Sustainability vs. Resilience in Urban Design

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ABSTRACT   **Cities are subjected to rapid changes, due to economic and cultural globalisation, demographic changes and migratory flows, urban planning strategies, social networks, and other factors. These spatial dynamics are happening under diverse visible and invisible relations between cultural changes, spatial boundaries between morphology patterns, voids, lost spaces, informal structures, self-organisation, planned regularities, etc., mainly following organic dialogues characterised by the complexity of the grid system. Research on sustainability and resilience in urban design indicates that the most functional urban structures are those with a multiple number of interconnections at all scales. The work articulates elements of identification, inventory, and evaluation of interconnections in urban open spaces, with added discussion on traditional city centres. By following the research methods of understanding the urban design, the study aims to investigate the open spaces in urban areas, prevailing on composition of urban morphology with perceptions in space. Here, the case study of the Municipality of Žiri, Slovenia, is included, where we explored the connections from the scale of the landscape to the detail in developing the concept of urban design for the central square of Žiri. This part of the study was done at the University of Ljubljana, Faculty of Architecture, as part of the Workshop *Developing the City Centre of Žiri,* with the students of architecture and urbanism involved together in experiential work.**

1   Introduction

Cities are subjected to rapid changes, due to economic and cultural globalisation, demographic changes and migratory flows, urban planning strategies, social networks, and other factors. Increasing ecological problems resulting from the overuse of resources and pollution, as a result of uncontrolled market-oriented production and consumption patterns, have made cities and regions more prone to such disasters as floods and droughts (Eraydin & Taşan-Kok, 2013, p. 1). The increasingly changeable natural and environmental conditions affect the quality of life and quality of living areas, both outdoors and indoors. Mayors, governors, developers, and suburbanites desperately need alternatives to sprawl, and architects need to be re-engaged practically - and theoretically - with the unavoidable issues of ecological sustainability, social justice, mobile capital, consumer culture, ethnic and cultural identities, and politics (Dunham-Jones, 2009, p. 16).

Today, our public spaces are undergoing major changes. City centres are being emptied, while life moves to cities of consumption with attractive commercial and entertainment content, which continuously grow on city outskirts. Shopping centres contribute to the emptying of city centres, where commercial services turn into tourist services. The users and their way of controlling space have, in general, changed the balance between various activities and public open space users. Shopping centres offer precisely those elements of open public space that are missing in traditionally designed European city centres: good access, fluidity, parking areas, entertainment also (and above all) for kids, events, etc. The image of a city centre with content as described by Lokar (IPOP, 2010) – "I dream of a Ljubljana where you can go buy bread and flowers on foot or walk to the nearest restaurant, park, or cinema, close to the place where you live" – seems a distant and idyllic vision of the past. On the other hand, regardless of all migration flows, we ask ourselves where and what is the balance of these values in terms of sustainability and resilience. Sustainable development attempts to weave together multiple values to confront the challenges of reversing environmental degradation and reducing overconsumption and grinding poverty (Bahrainy & Bakhtiar, 2016, p. 26). We wonder whether, based on this definition, we can make the shift from a consumer society to the challenges of reducing excessive consumption and diversity, reflected in the poverty of the sociocultural structure and the degradation of the quality of living environment. Is the latter reflected in the values of a sustainable society? Values of sustainability "are sometimes referred to as the three 'Es' of sustainable development: environment, economy, and equity" (Bahrainy & Bakhtiar, 2016). In the sense of the righteous three 'Es', what does open space offer us, as it is clearly the "venue" and catalyst of sustainability in the sense of weaving together people of various cultures, race, gender, knowledge, and image? Is sustainability, therefore, an idealised image of something that we would want in the form of a "just society" and is resilience then the negative counterweight that warns us about the responsiveness of sustainability, when its spatial balance shifts into environmental imbalance? Is sustainability in urban space thus a balance of humans, spatial organisation, and

environmental elements? Bourne (1995) claims that "urban systems change and reorganize according to the diverse outcomes of economic globalization, based primarily on population data, but with secondary reference to trends in economic growth and restructuring, and to the various roles played by governments in shaping the urbanization process". Thus, economic growth and restructuring that results from globalisation creates certain population dynamics and mobility patterns that influence the reorganisation of urban spaces (Santos Cruz, Costa, Ávila de Sousa, & Pinho, 2013, p. 53). In the discussion on urban centres as open public spaces, we can claim that most settlements in the European space are centrally conceptualised, following the 'central place theory' (Christaller, 1933; Lösch, 1954), which means that their design is subordinated to a central organisation (size, function, gravity, specialisation, and development dynamics). The question, however, relates to the inhabitants' awareness about the values of an organised central space, even more so in cases where the users are not exclusively permanent residents, but come from near and far – for them, the city centre means to attend activities, go for a walk, soak up in the sun, etc. City centres are of key importance for the general community, while permanent residents do not see only their quality-of-life value, i.e. they indirectly influence them with their use or lack thereof, according to the level of necessity or likeability. Questions that arise from the discussions about contemporary values, changes in urbanity, especially in public open spaces, and searching for quality of life are: How to approach new urban projects in ways that embed cities in the long term, and that factor in the constraints we are facing in a finite world, including in design solutions with the risks of climate, cultural, and social changes?

2 Sustainable, Resilience and Design Thinking

"Good bye sustainability, hello resilience" (Zolli in: Zolli and Heally, 2012)

"Resilience – resisting disorder – may be the key to global sustainability" (Center for Resilience, n.d.).

There are several definitions of sustainable development, but the simplest and clearest one is that given by the World Commission on Environment and Development, which says that to make development sustainable means "to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Commission, 1987). In the decades of growing environmental awareness, cultural awareness, and many public discussions, several different orientations were formed, each of which had six basic ideas fundamental to sustainable development in common, which Jacobs (1999) lists as: environment-economy integration, futurity, environmental protection, equity, quality of life, and participation. Given the meaning of sustainability (Brundtland Commission, 1987), two key concepts are defined: 1) the concept of "needs", in particular the essential needs of the world's poorest people, to which we should give overriding priority; and 2) the idea of limitations which is imposed by the

state of technology and social organisation on the environment's ability to meet both present and future needs. Our relationship to sustainable development is not only about waste treatment and how we act in protected areas, and use drinking water and other natural resources; it is, in the first place, about how we understand the process of spatial planning. Sustainability in urban development predicts a self-sustained development of the city within itself by closing the loop by eliminating the impact on the environment. The debates about ideal or desirable urban forms are not new; some can even be traced back to the end of the nineteenth century at the outset of the garden city movement (Breheny, 1997). Following the resilience approach, sustainable urban development (Fig. 2.1) should also take into account patterns that provide capacity to the system to absorb disturbances and reorganise itself (Eraydin & Taşan-Kok, 2013, p. 8).
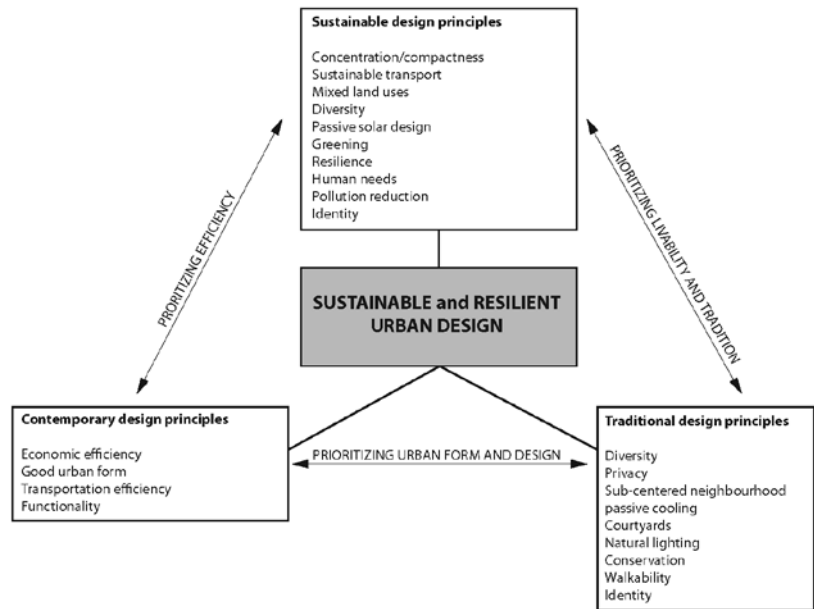

FIG. 2.1 Conceptualisation of sustainable and resilient design *(Bahrainy & Bakhtiar, 2016)*

Resilience, on the other hand, is the ability to resist change without undue deformation: that is, it resists physical and structural obsolescence (Carmona, Health, Oc, & Tiesdell, 2003: 202). Considering a city as a place of interactions between humans and the built environment, maps of social activity reveal how urban–social systems have self-adaptive properties like complex dissipative systems (Pulselli, Ratti, & Tiezzi, 2011). But other definitions of resilience are also found in scientific discussions and, as stated by Pendall, Foster, and Cowell (2010), the resilience concept indicates considerable fuzziness, and indeed, the numerous interpretations and definitions of urban resilience do make it rather fuzzy. However, as Lagendijk (2003) notes, this may simply be a symptom of the immaturity of the concept that will decrease over time. The three central features of resilience, according to Berkes, Colding, and Folke (2003, p. 6), are: 1) the ability of a system to absorb or buffer disturbances and still maintain its core attributes; 2) the ability of the system to self-organise; and 3) the capacity for learning and adaptation in the context of change.

Resilience thinking helps to interlink the spatial dynamics that lead to different urban forms with respect to the vulnerabilities of urban systems. The concept of resilience (and sustainable development some years earlier) has given rise to questions related to the contribution and role of certain land uses and urban forms in creating cities that are more resilient (Eraydin & Taşan-Kok, 2013, p. 8).

While there are as many definitions of sustainability and resilience as there are authors, there is one general idea that is confirmed by most, as we can see from the examples above. Generically, resilience is the capacity of a system, enterprise, or a person to maintain its core purpose and integrity in the face of dramatically changed circumstances; this can point to attributes of a built space, or urbanised space, to withstand dramatic changes in the environment. Resilience is a system and strategy to face unpredicted changes. Sustainability is oriented to solutions on the level of technological attributes, political will, and social incentives connected to urban design features when speaking of urban development, which guarantee the balance of a system. If sustainability strives towards a situation of equilibrium and balance preservation of all elements, it is resilience that deals with situations when imbalance is created. To put it bluntly, it is resilience that reminds us of the errors in planning and follows the doctrine of sustainability. This logic works in all manners of application, whether it is the financial world, environmental politics, or urban design, no matter the scale and location. Urban development, in a line to secure a quality living environment, is a cycle between sustainability and resilience. Yet to strive for resilience is not simply a contingency plan for when it is already too late to apply the term sustainable; the two are complementary, as resilience is what has to be thought of for situations when "things go wrong", as the world's artificial and natural systems are much too complex to predict.

2.1   Thinking in Terms of "Sustainable Urban Design"

When talking about sustainable design features, they cannot be avoided in any urban solution. In the discussion on sustainable principles, Carmona (2009) explored the works of other authors and identified a set of 10 generic principles: stewardship, resource efficiency, diversity and choice, human needs, resilience, pollution reduction, concentration, distinctiveness, biotic support, self-sufficiency (Table 2.1). The review of many authors and their papers on the topic of "sustainable urban design" showed that "good urban design is sustainable, but, as the paper has shown, this implies much more than simply reducing energy use and carbon emissions" (Carmona, 2009). Regardless of the theoretical definitions, for any urban solution that is claimed to be sustainable by the designers it is necessary to address the following: develop neighbourhoods that promote walking, prioritise bicycle networks, create dense networks of streets and paths, support high-quality transit, zone for mixed-use neighbourhoods, match density to transit capacity, create compact regions with short commutes, and increase mobility by regulating parking and road use. These design attributes are important elements of sustainability when we expect to

improve mobility, reduce carbon emissions, attract economic activity, improve air quality, preserve arable land, and support a harmonious and prosperous society, but the question is how to implement ideas of sustainability in projects where the limited scale of the intervention does not allow you to apply all of these attributes. As Carmona (2009) concludes in his discussion, "relevant issues are applicable at different scales", as are: buildings, spaces, quartiers, settlements. In terms of general design orientation guidelines, when producing large scale interventions or urban development strategies, they must be in line with physical design features that apply to the concept of sustainability for smaller interventions. It is the respect of the natural and built context, the selection of materials, and the building method that ensure sustainability of a specific urban design development project. Orientation, insolation, wind, water, greenery, as well as buildings and other artificial structures on location, have to be interpreted and included in the design of the intervention. It is more sustainable to select a local stone for the paving of surfaces instead of selecting materials that require oil tankers to deliver them overseas.

FEATURES	DETAIL (TECHNICAL AND DESIGN SOLUTION) SCALE	SPACE SCALE
Sustainable and resilient design attributes by scale		
ENSURING SUSTAINABILITY	• Use local materials • Use recyclable materials • Unique design approach for site specifics • Smart and innovative technical solutions	• Design for low maintenance • Take advantage of natural features (insulation, wind protection, natural water drainage,...)
ENSURING RESILIENCE	• Durable and robust materials • Smart and innovative technical solutions	• Design robust and durable spaces usable for many functions • Design spaces able to accommodate above and below ground infrastructure requirements • Design of serviceable space
Related features supporting both sustainability and resilience		
STEWARDSHIP	• Ensure easy maintenance	• Respond to and enhance context • Calm traffic • Allowing personalisation of public space • Manage the public realm
RESOURCE EFFICIENCY	• Use of recycled or renewable materials • Take advantage of natural features • Using local and natural materials	• Layouts to allow sun penetration • Spaces that reduce vehicle speeds and restrict vehicle circulation • Design spaces that reduce wind speeds and enhance microclimate
DIVERSITY OF CHOICE	• Provide opportunities for mixed uses • Ensure accessibility and safe use	• Design for mixed uses along streets and in blocks • Design for walking and cycling • Combat privatisation of public realm • Remove barriers to local accessibility
		• Ensure economical soundness for project financing and operation (can buy PPP contracts – to insure Public interest)
HUMAN NEEDS	• Design ergonomically • Use user friendly materials (adoption of tactile materials) • Safe technical solutions	• Provide high quality, imageable, public spaces • Combat crime through space design and management • Enhance safely by reducing pedestrian/vehicle conflict • Design for social contact and for safe children's play
	• Use of artificial, composite and other durable materials • Adoption of details and surface finishes difficult to get damage and wear	
POLLUTION REDUCTION	• Use vegetation for noise absorption and climate control • Use recyclable materials	• Reduce hard surfaces and run-off • Design in recycling facilities • Design well-ventilated space to prevent pollution build-up • Give public transport priority
	• Use durable and robust materials	

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CONCENTRATION	• Repurpose degraded areas • Maximize space usability	• Reduce space given over to roads • Reduce space given over to parking • Increase vitality through activity concentration
	• Preserve self-regulatory natural elements and features	• Preserve areas that are needed for self-regulation
DISTINCTIVENESS	• Adopt traditional local design solutions and visual elements	• Reflect urban form - townscape and site character in design • Retain distinctive site features
	• Adopt designs that ensure survivability of elements	• Design for sense of place - local distinctiveness • Retain important building groups and spaces
BIOTIC SUPPORT	• Think of planting typical local types of greenery	• Plant and renew street trees
	• Think of planting low maintenance and durable greenery	• Encourage greening and display of private gardens
		• Design in robust soft landscaping
SELF-SUFFICIENT	• Low maintenance details, elements, and furniture	• Encourage self-policing through design • Providing space for small-scale trading • Provide bicycle parking facilities

TABLE 2.1 Sustainable and resilient design attributes by scale *(Adapted and supplemented from Carmona, Health, Oc & Tiesdell 2003, p. 46-47)*. The column 'SPACE SCALE' has been revised. Divisions between Sustainable and Resilient attributes have been marked in colours; orange for Sustainable and blue for Resilient; all other attributes are common to both principles.

2.2   ## 'Resilience', a New Paradigm in Designing Open Urban Spaces

Resilient does not mean an upgrade of the term sustainable. Resilience, in terms of urban design, follows the principles for resilient urban planning and design in a post-carbon, climate-responsive building environment (Resilientcity.org, n.d.), identified as: density, diversity and mix; pedestrian first; transit supportive; place-making; complete communities; integrated natural systems; integrated technical and industrial systems; local sources; engaged communities; redundant and durable life safety and critical infrastructure systems; and resilient operations. It is therefore necessary to establish systematic solutions that deal with basic policies and attitudes of the city, functioning both from the infrastructural point of view as from the view of the correct composition of all other elements that comprise the city. However, it is the small intervention that finally completes the puzzle of a complex solution (by principles of sustainability or resilience), which can have an influence on the environment in a more complex and comprehensive way. On the level of small scale interventions, the resilient urban design development must address the questions of technical details and how they behave during stress situations (harsh winters, events of artificial pollution, floods, a brief different use, etc.; to care about maintenance protocol, to make it energy efficient, environmentally friendly, etc.) to establish the identity of the place and a sense of community as a result. In the sense of resilience, all principles of operation are stressed in the sense of "acting responsible to space" through the awareness of each individual in the community, and the inclusion of the bottom-up approach. The emerging dilemma relates to the question of the role of micro scale and detail, i.e. definition of the smallest detail, as, systemically, under the influence of sustainability principles, these principles should have been put in place already. This is theoretically the ideal system of coordination and complementarity of urban planning principles. However, this is a system that depends on dealing with a previously established order (as only resilience could complement or maintain the so-called "resisting disorder"). Each system should first follow sustainability principles, which are complementary and maintained by resilience principles.

3   Open Public Spaces and Urban Design

Open public spaces play a key role in creating a sense of city distinction and identity, acting as an important bearer of content and values in the widest sense. They act as the main platform to which programs, content, and values are attached. A public space is mostly a social space, created and defined by different practices of users (Lehrer, 2007). Public space is, by definition, a space or area that is accessible to everyone, regardless of race, gender, social status, age, etc. (Dešman, 2008). It is a susceptible, sensitive, democratic, and important space, whose role is to protect the right of the users (…) (Carr, Francis, Rivlin, & Stone, 1992). In the sense of the transformation of cities, we can use a wide definition of the urban stage, which can potentially be any open space, any closed public space, or any private space with a mainly public access, and which has any form of spatial setup or scenery in any area of the city that has, in different contexts, a minimal or more permanent characteristic of place-ness (Hočevar, 2000, p. 138). The notion of public space and its functions are best defined by the contemporary definition from the book The Metapolis Dictionary of Advanced Architecture (Gausa et al., 2003), which follows up on Aristotle's thought that a city must be composed of different types of people. Public space is precisely the area that enables people to learn, despite all seemingly impossible differences, and to learn to live together. Gehl (2011, p. 15) defines activities in the public open space as a series of social activities: "Opportunities for meetings and daily activities in the public spaces of a city or residential area enable one to be among, to see, and to hear others, to experience other people functioning in various situations". Zucker, in *Town and Square*, (1959) outlined five basic types of 'artistically relevant' urban squares while stating that a square rarely represents one pure type but more frequently bears the characteristics of two or more (Carmona & Tiesdell, 2007, p. 155). Zucker (1959) argued that many squares were 'undoubtedly art', because the 'unique relationship between the open area of the square, the surrounding buildings, and the sky above creates a genuine emotional experience comparable to the impact of any other work of art'.

How can one, with all these definitions, and many others – similar and different, understand the difference between the open space of a street in the centre of Amsterdam and the public space in Antarctic research stations? How can these two completely different places define the term open space, which includes the diversity of each location with its 'genius loci'. All these uncertainties and the incapability of capturing the many diversities of the definition can be complemented by the interesting thoughts by architect C. Moore about Disneyland's Main Street – "You Have to Pay for the Public Life" (Keim, 2001, p. XXIII) – where, even though the term contains the word "public", which can be interpreted as accessible, this is not necessarily the case.

3.1   Urban Design Scale and Measurability of Space

As defined by Carmona (2009), "in linking theory to practice consideration is given to how these principles impact across the range of different spatial scales: buildings, spaces, quartiers, settlements." However, the question of quantification in open spaces in relation to the quality thereof has always been part of ongoing research. Christopher Alexander, in his chapter on 'Small Public Squares', observes that 'for some reason there is a temptation to make these public squares too large' and goes on to recommend a maximum dimension of 25 metres for a successful public space (Makower, 2014, p. 96). Jan Gehl, in his Cities for People…, recommends that squares should generally not be larger than 80 x 100 metres, which is based on human sight – to achieve the 'best of two worlds: overview and detail' – rather than on spatial qualities (Makower, 2014, p. 95). We wonder how quantification of space impacts our perception of quality elements in the context of the questions that relate to sustainability and resilience in urban design. Both spatial paradigms set humans and their wellbeing to the forefront. The scale that is adapted to humans even when we talk about public spaces is important, regardless whether these places relate to old city centres or open spaces in new neighbourhoods. The form of quantifying the "scale adapted to man" has already been explored by Vitruvius, Leonardo da Vinci, and Gehl (contact of man with activities and space), as well as in the frequently cited Le Corbusier's Modulor, and Rapoport's defining categories of the private–public relationship, etc. The approach to applying the concepts of sustainability and resilience to solutions in planning or designing undoubtedly differs based on scale. The question of impact areas of open public spaces reaches beyond the settlement scale; however, individual interventions on the local or community scale are those that create a direct impact in the perception of users. What is direct and temporary (in use) has an impact on social, economic, and environmental sustainability and resilience; and affects us most in our quality of living, enjoying, exploring visible and invisible relations in open public spaces with cultural changes, spatial boundaries, voids, lost spaces, informal structures, self-organisation, planned regularities, etc. Let us take a closer look at Trg republike (Republic Square) (together with its surrounding buildings, built between 1961–1975, and renovated in 2014) in Ljubljana (Fig. 3.1). Its length is 90 m (125 m together with the street and the area in front of the buildings) and its width 80 m (135 m altogether). Along with the dimensions, the programme of the neighbouring structures is also important – RS Parliament and a bank, i.e. programmes that do not stimulate experiential activities but play the role of a spatial dominant, i.e. control of space and man. The square is minimally organised, without additional activities. Nevertheless, it is becoming more empty, and less friendly to humans. In terms of sustainability and resilience, we see a change: before the renovation the square was used as a parking area, while afterwards parking was provided in underground facilities at the location and in the neighbouring car park under the Kongresni trg. This change seems to promote sustainable mobility without cars. However, when looking at it from the perspective of urban heat islands, we realise that below-ground parking is even more burdensome in terms of overheating of ground surfaces. This development definitely fails to promote environmentally resilient urban design.

FIG. 3.1 Trg Republike; it was meant to be the political and cultural centre of the Slovenes.

3.2   (In)Finity in Open Public Spaces

In discussing the measurability of a square, like Trg Republike in Ljubljana, we wonder whether this dimension, which goes beyond the so-called recommended dimensions by Gehl (2011) and Alexander et. al (1977), does not hide any other spatial potentials. We wonder whether this rounded-off, clearly defined square, limited from all sides, has the best possible impact on human wellbeing in an open public space that would allow people to have positive interaction with other participants in space. What about the sense of infinity, view across the horizon, lack of limits? Can an arrangement in an urban space replace the view across the horizon of a sea? As already pointed out by Cullen (1961) 'townscape' and a sequence of spaces, as a continuation of features of a space, which attract and lead to the next point, experientially awaken the creativity of each individual, while curiosity leads us further in space. Infinity connects us with elements of open space and ambience ventilation (wind flow and flow capacity during flooding). Infinity is not quantifiable, while it is spatially connected with natural elements that are part of the horizon. According to Bachelard (1964, p. 180) "being myself a philosopher of adjectives, I am caught up in the perplexing dialectics of deep and large; of the infinitely diminished that deepens, or the large that extends beyond all limits". The discussion on infinity is continued by the dilemma pointed out by Cold (2000, p. 207), who states that the users wants "an environment with a richness of detail that is larger than our immediate ability to process it". In a similar manner, Nasar (1998, p. 75) philosophically determines the relationship between capturing the curiosity and interest of spatial users "while interest increases with the complexity of an environment, our preference increases only up to a point, beyond which it decreases", where we can claim that at a certain point infinity turns into boredom and disinterest.

4   Changing of Open Public Spaces through the Perceptual Dimension

At the local scales, in terms of the level of open spaces in settlements, we can observe that the perception of a space is determined by physical elements such as road profiling, roughness of paved surfaces, and

selection of greenery, and these details should enable safety for the users, easy maintenance, and resistance to ageing. The aesthetic on this level is dependent on the correct selection of materials, their final processing, and their attributes, such as colour, texture, acoustic properties, luminosity, reflectivity, etc., and all of these elements have an impact on our imagination. They affect our feelings, experiences in space, and integration; they create experientially changing images. They offer the dimension of feeling and trigger a response (comfort or discomfort), such as freshness of water or the sound of a waterfall on a hot summer's day, the scent of strawberries on a noisy Saturday morning market, or sitting cosily by a fire with a view of a snow-covered landscape. Social relationships are included in this process as well. Notably, open space in all its forms includes physically intangible elements that are defined as values, beliefs, symbols, and meanings – the values of each individual, which are both acquired from the environment and returned back there. These elements are of importance when evaluating the built environment, along with its forms and patterns, as they developed in tandem with society; they connect us with our past, and help us create our tradition and our experiential space.

4.1 Identity of Place and Space

The social idea that came with the change in society, the industrialisation and dramatic migration from the rural area to the cities, saw a change in urban design principles. The identity of place or place identity (Lynch, 1960) are those elements that define a place's individuality, i.e. something that distinguishes the place from other places. It is used as the basis for its recognition in the sense of a separate entity (Lynch, 1960). Assuming that identity is a mixture of characteristics ("inventory of inventories" of these characteristics), which are interdependent and have various impacts in a recognisable hierarchy, it can be concluded that this is, in fact, the essence in the overall identification of architecture (Fister, 1993).

The exponential growth and expansion of the cities brought a wide array of complex and unprecedented problems and, with it, the search for the preservation of identities of urban spaces that connected to the identities of the users, opened a new age in civic design. It is no longer an exclusive process of architectural design but rather an intricate interdisciplinary exercise. The 1980s movement New Urbanism sought to foster place identity, a sense of community, and environmental sustainability, and since then its influence has grown significantly (Day, 2003, p. 83). In contrast, the Modernist idea was one based on arguments of economy, technology, justice, and equity, but at its core disregarded individuality and all the unique identities of the spaces. As such, it is hard to see the concepts behind the Modernist idea as being able to adapt to the notions of sustainability and resilience, since the human scale, besides the application of human ergonomics in relation to building and furniture details, is generally neglected as a determinant for the identity of places, and is being replaced by a universal application of the theory.

The process of urban sprawl nevertheless negated the human scale and therefore slowly eradicated the notion of identity. As it coped with the city as a functional machine, it neglected the idea of place-ness, community, and, subsequently, sustainability and resilience.

4.2   ## The Image of the City

Lynch's (1960) systematic 'The Image of a City' is a rather subjective comprehension of the city, as each individual user creates his own ideas and mental maps of it. The image itself is a result of a combination of actual in-situ sensation and of the memory of past experience.

A legible mental map gives people an important sense of emotional security; it is the framework for communication and conceptual organisation, and heightens the depth and intensity of everyday human experience. The city itself is thus a powerful symbol of a complex society (Lynch, 1960). An environmental image has three components: identity (the recognition of urban elements as separate entities), structure (the relation of urban elements to other objects and to the observer), and meaning (its practical and emotional value to the observer). It is important that these urban elements are not hermetically designed to a precise and final detail, but present an open-ended order. Urban inhabitants should be able to actively form their own stories and create new activities. In relation to buildings and open spaces, Gehl (2011) defines three categories of outdoor activities: 'necessary', 'optional', and 'social or resultant' activities (Fig. 4.1). They all affect the intensity of use, for how long the activity lasts and, in this respect, which activity to develop. Importantly, giving full freedom to act, create, and move is not enough if not incentivised to do so. There must be a process that enforces regulations and takes care of equality in professional decision-making and equality of individual needs and opinions. An intervention in an open space has, by consequence, more chances of giving an image and impression of a democratic place, a place that also functions from the technological aspect when facing unforeseen changes and a place of commonly recognised identity if this understanding is applied in the design. It is when a general image of a specific space becomes the image of it that this space becomes the place.
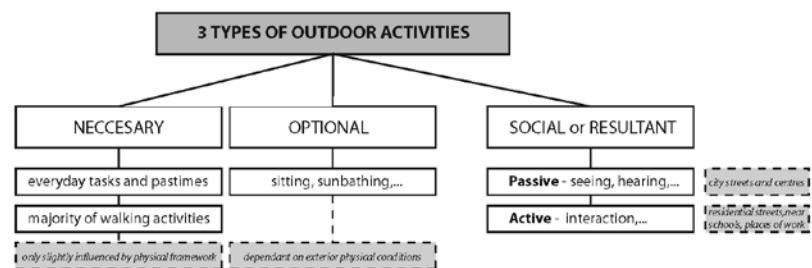

FIG. 4.1 Outdoor space and outdoor activities *(Gehl, 1980)*

4.3   Lost Spaces, Invented Places, and Voids

When speaking of physical presence in the spatial dimension, the lost spaces are the "undesirable urban areas that are in need of redesign- anti-spaces, making no positive contribution to the surroundings or users / they offer opportunities to the designer for urban redevelopment and creative infill and for rediscovering the many hidden resources in our cities" (Tracik, 1986). There are five major factors that have contributed to lost spaces in our cities: 1) an increased dependence on the automobile; 2) the attitude of architects of the Modern movement toward open space; 3) zoning and land-use policies of the urban- renewal period that divided the city; 4) an unwillingness on the part of contemporary institutions - public and private - to assume responsibility for the public urban environment; and 5) an abandonment of industrial, military, or transportation sites in the inner core of the city (Tracik, 1986).

However, on the other hand, the void is not just another lot to fill. Sometimes it is the sacred space between two different human groups, a border without the physic line, an imaginary obstacle that will never be surpassed even if there is no barrier, a wall, a limit. Just a void, even if, at a distance, it is touchably close to two buildings, it is an unlimited space between two souls.

In urban tissue, street connectivity is the basic structure, a symbolic void, a backbone to which different patterns of urban morphology are connected. Voids are often filled with informal construction that is in transition - structures without content or structures with a distinctly ethical programme (retail, small businesses, etc.). Why do we also talk about lost spaces? Because when we fill the void that has a symbolic value in it, this is a lost opportunity to have an open public space.

5   **Multiscale-Levels in Designing Open Public Spaces – Case Study Žiri**

The application of resilient urban design development to the case study was carried out mainly on two levels. The physical level dealt with the stream and its unpredictable nature. The design features are carried out in such a way that the intervention withstands the force of torrential waters during floods; they are able to self-regulate and fix themselves in the part where the intervention is made with green and natural elements; and the artificial part is made in such a way that it is very easy to clean after floods. As the intervention went through a lengthy process of public and professional discussions, the final result was accepted by the community and recognised as an integral part of the settlement identity. In the process of defining the project, its area, and content, there were several dilemmas, as the design of a project must answer environmental, social, and economic situations. How does an isolated local level intervention in a public open space integrate aesthetic and technical characters with environmental and

social complexity? How is this intervention designed to ensure the reinvention of identity, and its proliferation through it, is nurtured by protecting it, while still being able to react and even accept an overall accelerating transformation? How does a single project adapt to non-linear dynamics of overall changes?

Several divisions should be taken into account at this point, i.e. planning levels, the application method of design principles regarding sustainability and resilience discussed in Chapter 3.1, and the idea of measurability (size and scale), growth, and expansion. Scale is treated as a qualitative term, as it speaks of relativities as well as values and is just as relevant when viewing a city as a whole, or when touching the detail of a wall or a window frame. The word 'size' is quantitative and can refer either to the size of the population or to its physical extent (Makower, 2014, p. 32). To apply the thought developed by Makower to the case of Žiri means bringing in the notion of growth and scale. "If a city grows (as opposed to just expanding), where does it grow from? If it shrinks, what does it shrink back to?" (Makower, 2014).

5.1   Specifics of the Location –
Municipality of Žiri, Slovenia

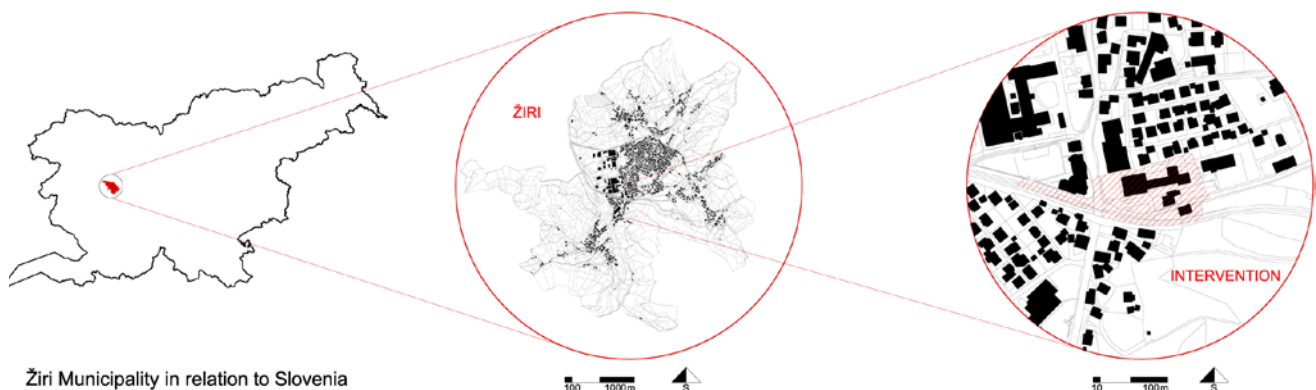Žiri Municipality in relation to Slovenia

FIG. 5.1 Municipality of Žiri, Slovenia
- Location

The settlement of Žiri lies in the centre of the Žiri Basin in the Gorenjska statistical region, in the extended upper part of Poljanska Sora at an altitude of 478m above sea level (Fig. 5.1). It is located at the junction of three Slovenian regions: Gorenjska (Upper Carniola region), Primorska (Littoral region), and Notranjska (Inner Carniola). The settlement of Žiri is the administrative centre of the Municipality of Žiri, founded in 1994. The river Račeva joins the larger Sora river on the west side of the settlement and both rivers are often flooded despite regulation efforts. Žiri, which already had a very urbanised structure, expanded from the old Žiri by connecting and partially absorbing nearby settlements of Stara vas and Nova vas and Dobračevo. Today, Žiri has almost 3,500 inhabitants.

The settlement was placed to East of the heavily fortified border between the Kingdom of Italy and the Yugoslavian kingdom before the Second World War. The industry began to develop rapidly after the Second World War. From individual shoemakers' cooperatives, the Alpina shoe factory was created and became the principle generator of the economic growth of the municipality. Private wood and metal industries also play important roles, while agriculture is a largely complementary activity. As rapid urbanisation resulted in many lost opportunities to generate quality open public spaces, the problems of urban functional and visual impression became exponentially evident and pronounced. Lost development opportunities were reflected in slower economic growth, in rising civic maintenance costs, and the slow loss of identity.

5.2   Developing the Town Centre of Žiri

The process of reading the space for intervention and designing a solution for it was rather linear. Spatial studies began with the organisation of a student workshop held by the Faculty of Architecture, UL, in collaboration with the Municipality of Žiri. The teams of students each developed a different solution under the mentorship of the teaching staff at the faculty and with consultations with the relevant staff of the municipality. Suggestions, comments, and criticism were collected and served as a basis for the design of a final solution that finally received general approval from the public and was within the boundaries of the municipality, which was the investor in this case.

5.2.1   New City Centre – From the Idea of Sustainability to Resilience Design

The location perceived by the local population as the town centre has been affected by a growing number of floods in the recent years (Fig. 5.2, Fig. 5.3). The lack of maintenance and proper regulation of the nearby torrential water stream has caused a deteriorating situation in terms of flood control. Inappropriate technical regulation of the watercourse banks was found to be the main cause of this situation. While being one of the main focuses in the urbanisation of Žiri, as a result of technical issues the Račeva stream became forgotten by the town's residents. The river was clearly identified as a part of the identity of Žiri in the past. As the vegetation gradually overran the stream banks, direct access to the Račeva is now completely denied.

FIG. 5.2 Račeva river about to flood, 22nd October, 2014 *(Image by Dejan Kacin, DK PICTURES, 2014)*

FIG. 5.3 Flood warning map *(Data sourced from Geopedia and Slovenian environmental agency, May 2007)*

In terms of developing the Žiri square, we talk about wider arrangements, including the Račeva stream; here, we stand in front of a dilemma that is, in this case, a quantifiable element in terms of scale and size. The square, i.e. the central part of the public space, has an area of 40–60 m × 55–70 m, while its diversified shape creates in itself an inherent hierarchy between ambiences. This dimension includes the area of roads and parking areas and the empty space between the buildings. The area intended for the market is clearly delineated, next to the cultural centre and a store. Because of the road and the level of the Račeva river area, the dimension changes into an irregular quadrilateral of 25–60m × 80–90m in size. The areas of the market place and the parking area intersect with the main square, The open public space transforms into the landscape and thus "escapes" any spatial quantifiability in the river area. In developing the system of the recreational axis, i.e. 'horizontal connections', which complements the central role of the square, the developments and connections with natural elements, i.e. vegetation, trees, water, forests, play a major role. In the context of (in)finity, water is the central element. However, in the case of Žiri and the Račeva stream area, this is not the case. The square and settlement itself are set against surrounding hills. The developments are subordinate to the system of sequencing in space and connecting the levels between the square, the river, and the landscape.

Creating more than a mere engineering design to fight off floods was the goal of the proposed project solution. Pouring vast quantities of reinforced concrete and economical resources as part of a strictly technical engineering solution would solve the problem, but would

lack any additional value and would further impact the location. Consequently, the design solution conceived the stream banks as new open public spaces with a selection of programmes. The supporting wall was formed in such a way that it can host a small climbing wall (Fig. 5.6). A platform close to the water became a sidewalk that follows the water stream, and ramps were introduced so that the higher level of the town's public spaces is connected to the newly created spaces with a technical feature, allowing for the disabled to access the water freely and thus ensuring good accessibility for everyone (Fig. 5.4, 5.5, 5.6). The municipal council decided that, if successful, this intervention would represent the first phase of a wider intervention. The results would then be used as an incentive and an encouragement for the further reconstruction works of open public spaces that are perceived as the wider context of the town centre.

FIG. 5.4 Visualisation of the Račeva river bank design proposal *(Fikfak, Grom, & Kalčič, 2016)*

FIG. 5.5 Visualisation of the river bank connection to the upper-level platform showing reduced motorised traffic surfaces and uniformity of material and detail features *(Fikfak, Grom & Kalčič, 2016)*

FIG. 5.6 Visualisation of the placement of programmes in the square/upper-level showing possibility of flexible uses, material selection, and traffic segmentation *(Fikfak, Grom & Kalčič, 2016)*

This second phase was executed at the level of variant idea projects, in which all the separate solutions followed the specific goal of establishing a multipurpose open space of "identity creation" and self-reflection. At the risk of sounding high-spoken and idealistic, this non-material element is the exact effect that is necessary to establish a long-term sustainable and resilient solution. The watercourse banks are flood-proofed, the degraded surfaces of the banks have been reinvented and returned to use by the implementation of creative solutions, the higher-level town centre areas have been re-connected to the water, the wider town centre with its spaces has been restructured, and the neglected character of the town has been re-established (Fig. 5.4).

Ensuring a resilient result in an urban intervention through adequate design features, the correct material selection and an adequate project solution is only the start (Fig. 5.7). These material and measurable elements need to be in balance if they are to become the basis for a new perception of the role of the place where the intervention took place. The perception of the user makes sure that the place will become resilient, not as much to future material changes, but to the change of the role it has for the people, only when a measurable solution transcends the materiality.

FIG. 5.7 Visualisation of the Žiri centre renovation proposal *(Fikfak, Grom & Kalčič, 2016)*

₆ Discussion – Thinking of Four Dimensions in Time and Space

This paper places emphasis on spatial quantifiability, (in)finity, and in terms of spatial perception, the identity, the image of the city, lost spaces, voids, and invented places. At the heart of physical elements and quantifiability, lies the dilemma about the location as a "place", while in terms of identity and voids lies the dilemma about "space". This dilemma is complemented by the mystique of the specificities of a site, or "genius loci", which includes the quality of the "sense of place". In genius loci, this mostly refers to the identity of a concrete place, to nature's own identity, and to the human relationship toward it. Identity and interactions are the key terms of ecological awareness. It is important to recognise two basic elements: symbols and structures of *locus*. Symbols present its content, its mental part, while the structure of shape represents its formal part (Norberg-Schulz, 1984).

On the other hand, the word "dimension" has a double meaning: 1) a simple quantitative measure of a line or a pixel; and 2) more complex aspects of time and space, built up in layers of perception and memory, purpose, and understanding. However, by defining the quantifiable dimension, the geometric explanation, we find that this "dimension" does not include everything that means "being". Humans have developed a special dialogue in other dimensions with space, both natural and man-made – the language of the mind – thoughts included in the fourth dimension of space, a space of behaviour, a cosmological space. This form relates to social interactions between individuals and the individual and the society, and vice versa. At the same time, it is clear that, rather than just physical or economic space, humans need space that is intangible and includes *values, beliefs, symbols, and meanings* – values of each individual.

With a mixture of quantification, dimensions, and questions about the infinity of space, we face the challenge of experience and personal integration with space- our experience. Experiential space is also the space that we enter and exit – a hodological space. The basic invention of Lewin was to introduce a new geometrical framework, a "hodological space" (from "hodos", a Greek word meaning "way") (Rainio, 2009), to describe psychological occurrences. There is always the question of what are the ways to it, what are the connections between two points in space (where we never know the start nor end points, and which are also never the same). The road is sometimes easy and at other times hard or, on the contrary, the most pleasant one, depending on one's wellbeing and purpose. The experiential space is never uniform (nor equal): it contains places and in-between places; in a place the goal is activities, while there are no goals in in-between spaces, only distances.

The understanding of the fourth dimension "Spacetime", which cannot be measured in metres, is the basis of spatial paradigms that follow progress that is both sustainable and resilient in nature.

7 Conclusions

It is unavoidable to define what makes an urban intervention, or temporary use of space, sustainable or/and resilient is a combination of several elements. The basic step is the function and impact of the technological detail that follows and respects the idea of sustainability and makes the result of an intervention in space a resilient solution. We can call a solution a "good design" when the sum of the singular elements is more than the singular element alone. If the sustainability of intervention is what supports the definition of identity, measurability, and (in)fininty in space, and has a positive impact on its user, then the "duty" of resilience is to replace, react, and recycle it when the role or use no longer follows the positive effects (for the user, owner, natural and built environment, and all stakeholders). By considering the basic design dilemmas between the modernistic concept "less is more" and the ecological concept "more is more" or "more from less" (Buckminster Fuller's adage), through sustainability strategy with "more value – less impact", in the resilience strategies we come to "less is more because more is more" (Zolli & Healey, 2012).

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