheller, 2018). Thus, the transition from static "command-and-control systems" (Swyngedouw, 2005: 2002) to horizontal networked forms requires bottom-up, decentralized, and self-organized structures that scale-up into participatory governance or hybrid governance (Parés et al., 2017). Governance hence becomes a constant coordination, negotiation, and dispute of social relationships, characterized by complexities and reciprocal dependencies (see Swyngedouw & Jessop, 2006), between organizations including the state, self-organized networks that are committed to each other, and initiatives that create solidarity. The study of participation in governance practices, configurations, and processes also pays attention to multi-scalar and power structures (Moulaert & McCallum, 2019; Van den Broeck, 2019). This highlights how the input from civil society in decision-making could be an opportunity for multi-level governance. It relates to which actor configurations manifest themselves within the social and power structures involved in various types and patterns of collective decision-making in a broad sense and in all diversity, and how they organize society through it (Moulaert et al., 2013; Van den Broeck, 2019). This approach allows these initiatives to scale-up *in* diverse ways, to interact and operate in duality between their social efficiency, ethics of respect, and solidarity (Manganelli, 2019).

To mobilize this socio-spatial institutional perspective, the sections following examine the epistemological and methodological approach taken, and inform the reflexive process about the efforts of BMP–RR as NGO in producing innovative responses that enhance the informal transit system while challenging Beirut's mobility narratives amidst a highly contentious politico-sectarian environment.

3 Methodological approach: Dialectical relationship between theory and practice

PAR is not merely a descriptive methodology, since it not only documents social realities, but rather contextualizes that reality and works towards changing it. This section elaborates on the literature that has guided PAR researchers to reflect on their different works and experiences with BMP–RR's upscaling trajectory. In this sense, the participatory process is used to express the political commitment of the researchers to the transit community. In terms of data gathering techniques for PAR, the article begins with the descriptive stage where certain events are described empirically through qualitative, participatory, and mapping methods conducted by the first author between 2018 and 2021. They are based on coding in-depth interviews transcripts with transport-related stakeholders, including 7 community activists, 10 transit planners, 8 RR volunteers, and 5 state agencies, and nearly 200 informal interviews with different drivers, operators, riders and non-riders in this 4-year timespan, who generously took time to explain the issues related to the transport sector. Other data were collected in socio-spatial and ethnographic analysis of the transit system conducted in the two main transport hubs in Beirut, Cola and Dora. Overall, the collected data present a reading of the current differentiated mobility experiences in Beirut, its socio-spatial segregations, and transformations triggered by recent socially innovative initiatives regarding current mobility patterns.

3.1 The basics of participatory action research (PAR)

SI research studies practices that improve human conviviality in a broad sense, support collective agency to address unsatisfied needs, and facilitate emancipatory bottom-up initiatives (Jessop et al., 2013; Moulaert et al., 2013; Van den Broeck et al., 2019). To relate the theory and practice of SI, actions and reflections need to be intertwined (Van Dyck, et al., 2019). Jessop et al. (2013) argue that SI researchers should enter SI dynamics reflexively, and not as "anthropophobic consultants. In this way, the researchers should be capable of developing a meta-theoretical framework to analyse SI in accordance with its own nature and ethics, and to expand their networks of knowledge through initiating partnerships and experimenting with other agents of SI within their societal settings. Moulaert et al. (2015) argue that reflexivity in SI research is inherently transdisciplinary, which establishes methods in theory-building as a component of action. Transdisciplinary research valorizes complexities, and allows researchers in actions to perceive contradictions and to grasp multiple perspectives and opposing interests. Through this pragmatist approach, the researchers are encouraged to be open to experimentation and innovation, which includes a more activist approach to research activities (Silva et al., 2015). Such an approach helps the researcher to build meta-frames that are not fixed but open, adaptable, and dynamic rather than static. Hence, the reciprocal relation between the scholar and practitioners in decision-making could build scientific data that feed into collective actions (Jessop et al., 2013). Examining the reach of BMP–RR in transdisciplinary research means mobilizing researchers to move from practising fixed scientific procedures (such as performing surveys, conducting interviews, and analysing documents) to collaborative learning processes. Knowledge coproduction and sharing resources between different agencies have the potential to initiate discussions about the socio-political transport-related issues in Beirut. To note, the agency dimension of SI is "spatially negotiated between agents and institutions with strong territorial affiliations" (Moulaert, 2009: 12; Jessop et al., 2013). Therefore, the collaborative process created with BMP–RR coproduced space for co-constructing knowledge, mutual learning, and joint action between academics and practitioners from diverse disciplines and societal fields, while understanding and inducing transformations for problem-solving and the development of new scientific insights (Albrechts, 2012). As a consequence, placing SI initiatives within a meta-theoretical framework allows understating SI's structural frameworks, which are spatially and institutionally embedded (Van den Broeck, 2011; Jessop et al., 2013). In this way, researchers have the opportunity to get closer to practice, through deploying a reflective PAR methodology or performative research, as also advocated by Gibson-Graham (2018). Participating in social experiments strives to embody a democratic commitment to breaking the monopoly of whoever holds knowledge and for whom social research should be undertaken (Kindon et al., 2007; McIntyre, 2008), by explicitly coproducing knowledge through a collaborative process (Popa et al., 2014; Van Dyck et al., 2019). Doing "hybrid research collectively" (Gibson-Graham, 2008: 626) means working together with people who are already involved in making new societies, without abandoning academia. Rather, the researchers could attempt to bridge the imagined divided world between academia and community (by becoming activists in the traditional sense) to become agents of change (Moulaert & Nussbaumer, 2008; Jessop et al., 2013). The research steps in this case are explained in the following sections.

3.2 Performing PAR with BMP–RR

Through PAR, SI research is praxis-oriented and aims to facilitate knowledge coproduction through a non-linear process between different actors. When immersing in SI processes, the first and second author illustrate their roles as active actors by democratically contributing to

knowledge co-creation with BMP–RR and vice versa. The role of researchers as documenters and analysts of the SI reality is always different from that of practitioners or other stakeholders.

The collaboration between the first author and BMP–RR avoided a hit-and-run research strategy. It started from a personal interest, which triggered the researcher to find ways to be part of this community through building trust and negotiating the research, creating networks with various stakeholders, and becoming an agent of change herself. As a scholar-activist-practitioner and community resident, the researcher's work was enriched through the collaborative process with BMP–RR. In late 2017, the researcher contacted BMP with the aim of conducting an interview about their work. After following-up their work, in mid-2018 the researcher decided to get involved with the initiative. At the beginning, the researcher helped the team in distributing maps and conducting interviews with local transport-related stakeholders, informal transit service providers, riders, and non-riders. After working with the team for more than a year, the researcher decided to become a fully committed member of the NGO in the summer of 2019, along with other volunteers who were initially involved in BMP's work. Accordingly, her role was hybrid, first as an academic linked to research practice, then as part of collective actions, nourished by the socio-cultural, political, and economic context. To frame the work of BMP–RR, the researcher has led a process of building collectively with the initiative a meta-framework on mobility (in)justice. This meta-framework has supported her hybrid position and allowed her to participate in experimenting with the work of BMP–RR from an active participatory perspective rather than merely assessing the initiative's social innovation capacity (Jessop et al., 2013; Moulaert & Nussbaumer, 2008). In this manner, BMP–RR was not an object to be studied or to be interviewed, but it became an ongoing process.

Through PAR paths, the researcher's insider status enabled her to participate in two of the three committee groups: funding and social media, while leaving out awareness and outreach group. Her contribution to the initiative's work was not limited only to sharing expertise on transport but extended to employing several professional skills. As part of being a scholar-activist, she was involved, among others, in designing processes, negotiating and advocating agendas, coordinating research, preparing workshops and writing, funding proposals and blogs. The second author's approach was to engage her students from the Bachelor of Architecture programme at Notre Dame University–Louaize (NDU) with real issues by having the opportunity to work on various projects with the NGO. At first, BMP was invited in 2018 to give a public presentation on their work at NDU. Then, BMP–RR began to take part in the Urbanism course in every semester since 2019; in exchange, students groups built a transport database for the initiative and generated ideas for disseminating knowledge on mobility in Lebanon. The first author stepped in to liaise between academia and practice by assisting BMP–RR in mentoring students. In the same spirit, the first author is currently developing a module about corruption in the transport sector with the third author for a course owned by the "Youth Against Corruption" (YAC) NGO. Education has a potential in building capacities for citizens by making them conscious about the forces that shape their lives. Believing in cultivating a substantive democratic culture, her commitment is rooted in the idea that there is a realm in which, through sharing knowledge, individuals can become more discerning about the common good, attain membership in the community, and participate in civic life. In this way, the initiative benefits from sharing stories with different audiences. Accordingly, the researcher is playing the role of a (backstage) facilitator, shadowing the (frontstage) practitioners' work.

The process of coproducing knowledge between the scholars and practitioners was challenging. For instance, conducting qualitative research under lockdown due to the global pandemic was an opportunity for the researcher to be more committed to BMP–RR work through organizing

webinars, investigating, and gathering information related to their activities through video-calls or text-based messaging. Accountability and reciprocity were two other fundamental challenges, providing the criteria for establishing connections, assessing how the individual scholar could be self-perceived as a practitioner and activist, how the collaborative partners perceived the latter, and what kind of relationships were built. Even though the work is voluntary, the scholar-activist-practitioner is evaluated by the team based on the amount and type of work produced during this collaboration. The purpose of having such a position is to be embedded in a web of relationships, which demanded a high level of accountability. This required the researcher to take part in the community struggle rather than being an academic who occasionally dropped in. The co-founder of BMP–RR expressed this issue during an informal discussion with the first author, saying that "one problem with academics is that they are sometimes not sufficiently rooted in the community problems; they privilege their own agendas and work. We do not mind helping them without expecting anything in return because we want to share knowledge and build connections." This is understandable, as academia is mostly geared towards an individual's research, teaching service, evaluation, and promotion. However, reciprocity requires a mutual give and take, which is something that the researcher was attentive to. For instance, BMP–RR team members, especially the co-founders, have assisted the researcher in fieldwork and in building connections with transport-related stakeholders. Eventually, the democratic process has taught her that the innovators' small-scale projects could be the embryos of challenges to the hegemonic politico-sectarian system. The value of being involved in such work is to build a transit community that coproduces knowledge accessible to all.

4 Results: Reconstructing the trajectory of BMP–RR

This section discusses the trajectory of BMP–RR in improving the accessibility of the informal transit networks to various users and co-creating pathways that generate seeds for mobility justice through collective participatory processes. A triangulation of information was achieved through combining primary and secondary sources.

4.1 From BMP to RR: Perspectives on the upscaling process

When observing Beirut's streets, one can notice the heavy traffic congestion dominated by private vehicles, and the scarcity of pedestrians and public transport, amidst a highly securitized politico-sectarian context, circumscribed by setting up security installations (e.g. concrete blocks or checkpoints) and re-routing of traffic flows (Fawaz, 2009; Mady, 2020). Accordingly, Beirut's mobility varies according to socio-economic classes, since the car has become not only the dominant mode of transport available but also a reflection of social status (Monroe, 2010; Mady, 2020).

BMP emerged in the summer of 2015 as a collective mapping grassroots initiative to palliate the lack of data (maps, timetables, stops, etc.), which made the informal transit system quasi-inaccessible for non-riders and non-transparent for riders and operators. So far, BMP produced the first two maps of Beirut's informal transit network in 2016 and 2018 (see http://busmap.me/#downloads). BMP became an opportunity to try and embody *certain* principles grounded in several annoyances concerning the ways in which activism or even politics are understood and practiced in Lebanon. *A*ccording to BMP–RR (2018), "the first map was a manifesto to acknowledge the informal transit system". It is noteworthy that BMP was founded by two bus-riders with backgrounds in Media Studies, Human Geography, and Computer Engineering, who had understood that collective mapping can initiate collaborative

processes that capture imagination and catalyse participation. “In the first few years, the team had few volunteers, so the tasks at hand were gargantuan. This made the progress slow. Since the summer of 2018, the team has grown to a solid core group, which helped BMP–RR to get a lot more done with little funding,” expressed Jad Baaklini, the co-founder of BMP–RR during a team meeting in 2020. However, BMP is still a modest initiative without pretending to be authoritative or definitive. Since mobility is contextually dependent, BMP follows a piecemeal rather than a comprehensive approach to change.

The question then is how and to what extent Beirut’s informal transit system is empowering the dispossessed to commute across the city and its outskirts within such highly divided milieu. The story of informal transit began with the lack of state endorsement after the civil war, when the public transport network was fully taken over by the private sector. Ziad Nasr, the President and Director General of the Railways and Public Transportation Authority, explained that “the history of Beirut’s everyday mobility had to face a completely corrupted, clientelist, and chaotic environment perceived as a form of informal arrangements, which are customized to people’s needs and feed the political system” (interview, 8 Mar. 2018). “The failure of the post-war state at implementing long-term solutions for public transport and pursuing an inclusive agenda for drivers from different religious sects” (Nakkash, interview, 7 July 2020; Baaklini, 2020) pushed private operators to gradually take over the formal system (Assaf et al., 2020). Nowadays, the transit system includes 40 badly maintained stated-owned buses, which have stopped operating in August 2021 in the wake of the Beirut explosion (Nasr, 2021). In addition, there are 4000 privately-operated licensed vans (as well as 12,000 illegal ones with duplicated license plates) and 2000 licensed buses (as well as 1500 illegal ones), which often negotiate and compromise to the benefits of various political figures, operating on approximately fifty trajectories (Mohieddine, interview, 9 Mar. 2018; Faraj, interview, 11 Nov. 2020). The ubiquitous informal transit is perceived by many transport-related stakeholders and citizens as serving a homogeneous stereotyped user group rather than multiple users identities (Mady, 2020). Based on the socio-spatial and ethnographic analysis in the transport hubs, one could notice the different religious affiliations reflected in the service providers’ dress codes and ornaments. However, riders included passengers of all ages, genders, and ethnicities. Moreover, no matter how chaotic its internal logic appears to outsiders, decoding the informal internal operational system reveals a monopolized, *privately*-operated, incrementally constructed collective transit, which defines and redefines socioeconomic variables while reproducing and reinforcing socio-political hierarchies (Assaf et al., 2020). The analysis revealed *th*at the entire operational system is divided among operators who serve their own communities. A transport hub de facto transfers commuter from point A to B. However, the spatial positionalities of the collective transit stops are dependent on the politico-sectarian mosaic. For example, speaking about routes, some drivers in Cola and Dora expressed their particular party allegiance and choice to drive in “their sectarian territoriality to hunt for their riders since the drivers’ duty is to serve their people”. Accordingly, “these routes emerged to offer a service to facilitate the movement of their communities living in rural areas to Beirut,” explained other drivers. However, the informal transit system has an ambivalent feature, since “it operates just like board-games”, as a driver on bus line 2 explained (interview, 5 Mar. 2018). Such conditions (re)produce socio-spatial injustices within the internal transit system. As for some interviewed riders, “it is safer to take the bus that belongs to their community, and our community could profit” (interviews, 4 Feb. 2018 – 25 June 2021). As Nucho (2016) claims, notions of sectarian community are most obviously produced within the material landscape not only through engaging with sectarian institutions but also through the day-to-day exercise of “being” (Nucho, 2016: 7). Each bus and van route (keeping in mind that some routes are shared by more than one provider) is a battlefield between various political parties and sectarian groups. Moreover, the shadow of the

politico-sectarian fabric is portrayed in Beirut's urban mobility not only in the division of informal transit routes but also in the division of the transit drivers unions (El Zein, 2020). BMP–RR, however, considers that "everyone is a rider on the bus, there is no difference. And the system is providing a service even if it is reflecting a divided society" (Faraj, interview, 11 Nov. 2020). BMP–RR recognizes the existence of an urge to (re)shape the perceptions and stereotyping of the system.

To achieve that, BMP's work faces a series of challenges, which are entrenched in the politico-sectarian affiliations of actors and mobility culture, and which cannot be really addressed by such small-scale initiatives. That is why "BMP scaled-up to build-up a community engagement and a network of different actors interested in the transport sector that could challenge such problems deeply rooted in the Lebanese history," said Faraj (interview, 11 Nov. 2020). In 2019, the state recognized Riders' Rights (RR) as an NGO. The latter aims to "protect the rights and raise the voice of the providers and riders of the informal transit service by upgrading and supporting their current services" (Baaklini & Faraj, interview, 16 Feb. 2018). The informal transit service could be supported through implementing low-cost solutions such as the reuse of old smartphones to map and track the buses and vans. That is when Smarter Buses, initiated in 2008 as Lebanon Buses and founded by Chadi Faraj, emerged as a social entrepreneurship in 2018. Smarter Buses is an online platform with the aim of helping and working alongside BMP–RR by sharing all data collected on an app. In this way, said Faraj (interview, 11 Nov. 2020), "the service could be improved by making it more transparent and accessible, and bridges between riders, service providers and local authorities could be built".

Upscaling of BMP–RR to an NGO aspired to improve connections among the informal transit service providers and riders, and support more inclusive processes of community participation as a means to attain greater control over their own development agenda. The NGO status helped the grassroots initiative to avoid the above-mentioned dangers of political agendas and the lack of accountability faced by public and private bodies. Based on interviews of 8 out of 15 BMP–RR members in July 2020, it appears that when the members introduced themselves to the service providers, city authorities, or even associations as representatives of Riders' Rights NGO, trust was immediately built. "This is quite different than previously, when the team used to present themselves as a 'grassroots initiative'." According to Faraj, "BMP did pave the way for RR to obtain such trust with their achievements before becoming an NGO" (interview, 11 Nov. 2020). Recently, BMP–RR has assumed a horizontal character by decentralizing the decision-making. The NGO is divided into three committees that work collaboratively with each other and meet on a monthly basis. The meetings are usually facilitated by the board members who guide and develop communication between the committees. In meetings, the team attempts to (re)frame the everyday political talks into deliberative exchanges and take decisions collectively. Collective intelligence in democratic participatory process is highly valued. According to the interviewed volunteers, "there is no clear leadership, which is understandable, and it is interesting to have every member's vision. In this way, democratic leadership is revealed in the decision-making." Hence, "BMP–RR is building an inner, horizontal organizational system that does not depend on individuals but on collective work," as expressed by another volunteer (interview, 2 Feb. 2021).
This was reflected in the election of the new general board members of the NGO in July 2020. Baaklini did not run for election, which gave an opportunity for other members to take part of the change. Nevertheless, a vertical hierarchy has not been fully eliminated as the democratic process is limited to the availability of certain members. Regarding unsuccessful projects, the team re-evaluates their work to identify their weaknesses and reformulate new strategies. Still missing from BMP–RR's endeavours are strategies to address the modalities of governance in

the informal transit system, which are deeply rooted in the (re)production of politico-sectarian infrastructures. Such strategies, discussed in the next section, are limited by structural problems of a consociational government.

4.2 If it is innovative, why is it limited?

"It is an extraordinarily complex exercise to be innovative in a deeply divided and neoliberal city like Beirut," said Nakkash (interview, 1 Mar. 2018).

The production of a bus map was "an act of legitimizing the status quo of the informal transit system. The map could become a traditional blueprint document," said Baaklini during an interview in 2018. To illustrate, the Ethiopian community *Egna Legna* in Beirut has used the BMP map as the basis to (re)produce an Amharic bus map to facilitate the movement and safe travel of the Ethiopian domestic workers. Abdel Hafiz El-Kayssi, the former General Director of Maritime Transport at the Ministry of Public Works and Transport, stated that "BMP–RR could bring to light the existence of the informal system, but this does not mean that the state will take their work into account" (interview, 4 May 2018). As explained by Nakkash, "the growing frustration of the state agencies lead them to ignore the production of the map because they do not want to acknowledge the existence of the informal transit infrastructure. If they do, the social infrastructure destroyed after the civil war could be reinstated, while the state is benefitting from the politico-sectarian scenario" (interview, 1 Mar. 2018). In fact, the power-sharing scenario was in existence even before the war; it was grounded in the consociational model implemented after the National Pact of 1943 (see Khalaf, 2002; 2006) to engender a governance system that (re)produced different state entities within the state and catered to sectarian patronage networks and loyalties. Clientelism emerged to redirect individual loyalties from public institutions towards their particular politico-sectarian communities (Schenker, 2017).

Mapping the informal transit goes beyond the production of a map. "BMP–RR did not only produce a manuscript on potential ways to stitch and address urban issues found in a highly polarized environment due to the absence of political will. BMP–RR also produced a manifesto to provoke socio-spatial justice within the collective transit. This could only happen when partnerships are built in the city," said Faraj during a BMP–RR team meeting in October 2020. Around this core objective, the team is opening up opportunities to collaborate with various actors and to generate a collective force that can co-create advocacy and build a solidarity-based community to achieve mobility justice. BMP–RR is building coalitions on the local level with, for example, Train–Train NGO, The Chain Effects, Bicycle Mayors Tripoli, Public Works, Lebanese Union for People with Disabilities, academic institutions such as NDU, and internationally with the World Bank and the Transit Union Riders in Seattle.

Although it is acknowledged that these initiatives have their own agendas, "if they unite together, they could achieve good results. If they fail, they will be reproducing the image of a divided state. The floor is theirs, so let them mesmerize us," said El-Kayssi (interview, 4 May 2018). Multi-actor coalitions require negotiations to coproduce processes that can address the socio-political complexities. To achieve their personal agendas, these partners should co-create an integrated transport infrastructure plan that seeks mobility justice. For example, when the Lebanese Government took the decision on 15 March 2020 to stop the operation of the collective transit system as part of COVID-19 measures, severe losses resulted for bus and van drivers who survive on a daily wage. BMP–RR launched a campaign "Bus Lines Heroes" in partnership with Train–Train NGO and Riders' Rights International to fundraise and empower the drivers to support themselves during the lockdown. Moreover, BMP–RR has co-developed a "position paper" with transport-related actors, such as specialists, academics, civil society

organizations, etc., to expose realities of the mobility and transport sector in Lebanon. Working in unison, they can co-create a force to lobby for the Ministry of Public Works and Transport's decisions. According to Nakkash, "if these actors do not get the approval of the 'real state actors', the attempts of these initiatives will remain on hold" (interview, 7 July 2020). Needless to say, processes of constructing these new choreographies to shift from government to a hybrid form of governance or bottom-linked governance are associated with the prominence of new social actors, the consolidation of the present ones, and the exclusion of others *(S*wyngedouw, 2005). This adds a new layer of macro- and meso-level of governance to SI (see Jessop, 2002; Oosterlynck & Cools, 2020; Paidakaki et al., 2020) and links it to a broader debate about the potential roles of these initiatives in becoming part of (state) administrations. Although BMP–RR operates at the micro level, it still relates to the overall socio-political and economic situation in Lebanon. However, the inability to scale up to the meso- and macro-levels, which engage with the bureaucratic, policy, and institutional settings, would indicate that the dynamics of BMP–RR are limited by the structural problems of the consociational government. BMP–RR as a socially innovative initiative cannot be considered as utopian, not even in an unstable context like that of Beirut. It has proven its relative resilience because there is the will to change despite its meagre funding, all the socio-economic and political meltdowns of the country, and the perseverance of the corrupt oligarchic state. To some extent, BMP–RR could be considered as an alternative that creates awareness about "a sector that has not been prioritized by the state bodies" (Mohieddine, interview, 09 Mar. 2018; Nasr, 2021). It paves the way to bringing to light and reframing debates about (in)justice in informal mobility by encouraging citizens to think about modes of transport alternative to prevailing automobility.

5 Conclusion

The present article has explained how collective transit practices are socially and spatially embedded. The socio-spatial configurations in which SI occurs are crucial in determining its character and capacity, and ultimately in providing the answer to the question posed at the outset: To what extent and how do socially innovative initiatives negotiate transport and mobility (in)justices, and transform power relations in a highly divided and conflictive milieu?

The article has mobilized a socio-spatial institutionalist perspective, social innovation theory, and the concept of mobility and transport (in)justice. These concepts became part of a living process when the researchers decided to join the project of BMP–RR in fighting socio-spatial (in)justices. By instinct and experience, the scholar-activists in collaboration with the community aimed to find alternative answers from below that would generate collective seeds to (re)shape the politico-sectarian scenario found in the transport sector resulting from a dysfunctional elitist state. The project of the researcher through PAR became subject for negotiation and adaptation. Being reflexive within research is not static but rather an exercise that continues throughout the research process. Through such a process, transport was not only a neutral technological artefact but rather an interplay between different actors and their interests within socio-economic and politico-sectarian territorial and cultural differences, which (re)produce concomitant (in)justices. Consolidating the social turn in transport research through SI invited the researcher to comprehend mobility as a complex, often invisible bundle of multi-actors' coalitions deciding whose needs are to be addressed and the socio-political configurations that benefit them. In other words, transport politics are always pursued for the benefit of some and to the detriment of others.

Research on mobility systems should not be isolated from socio-political and physical relations, which materialize the condition of urban existence and the essential capacity for participation in collective life. The notion of (in)justice, enacted by the local initiative BMP–RR, is conceptually rich. Without financial resources, BMP–RR is resisting and seeking redistributive remedies to historic problems, and is unsatisfied with being excluded. Socially innovative initiatives hence appear to empower the dispossessed, while happening in an unstable context filled with practices of differentiation. However, when it comes to the production of a structural reform in the informal transit system itself, BMP–RR faces a securitized politico-sectarian arena with the presence of socio-spatial injustices. The upscaling of BMP into RR NGO helped co-create a network of actors who aim to find innovative alternatives for Beirut. Civil society initiatives are important in so far as they can help transcend divisions and potentially bring together different factions, promote a culture of negotiation and dialogue, and (re)create institutions that can integrate top-down and bottom-up initiatives. However, the act of governing-beyond-the-state apparatus shows that the horizontal figures of SI are merely short-term solutions. The problem is not the lack of projects or initiatives, but the unwillingness of a consociational government to update its planning regulations and invest in an infrastructure that would integrate different modes of transport. Therefore, the impact of the initiatives of these collectives' is limited by a syndrome of structural problems. The optimistic commitment to the potential for socio-political transformations can offer the socially innovative initiatives new pathways for collaborations and solidarities, and channel the sectarian notions of belonging to one community into practices, policies, and feelings of being part of a larger society.

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Re-claiming space for public life: messages from the north-western periphery of Sofia

Abstract
A case-study based qualitative research on public space and public life in four housing estates in the north-western periphery of Sofia provides the basis for re-thinking urban legacy and the Modernist concept of public interest, once placed in the core of urban planning. The expert estimation of the current physical state and functioning of open public space in the housing estates, initially developed from the 1960s to 1980s, is compared to current inhabitants' estimations of the potential of public space to respond to their needs and visions regarding its quality. The capacity and limitations of local inhabitants to articulate a common vision of public space in dialogue with experts and authorities are discussed. The authors claim that further urban research is needed to conceptualize present visions for public interest, public life, and public space in the transforming housing estates in Central and Eastern Europe in order to enhance the effectiveness of inclusive planning approaches for urban regeneration.

Keywords: urban research, public space, Modernist housing estates, Sofia, inclusive urban regeneration.

1 Introduction

A growing interest in the city and in public urban space is clearly visible in the present day. Initiatives in defence of public space in the city unfold at many levels – coming from the bottom-up, where local tensions focus on who uses it, and with what benefits and responsibilities; and from the top-down as part of the global political process. Nowadays, public space is a central topic in urban theory, policy, and practice (e.g. Benhabib, 1992; Angeles, 2010; UN HABITAT, 2016; Zárate, 2018; Riegler & Bylund, 2020). This also raises questions on how inherited public space in the post-socialist housing estates (HEs) in the cities of Central and Eastern Europe (CEE) is currently being used and transformed, what are the perceptions of its inhabitants about its potential to respond to their visions regarding quality, and whose rights and responsibilities are considered in the dialogue of citizens, experts, and local authorities.

The study of ongoing processes in the open public space of four housing estates in the urban periphery of Sofia links the current functioning of public space, inherited from Modernist urban planning, to the inhabitants' perceptions of its potential to adequately respond to their needs, and to existing local capacity and motivation for creative action aimed at transforming the urban environment in dialogue between inhabitants, experts, and authorities. The global, EU, and national policy and research context of conceptualizing public space in Modernist housing estates is briefly outlined in Section 2. The aim and methodology of the undertaken study are presented in Section 3. The results are described in Section 4 and discussed in Section 5. Conclusions about the development potential of public space and needed further research in support of inclusive planning approaches for urban regeneration are drawn in Section 6.

2 Research framework

2.1 Public space in the cotemporary city

Public space in the European city has been historically related to its capacity to enable human activities and to provide for access, encounter, and exchange. Contemporary western philosophical and political thought interpreted public space in its relation to the political process (Benhabib, 1992). The Modernist concept of the city, which played an important role in shaping the 20th-century urban environment, regarded public space as a key urban element of public interest (Mumford, 2019: 295). The birth of Modernism was related to the post-war situation in both Europe and the United States, with the building boom of the 1920s and 1930s providing strong arguments for standardization. Being true to the social promise of "adequate housing for all", including residents of modest income, Modernist housing design turned to the achievements of technology but also accepted its social anonymity. It thus contributed to a situation where "normative programmes of accommodations and spatial organization also run the risk of curtailing precisely those non-specific spatial realms that seem to be the genius of truly well-functioning public places" (Rowe, 1993: 63). The major planning advantages of LHE were seen in the integrity of the engineering infrastructure, the abundant public greenery, and the presence of a set of key public service elements. Modernism also abandoned the traditional meaning of public space as one satisfying political, economic, and cultural needs, by being a place of assembly, a marketplace, and a place of rituals and ceremonies (Madanipour, 2004). The adoption of the "social space" notion in large housing estates shifted the focus on a single important function of public space where the key attractive environments are to be supported by proper management, maintenance and renewal, resident participation, and safety (Sendi at al, 2009). That partially raised Arendt's concern about the modern transformation of the public space of politics into a pseudo-space of interaction in which individuals no longer "act" but "merely behave" as economic producers, consumers, and urban city dwellers (Arendt, 1958: 56, cited in Benhabib, 1992: 90). The strongly deterministic functional doctrines were gradually abandoned in the Western countries by the late 1950s, and new intellectual concepts of the city as a complex dynamic system emerged (Alexander, 1964; Rapoport, 1969), with social sciences entering the urban planning field.

An important perspective of urban space as a socio-spatial construct was brought up by the "Right to the city" concept in the late 1960s (Lefebvre, 1967), which further evolved in urban theory and practice, and was recognized in legal instruments and public policies worldwide (Zárate, 2018). This concept also inspired the claim that "we can inhabit a world that includes our own praxis, meanings, values, signs and symbols, art and culture and not merely be forced to endure a habitat created for and imposed on us by those with power" (Zieleniec, 2018: 13). In the early 21st century, urban public space is valued for teaching tolerance and responsibility (Bodnar, 2001). It is claimed that "values, ideas, actions and spaces define one another and are constantly produced through each other" (Stevens, 2007: 218), and that people define the use and meaning of public space (Harrouk, 2020). The ongoing global political debate on development and resilience has acknowledged the key role of public space in contributing to sustainable and resilient urban development. The 2030 Agenda for Sustainable Development recognized the key role of cities and public urban space in the process. Target 11.7 explicitly requires "universal access to safe, inclusive and accessible, green, and public spaces, particularly for women and children, older persons and persons with disabilities" (UN HABITAT – SDG11, 2015: 21). The New Urban Agenda adopted at the United Nations Conference on Housing and Sustainable Urban Development likewise declared a commitment to "promoting safe, inclusive, accessible, green and quality public spaces that are

multifunctional areas for social interaction and inclusion, human health and well-being, economic exchange and cultural expression and dialogue among a wide diversity of people and cultures" (UN HABITAT, 2016: 13). Public space is currently strongly supported by international initiatives from a cultural perspective, e.g. the European Prize for Urban Public Space (Angeles, 2010), and by international cultural organizations (UNESCO, 2016). In parallel, EU research programmes such as Horizon 2020 are increasingly interested in the various roles of urban public space while research results are integrated in EU urban policies to create spaces to mitigate shocks under a global pandemic (Riegler & Bylund, 2020).

2.2. The Modernist concept of housing and public space in the large housing estates in Central and Eastern Europe (CEE)

Large housing estates have functioned for more than half a century under differing social and economic contexts across Europe being subject to complex socio-spatial transformations. The diversity in the formation and development trajectories of the housing estates in West and East European countries was strongly influenced by factors such as social and economic development, building period and size, location and connectedness, maintenance, population structure, stigmatization, etc. (e.g. Internet 1; Tsenkova & Nedović-Budić, 2006; Brade et al., 2009; Anderson et al., 2013; Monclús & Medina, 2016). The similarities are related to the fact that LHEs were designed and built everywhere in Europe to meet urgent social needs under economic restrictions by using the available construction technologies. The strict normative approach to urban planning and design in the housing field was aimed at socio-economic efficiency while guaranteeing the provision of a minimum standard of services and facilities for all. Although equipped with the basic social infrastructure, the vast plain urban landscapes in the LHEs provided anonymous public spaces that usually lacked human scale and cosiness. The outlined common characteristic of CEE housing estates concerns the sociocultural characteristics of their initial inhabitants (belonging to diverse social strata), despite the "constitution of the social and spatial meanings of large housing estates within [...] different national contexts" (Glasze et al., 2012:1192). Since 1975, the estimated deficiencies in LHE public places motivated top-down attempts in many CEE countries to rethink public life settings and the localization of public space (Marciniak, 2015).

In the early 1990s, the CEE-based researchers predicted systemic changes in the urban systems reflecting the profound political and economic transition in the region (Musil, 1993). Growing income inequalities and housing system transformations were registered in CEE cities by late 1990s and claimed to be the main causes for growing socio-spatial disparities (Sýkora, 1999). The land market was already reshaping the cities, while municipalities had difficulties in adopting strategies for suburban development (Bertaud, 2004). Around the turn of the millennium, doubts about the legitimacy of CEE planning were rising due to its lack of sensitivity to the local context when borrowing methods from abroad or applying old planning approaches (Nedović-Budić, 2001). Two decades after the start of the transition, researchers identified heavy social costs of the transition process under the context of an extremely weakened planning system (Hirt & Stanilov, 2009). Positive development trends – improved institutional and legislative framework of urban planning, enhanced public participation in the planning process, and a declared explicit planning focus on sustainable development – were acknowledged in the CEE countries joining the European Union.

2.3 The prefabricated housing estates in Sofia: a contested legacy in transition

The rapid industrialization of Bulgaria in the early 1960s triggered an urgent demand for urban housing, and large housing estates of prefabricated panel buildings were considered an optimal economic and social solution. The LHEs in Sofia were built mainly at the city periphery in a relatively short period to provide homes at affordable prices and meet housing shortage in the face of growing industrialization and intensified migration from rural to urban areas. The promoted collective housing resulted in sheltering under one roof people with diverse origin, education, way of life, and culture – immigrants from the countryside and local inhabitants. The first prefab housing estates in Sofia for 15,000–20,000 inhabitants each, with schools and kindergartens centrally located within walking distance in the neighbourhoods, were planned in the 1960s. In the mid-1970s, larger housing districts for up to 50,000 residents with planned healthcare and cultural facilities in the district centres were already under construction (Tashev, 1972). The next large housing estates, built in the mid-1980s, had up to 200,000 inhabitants (Kiradzhiev, 2006). According to the census from 2011, nearly half of the functioning housing stock in Sofia had been built between 1970 and 1990; prefabricated housing estates sheltered about 575,000 inhabitants, 47% of the city population (Internet 2).
The urban dimensions of Bulgarian transition after 1990 were related to class differentiation and to changes in land ownership due to privatization and restitution1 (Staddon & Mollov, 2000). In parallel, local authorities lacked financial resources for the maintenance of LHEs. The general withdrawal of the State, the uncertain political context, and the outdated planning system postponed many of the planning activities for more than a decade (Thornley, 1993), despite the emerging new societal needs, conflicts, and challenges (Alexandrov, 2006). Transformations with negative impacts in the physical space of the large housing estates were motivated by market demand, unlocked by the restitution and privatization of urban land, and facilitated by the lack of effective planning instruments. The investment interest was higher in the LHEs in the southern and south-eastern peripheries of the city, and generated conflicts provoked a higher level of local activism there in defending the common asset – public open space. By the beginning of 2006 this form of resistance resulted in the emergence of up to 40 NGOs which integrated the knowledge and efforts of inhabitants, environmental activists, and urban experts (Grimm-Pretner et al., 2006).

3 Research aim and methodology

The present study stems from an on-going URBiNAT project (HORIZON 2020), focused both on the inclusive regeneration of social housing districts in several European countries and community driven design of healthy corridors in urban public space. Potential public space transformations are to improve access and mobility, promote healthy living environment, and experiment with inclusive planning and design approaches (Internet 3). The current study builds upon the analysis of the Bulgarian case study in URBINAT project – four neighbouring housing estates (HEs) in Nadezhda administrative district in the north-western periphery of Sofia (Figure 1), with overall 17,069 dwellings and 37,770 inhabitants in collective apartment buildings, mostly built between the 1960s and 1980s (Internet 2). The initial urban plans of the HEs have been updated during the last decade to respond to the changing situation in the neighbourhoods. The updated plans, adopted between 2013 and 2015, regulate the general access in the area without addressing issues of non-motorized mobility and accessibility in the neighbourhoods. The current study aims to link the current physical state and functioning of

1 Restored private ownership of urban and rural land property in Bulgaria, nationalized in the early 1950s.

public space in the HEs to the inhabitants' perceptions of its quality, and the local capacity and motivation to articulate a creative common vision for needed transformations of the urban environment.

Three research questions (RQ) were raised: RQ1: What are the present-day physical state and functioning of public space in the housing estates? RQ2: How do residents and local authorities estimate the quality of public space and the effectiveness of its functioning and management? RQ3: What is the local motivation and capacity for implementing inclusive planning approaches to regenerate public space? The methodological framework of the study includes a variety of research methods for responding to each question (Table 1).

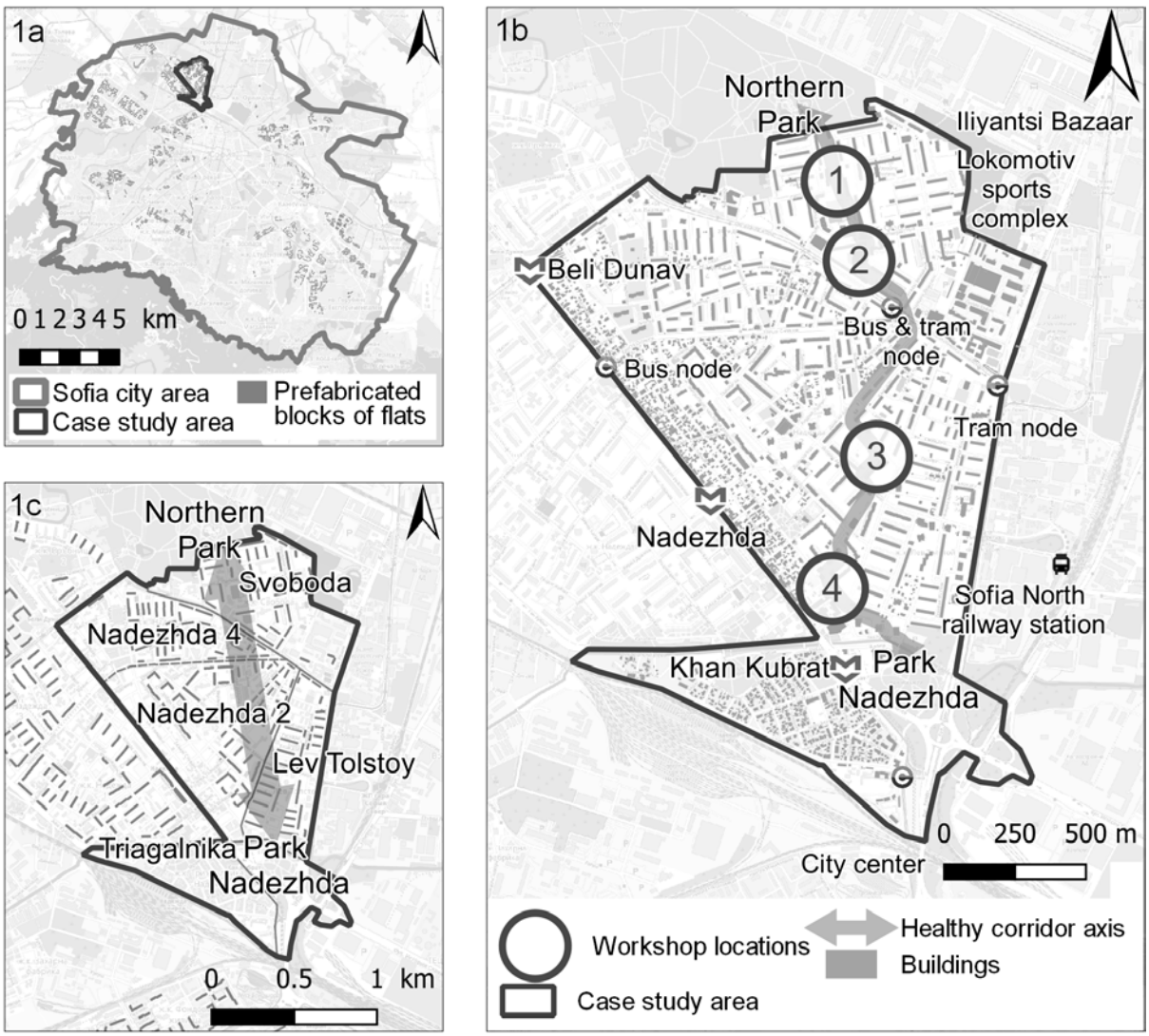

Figure 1 (the study area): 1a) location within the compact city of Sofia; 1b) healthy corridor area and co-design workshop locations; 1c) names and locations of the housing estates (based on: Internet 4; Internet 5).

Table 1. Research methods applied

Methods applied	Time interval	Questions addressed
Direct expert observations and analysis	Aug. 2018 – Sept. 2019	RQ1
Diachronic spatial analysis	Oct. 2018 – Aug. 2019	RQ1
In-depth semi-structured interviews – 10 respondents.	Jun.–Sept. 2019	RQ2, RQ3
Survey among citizens on the quality of life – 440 respondents	Nov.–Dec. 2019	RQ2, RQ3
"Walk through" and "photovoice" events	May 2019	RQ2, RQ3
Focus groups – 3 groups with overall 20 participants	Jun.–Sept. 2019	RQ2, RQ3
Cultural mapping – 64 participants	Aug. 2018 – Sept. 2019	RQ2, RQ3
Motivational interviews (pupils – 30 respondents, district administration – 4 respondents)	May 2019	RQ2, RQ3
Territorial mapping (inventory of furniture, paths, and greenery)	Oct. 2018 – Aug. 2019	RQ1
Behavioural mapping	May–Jun. 2019	RQ1
On-site co-design workshops with citizens – 4 workshops with 140 overall participants	Aug.–Sept. 2020	RQ2, RQ3

Diachronic spatial analysis, based on desk research and territorial mapping, was chosen to identify the changes in land ownership and the spatial transformations of open space and street patterns since the first Modernist housing estates had been developed in the area in the 1960s. The expert estimation of the current state and functioning of public space concerned the quality of the built and natural environment. The chosen key aspects of the built environment included accessibility (openness and permeability), usability (physical state and maintenance), functionality (diversity of users and uses), comfort of use (soundscape, lighting, shading, urban furniture), and safety and security (conflicts of use and vandalism). The key elements of the natural environment comprised air quality, water, and public greenery. These results were supposed to provide the ground for estimating the effectiveness of public space management. Expert observations following the methodology of Gehl Institute (Internet 6) were chosen for the evaluation of ongoing public life in the open spaces: types of activity, actors, and temporal intervals. The results regarding public life were then related to residents' and authorities' views on the quality of public space and its management. Citizens' proposals for urban design intervention registered during four onsite co-design workshops in the neighbourhoods provided the basis for identification and estimation of existing local motivation and capacity for inclusive urban planning and design.

4 Results

4.1 Expert estimation of the physical state and functioning of public space

The street network, the residential buildings delineating the public open spaces, and the schools and kindergartens located within the urban units had a major long-term effect on the housing estates development. The main elements not realized until 1990 were the two green axes, linking Nadezhda 4 and Svoboda HEs with the Northern Park (Bg. Severen park) and Svoboda HE to the sports area to the east. After 1990, the main pedestrian access from the housing estates to the park and to the sports area has been compromised due to construction on the non-built-

up plots and the public greenery along the street sidewalks. The initially designed sidewalks and alleys – together with the non-formal pathways through the greenery and non-utilized plots – currently provide numerous pedestrian mobility options in the area (Internet 7).

The outlined positive aspects in the built environment include the visible presence of people in public space and the considerable variety of users and uses throughout the day. Pedestrian mobility and socializing are observed in most of the public places. Sidewalks, inner streets, alleys, and informal paths are intensively used by pedestrians. The daily use of some of the sites is gender-specific; others are equally preferred by men, women, and children. Individuals or small groups use parts of the space around the residential buildings for small flower gardens. The small kiosks at the bus stops and street intersections are intensively visited and crowded, despite high noise levels and polluted air. Most of the sites inside the area offer basic comfort for standing, sitting, and moving. The residents have followed a long-established tradition and adapted sitting places to their needs (Figure 2). Negative tendencies are related to the appearance of fenced plots and sports facilities with restricted use, which have reduced the accessibility and permeability of public space in some parts of the area. The lack of adequate parking area has caused considerable pressure on the public greenery and additionaly contributes to air and noise pollution (Figure 3). The inner street sidewalks and street crossings are badly maintained and rather unsafe to use, especially by vulnerable, disabled, and elderly groups; no cycling lanes are provided. Lighting is largely missing inside the area; shading and greenery are missing in the busy places around public transport stops and playgrounds. The management of both the built and natural environment in the study areas was generally estimated as unsatisfactory.

Figure 2: Sitting places in front of a block entrance (photo: authors)

Figure 3: Cars parked in the inter-block space (photo: authors)

4.2 Inhabitants' perceptions of the quality and management of public space

Inhabitants ranked highly several groups of urban elements in the HEs public space: the public parks and gardens in the area, used for daily or weekly recreation, and well maintained and landscaped by the municipality; inter-block spaces, broadly estimated as important for their proximity and favourable microclimatic characteristics; the meeting places with benches in front of the residential buildings, regularly used and maintained by some of the inhabitants; the main streets and their sidewalks, considered well-functioning and highly permeable; the metro line set into operation in 2012, estimated to provide an excellent connectivity to the city centre. Inhabitants' satisfaction with the environmental components relates inversely to the location within the neighbourhoods; e.g. the air quality and noise levels are considered very unsatisfactory at the edges and very satisfactory in the inner parts. Small meeting places attract people and are run by local communities (spaces in front of entrances, children's playgrounds, or sports facilities) or private entities (cafes, restaurants, and shops). The people involved in voluntary day-to-day management of the public space near their blocks of flats have developed a sense of ownership and tend to restrict outsiders' access. Inter-block spaces, when perceived as "nobody's space", receive minimal care by the local authorities. Despite being well-landscaped, spacious, and with many trees, they are estimated as unsatisfactory because of the poor maintenance of the greenery and the scarce, missing, or damaged furniture for sitting and relaxation. Survey respondents gather around the need for better protection of the natural environment – air, soils, vegetation, biodiversity, water – and improvement of waste management. Some people insist on providing more parking places, while others are concerned about the negative effects of the increased parking in the area. The schoolyards are popular meeting and playing places; it is acknowledged that the renovated ones provide excellent conditions, but the limited access is disappointing. The management responsibilities there are delegated to private companies. Inhabitants are sensitive to cases of obvious infringement of residents' rights, such as green space being built up, a playground turned into a parking area, a one-storey house replaced by a high-rise building, but also to activities that cause overcrowding or a green space generating light pollution, noise, and waste after having been turned into a playground.

4.3 Local visions for needed public space transformation and motivations for social action

The four locations of the onsite co-design workshops (WS) were on plots of public ownership and with estimated capacity for future interventions: WS1 – by the entrance of the Northern Park; WS2 – by a currently non-functional privatized service building; WS3 – by a captured mineral spring with non-drinkable water; WS4 – close to the main pedestrian access to Nadezhda Park (Figure 4). The 140 overall participants (89 female and 51 male) who joined in the workshops were asked to propose interventions which would improve the quality of a particular public space. The results of the co-design workshops could not be considered representative of all the residents' visions and preferences for public space in the area.2 However, they seem to be indicative of certain shared values and priority needs in the area. For the aim of the current study, the registered 150 proposals were classified into 3 groups concerning: mobility and comfort of use (55 proposals), healthy living (physical activity and contact with Nature) (105), and social action and interaction (85). The most frequently proposed ideas comprised vertical green walls (51), educational gardens3 in schoolyards and kindergartens (32), the provision of smooth surfaces and adequate lighting for pedestrians and bicycles (23), and a thermal water swimming pool (18). The proposals also included farmers' and solidarity markets, leisure activities (art exhibitions, an open-air theatre), improvements of meeting places in front of the entrances. Based on the work with citizens during the on-site workshops, the study outlined several types of inhabitants' attitude to social action for transforming public space: (a) actively addressing certain problems (a rather limited group, with most of them already involved in ongoing initiatives); (b) ready to join if invited, with asking for further guidance; (c) reluctant to join in activities considered to be a responsibility of the municipality; (d) unwilling to be bothered; (d) providing advice and proposing solutions yet unwilling to be involved in practical action; (e) suspecting a hidden agenda behind the project initiatives; (f) easily disappointed when things do not happen immediately.

2 Results were also influenced by URBiNAT suggestions for nature-based solutions (NBS), made in advance.
3 Tasty Gardens of Learning (Internet 8).

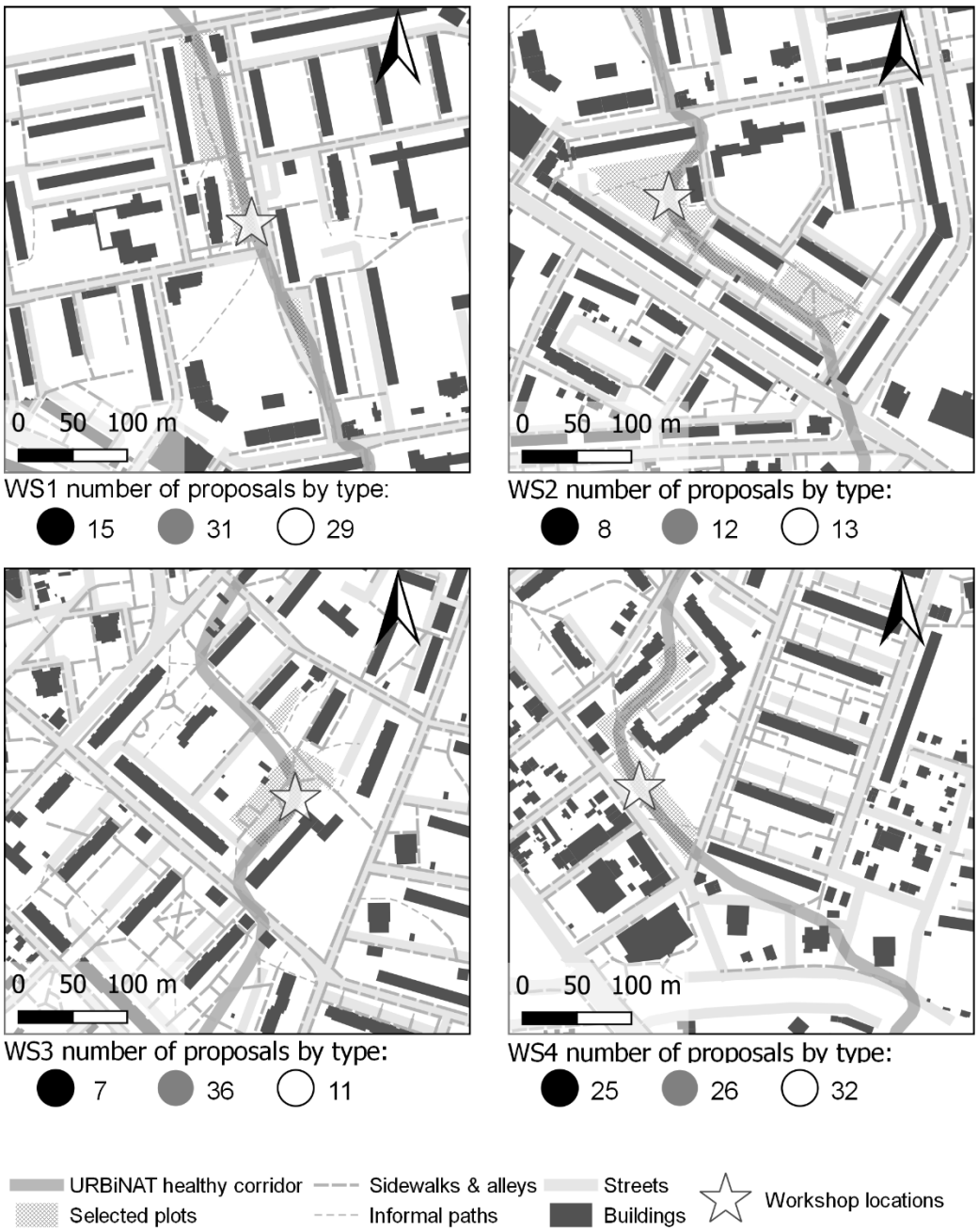

Figure 4 Workshop locations and typology of inhabitants' proposals for interventions in public space. Number of inhabitants' proposals by type: access and comfort of use (black); healthy living (grey); and social action and interaction (white) (illustration:authors).

5 Discussion

The analysis of data, on-site observations, and participatory events enable an understanding of the role and transformation potential of current public space. Linking the outlined important characteristics of public space and public life in the LHEs to the inhabitants' perceptions of public space quality provides an insight into the current inhabitants' concept of public space and its influence on their motivation and capacity for social action.

5.1 Public space in the present-day housing estates: role and transformation potential

Three decades after the collapse of a society which proclaimed the priority of public to private interest, the transforming LHEs are open socio-spatial systems, influenced by numerous external factors that strongly stimulate population dynamics and challenge the territorial cohesion at hand: the ongoing social stratification of society, the development of the real estate markets, the opening of the capital city of Sofia to newcomers from the countryside or abroad with their diverse culture, values, and lifestyles. The concept of public interest has evolved alongside societal transformations in time of dynamic formal or informal, planned or spontaneous change of communities and space.

The expert analyses confirmed that the public space in the HEs is still physically abundant, multifunctional, and liveable. Contrary to existing prejudices about life in the "dormitory type" residential areas and despite the identified deficits in the physical state and maintenance, the public spaces in the studied LHEs shelter diverse public life activities. Although intensive and multi-layered, with established rhythms and meeting points, the public life in the LHEs is rather fragmented into numerous places due to the dispersed location and discontinuity of the public plots, the poor amenities, and the existing barriers such as abandoned and non-maintained private plots. Public life is interwoven into residents' daily activities. The specific atmosphere in the neighbourhoods and the community spirit there are shaped by the prevailing pedestrian walking and biking. There is no public place explicitly intended for teenagers in the housing estates, and only scarce places for public gathering and entertainment; few cultural activities are organized in the open space. There is a general lack of large public gatherings of all the residents in open space; only small communities gather at specific places. The cultural perceptions of public life and public space are also specific for different generations – the elderly enjoy everyday socializing in public space, while teenagers prefer to communicate in virtual space. The lack of established rules and proper organization of use are major risk factors for a decreasing quality of life in the neighbourhoods. The number of workshop participants in the different locations of the housing estates could also be considered as indicative for the importance residents attribute to different public places in the neighbourhoods.

5.2 The LHE inhabitants' concept of public space

Present-day population of the housing estates includes people with diverse paths of life and a broad variety of incomes and qualifications. Many of the inhabitants have scarce or no memories of the time of socialism. However, some of the blocks of flats in Nadezhda District are occupied by second or third generation residents who have grown up together with the HEs, and their history and memories are locally rooted in the changing urban environment. The most often declared topic of common interest during the on-site contacts in the north-eastern periphery of Sofia is public health. It is seemingly able to integrate the diverse values, needs, and aspirations of all the actors. Contacted inhabitants acknowledge the important beneficial impact of open public space on the health and wellbeing of individuals and communities. They mention clean air, access to greenery, calmness and cleanness, physical and psychological comfort, access to services, safety and security, and urban infrastructure in support of sports and physical activity among the valued determinants of health and healthy urban environment. Yet, positioning all these in relation to needed common choices on local development seems difficult. The commodification of public space is one of the most controversial transformations threatening the democratic dimension of public space and bringing new emphasis to the still open question about "whose city" it is. Property rights, highly valued in a neo-liberal society, have brought a shift towards a model prioritizing the economic value of public space, leading

to negligence and appropriation of (quasi-) public spaces, and turning them into either “no man’s land” or into “club” places with restricted access. The researchers’ contact and interaction with the residents and authorities in the housing estates indicated a considerable misbalance in their acknowledging of public and private interest. People more readily distinguish their personal rights, and they are much more prepared to stand for those than for their responsibilities to a community. Moreover, rights and obligations are differently perceived and based on diverse arguments, thus bringing tensions and inspiring competition for the utilization of public space. The role of collective land ownership under the changing property context in the HEs is a topic still in need of debate. There is a major mismatch between authorities’ and citizens’ views on public space management. On the one hand, the district administration staff acknowledges the importance of working with citizens in transforming public space, but this is also seen as quite a challenge; the lack of penalty mechanism isperceived as the main reason for the poor state of the inter-block spaces. On the other hand, inhabitants claim they need to be better informed, guided, and instructed in order to participate in activities organized by the authorities. The analyses outline a variety of multi-layered conflicts concerning mobility conditions and practices, and serious clashes of different interests. There are contradictory and conflicting claims by car-owners, pedestrians, cyclists, and motorists regarding the right to public space. The tensions were explicitly deep when discussing the "right" to park private cars on green and underused areas due to the lack of parking places. Inhabitants react sharply against the change of functions and the resulting transformations of public space, especially when free access to public assets is threatened. Conflicts deepen with the appearance of new actors, and citizens’ distrust only grows when a replacement of activities and uses happens on the quiet.

5.3 Local capacity to articulate a common vision of public space and jointly stand for it

During all the interactions, residents, pupils, and district administration expressed their interest in and commitment to the co-creation of public places. Children were seen as influential “channels” for shaping opinions and motivating parents’ action in the neighbourhoods; pupils demonstrated readiness to participate in the cleaning of public space and in building or repairing street furniture if guided and instructed in how to perform. Although young people (aged 19–27) stated their readiness to participate in the process, they refrained from being organized and guided; instead, they were rather ready to act spontaneously and without postponement. Inhabitants broadly see a healthy living environment as a priority; they highly value public greenery and care for it. Despite the abundant greenery in the area, the intervention proposals are largely focused on vertical green walls as an affordable and easy way to structure large open spaces into smaller units, provide for greater cosiness, and hide ugly urban elements. The estimated importance of Nature for a healthy life was also the reason for the high popularity of the Tasty Gardens of Learning as an educational tool to enable the transfer of values to children. Residents value walking within the housing estates and insist that safety and comfort of the practice should be provided for. The availability of the thermal mineral water in the area has long been acknowledged and broadly associated with an opportunity for a school swimming pool. Presently, concerns are already emerging about construction and maintenance costs, and the consequences of a possible public-private partnership to provide funding needed. The workshops have also revealed participants’ initial general lack of self-confidence when sharing an idea in public. There is a broadly shared expectation that local administration should take the initiative to propose certain action, and inhabitants would then either accept or criticize it. Despite a certain lack of trust in top-down initiatives coming from outside, the process of building a joint vision for the interventions in the target area between the inhabitants and the administration resulted in strengthening public awareness of the potential of urban public space

and needed joint action for re-claiming it. The declared good will for collaboration could be expected to provide a solid ground for future action, but strategic thinking and communication skills are currently lacking. A clearer communication for conceptualizing the value of public space among all the participants could be expected to enable a clearer vision on needed strategic action for its achievement.

6 Conclusion

A century ago, Modernism placed public interest in the centre of urban planning concerns. It promoted collective living and public space for all but stood in defence of an abstract concept of "public" in which public ownership equalled state ownership. In the numerous housing estates designed and built in Bulgaria, the diversity of inhabitants and their needs was never really considered. Thus, uniformity of urban design reflected and encouraged uniformity of life. Thirty years after the beginning of the political and socio-economic changes in CEE, research findings about the changing character of public space and public life in the housing estates in the north-western periphery of Sofia provide evidence that, although having a difficult legacy to deal with, the HEs have successfully taken their paths to the future. In this process they are facing serious deficits and challenges but have also demonstrated remarkable resilience – probably rooted in the social diversity of their initial and current residents. Despite maintenance shortcomings and visible signs of degradation, the public places in the housing estates are nowadays vital and responding to changing lifestyles and value systems, to social needs and environmental challenges. They preserve the potential for being truly public space – in Arendt's words, the space where "men act together in concert" (Arendt, 1961: 4, cited in Benhabib, 1992: 93). The discussion on public space and public life initiated by URBiNAT project drew the attention of citizens and authorities to the need to think more strategically about the present and future of public space. However, re-claiming space for public life through democratic urban governance still has a long way to go. Inclusive planning and creative co-design for urban regeneration with citizens will be effective tools only if processes are based on mutual trust and respect, and organized according to clear planning rules and communication strategies.

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Environmental performance of the urban microclimate in pedestrian zones of Tarija, Bolivia

Abstract
One of the main challenges facing the city is the need to improve the conditions of urban mobility and accessibility as fundamental aspects of urban life with social, spatial, functional, and cultural repercussions for adaptation to climate change. For this purpose, analysing thermal comfort and the influence of microclimate as the main factors of determining urban heat islands (UHI) caused by solar radiation from construction materials and surfaces leads to the following research question: How do pedestrian zones affect the microclimate and how can they contribute to thermal comfort? The objective of this article is to evaluate the environmental performance of the urban microclimate in a single street in the historic centre of the city of Tarija. The method consists of applying a simulation with the ENVI-met 4.4.5 software to two scenarios: 1) asphalt road and parking areas, and 2) pedestrian path with vegetation and natural surface materials. The simulated maps present variables of air temperature, T surface, and radiant temperature to determine the level of thermal comfort calculated with the predicted mean vote index (V). The results showed a 6 °C difference in the surface temperature between both scenarios, and the PMV index was comfortable at 9:00, while later, at 12h and 15h, the index improved with the incorporation of vegetation and natural materials on the road surface. Similarly, through remote sensing, 5.14 °C was obtained as the land surface temperature (LST). These indicators spotlight the effects of the change in the urban microclimate to improved decision-making in urban design and argue for a network of pedestrian areas in the city.

Keywords: microclimate, ENVI-met simulation, pedestrian streets, Tarija (Bolivia)

1 Introduction

Pedestrian environments in cities chiefly favour accessibility and walkability; however, they also have an impact on the urban landscape and urban microclimate. The term accessibility relates to the idea of ability to access a particular service or activity, and is measured with distance or time. On the other hand, walkability focuses more on the sensorial experience of space. Walkability can be understood as one of many components of the entire idea of accessibility and vice versa (Juvančič & Žnidaršič, 2020). Walkability is beneficial to human beings in many ways. Within the social aspect, walking is a sustainable mode of travel that protects the environment both for present-day inhabitants and future generations. Walking has positive effects on both physical and mental health: locomotion leads to healthier bodies; exposure to the physical and social environment leads to healthier minds; reduced automobility means reduced risk of dangerous traffic collisions and reduced harm from air pollution. Each of these benefits is especially important to babies and toddlers, who are particularly sensitive to air pollution (Internet 1).

When people perceive an active public space with a functional aspect, they develop their activities around a new range of opportunities and resources offered by the city; even more so when there is an opportunity for local tourism in the historic centre with its architectural heritage and cultural value that creates attractive routes and ensures the permanent presence of pedestrians. Making downtown into a walkable, viable community is the essential fix for the typical American city; it is eminently achievable and its benefits are manifold (Speck, 2012). Considering other land uses in open spaces – which, according to Gehl (2006), is where the

character of activities between people is defined – three types can be identified: necessary, optional, and social. The planning or design phase of an urban project, as indicated by the TOD Standard (Internet 1), comprised of eight principles, should take into consideration walking (safe, complete, and accessible pedestrian network for all, an active and vibrant pedestrian environment, a warm and comfortable pedestrian environment), connecting (short, direct, and varied pedestrian routes), and changing (space occupied by cars reduced to a minimum).

In terms of both climate and local air quality, walking has a lesser environmental impact than any other mode of transportation. The spatial aspect and the microclimatic factors in the environment can affect human health and well-being. According to Oke (1987), the influence of urbanization on climate creates urban heat islands (UHI), where the difference in climate conditions recorded by an observer in the urban area of the city, compared to one in the rural environment, is determined by its thermal balance and can reach up to 10 °C (Tumini, 2012). There are manifold factors of anthropogenic origin contributing to the creation of UHIs: maintaining impermeable surfaces; finishing materials in buildings; geometry of urban canyons; cars, air pollution, and CO2 emissions; traffic and metabolism of living organisms; and soil cover. In order to understand these differences, the present article presents a microclimatic simulation of a potential pedestrian environment, comparing the results of temperature (radiant, surface, and air temperature) with the PMV comfort indicator.

There are more than one hundred neighbourhoods in the city of Tarija, some of them of recent creation and in urgent need of a re-think of an urban planning mechanism that would ensure the quality of life, since, according to Jacobs (2011), the relationship of people with public space as a social connector is a key issue of the city. It is even more urgent nowadays in order to combat the fragmentation that is one of the legacies bequeathed to the cities by the current health crisis. In their discussion of the concept of “chrono-urbanism” as a way to improve the quality of life in cities in regard to space and time with the introduction of the “15-minute city”, Moreno et al. (2021) propose creation of walkable neighbourhoods that would increase social cohesion and interaction, and contribute to sustainable ecosystems in cities with the introduction of more biking and walkable streets, and thus also help combat the challenges of private car ownership. Meanwhile, Sweden’s plans to arrive at net zero greenhouse gas emissions by 2045 are implementing a pilot project of transforming single blocks in order to redesign space with a vision of one-minute city (Peters, 2021).

As pointed out by Moreno et al. (2021), streets should be more optimized towards the needs of humans and nature. Present-day streets are mainly designed for cars, leaving little or no space for other activities. Such a situation is not sustainable. One of the main goals in the cities consists of increasing the number and area of pedestrian zones as a way of adapting to climate change and improving urban comfort and health. Therefore it is necessary to understand their environmental performance. The morphological perception of urban tissue and intraurban landscape correlated, under quality perspective, with urban findings such as the land use, urban infrastructure, and environmental balance assessments offers a safe way to classify the urban quality of a territorial fraction (Romero et al., 2019).

In order to study this effect on the physical consolidation and growth of the city, it is necessary to define a scale for future interventions, and analytical real-life and alternative scenarios. Different authors have arrived at different classifications regarding built structures, surfaces, and human activities. Stewart & Oke (2012) propose an urban climate classification in which the urban landscape is ordered into structures with similar properties related to the types of construction and land cover, called local climate zones; this method is then organized in

technical data sheets. The characteristics of the elements that make up urban landscapes, such as sky view factor, height and width of urban canyons, roughness, fraction of the built surface, fraction of the impermeable surface of the soil, and proportion of the permeable area of the soil, are among the characteristics that can be adapted according to the specificity of an urban climate study.

Classification of spatial scales is defined by each particular context: city, district, neighbourhood, and block. The city is defined by its geographic distribution, maps of communication routes, public transport, and location of energy consumption centres. The district is marked by the complexity and connectivity of street networks, diversity in house sizes and prices, different activities, and land use mix. On this level, the walkable distance is estimated as 1,500 m (or c. 1 mile in the North American context). Next, the neighbourhood is characterized by the morphology of physical phenomena within the urban fabric. Physical parameters are influenced by the shape of the streets (urban canyons of h/1 ratio), while another important factor on this scale is segregation by proximity parameters. The walkable distance is estimated as 400m (or c. 1/4 mile in the North American context). Finally, the block contains the morphological parameters and urban configurations of adjacent or homogeneous buildings. Of importance for thermal calculations are connectivity and proximity, as referenced by Moreno et al. (2021), as well as distribution indicators such as diversity and morphology. In a highly versatile block, the built part is framed by the streets and buildings. According to Salat et al. (2011), the spatial measurement systems for formal or typological choice, and their implications for energy, should not be used as absolute values but as a means of evaluating relative performance while comparing different types of forms, neighbourhoods, or cities. Since the present article compares two scenarios, the analysis is based on this classification overlapping the categories that emphasize the main themes of the spatial scales considering land use, mobility, water management, biodiversity, energy, equity, economy, well-being, waste and materials, energy and bioclimatism. The themes proposed by the author overlap the seven analysis grids with a subdivision of the indicator, resulting in: 1) intensity, articulated with regard to the concentration of people or density of habitations; 2) diversity with a mix of diverse but similar objects on a certain scale; 3) proximity, regarding the distance required to reach certain activities, places of work, and nodes of public transport; 4) complexity, being a vital feature of sustainable urban places and energy efficiency; 5) connectivity, regarding accessibility and spatial interconnection of systems and networks; 6) distribution, considering population concentration or density of residential buildings; and 7) form, referring to the spatial form of the elements, their dimensions and footprint (Salat et al., 2011: 485).

After the global health crisis caused by the Covid19 pandemic, the great challenges that present-day cities face are fundamentally expressed in guaranteeing – in a sustainable way– an adequate use and occupation of land, adapting development to the demand for new relationships with the environment, which presupposes an adequate understanding of the place. Consequentially, there is a growing need for synergy between technique, governance, and culture (Martínez & Bustos, 2020). It implies walkable neighbourhoods with reachable provision and amenities, and a healthy lifestyle (Moreno et al., 2021). There is an urgent need to change the unsustainable practices, since the creation of urban environments accommodating cars has prompted the demand for vehicular-dependent cities, associated with mass production, industrialization, oil dependency, social inequalities, and worsening effects of climate change.

This paper is composed of three sections: firstly, a characterization of climate in Tarija on a typical warm day in 2019; secondly, applying the method to capture the UHI comparison with

microsimulation and LST above the historical street with two scenarios (an actual and an alternative one); and, finally, the discussion of the results.

2 Methods

This research, inductive in nature, is composed of two modelling phases and two previous procedures to characterize the local climate and to define the scenarios. Firstly, the method includes a specific and precise analysis on the 15 de Abril Street in Tarija, Bolivia. The vehicular road has the following surface characteristics: asphalt road and concrete grey pavement / sandy soil in the two vehicular garages on the block). The cut-out in the historical centre of the city articulates two squares (the main square Luis de Fuentes and Plazuela Sucre), while the pavements were widened in 2014 (Figure 1).

Figure 1: Cut-out of the case study – territorial fraction (source: Google Earth Pro, 2020; adapted by the author).

Secondly, the research applies remote sensing to review Land Surface Temperature (LST) in order to identify centralities in neighbourhoods as an alternative pedestrian circuit. Regarding the scale, the place can be classified into three types of neighbourhoods: the historical centre (with architectural and cultural heritage), the conventional neighbourhoods, and the new settlement (with temporary informal occupations). Note the extension to the rural area (Figure 2).

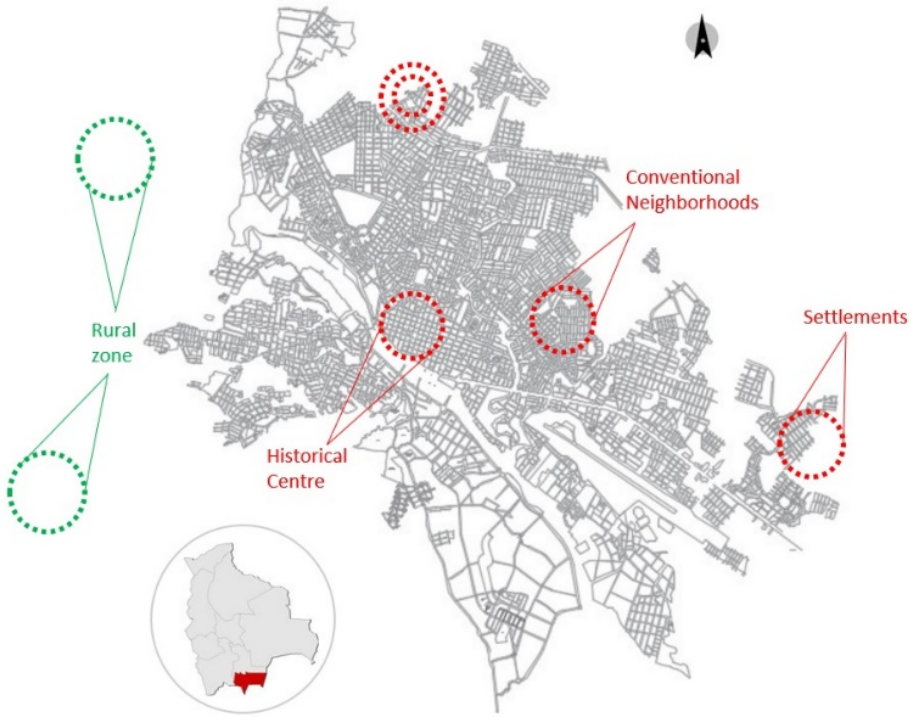

Figure 2: Urban area of Tarija (illustration: author).

In order to qualify an urban space, Romero (2011) proposes a set of urban climate scales and, additionally, a formula to determine the interaction of the elements: urban + architectural + environmental + inhabitants of the place. On this basis, it is possible to verify the relationship that exists between urban geometry and environmental factors of climate. The present research focuses on environmental performance factors through urban microclimate.

2.1 Characterization of the climate in Tarija

The city of Tarija is located in southern Bolivia at 21°32'07" S latitude and 64°43'46" W longitude and at 1875 m asl. According to the Köppen–Geiger climate classification, its climate corresponds to BSk (cold semi-arid climate), subtype Cwb (oceanic subtropical highland climate). Data from the Bolivian meteorological database SISMET (Meteorological Data Processing System) shows the average maximum temperature in Tarija in the historical record 1962–2017 reaching 31.8 °C for the month of November 2009 (Tarija Airport weather station). The average annual temperature was 17.7 °C; however, in the same month of November 2009 it reached 24 °C, followed by 23.6 °C in December 2012. The average minimum temperature was 15 °C and the average maximum temperature 25 °C, making December 7, 2019 the warmest day. The relative humidity varies on average between 45% and 70%. The average wind speed is 1.6 km/h, predominantly blowing from the east. The average rainfall consists of 556 mm. Due to its temperate climate, Tarija is an important centre of production of wines and spirits with the designation of origin (for instance, the world-famous Singani brandy). During the summer season (between December and March), high-altitude vineyards, located at 2,100 m asl, attract a large number of tourists to the city (mainly from neighbouring Argentina).

2.2 Definition of scenarios

Two different scenarios were applied in the street with different surface materials, and with 8-m wide and 8-m high buildings (Figure 3).

– Scenario 1: asphalt on the vehicular road and granite pavement on the sidewalks. Road profile: total width of 8 m, with 6 m of asphalt (space for parking, and space for traffic and vehicular circulation) and 1 m of pavement on each sidewalk (actual situation).
– Scenario 2: granite pavement only (block pavers), with total width of 8 m and incorporated vegetation (5 *lapacho* trees) to convert the street into pedestrian and cycling zone (alternative solution).

For the present purpose, pedestrian walkability was assessed on the basis of TOD standards considering accessibility of 10- and 20-min walks at an average speed of 3 km/h. Each scenario was modelled by defining environmental parameters, material physical properties, and boundary conditions in ENVI-met (Table 1). This is characteristic of most of the streets (tertiary routes in the neighbourhoods) in the city (scenario 1), while the road profile varies up to 70 m on the principal avenue (three lanes with planters).

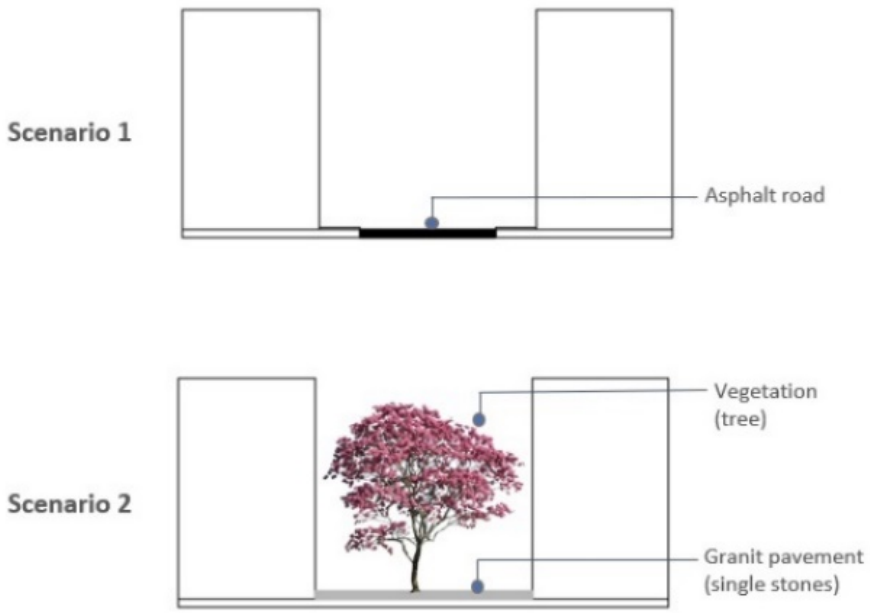

Figure 3: Simulation scenarios (illustration: author).

2.3 Simulation ENVI-met 4.4.5

ENVI-met is a "holistic computational model based on thermo-fluid dynamic principles that evaluates fluid-dynamic and thermodynamic interactions between the atmosphere, plants, surfaces, and urban contexts" (Marrone & Orsini, 2018: 350) in order to estimate microclimatic performance. The three-dimensional urban microclimate model includes the simulation of flooding around and between buildings, exchange of heat and steam processes on the ground surfaces and walls, turbulence, vegetation exchange and vegetation parameters, bioclimatology, and particle dispersion (Bruse, 2004). The results show climate change in a given sector and provide a critical observation in order to propose bioclimatic strategies that would improve the characteristics in different scenarios.

The method includes five procedures: data collection (crop and climate archive), modelling and simulation (both in Envi-met), map extraction (Leonardo plugin), and finally analysis and discussion of results. Table 1 contains the calibration parameter.

Table 1: Values used to define the model's boundary conditions.

Variable	Parameter
Grid size	80*80*60
Simulation date	07 December 2019
Total Simulation Time	24h
Start Time	07.00.00
Wind speed (m/s)	1.50
Wind direction (deg)	90.00
Roughness length	0.010
Temperature of atmosphere T (°C)	22 (min) 34 (max)
Humidity q (%)	50 (min) 70 (max)

Source: adapted from ENVI-met (2020).

The ENVI-met model, which is able to simulate microscale interactions between urban surfaces, vegetation, and the atmosphere, allows to analyse the effects of small-scale changes in urban design (trees, backyard greening, new building constellations) on microclimate under different mesoscale conditions (Bruse & Fleer, 1998). The environmental variables for this case study are as follows:

a) Air temperature – the AT value is strongly influenced by irradiance conditions (RS) and surface temperature (ST) (Marrone & Orsini, 2018).
b) Surface temperature – the ST value varies with the direct or screened irradiance conditions (RS) and the type of material (material albedo and thermal conductivity), (Marrone & Orsini, 2018).
c) Median radiant temperature (Tmrt °C) – one of the main factors of influence on the outdoor thermal comfort level; it is affected by the total amount of radiation absorbed by the human body and is directly affected by urban morphology, street canyons, wind speeds, building facades, and surface materials (Yilmaz et al, 2020).
d) Predicted mean vote (PMV) – thermal comfort index is calculated on the basis of personal factors (metabolic rate [met] and clothing insulation [clo]) and environmental factors (air temperature [Ta], radiant temperature [Tmrt], air velocity, and relative humidity) (Soelaiman et al., 2018). The scale based on Fanger's (1972) thermal comfort model ranges from Cold (-3) to Hot (3), while it is regarded as thermally comfortable between -0.5 and 0.5. PMV index with seven scales is used to measure thermal comfort level (Table 2). According to the ASHRAE Standard 55, thermal comfort is the condition of mind that expresses satisfaction with the thermal environment.

Table 2: PMV index scales with thermal perception.

Scales	Thermal perception
-3	Cold
-2	Cool
-1	Slightly cool
0	Comfortable/Neutral
1	Slightly warm
2	Warm
3	Hot

Source: adapted from Dyvia & Arif (2020).

The PMV has been criticized for overestimating warm/cold discomforts with errors larger than one scale, which results in overcooling/overheating, thereby thermal discomfort and energy wastage. In fact, available climate models are effective in predicting global temperature changes associated with greenhouse gases, with most models forecasting increases above 3 °C (Lombardo, 2004).

2.4 Land surface temperature (LST)

According to Baptista (2021), the MOD11A2 product provides an average 8-day land surface temperature (LST) on a 1200 x 1200 kilometre grid. Each pixel value in MOD11A2 is a simple average of all the corresponding MOD11A1 LST pixels collected within that 8-day period. The 8-day period compositing period was chosen because twice that period is the exact ground track repeat period of the Terra and Aqua platforms. Along with both the day-and night- time surface temperature bands and their quality indicator (QC) layer, this tool also includes MODIS bands 31 and 32 and eight observation layers (https://developers.google.com/earth-engine/datasets/catalog/MODIS_006_MOD11A2).

LST is a key parameter in the physics of land surface processes from local to global scales. LST data is acquired using thermal remote sensing by the Terra (MOD) and Aqua (MYD) satellites with the MODIS sensor on board (Morin et al., 2021) (elevation data in Table 3). The MODIS thermal satellite imagery was acquired through the code editor of Google Earth Engine (Figure 4). Mapping system with moderate resolution allows for two innovations: firstly, the tool using MODIS11A2 to measure LST for 1 km in an 8-day period creates an image of surface temperature with 1 km of spatial resolution for each pixel; secondly, it provides both day- and night-time data, and thus allows for comparison of the phenomena of day and night heat islands, proving that they were maintained in both periods (Baptista, 2003). Thermal remote sensing data with high temporal resolution is an interesting alternative for identifying comparable spatial distribution of air temperature or LST.

Table 3: Overview of dataset.

Product and source	Spatial resolution	Temporal resolution	Variable
MOD11A2/MYD11A2	1000 m	8-day composite	Minimum and maximum land surface temperature (°C)

Source: adapted from Morin et al. (2021).

To obtain surface temperature, the following procedure is applied to the code editor of Google Earth Engine (Baptista, 2021) First, choose the script MODIS_006 (version 6) product MOD11A2. Make a change in the time filter for the year 2019 (the same year evaluated with ENVI-met), present a resolution of 1 km (LST_Day_1km) and a change of 64°43'46" in longitude and 21°32'07" in latitude corresponding to the city of Tarija. When processing the dataset centre, a sinusoidal projection appears with the following information obtained in the Inspector tab: 46 images to compose the data in 2019, 1 band, the temperature data, and the resolution of the pixel/km data. For this research, 5 points have been considered (Figure 2), corresponding to the 3 types of neighbourhoods (in the historic centre, conventional neighbourhoods, and new settlements). Additionally, the temperatures in the rural area and the hottest pixel are presented in Figure 4. The result of the radiometric temperature in Table 4 was converted to degrees Celsius. There is a thermal gradient and the LST maximum is 46.85 °C.

Table 4: Land surface temperature – thermal gradient.

Location	Pixel/km	LST
Rural area	14942	25.69 °C
Hottest (Los Chapacos)	15539	37.63 °C
Historical centre	15439	35.63 °C
Conventional neighbourhood	15282	32.49 °C
Settlement	15283	34.51 °C

Source: author (2021).

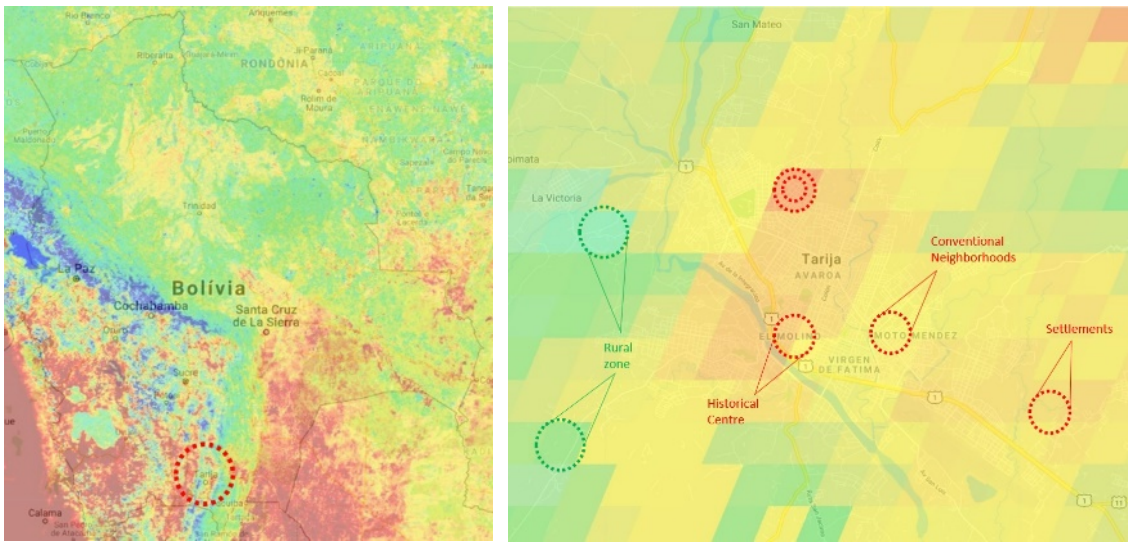

Figure 4: LST of Bolivia, Tarija (source: MODIS11A2 – Google Earth Engine, 2021).

Several studies have demonstrated the utility of methods for "downscaling" land surface temperature (LST) derived at low spatial resolutions from remote sensing to improve the precision of these data by using robust statistical methods and predictors (Morin et al., 2021). Such "downscaling" is related to reducing pollution and stress, and creating socially and economically mixed districts, in order to improve overall quality of life for both residents and visitors.

3 Results

Comparing LST measurements, a 11,94 °C difference between urban area with rural area was arrived at. Additionally a 5.14 °C difference between the three types of neighbourhoods within the urban area (historical centre, conventional neighbourhoods, and new settlements) was observed (Table 4). These results on a macro scale (thinking at the city level) give a guideline to the results obtained with the simulation, as developed below. The results of the simulation with three parameters (air temperature, temperature surface, and median radiant temperature) at five different hours (9:00, 12:00, 15:00, 18:00, and 21:00) for each scenario are shown in Figures 5, 6, and 7. Meanwhile, the last chart (Figure 8) compares scenarios 1 and 2 with the PMV index. All maps extracted by Leonardo are standardized.

As pointed out by Bruse (2004), a wide range of different soil and surface types is characteristic of urban environments, varying from natural soils to completely artificial materials. For this reason, values in both scenarios should be standardized in order to compare observed data in the maps of surface temperature, median radiant temperature, and PMV. The maps for the four environmental parameters (air temperature, surface temperature, median radiant temperature, and PMV) resulting from the simulation, and considered at 1.5 m reference height, according to the rules of the World Meteorological Organization, show the differences in both scenarios at 9:00, 12:00, 15:00, 18:00, and 21:00.

3.1 Scenario 1: asphalt street and parking areas (actual situation):

– Air temperature reached between 18 °C and 25 °C. The minimum value was reached at 9:00 and the highest value at 15:00 (Figure 5).

– T surface reached between 21 °C and 29 °C. At 12:00 and 15:00 the worst performance was recorded even in the vehicular garages. The more comfortable performance was recorded at 21:00 (Figure 6).
– Median radiant temperature reached between 22.5 °C and 42.50 °C. The minimum value was registered at 21:00 and the highest value (over 42°C) at 15:00 (Figure 7).
According to the three environmental factors / bioclimatic parameters represented, the worst performance in this scenario was recorded at 15:00 .

3.2 Scenario 2: street with block pavers and vegetation (alternative solution):

– Air temperature reached between 18 °C and 23 °C. The minimum value was registered at 9:00 and the highest value at 15:00 (Figure 5).
– T surface reached between 21 °C and 29 °C. The worst performance was recorded at 15:00, with slightly higher temperatures than at 12:00. The more comfortable performance was recorded at 9:00 (Figure 6).
– Median radiant temperature reached between 22.5 °C and 42.50 °C, with the minimum value registered at 18:00 and 21:00, while at 15:00 the temperature reached around 30°C (Figure 7).
Compared to scenario 1, this result registered a decrease of about 12°C at 15:00. Additionally, the minimum value was recorded at both 18:00 and 21:00 in scenario 2. The following three maps show the distribution of temperature from scenarios 1 and 2, obtained from ENVI-met 4.4.5.

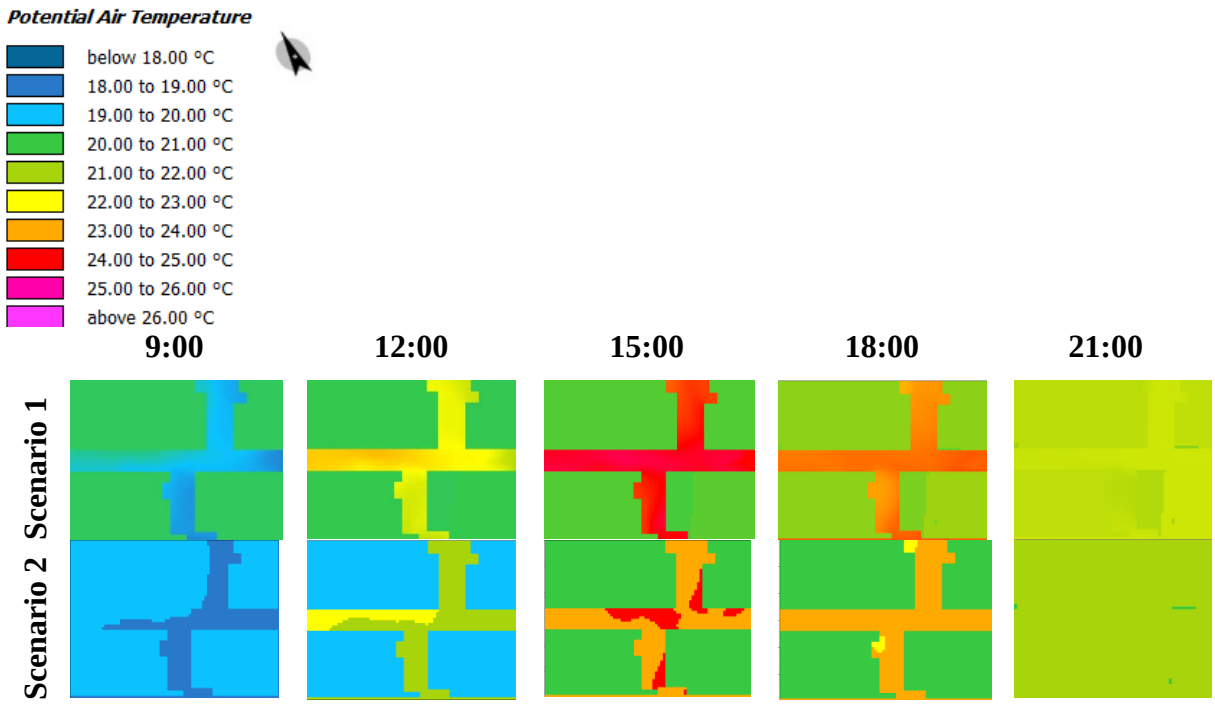

Figure 5: Map of Air Temperature (illustration: Leonardo plugin, 2020).

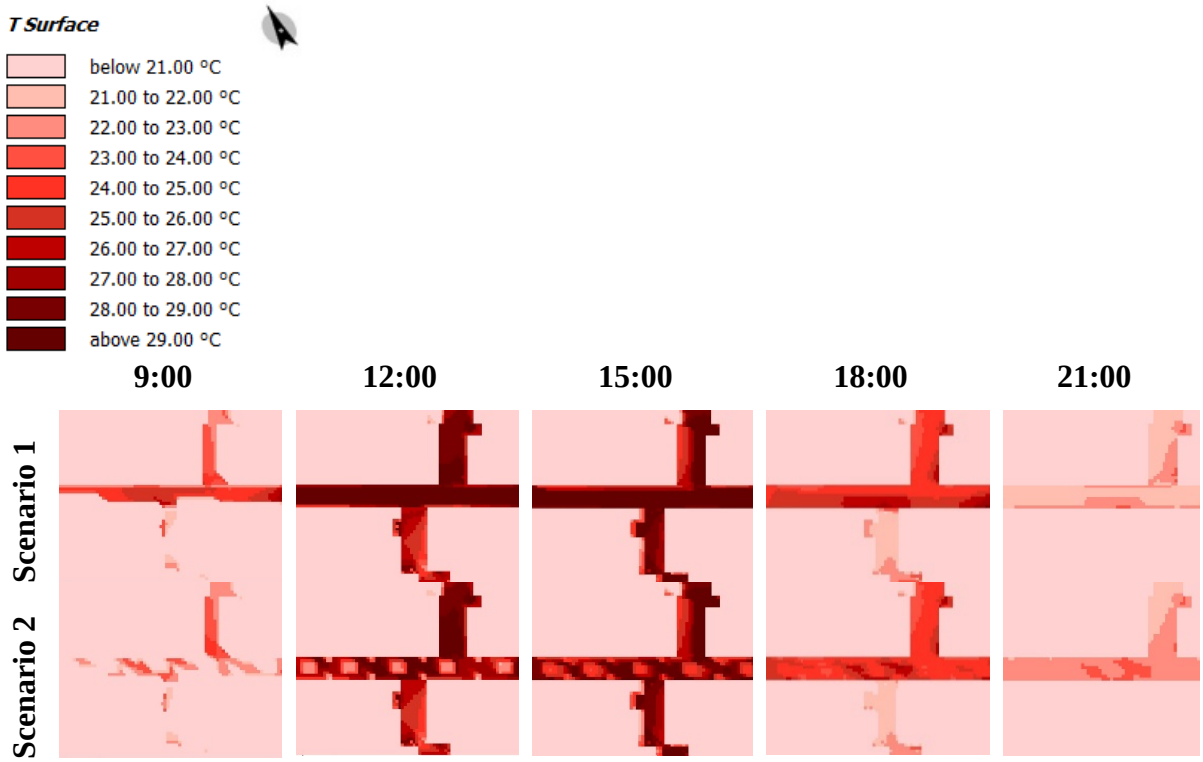

Figure 6: Map of T surface (illustration: Leonardo plugin, 2020).

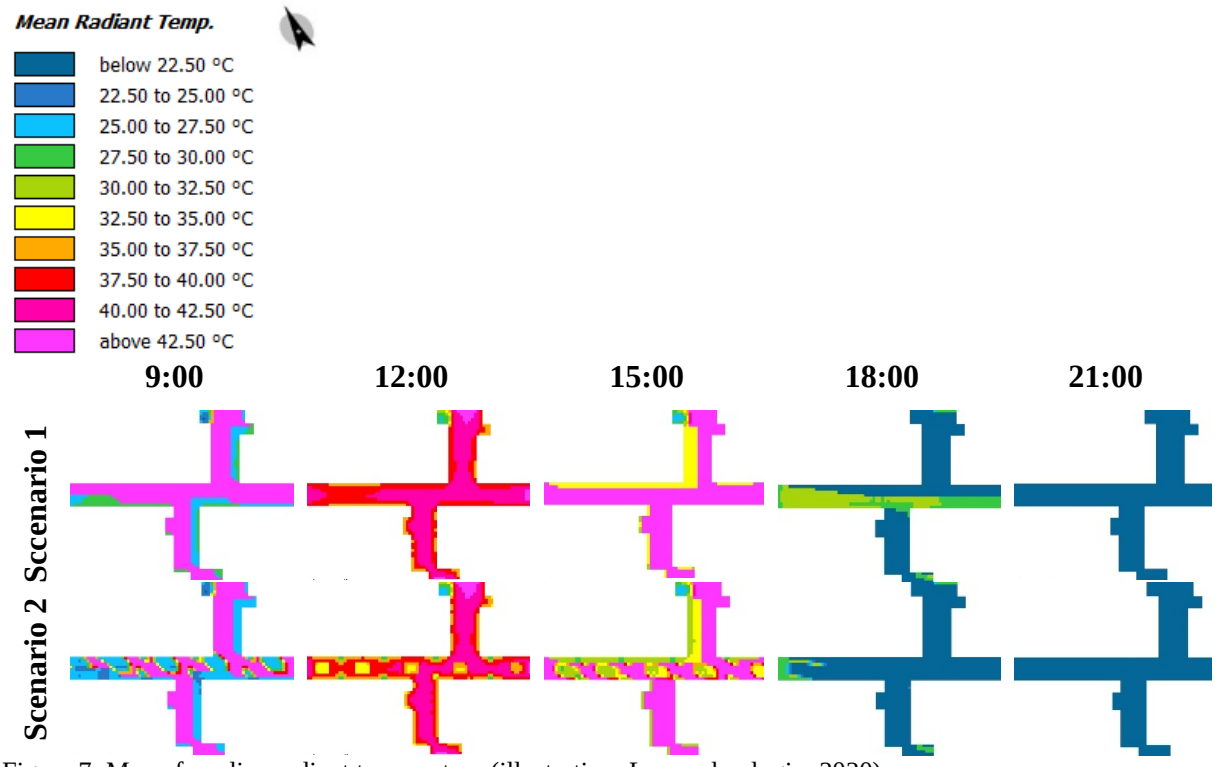

Figure 7: Map of median radiant temperature (illustration: Leonardo plugin, 2020).

In both scenarios, 9:00 coincided with minimum air temperature values (18 °C) and 15:00 with maximum values (25 °C). A 2 °C air temperature difference was obtained in scenario 1 (without vegetation and with asphalt).

The surface temperature cooled down to 23 °C was recorded at 12:00 and 15:00 in scenario 2 (with vegetation and granite block pavers), compared to over 29 °C recorded in scenario 1

(without vegetation and with asphalt). A 6 °C difference has thus been observed between the two scenarios.

3.3 PMV – Scenarios 1 and 2

The outdoor thermal comfort was determined according to the range of values given to the predicted mean vote (PMV) index by simulation results of ENVI-met. The standard range of thermal perceptions between cold (-3) and hot (3) (Fanger, 1972) was applied to both cases. The results describe the conditions of thermal comfort outdoors, on the street. By looking at the maps, it is possible to identify the most comfortable PMV index at 9:00 for scenario 1 (without vegetation). Comparing both scenarios, the maps show that at 15:00 scenario 2 (with vegetation) has better performance according to the PMV index (comfortable), and the same is true at 12:00. Finally, at 21:00 scenario 2 (with vegetation) reaches slight heat stress in the entire street. The thermal comfort on pedestrian zones is relevant, and evaluation of this performance suggests possible strategies to be applied to improve it.

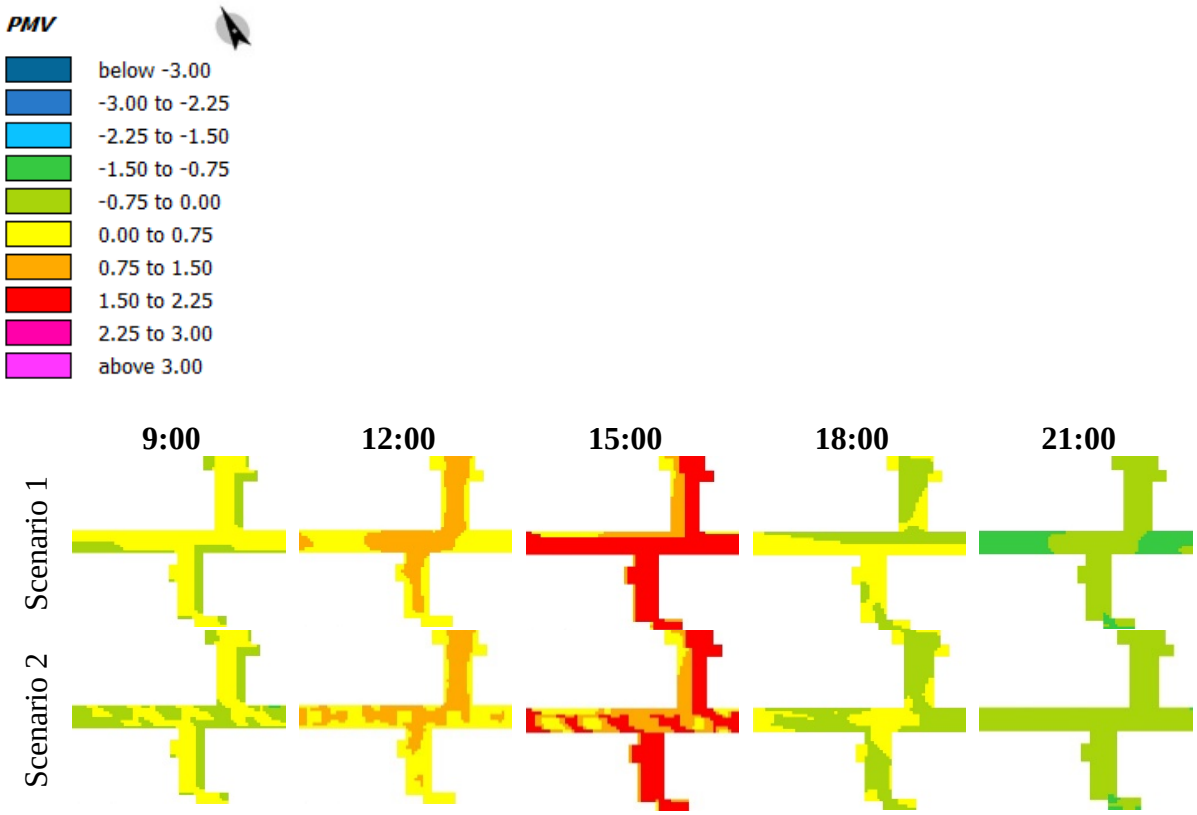

Figure 8: PMV simulation for Scenarios 1 and 2. (source: ENVI-met, 2020).

4 Discussion

More pedestrian zones in the city not only contribute to accessibility but also help improve the urban microclimate. The performance of the streets in both scenarios clearly shows the differences; compared with the scenario 1 (with asphalt), scenario 2 reduces the temperature surface by 6 °C with the help of vegetation and natural materials. Other results regarding median radiant temperature show a difference (12 °C) in performance at the same time (at 15:00) in both scenarios. From a theoretical perspective, this phenomenon could be adopted

throughout the city and promote sustainability with pedestrian zones, key feature of sustainable cities.

This work methodology presents a specific analysis of a single street; adapted to the local context, it could be replicated in other formal scales where pedestrian zones are being planned. It assumes an adequate understanding of each place. In the global context of climate change, outdoor spaces that provide a pleasurable thermal comfort experience for pedestrians effectively improve the quality of urban living. The influence of thermal comfort on outdoor activities is a complex issue comprising both climatic and behavioural aspects (Chen, 2012). The relationship between morphology, climate, and urban landscape is a relationship between aspects that interact in urban spaces and fundamentally determine human activities. Thus, the method used in this research can be applied to any city and translated into a sustainability strategy as the basis for an integrated analysis of urban space.

The PMV results show that at (and before) 9:00 in the morning and at (and after) 21:00 in the evening the index stayed in the comfortable range, having to calculate the peak hours of pedestrian traffic to measure the gauges earlier in the morning and at the sunset. Adopting the best solution suggests incorporating vegetation in order to maintain a constant performance and more hours within the comfortable range of PMV index. The PMV index defines the thermal comfort of a walking person influenced by several environmental parameters (air temperature, mean radiant temperature, relative humidity, air velocity). Thermal comfort is additionally affected by the metabolic rate and clothing insulation (Dyvia & Arif, 2020). Introduction of pedestrian zones in neighbourhoods would contribute to a decrease in surface temperature and thus to better thermal comfort of pedestrians.

Discussing the results must consider the scale, vegetation and materials, and the method applied in the simulation. Scale of microclimate change: urban microclimate on all kinds of urban scales is fundamentally affected; however, each scale has its own characteristics. This has been validated by the analysis performed on the 15 de Abril Street. In this study of sustainable urban development, the local represented in the scale prevails, the climatic in nature, and the zonal in the representation of the environment; therefore, observing the alterations and effects of the climate on the surface and atmosphere influences the well-being of the people and the preservation of the identity of the place. Vegetation and materials: Werneck & Romero's study (2018) of the impact of UHI mitigation strategies on the radiant average temperature emphasizes that the characteristics of the finishing materials commonly used on surfaces around buildings should be thought of in order to improve the pedestrians' experience of the thermal environment. In order to obtain a reduction in air temperature, an analysis of negative impacts of the radiation reflected in the TMR to estimate the potential of the mitigation of UHI with cold floors at the microclimate level should be considered.

The impact of vegetation on microclimate results suggests greening could help alleviate the effects of the urban heat island (Yilmaz et al., 2020). Increasing vegetation in cities is therefore one of the key approaches in reducing both air and heat radiations. Cooling benefits of urban vegetation improve environmental temperature, especially in the summer. The effect is local and contributes to improve our sensorial system. A green continuity in the city, including city blocks, creates an ecosystem with multiple benefits, which suggests a number of actions directed towards creation of new centralities (Martínez & Romero, 2020) and integration of an environmental structure with an urban synergy between nature and society. The re-think on nature-based solutions (NBS) supports a sustainable and resilient urban planning while implementing different ecological concepts: green infrastructure, urban green (and blue)

spaces, service providing units, service providing elements, sustainable urban drainage systems, and ecosystem-based adaption (Babí et al., 2021). Vegetation should not be confined to parks or green roofs alone. In the streets, attempts should be made to convert the sidewalks into completely pedestrian zones, while urban trees play a vital importance in urban environment and urban landscape, and improve the image of the city by giving it identity. In collaboration with the inhabitants, plans should be made to green the city, choose the appropriate trees, and disseminate the information on incorporating green and civic aspects in building and planning. Through careful planning, use of green building and planning systems and technologies, including green spaces in the built environment, should be encouraged.

Using ENVI-met software: PMV values calculation by Fanger (1972) is very complicated when using manual calculations (Dyvia & Arif, 2020). Most research and studies on urban microclimate are associated with ENVI-met software. The ENVI-met model analysis was performed on the street level to investigate the thermal comfort effect in addition to configuring climate data and enabling the generation of all simulated data while offering a very simplified modelling platform. Computer simulation of urban microclimates can be used as a research method to understand phenomena related to urban climate and to evaluate mitigation strategies for ICU impacts before their implementation (Werneck & Romero, 2018). With the simulations, technical information contributes to the diagnosis of the thermal performance of different urban morphologies. According to Silva (2013), the prediction of environmental problems through computer simulations can point out important solutions at low operational cost. For the reliability of the data, however, it is essential that the source of the data is secure and derived from a weather station as close to the study area as possible. The use of computational tools in environmental assessment can assist in decision making, in prognostic studies, and in the construction of a space of higher environmental quality.

5 Conclusion

Evaluation of the environmental performance in the urban microclimate on urban roads in the historic centre of the city constitutes an argument for the promotion of urban pedestrianization since the method applied in this work, namely calculating the surface temperature and urban heat islands compared in the two scenarios, highlights the climate effects on local scale. The use of computational simulation provides a tool for urban and spatial analysis that enables the identification and interpretation of the interactions between climate and urban environment. The comparative analysis of the two scenarios, the current situation (scenario 1) and the proposal (scenario 2), considering the variables that affect environmental performance, identifies increased values in land surface temperature and PMV index in public spaces.

In conclusion, scenario 2, which incorporates vegetation and implements natural surface materials, presents a better thermal comfort index while the average radiant temperature performance remains the same. These identified values must be addressed in urban design and planning of cities, essentially with the increase of vegetation and natural surfaces to promote urban adaption to climate change and endorse active mobility with pedestrian zones.

It is recommended that the results of this work be reviewed by urban planners, politicians, and citizens in generalto promote awareness of improvement of urban microclimate. The environmental impact socialized among the actors of society improves the microclimate and consequently the quality of urban life, making neighbourhoods more liveable and efficient by prioritizing pedestrians and bicycles over road traffic. In the future, these city streets could

constitute a network of pedestrianization which presently seems so necessary to counteract the disorderly urban growth.

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