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LA FORME URBAINE DURABLE: MULTIFONCTIONALITE ET ADAPTATION

Redéfinir les espaces urbains en tant que zones partagées multifonctionnelles

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LA FORME URBAINE DURABLE: MULTIFONCTIONALITE ET ADAPTATION

Résumé

Plus de la moitié de la population mondiale vit dans les villes et cette proportion ne cesse d'augmenter. Afin de rendre nos villes existantes plus durables, de générer de nouvelles formes d'installation et d'apporter des modifications en plus, l'utilisation des installations actuelles devraient être plus efficace ainsi.

Un espace urbain, à différentes échelles –un immeuble, un îlot, un quartier ou une ville entière- a une fonction définie, qui est limitée à certaines heures de la journée, les jours du mois ou les mois de l'année. Par exemple, les places de stationnement d'un immeuble possèdent de nombreux espaces libres pendant les heures de travail, tandis que l'aire de stationnement d'un bureau a des zones libres en dehors des heures ouvrables et aussi les jours fériés. Ces espaces pourraient être ravivés avec d'autres fonctions pendant leurs heures de ralenti. D'autre part, les espaces avec des usages privés ou semi-privés pourraient également être attribués à une représentation publique. Par exemple, les cours des écoles peuvent être ouvertes au public pendant les vacances scolaires et temporairement utilisées comme un espace communal partagé.

L'objectif de cette thèse est d'étudier les possibilités de faire revivre les espaces publics et semi-publics pour d'autres fonctions que leur fonction principale, pendant leurs heures creuses, afin d'en faire des espaces partagés multifonctionnels. Pour cet objectif, l'identification et la compréhension du fonctionnement de ces espaces, leurs fonctions actuelles et potentielles, et enfin leurs utilisations possibles sont d'une importance primordiale. Il est impératif de déterminer l'ensemble des possibilités

d’usage, mais aussi les limites de tels espaces, d’envisager les restrictions juridiques, réglementaires et/ou culturelles, au regard des besoins des utilisateurs potentiels ou des acteurs locaux. Environ 80 cas ont été analysés qui sont spontanément utilisé comme un espace multifonctionnel ou qui ont le potentiel d'être l'un d'entre eux. 30 critères ont été sélectionnés pour l'étude et l'analyse des espaces urbains multifonctionnels.

Le résultat final est un ensemble de critères recommandés à prendre en considération pour changer un espace monofonctionnel à l'un multifonctionnel. Ces critères nous conduisaient à l'information qui doit être recueillie dans le but de créer une base de données SIG. Nous concluons par une discussion sur les capacités des SIG pour atteindre les objectifs dans ce domaine et de la façon d'améliorer ses fonctions.

MOTS CLES: durabilité urbaine, forme urbaine, espace partagé multifonctionnel, SIG, des outils de prise de décision.

Résumé en anglais

More than half of the world population lives in cities and this proportion is increasing. In order to welcome new populations avoiding urban sprawl, to make our existing cities more sustainable, besides generating new facilities and making changes, the use of current facilities should be more efficient as well. To satisfy these goals, new opportunities have to be found to strengthen the urban sustainability. The multifunctionality of urban spaces might be an efficient concept to (re)design cities and to propose new urban planning rules.

The aim of our research is studying the possibilities of reviving public, semi-public and private spaces, for functions other than their main destination and during their idle hours, to consider them as multi-functional shared urban spaces. Different types of relation between function(s) of space and time have been studied. It has been tried to clarify the definition of

“multifunctional space” in architecture and urban design based on definitions of the concepts in agriculture and landscape. About 80 cases have been analyzed which are spontaneously used as a multifunctional space or which have the potential to be one. 30 criteria have been selected for studying and analyzing multifunctional urban spaces. The final result is the criteria recommended to take into account while transforming a mono-functional space to a multifunctional one. These criteria would lead us to the information that must be gathered in order to create a GIS data-base customized for this purpose. This research is concluded with a discussion of the capacities of GIS software in the way to improve the operation of an urban space through the multifunctionality.

KEYWORDS: urban sustainability, urban form, multifunctional shared space, GIS, decision-making tool

UNIVERSITY OF STRASBOURG

SUSTAINABLE URBAN FORM; MULTIFUNCTIONALITY AND ADAPTATION

Redefining urban spaces as multifunctional shared areas

Presented by

Atieh Ghafouri

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To my past "ALI"

my future "RAHA"

and my eternity "BATOOL"

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Table of contents

Table of Figures

Tables

1. Introduction

1.1. Background

According to the Intergovernmental group on the evolution of climate, change would lead to a rise in global average temperature of 1.1 to 6.4 °C and it affects all the continents. Therefore, climate change and global warming have led the international community to reduce greenhouse gas emissions (Da Cunha, 2005).

In addition to energy issues, the challenges related to construction and transport play a big role in this game (Figure 1).

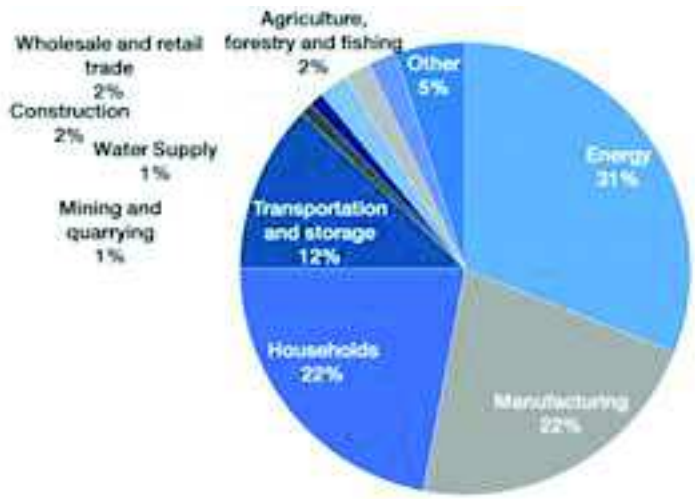

Figure 1: What are the source of European CO2 emissions? (OECD, 2001)

Besides making changes in small scales (isolation and reduce energy consumption in buildings, using sustainable materials, the use of renewable energy), the form of the city has a considerable impact on the whole city's function in this process.

More than half of the world's population lives in the cities and this ratio is increasing steadily (U.N., 2015). Consequently, landscapes and forms of the cities are constantly changing, developing and expanding horizontally and vertically. In addition, urban sprawl is recognized as a harmful process, due to the increase in CO2 emissions, increase of artificial soil, fragmentation of landscape in peri-urban areas and so on (Ng, 2009). Costs incurred by this spread (such as transport, infrastructure and outlying areas) are of paramount importance. Moreover, the

vertical growth and increased density degrades the quality of life of citizens, favor the diffusion of diseases or the vulnerability of population (Soule, 2006; Squires, 2002).

Many experts have tried to address this complexity (interaction between social, environmental and economic aspects) from different points of view. The concept of sustainable urbanism faced this problem through various issues identified: social issues (mobility and equity), technical issues (infrastructure and urban form), mobility (transport, routes and infrastructure) and resources (energy, food resources and materials). It involves the objectives such as democracy, social welfare, preserving natural resources and environment, economic viability and transportation and it requires a framework that can encompass all these aspects (Farr, 2012; Favet & Gauzin-Müller, 2002; Haas, 2012). These different aspects are shown in figure 2.

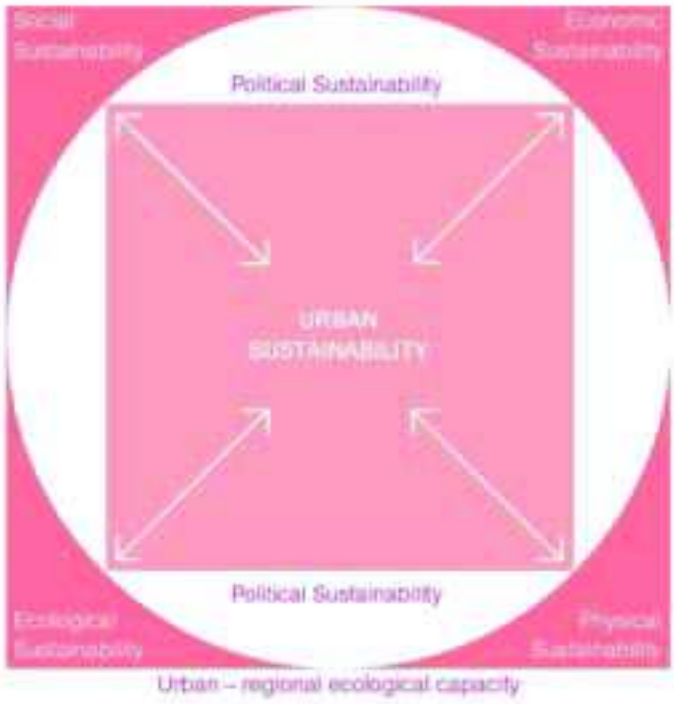

Figure 2: The 5 dimensiions of urban sustaiability (Allen, 2001)

The Urban form (the spaces, buildings, paths and boundaries that define city life) is considered as (a) a “general pattern of building height and development intensity" and (b) the "structural elements" that define the City physically, such as natural features, transportation corridors (including the planned fixed rail transit system),

open space, public facilities, as well as activity centers and focal elements. "Neighborhood design" is defined as the physical character of neighborhoods and communities within the City (Warner & Whittemore, 2012). A sustainable form should have these characteristics (Jabareen, 2006):

- **Formal and physical aspects**: 1) compactness and population density (increased structural compactness in urban development: increasing population and building density, directing the structural urban development in a compact way along the path of fast lines of public transportation, creating multiple urban centers in metropolitan area by considering the proportion of population and employment opportunities in each area, turning towards urban village models for residential neighborhoods and preventing sprawl by creating mixed-use area); 2) polycentric structure, varied densities (in city center, intermediate area and suburb); 3) urban form facilitating active mobility (walking, cycling, skating, etc.); 4) walkable neighborhoods, adaptive and flexible zoning and land use plan

- **Social aspects**: mixture of generations and generational adaptation, social diversity (a sustainable city is one with diversity which is supported by the people whithout social or income group separations. all individuals and groups have access to services and basic facilities and residents have equal status.)

- **Environmental aspects**: integrated with nature, building design adapted to climate change (materials, compact form, ventilation corridors, etc.) or nature based solutions.

But when the city goes to the density, without taking into consideration the other aspects of urban sustainability (environmental and social aspects) and the need for facilities related to urban design, such as mixity of uses and activities, transport choices and the spaces for non-necessary activities (optional, social and recreational), we reduce the quality of life of residents (Gehl, 2011). Quality of life is a multifaceted concept that embraces not only the material aspects of life, such as level of living and availability of social and physical infrastructural facilities but also less tangible aspects of life such as good health and opportunities for recreation and play (Lim, Yuen, Low, Building, & Estate, 1999). Now the question is: "*How can we*

expand the functionality of our existing urban spaces, for more hours and with higher efficiency?"

In this research our hypothesis is rooted in the idea of multifunctionality. This idea first has been used in the field of agriculture. We assume that the multifunctionality of urban spaces can optimize their operating rate and improve the quality of life of citizens. It reduces the drawbacks of both urban sprawl and excessive urban density. This idea is not a new concept (especially in agriculture and landscape) but this research tries to adapt it as an answer to the dilemma of compactness of future cities and the quality life of citizens.

1.2. Research Goal

Our objective is to explore the possibilities to revive the public, semi-public and private urban spaces for functions other than their main during their idle hours, in order to make multifunctional shared spaces.

1.3. Research questions

This research aims to answer the following questions:

Can we expand the functionality of our existing urban spaces, with higher efficiency and for more hours? Can we use private or semi-public open areas for public purposes? How it can be possible? What kind of spaces we need? What are the characteristics of theses spaces? What is going to change with this concept?

1.4. Research assumptions

In order to adapt our cities for the future regarding the increase of the urban population and global issues, the hypothesis of this research is rooted in the idea of multifunctionality of urban spaces. We would like to define a method adapted to this

goal, able to help to choosing the appropriate areas (within the urban agglomeration) with potentialities to become a multifunctional urban space.

We believe that the multifunctionality of urban spaces (even in local scale and small areas) might optimize their operating rate and in consequence (according to Gehl, 2011) improve the quality of urban spaces and therefore, the quality of life of citizens. It reduces the drawbacks of both urban sprawl and excessive urban density.

To reach this aim, understanding this kind of spaces, their functions, and possible added uses is of paramount importance. For this goal, it is imperative to determine the possibilities but also the limitations of urban spaces considering legal and/or cultural restrictions, as well as the needs of the possible users.

This research deepens first the definition of multifunctionality of spaces, the developed approach is described in the second part and the third part presents some conceptual proposals and patterns and illustrative realizations. The next section, is putting an experimental scenario into test for the city of Strasbourg. This research ends by proposing a perspective: introducing a tool named SOLAP (Spatial On-Line Analytical Processing) as a possibility to simplify the decision-making process.

1.5. Research background

The concept of multifunctionality was introduced in many international negotiations since 1992 to allow public aid to agriculture by legitimizing governments to offer farmers compensation for additional functions such as meeting other demands from society. Multifunctional agriculture, beside food production, considers the ecological, economical, socio-cultural, historical and aesthetical roles and values of the farm.

In this regard, multifunctionality is the ability of rural spaces to fulfill more than one function at the same time, such as the provision for healthy recreation while performing nature’s ecosystem services. This concept requires both planning and ecological management to optimize these functions. This holistic view makes a direct

relationship between multifunctionality as an activity-oriented process and sustainability as a resource-oriented process (Brandt & Vejre, 2004).

But this is a little bit different in architecture and urbanism. In architecture the word «function» is one of the keywords and refers to the building's purpose and the activities the designers define to be done by users inside the space. This word is always used in the architectural literature beside the words "form, space, stability and beauty". Although there is somehow a gap between the defined function for the space and the activity done by users inside (use), the "multifunctional spaces" concept has been always used beside the mixed-use, multi-use and multi-purpose buildings and often without any distinction or difference.

In urban design, this concept has a more precise definition. Ziedler (Zeidler, 1985), relates the concept of multi-use construction to the ancient Greek or medieval constructions. In his book, Mmulti-use architecture in urban context (Zeidler, 1985), he mentioned that the city should be a pattern of different uses and activities. As the best example for such spaces, there were "Agora"s. Agora was a central space or square in city-states of Ancient Greece. The agora was the centre of athletic, artistic, spiritual and political life of the city (Madanipour, 2003).

In this research, in our definitions of multifunctionality, the notion returns to the synergy between the various functions which are combined in one area. This synergy comes into existence due to the interaction between activities.

1.6. Methodology

The approach of this research is comparative, composed of studying, analyzing and evaluating similar experiences initiated worldwide to find the preconditions and prerequisites of a multifunctional space.

We have identified the different types of urban spaces and analyzed their current operation to find all the new opportunities for shared uses taking into account the legal, cultural and organizational restrictions.

We used a combination of Case-based reasoning (a common research method in industrial design and artificial intelligence) with the Pattern Language theory of Christopher Alexander (Alexander, Ishikawa, & Silverstein, 1977) for analyzing the 80 cases. We developed a reflexive approach in which each new case makes us revise our process in order to precise the choice and the criteria of search/analysis. We used these criteria for proposing a conceptual GIS data model. Based on the cases we analyzed, in a scenario we tried to put our findings into practice for Strasbourg: the schoolyard playgrounds. In this experimental scenario, we used GIS to visualize and evaluate the impact of this concept on the residents' life.

1.7. Research scope

The approach of this research is composed of the study of the experiments initiated all over the world in this field to adapt to the city of Strasbourg.

1.8. Achievements and results

Although the concept of multi-functional space exists in architecture, but the definition we clarified (using the definition of multifunctionality in agriculture and landscape) is the value of this research. This research argues for multifunctional spaces as an essential element for sustainable urban design. It outlines the development of the concept multifunctionality, and defines its use within urban design practice.

Based on the clarified definition, this research proposes a structured framework analysis for multifunctional urban spatial design, including various indicators and measurement tools to consider diverse activities and functions within a space. The originality of this research is in the empirical cases collected to develop a typology and characterization of multifunctional opportunities in an urban setting that can contribute to a great discussion on the role of multifunctional spaces in creating sustainable urban forms.

Table 1: Research key elements

Problem definition	The future cities: adapting to population growth and climate changes
Research assumption	The idea of multifunctionality can optimize the operation of urban spaces. It reduces the disadvantages of urban sprawl and increased urban density as well. (Increasing commuting, consuming space, heat islands, social tensions, etc.)
Research goals	Improving “functional performance” of current urban facilities besides generating new facilities and making changes in order to make our existent cities more sustainable
Research objectives	Feasibility study of reviving public, semi-public and private spaces for functions other than their main purpose and during their idle hours to make multi-functional shared urban spaces within urban planning strategies in order to improve the sustainable urban forms
Approach, Methodology	Comparative: bibliographical search (literature review and extraction the morphological, functional, cultural indicators), CBR (Case-based reasoning), Pattern Language, AHP (analytic hierarchy process)
Research program	Study the different types of urban spaces and analyze their characteristics to release all new shared-use opportunities considering legal, cultural and organizational restrictions. The project will draw on a wide bibliographical research and global experiments to suit to our case
Tools	GIS software (ArcGIS) for see the spatial impact of an experimental scenario for strasbourg
Expected result	Planning principles for the creation of multifunctional shared spaces based on global experiences[1]

[1] Although, in the title of thesis the terms "urban form" and "adaptation" have been used, the main focus was on the concept of "multifunctionality" and the approach towards these terms was relatively general and roughly classical.

2. State of Art: What is multifunctionality?

2.1. Introduction

The expression “multifunctional” has different meanings in different fields. For example, literally the meaning of multifunctionality refers to something that has or fulfills several functions (Oxford, 2016). For example, Roman Jacobson defines 6 different functions for the language (Rudy, 1990):

1. The Referential Function
2. The Poetic Function
3. The Emotive (alternatively called "Expressive" or "Affective") Function
4. The Cognitive Function
5. The Phatic Function
6. The Metalingual (alternatively called "Metalinguistic" or "Reflexive") Function

Therefore, the linguists consider the language as a multifunctional phenomenon. While the phrase in literature and linguistic could have different meanings that does not reach to mind easily, the definition of the phrase in planning and urban design could reach to a general definition of the subject from a different points of view.

Beside that the term of " Multi-objective function optimization" could be found in engineering and economics which is an area of multiple criteria decision making, that is concerned with mathematical optimization problems involving more than one objective function to be optimized simultaneously (Caramia & Dell'Olmo, 2008). This method is used for solving the complex problems.

In linguistics, the different functions of the language have been considered. In industrial engineering, the mentality was mathematical. In agriculture, landscape and urban planning the regard has been more specialized and spatialized. "Multifunctionality" as a concept has several roots: some authors consider it as an old architectural concept in urban areas by relating it to the ancient Greek or medieval constructions (Zeidler, 1985). Others consider it with a background in agricultural studies (OECD, 2001) specifically in subjects such as agricultural intensive production or modification in production systems. It's about the idea that agriculture has many functions in addition to producing food and fiber, e.g.

environmental protection, landscape preservation, rural employment, food security, etc. (WTO, 2015).

In this research, it is tended to be inspired by all of these definitions and look at a multifunctional space with a general regard: once as space, once as an object that has different aspects and at last as an active system who could be optimized. This definition would be explained according to this approach in next sections.

2.2. Multifunctionality in agriculture, ecology and environmental studies

The concept of multifunctionality was introduced in many international negotiations since 1992[2] to allow public aid to agriculture by legitimizing governments to offer farmers compensation for additional functions such as meeting or other demands from society (Dufour et al., 2007). The effects of these additional functions could be broadly classified as benefits to society, culture, a national economy as a whole, national security, and other concerns. For example, in addition to providing food and plant-derived products for the population, agriculture may also provide jobs for rural people and contribute to the viability of the area, create a more stable food supply, and provide other desired environmental and rural outputs (OECD, 2001).

The concept of multifunctionality also has been entered in other parts of economy other than agriculture such as forestry, fishing and banking (OCED, 2001).

2.2.1. Definition

Multifunctional agriculture, beside food production, considers the social, environmental and economic rules and values of the farm (Pérez-Soba et al., 2008).

[2]United Nations Conference on Environment and Development (UNCED) 1992, World Food Summit 1996, OECD 1998, 2001; World Trade Organization, 1998

This concept in the field of landscape, considered these 5 roles simultaneously (Brandt & Vejre, 2004):

1- Ecological role (as an area for living)

2- Economical role (as an area for production)

3- Socio-cultural role (as an area for recreation and identification)

4- Historical role (as an area for settlement and identity)

5- Aesthetical role (as an area for experience)

A multifunctional landscape is a Landscape that provides a range of beneficial functions across production, ecological, and cultural dimensions, considering the needs and preferences of the owners and users (Lovell, 2010; Otte, Simmering, & Wolters, 2007). This shows the importance of actors' role in succeed of this concept.

As it is demonstrated in figure 3, according to Lovell and Taylor (2013) for the definition in agriculture, the multifunctionality of the system has been considered in a hierarchy. Although in a sustainable definition all the aspects have the same and equivalent value, cultural aspects have been considered before other aspects.

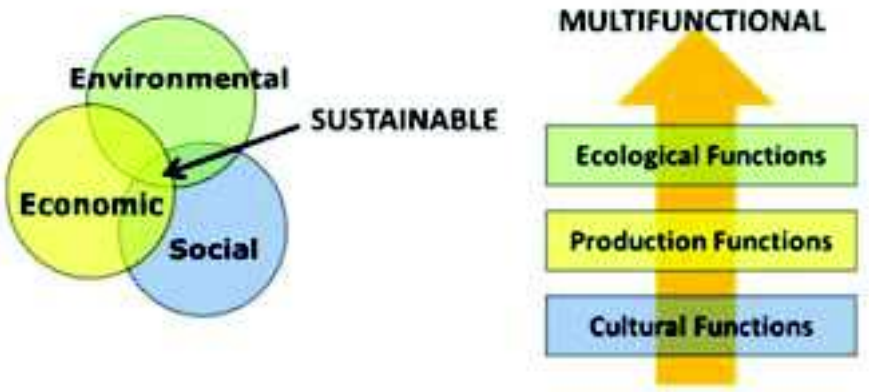

Figure 3: Comparison of the concept of sustainability with that of multifunctionality (Lovell & Taylor, 2013)

As an example for this type of landscape, the wine route in Alsace, France could be mentioned; where there are different roles beside each other: vineyards, which provide a special land pattern, an identity for the whole area, an aesthetical experience and an attractive place for the tourists.

There are many examples of such rich landscapes all over the world. The figures below illustrate different aspects a landscape might contain. The first figure (Figure 4) focuses on the economic and identical aspect, the second one (Figure 5) concentrates on historical and cultural roles beside economic and ecological values and the last one (Figure 6) represents the esthetical aspects.

Figure 4: Wine route in Alsace, a good example of a multifunctional landscape (www.alsace-wine-route.com, 2015)

Figure 5: More than 3000 dovecote[3] in the farms around Isfahan (Iran) that became to historical monuments (as a part of cultural landscape).

Figure 6: The rice fields in the north of Iran which have the aesthetical value and attract the tourists (beside food production)

[3] A dovecote is a structure for gathering pigeons or doves for agricultural use. Their droppings were prized by farmers and were thus collected for fertilizing their arid fields, in leather industry and gunpowder. The possession of a dovecote was a symbol of status and power and was consequently regulated by law. In Iran, these dovecotes could be found near Isphahan and Yazd.

These various functions, whilst providing the ‘ecosystem services’ that benefit humans directly or indirectly, will need to be considered simultaneously and to be balanced to meet the needs and preferences of local residents as well as society as a whole (Lovell & Taylor, 2013). Ecosystem multifunctionality has long been recognized as a pre-condition for sustainability in unmanaged systems (Hein, van Koppen, de Groot, & van Ierland, 2006), and recently the interest in multifunctional landscapes has expanded to intensively-managed ecosystems (Brandt & Vejre, 2004; Piorr & Müller, 2009). The existence and preservation of ecosystem services are necessary for biodiversity and these services should be kept and developed for preserving the biodiversity.

In this regard, multifunctionality is the ability of spaces to fulfill more than one function simultaneously, such as the provision for healthy recreation whilst performing nature’s ecosystem services (L. Grant, 2010). This concept requires both planning and ecological management to optimize these functions. This systemic view makes a direct relationship between multifunctionality as an activity-oriented process and sustainability as a resource-oriented process (Garzon, 2005; L. Grant, 2010; Mander, Wiggering, & Helming, 2007).

The systemic approach leads to consider the various dimensions of this concept and the associated objectives according to the identified areas: agricultural, forest or peri-urban areas. The advances realized in multifunctional agriculture or forestry show the different steps of maturity of the concepts from multi-uses to multi-purposes or multifunctional objectives. The possibilities to attach several objectives to a place, for instance a recreational objective and an agricultural production one, lead to adapt the way to manage the area, the possibility to access to the site and the relationship between producers and other actors. If multi-purposes are defined the conception of these areas need to be set up on in a comprehensive vision, passing through the various components of the studied system, its spatial scales and social, economic and natural dimensions. According to what has being said, a multifunctional approach focuses on the various roles areas can play. This extensive concept must be considered globally and comprehensively in order to embrace the complexity of such elements (Vaz, 2010; Wilson, 2007).

2.2.2. The benefits of Multifunctionality in agriculture, landscape and ecology

Although it seems that the concept of multifunctional agriculture is formed on the basis of optimizing production systems, but in this evolution, the function has changed its initial meaning from “use” to “role”, “purpose” or “target”. In order to integrate all these purposes, a comprehensive transdisciplinary approach is definitely needed. The goal is to coordinate the roles in the way that the growth in one feature does not lead to weakness in the others (Mander et al., 2007; Naveh, 2001; Tress, Tress, Decamps, & D'Hauteserre, 2001).

Figure 7 demonstrates different social, economic and environmental roles of a field along with the realization of purposes such as cultivation and commercialization of traditional food, valuation of environmental services and recognition of traditional and diversified land-use. Although the final target is still the food production, this target is realized through different roles and purposes (objectives).

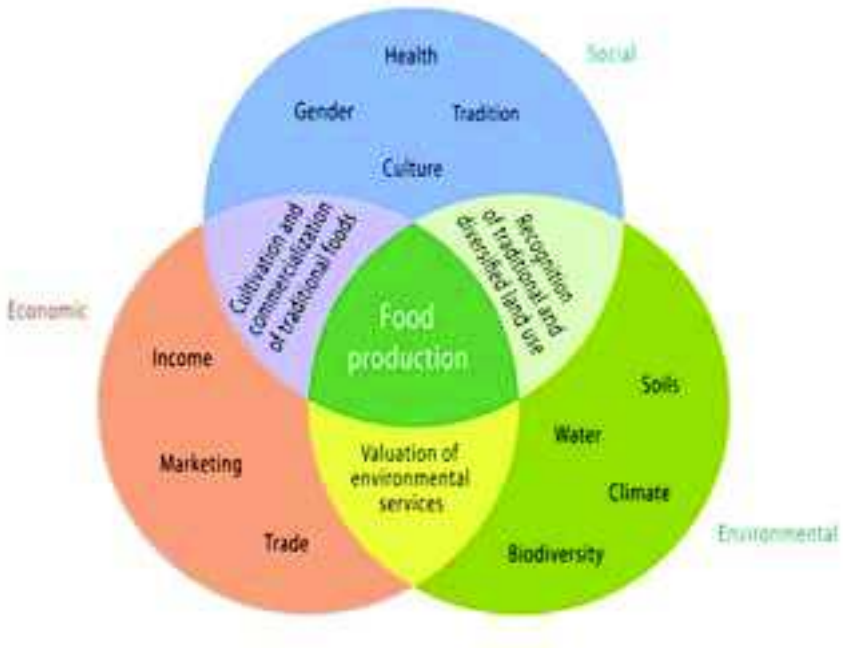

Figure 7: The inescapable interconnectedness of agriculture’s different roles and functions (IAASTD 2008)

The most important social value of the concept of multifunctional agriculture is that it ensures the social viability of rural areas. It leads to “rural development” by proposing “alternative activities” (Karasavvoglou, Ongan, Polychronidou, Todorova, & Ikova, 2014). The fact that it considers the different roles and values of a place, results to a diversity of activities which attracts different social groups with different backgrounds and leads to a wide social mixity (Gehl, 2010; McGlynn, Smith, Alcock, Murrain, & Bentley, 2013). Its non-commodity outputs include also nutrition safety, food production security and the welfare of production together with cultural and historical heritage which also can be considered as social effects and impacts.

From the economic point of view, a natural framework for multifunctional agriculture is a model where the emphasis is given to heterogeneity of land-use policies of agriculture and on the changes in farmers’ incentives because of changes in profitability between crops under alternative policies (Ollikainen, 2005). The policies in each country might lead to different social consequences which are out of the scope of this study. In fact, the important point is that the agriculture has turned into a complicated subject that includes many elements with different roles, but the target still remains the food production.

2.3. Multifunctionality in architecture, urban geography and urban design

The word «function» is one of the keywords in architecture and refers to the building’s purpose and the activities done by users inside the space. This word is always used in the architectural literature beside the words “form, space, stability and beauty” in the scale of a building and it is equivalent to the concept “utilitas” that Vitruvius made in the first century AD. Therefore, “multifunctional spaces” concept has been used beside the mixed-use, multi-use and multi-purpose buildings and often without any distinction or difference. In fact, the concept of multifunctionality could be linked with the concept of multi-uses (which means the different uses of space in different times) (Zeidler, 1985) and the concept of mixed-usage (which means having a combination of at least 3 different revenue-producing uses in a specific period of time) (Florida, 2002).

In urban design, this concept has a more precise definition. Ziedler (1985) focuses on the "space" and "function" and relates the concept of multi-use spaces to the ancient Greek or medieval constructions. He believes that the city should be a pattern of different uses and activities (in city scale not just a building). These various uses come at first from the buildings but they spread in the whole city by a comprehensive planning. He believes that the characteristic of multifunctionality should not be confined to a single space, but in logic of an integrated network, promoting functional complementarities between several public spaces in the city, always keeping the principle of proximity in mind (Pinto & Remesar, 2009).

2.3.1. From zoning to multifunctionality

Contrariwise the classical point of view about the variety of uses in different parts of the city, modernists were against any kind of mixed-use. By exact separation of land uses from each other, they wanted to create a city which is free of nuisance and pollution. They introduced the concept of "Zoning". In Principles and Practice of Urban Planning, William Goodman (1968) defines zoning as follows: "Basically, zoning is a tool to guarantee the proper interaction of land uses with each other in urban communities and to provide sufficient space for any kind of development (Goodman & Freund, 1968). Zoning makes it possible to control the density of development and also lays the groundwork for providing public facilities such as streets, leisure spaces, and systems related to infrastructural facilities to citizens. Zoning also directs growth to suitable areas and guarantees the necessary light, air, and privacy for existing areas." (Institute for Training in Municipal Administration & Association, 1941)

Another definition is provided by Arnold Whittick (Whittick, 1974) who defines zoning as follows: "Zoning is dividing the city into zones or areas based on current land use and their potential use in order to control and direct land use".

According to presented definitions, it can be concluded that zoning is a kind of regulation formulated for executing land use plans. Zoning regulations divide the city into zones in a map (or a series of maps). Regulations for how to utilize each land is

compiled in a report by enumerating all authorized land uses in each zone. Furthermore, these regulations specifically determine minimum component size, permissible height for buildings, maximum building density, minimum open space, maximum foundation and building occupancy levels (Saeidi Rezvani, 2001).

In France PLU (plan locale d'urbanisme) is one of documents that regulate urban development, it is a reflection of the idea of zoning, even though it changes its way to the mixity in recent years.

2.3.2. The disadvantages of Zoning

Later experiences showed that ideas of modernists were unsuccessful in practice and was abused by procapitalists.

On the one hand, single function residential complexes resulted from zoning were lacking the necessary dynamism, mobility, and diversity for urban life. On the other hand, in terms of indicators such as green and open spaces per capita, they did not have a suitable condition due to economic constraints (Saeidi Rezvani, 2001). Also, single functionality of urban areas led to traffic congestion, increased per capita trips, and increased population in the commercial city center and other similar single functional areas in some daylight hours and its evacuation in other times, which was not favorable in both cases.

These shortcomings raised serious criticisms from other theorists towards zoning. Emphasizing anthropocentrism, Jane Jacobs (Jacobs, 1961) insisted on mixed-use (and not separated land use). The solution provided by Jacobs is not generalizable. The idea of implementing mixed-use in a way that there would be constant monitoring of streets is not applicable in every part of the city. For instance, there is not enough demand for creating cultural and artistic institutions in low-density areas.

Nowadays it seems that experiences of the past half century have made urban planners aware of adverse consequences of inflexible separation of land uses. As a

result, various solutions for flexibility in zoning regulations have been proposed and implemented.

2.3.3. Multifunctional land-use vs. Zoning

In recent years, city planners have introduced the notion of multifunctional land use as a new concept for urban land use. It can generally be defined as the combination of different socio-economic functions in the same area (Verhoef, 2004). This concept aimed at a spatial and socioeconomic synergy of different land use functions in order to save scarce space by intensifying its use, while still maintaining a high level of spatial quality (Nijkamp, 2003).

Although a commonly accepted definition of multifunctional land use is still lacking, the notion returns to the synergy between the various functions which are combined in one area. This synergy comes into existence due to the interaction between activities. This is underlined by Brandt and Vejre (2004) who introduce three types of multifunctionality states according to the spatio-temporal characteristics of land (Brandt & Vejre, 2004):

1. A spatial combination of separate land units with different functions;
2. Different functions devoted to the same land unit but separated in time;
3. The integration of functions on the same unit of land at the same time.

All these types share the fact that, from a certain perspective, they choose some kind of "optimal" arrangement and superimposition of land-uses (Potschin, Klug, & Haines-Young, 2010).

A re-design of existing land use in the city with a view to a multifunctional urban planning concept has huge implications for business activities as well as the quality of life of the residents (Rodenburg, Nijkamp, Groot, & Verhoef, 2009). At the same time, it can of course be viewed as a measurable spatial-economic characteristic of a given area (Rodenburg, Nijkamp, De Groot, & Verhoef, 2010). Therefore, multifunctional land-use planning is an integrated approach aimed at increasing the efficiency of how land is used in different areas and at different scales (Vreeker,

Groot, & Verhoef, 2004). This capacity helps the planners to control the urban sprawl and urban growth by reviving the existing mono-functional spaces with a function different than their mains' and optimize the operating rate of multi-use spaces toward a multi-purpose project. This approach can enhance the quality of life in the city and thus create valuable spaces. Multifunctional and interconnected urban districts can be the places to live, work, shop and play (J. Grant, 2006). Van Schaick and Van Der Spek (2008) emphasized on the relationship between human being and nature. So they believe that combining these multiple functions and uses within green spaces leads to create high-functioning, high value open spaces (Van Schaick & Van Der Spek, 2008).

Although in these definitions the concept is addressed in large scale and that economic aspects are much more emphasized, compared to social and environmental aspects, this approach can also be applied in local projects and small areas (for example in the scale of a neighborhood or a community). In these cases, the social aspects -improvement of urban vitality (dynamism) and enhancement of the quality of life for citizens- become more influential (McGlynn et al., 2013).

This research focuses on the small-scale multi-functional areas considering the definition given above.

2.3.4. The benefits of Multifunctionality in urban design

If the concept of multifunctional urban spaces would be taken as mixed zoning, some more advantages could be obtainted compared to traditional zoning, such as:

1. Creating balance between residential and employment uses and facilating of providing basic needs of urban life
2. Making a continuous relationship between the individuals and the city enhancing the sense of belonging along with satisfaction obtained from income provision
3. Equilibrium of commercial and residential uses in neighborhoods that leads to enhancement of social interactions

4. Increased diversity resulted from decentralization and distribution of services across the city
5. Increasing the possibility and easiness of accessing to leisure facilities and health services

All the advantages and benefits of the multifunctionality of spaces mentioned before persuade us to use this concept as a considerable method to achieve sustainable urban forms. However, there is an important point that should not be neglected: the notion of "time". Contrariwise the agricultural spaces and landscapes which have an annual functioning rhythm, urban spaces could have various operational time intervals. This subject will be discussed in more details in the next section.

3. Multifunctionality as a new relationship between time, activity and space

3.1. Introduction

This section focuses on the relation between activity and time in an urban space. Time is the indefinite continued progress of existence and events in the past, present, and future regarded as a whole (Oxford, 2016). In physics, space-time is any mathematical model that combines space and time into a single interwoven continuum. The space-time of our universe has historically been interpreted from a Euclidean space perspective, which regards space as consisting of three dimensions, and time as consisting of one dimension, the "fourth dimension" (Archibald, 1914).

3.2. Time-space framework of an event or activity in time geography

In geography, Time geography or time-space geography is an evolving transdisciplinary perspective on spatial and temporal processes and events such as social interaction, ecological interaction, social and environmental change, and biographies of individuals (Thrift & Pred, 1981). Time geography is an integrative ontological framework and visual language in which space and time are basic dimensions of analysis of dynamic processes. Inother words each process occurs in a time-space framework (Hägerstrand, 1970). The concept of multifunctionality could be consideredas not only a relation between different functions and values of a space in a specified time interval, but also something that changes during different time intervals (especially different seasons in agriculture).

3.3. Time-space framework of an event or activity in architecture

In architecture, an activity occurs in a space and in a time framework. Therefore, if we study the whole life cycle of a space we will see that in some periods, space is more elaborate and more efficient. In contrast, in some time intervals it has less efficiency or even might not work.

3.3.1. The notion of "functional efficiency" of a space

In fact, if we consider the maximum functional efficiency (the maximum use that space have been planned for or when crowds fill the space but the space continues functioning) of a space as 100%, different percentages from 0 to 100% (0-1) in different daily, monthly and even yearly periods will be achieve (in comparison with the maximum efficiency).

Figure 8 illustrated the functionality of a space in the course of daily and weekly intervals. In this example space is a place near a high education campus. It is highly crowded by the students and neighborhood residents between 8 and 10 in the morning, the lunch time and also between 4 and 8 in the evening; but it is almost empty around 10 o'clock an after. On Saturday, this place becomes an urban fruits and vegetables market. On Sunday, there is almost no specific function and it is only used as a passing area.

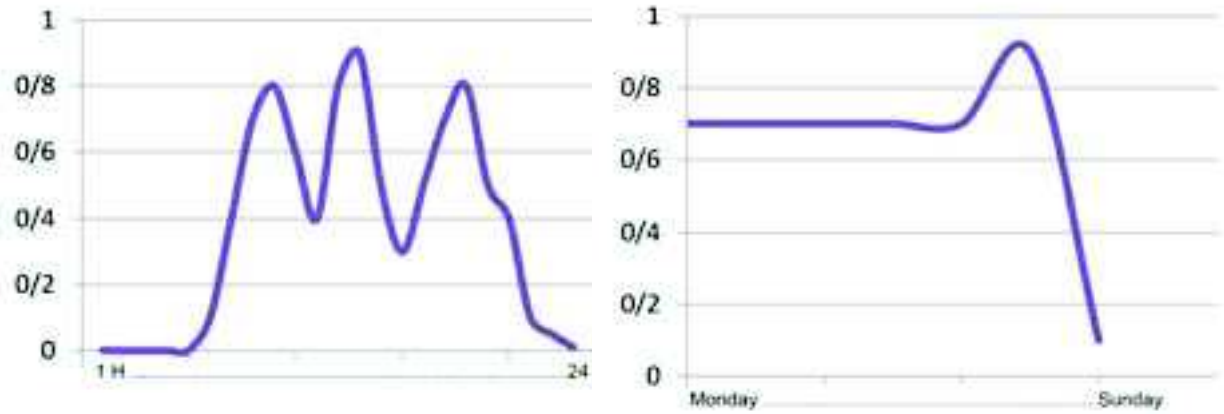

Figure 8: The functional efficiency graph of a sample space during a day (left) an a week (right) (Ghafouri, 2016)

3.3.2. Functional performance of a space in different periods of time

According to Brandt and Vejre (2004), in order to improve the functional performance of the space-time in an area, it is essential to deepen the understanding of relationship between time, function and space.

Function is the main purpose or the main activity a building or an area has been designed to fulfill. The concept of multifunctionality in architecture and urban design relates to the various activities which take place in a location (Iveson, 1998). This concept is at odds with the notion of mono-functional space and can be used in different ways. In addition to the main function of a building, it could be a scene for different type of activities taking place at the same time or in different periods of time. Figure 9 shows the 6 ways of using a space during a cycle of its activity (time).

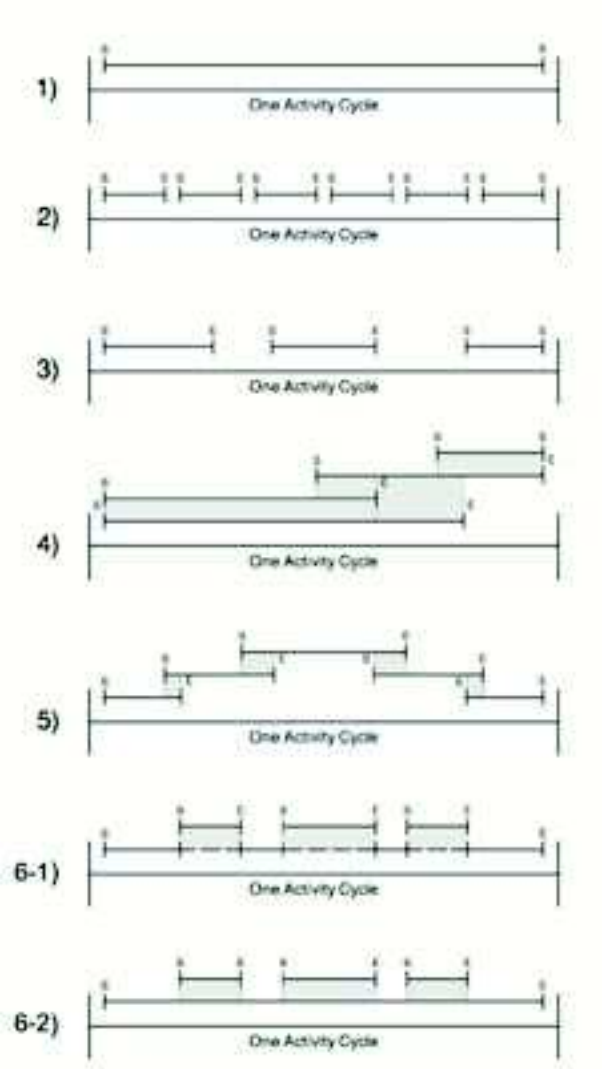

Figure 9: The different ways of using a space (Function) during a cycle of its activity (Time) (Ghafouri, 2016)

1- Mono-functional space: This space has only one function and covers just one activity and one group of users. It is the most general methods for designing the

space and the majority of existing spaces have been designed on this basis (example: an office or a house).

2- Periodic-functional space: The space which change its users or their activity; the new activity begins immediately after the previous and the space is empty just for the short period. For example, a gallery hosts the work of different artists in different art domains over a year. There is a short interval of time between two consecutive exhibitions.

3- Multi-purpose space: Space designed for several activities which need similar installations and equipments. The space can be adapted to the new function and circumstances with a few changes or modifications. For example, a multi-purpose sport hall can provide the facilities for different matches but it is empty off-seasons. There is a remarkable interval of time between two consecutive activities.

4- Mixed-use space: The starting or ending times of the activities correspond to the same moments and there is always more than one activity going on in the space. The majority of time of an activity overlaps with at least one other activity (example: commercial-leisure centers).

5- Complex space: Activities are accomplished consecutively, but at the beginning or at the end they have a short overlap with other activities. These spaces usually have different parts and a sequence of use which permits the new group of users to enter when the previous group has not completely vacated the complex. Although total space is not still empty, some parts can be used for other groups. (Example: a cinema complex)

6- Shared space: Space has a main function, but in some parts of the activity cycle, it can be replaced with another activity or have the two activities at the same time. In cases in which the main activity stops, the first function will be resumed after finishing the replacing function. As example, we can mention the weekly markets which take place in parking lots or the café terraces that occupy a part of sidewalks in some hours of the day. The mono-functional spaces which have the capacity to accommodate two or more activities at the same time can optimize their operating

rate and be concerned with new functions. In our definition, these spaces could also be considered as potential space to be multifunctional.

To clarify this issue we may consider that “an urban space, in different scales - from a residential complex or a city block to a neighborhood or the whole city - has a defined function which is limited to specified hours of the day, days of the month or months of the year”. For instance, the parking spots of a residential complex has many free spaces during working hours; while the parking area of an office has free areas outside working hours and during public holidays. These spaces can be rekindled with other functions during their idle hours. Spaces with private or semi-private uses might also be allocated to a public performance. For example, the school yards can be opened to the public during school holidays and temporarily used as a shared communal space.

A mono-functional space or a mixed-use area can perform better with some little changes. This concept can be investigated in different periods of time. Figure10 shows the potential of multifunctional using in the daily, weekly and annual rhythms. For example, the café-terrace could illustrate the daily rhythm which is a part of the sidewalks especially out the hours of lunch or dinner. Weekly markets could be a good example of a week round activity. The space has a different function in the other days of the week. As a year round activity, we can mention the summer streets and the occasional markets.

Figure 10: The potential of multiple using of a certain space in the daily, weekly and annual rhythms (Ghafouri, 2016)

3.3.3. The notion of "Functional efficiency" and "Functional density" of a space

If considering maximum functional efficiency of a space (using the maximum of space capacities in accommodating users) with number one, comparing space functional in different times with the time that space from functional point of view is on the peak, we could define the notion of functional density.

Functional density which comes out of dividing the number of users of space accommodating by different functions in a specific period by the number of the users in its climax, demonstrates that space in every period has how much capacity for receiving new users and thereupon new functions. This situation happens in events or specific situations. As an example, for the end of school year fete, the school occasionally accommodates almost all the children and their parents but the school is planned only for the children. This new situation is the fruit of increasing the funcyional density and providing various activities for the users.

Functional Efficiency = (the number of users of space in a specific period)/ (the number of the users the space has been planned to accommodate for its specific function in optimum) (eq.1)

Functional Density = (the number of users of space in a specific period)/ (the number of the users of space in its climax by accommodating new functions and activities) (eq.2)

The transformation of space into a multi-functional space is with the aim of maximum beneficiary of space capacities. This densification occurs not only in "space" but also in "time". That means even a space that has all the users it had been planned to accommodate, always has hidden potentials (for diverse activities) that could be extracted in different time intervals.

Increasing the functional efficiency leads mainly to using the space better in the way it has been planned to be, but increasing the functional density mainly focuses on new possibilities for using the space (rather than the initial planning).

3.3.4. The benefits of multifunctionality in architecture and urban planning

If we use the concept of multifunctionality be used in urban areas, the most important benefit of sharing use of a space is reducing the need for new constructions. They not only increase the density in existing urban areas, but also by enhancing the diversity of activates, lead to more vital cities (Batty et al. 2003). The economical value of this result is comparable with its social and environmental values. These three aspects (shown in table 2) are very important for the future world.

Table 2: The benefits of sharing use of urban spaces

The benefits of sharing use of urban spaces		
Social Impacts	**Environmental Impacts**	**Economical Impacts**
- save travel time and increase the effective time for activity - increase the diversity of activities in an area - create a vital attracting area that must be re-visited - improve the citizens' quality of life	- reduce the material use and pollution caused by new construction - reduce urban sprawl and increase density	- reduce the need for new constructions - reduce the need for displacement - improve the economic performance of the whole space - save scare space by intensifying its use - receive a greater number of people at the same space

The multifunctional spaces, in small scales, have many advantages among which we may notice saving travel time, increasing the effective time for activity and decreasing the costs for maintenance, repairing and security because of centralization the activities, facilities and infrastructure. They also guarantee that the people will revisit the space (Pourbakht & Fujii, 2009).

In large scales, urban design and land-use planning, multifunctionality can reduce urban sprawl and increase density, promote spatial and environmental quality, save scare space by intensifying its use, improve the economic performance of the whole space and create a vital attracting area (Iveson, 1998 ; Lloyd & Auld, 2003; Rodenburg, et al., 2003; Vreeker, et al., 2004).

Jan Gehl in his book, “Life between buildings” (2011) distinguishes between different types of activities that occur in an outdoor space: necessary/functional activities, optional/recreational activities and social activities in public spaces. While necessary activities take place regardless of quality of the physical environment, optional activities depend, to a significant degree, on what the place has to offer and how it makes people behave and feel about it. The better a place is, the more optional activities occur and the longer necessary activities last. Social activity is the fruit of the quality and length of the other types of activities, because it occurs spontaneously when people meet in a particular place. Social activities include children’s play, greetings and conversations, collective activities of various kinds, and simply seeing and hearing other people. Communal spaces in cities and residential areas become meaningful and attractive when all activities of all types occur in combination and feed off each other.

It is often possible to use whole or a part of areas dedicated to necessary activities (passing, working or shopping) for other functions in their idle hours or benefit the spaces as a multifunctional area. This will change the quality of life in whole area.

When outdoor areas are of poor quality[4], only strictly necessary activities occur.

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[4] Kevin Lynch (1984) defins a haigh quality urban space whith 8 characteristics:

• Imageability: the quality of a place that makes it distinct, recognizable, and memorable. A place has high imageability when specific physical elements and their arrangement capture attention, evoke feelings, and create a lasting impression.

• Enclosure: refers to the degree to which streets and other public spaces are visually defined by buildings, walls, trees, and other vertical elements. Spaces where the height of vertical elements is proportionally related to the width of the space between them have a room-like quality.

• Human Scale: refers to a size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which humans walk.

But when outdoor areas are of high quality, necessary activities take place with approximately the same frequency but clearly tend to take a longer time, because of the physical conditions. In addition, however, a wide range of optional activities will also occur because the place and its situations now invite people to stop, sit, eat and play.

In streets and city spaces of poor quality, only the bare minimum of activity takes place. People hurry home. But in a good environment, a completely different, broad spectrum of human activities is possible. When the quality of outdoor areas is good, optional activities occur with increasing frequency. This comparison is showed in figure 11.

Building details, pavement texture, street trees, and street furniture are all physical elements contributing to human scale.

• Transparency: efers to the degree to which people can see or perceive what lies beyond the edge of a street or other public space and, more specifically, the degree to which people can see or perceive human activity beyond the edge of a street or other public space. Physical elements that influence transparency include walls, windows, doors, fences, landscaping, and openings into midblock spaces.

• Linkage: efers to physical and visual connections - from building to street, building to building, space to space, or one side of the street to the other - that tend to unify disparate elements. Tree lines, building projections, and marked crossings all create linkage. Linkage can occur longitudinally along a street or laterally across a street.

• Complexity: refers to the visual richness of a place. The complexity of a place depends on the variety of the physical environment, specifically the number and kinds of buildings, architectural diversity and ornamentation, landscape elements, street furniture, signage, and human activity.

• Coherence: refers to a sense of visual order. The degree of coherence is influenced by consistency and complementarity in the scale, character, and arrangement of buildings, landscaping, street furniture, paving materials, and other physical elements.

• Legibility: refers to the ease with which the spatial structure of a place can be understood and navigated as a whole. The legibility of a place is improved by a street or pedestrian network that provides travelers with a sense of orientation and relative location and by physical elements that serve as reference points.

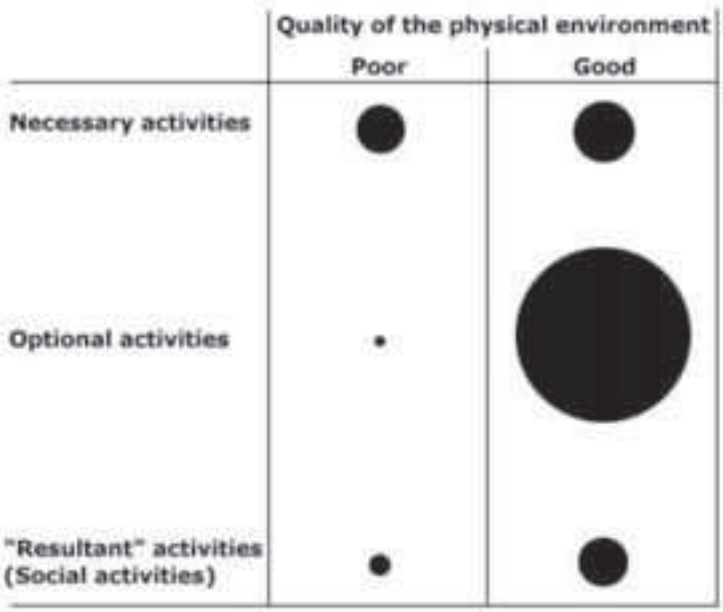


Figure 11: Graphic representation of the relationship between the quality of outdoor spaces and the rate of occurrence of outdoor activities (Gehl, 2011)

3.3.4.1. Functional density: optimizing the capacities of existed spaces with diversified activities

In the event that space could be considered as a set of: space, function(s) (activity) and user(s), the mathematical interpretation of the concept of combining spaces and activities will lead to figure 12. The recovered space could be used for optional activities and as levels of optional activity rise, the number of social activities usually increases substantially.

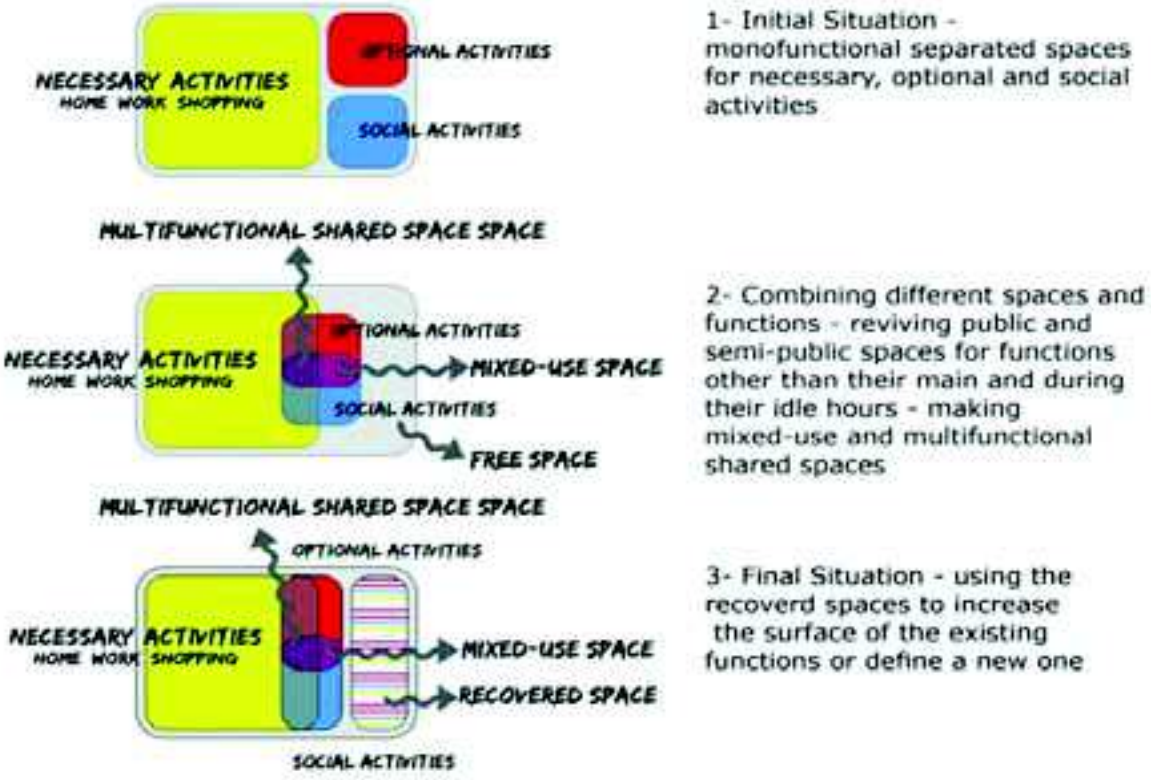


Figure 12: The combination of activities and in consequence, land release for new ones lead to a high-quality space (Ghafouri, 2016)

3.3.4.2. Functional efficiency: optimizing the capacities of existed spaces for a larger time interval

Considering the population growth, an economic way to enhance the functions of spaces is using these existing areas for more people and activities. Thus an appropriate solution is to increase the functioning hours of an area to receive a greater number of people at the same space. Another method is simultaneous using of the space for two or more activities. It is obvious that the combination of these two concepts (using idle hours and modulation of the activities) can significantly improve both functional efficiency and functional density of space. We should also keep in mind that according to system ecology, all these interventions in functionality of

spaces and working hours of a space could influence the interactions and transactions within and between biological and ecological systems (Kitching, 1983).

According to what has been developed, the notion of multifunctionality in urban planning is much more complicated than in agriculture or landscape because of the synergy not only between the space and activity, but also between activity and time (because of the various possibilities for the temporality). In addition to this complexity, the lack of written resources about this subject forces us to choose a combination of research and analysis methods based on case-study that cover all the different aspects and lead us to design principles. The next section focuses on the methodology of this research in order to find the criteria should be considered while planning for multifunctional urban spaces in different phases, from primarily decision makings to conceptual design.

4.The potentials for multifunctional use of urban spaces

4.1. Choosing an appropriate method

Although the demarcation of designing practices may lead to monotony and lower creativity, it allows the designer to overlook certain less important elements in favor of the more important, valuable ones. In this scenario, there will still be room for creative design. Adoption of a specific method can bring about several advantages such as precise, scientific process throughout which the designer will be enabled to make optimum decisions.

Similarly from the methodological perspective, adoption of a specific method from other fields of science and putting it into architectural practices will generally have two consequences. Firstly, it may be countered by professionals because of the artistic aspect of architecture resisting against rigid scientific methods. The second consequence is all about functionality. In fact, an architectural piece should not be treated like a test tube in a laboratory; the interaction of a building with external factors and the construction context arise from multiple subtle elements, the identification and evaluation of which within an architectural research project might not always be practical, thus distinguishing it from the rest of scientific fields.

4.1.1. Common research methods in architecture

According to the subject of this thesis, it is intended to define practices for designing multi-functional spaces. Therefore, a certain method appropriate to the subject must be used to extract and explain the practices. However, the multi-layer and multi-dimensional nature of architecture (and generally human sciences and art), makes the process of criteria development a difficult task. Basically, there is no clear instruction to develop design criteria. According to the literature, criteria are often known to be the result of objectives and are designed and expressed on the basis of the perceived goals for the design. The presence of one (or more) mechanism(s) for criteria development can partially eliminate theoretical confusion in architecture.

4.1.1.1. General Approaches of Criteria Development

Criteria are statements that must be proved through logical reasoning. According to Saunders et al. (2009), there are two reasoning approaches for any research, namely deductive and inductive approaches. In accordance with these approaches, various strategies and methods can be used to define criteria. Thus, the first step is to define the reasoning strategy.

Since deduction requires absolute mastery of different subjects and situations, as well as true preconditions and bases, it is rarely used in such fields as architecture. In contrast, inductive reasoning usually deals with limited cases to express generalized statements (here criteria) to be used in future experiences. Therefore, the results of inductive reasoning are not always true, because a total induction is never realized (at least in the field of architecture). In addition, generalization of "an incomplete induction" may not be necessarily true, but logically is better than confusion and uncertainty. At least in this case, possible errors can be detected and gradually eliminated through experience.

The following methods can be considered for each of above reasoning strategies:

- Criteria development based on bibliographic resources (theoretical)
- Criteria development based on tests and observations (experimental)
- Criteria development based on previous cases (theoretical-experimental)

Among the above methods, the first one cannot be met due to the paucity of written resources. The second situation is often used in experimental sciences (such as physics and chemistry, etc.), than can be examined in laboratory. The third situation is more acceptable among architecture researchers because of the availability and compliance with architectural restrictions. That is why the majority of architectural studies contain a section called "case study", to which a researcher refers aiming at expressing an argument to confirm one or more components.

4.1.1.2. Previous Experiences

Accordingly, if we consider the inductive approach, we should analyze previous instances to lay out criteria for future projects. Although this process occurs intuitively in designers who often refer to previously observed instances during design, the more this referring removes intuitive and individual constraints and becomes regulated, the greater the accuracy of the extracted statements (practices and criteria) will increase.

The main question is that in what conditions, a researcher refers to examples? It seems that the constraints of primary theoretical resources compel the researcher to refer cases for data collection to use them as a basis for his/her research.

This strategy is recommended when theoretical resources are not enough to do research (Saunders, Lewis, & Thornhill, 2009). Reference to previous cases, as practically implemented projects whose cons and pros are revealed with time, is of great importance. In this situation, research data are obtained from case studies; whereas, in "experimental strategy", data are derived from tests and experiences.

For the analysis of input data, it is necessary to use techniques and methods appropriate to the data type and subject of research. These methods are based on logical reasoning and divided into three major categories of inductive, deductive, comparative methods, or combination of them (e.g. inductive-deductive). Based on these three categories, various methods and techniques have been proposed for different spheres of sciences.

4.1.2. Case-based Reasoning (CBR)

Robert Yin, the author of a reference book on the case study (2009), provides the following phenomenon in the context of real life, especially when the boundaries between phenomenon and time are not quite clear. In other words, CBR within the realm of architecture is defined as follows: “An empirical search of a phenomenon or a certain location”. By deleting the word "contemporary" and adding the word

"location", environments and historical sites are considered as potential areas of case studies (Groat & Wang, 2002).

According to the Yin's typology (Yin, 2009) this study intends to explain and explore the aforementioned practices through case study. In fact, a case study is an instrument used to achieve research objectives. The cases in this study are selected relying on experts' points of view.

The use of updated and scientific techniques can serve that purpose. To do this, a common methodology that contains an appropriate theoretical framework, called case-based reasoning (CBR), has been used.

- **What is CBR?**

CBR is a problem-solving method that instead of relying on general knowledge of the problem area or establishing generalized relations between problems and solutions, it uses specific knowledge related to previous experiences and status of other problems. A new problem is solved by finding and using a similar situation previously observed. Another important difference is that the CBR is a *method for incremental-reinforcement learning*, because every time a problem is solved, a new experience is retained and will be available for the next problems. Rapid growth in the application of CBR in recent years is evident from many articles in many conferences, commercially available tools and its successful applications (Bichindaritz & Montani, 2010).

- **CBR History**

Research on CBR in Europe began a little later than in America. It seems that CBR in Europe has been used more efficiently in the development of expert systems and knowledge acquisition research. Recently, CBR activities in America and Europe are increasing and the number of CBR articles in artificial intelligence journals is rapidly growing. It seems that Germany has a major position in terms of the number of active

researchers and groups in this field. Some relevant activities are also carrying out in Japan and other Asian countries like India. In Japan, CBR studies mainly focus on CBR parallel computations (Nayyeri, 2006).

The roots of case-based reasoning in artificial intelligence can be found in the works of "Roger Schank". Schank investigated dynamic memory and the role of reminding previous situations (episodes, cases) in problem solving and learning (Schank 1982). Other footprints of CBR can be found in studies on deductive reasoning and earlier theories of concept formation, problem solving and experiential learning by philosophy and psychology, especially in the field of human sciences and art, in which finding a solution to a problem is distinct from pure sciences. Patterns and old patterns in architecture are a kind of CBR. Therefore, although CBR is unfamiliar to architects, they empirically have used it to find the best solution for new architectural designs. In his theory (pattern language), Christopher Alexander tries to find repeated old patterns to achieve new solutions for architectural designs.

It should be noted that problem solving here has a very wide-ranging implication and is related to the efforts carried out in knowledge-based systems. In other words, problem-solving does not necessarily refer to finding a real solution to a practical problem, rather it can be a problem raised by a user. For example, verification or criticizing a proposed solution by a user or obtaining expectancy of observed data can also be instances of problem solving.

- **CBR in Plain Language**

Basically, CBR solves a new problem by recalling a previous similar situation by reusing relevant information and knowledge.

Experience-based reasoning is a powerful common method for solving problems by humans. This claim is confirmed by the results of psychological research. A part of the foundation of CBR is its psychological reasonability. Many studies have provided empirical evidence required to prove the importance of using previously experienced situations (cases) to solve human problems. Schank (1982) proposed a theory on

experience-retainment based training and reminding in a dynamic inductive structure. Anderson showed that once people learn how to solve problems, they use past situations as models (Ahn, Kim, & Han, 2007).

In CBR terminology, a case usually denotes a problem situation. A previously experienced situation, which has been captured and learned in a way that it can be reused in the solving of future problems, is referred to as a past case, previous case, stored case, or retained case. Correspondingly, a new case or unsolved case is the description of a new problem to be solved. CBR is - in effect - a cyclic and evolutionary process of problem solving, which learns from existing experience to solve new problems (Nayyeri, 2006).

In a CBR-aided research, it is tried to use common features of studied cases (the lowest layer) to achieve criteria and patterns. This hierarchy is presented in figure 13. The aim of the present study is to achieve design criteria and practices.

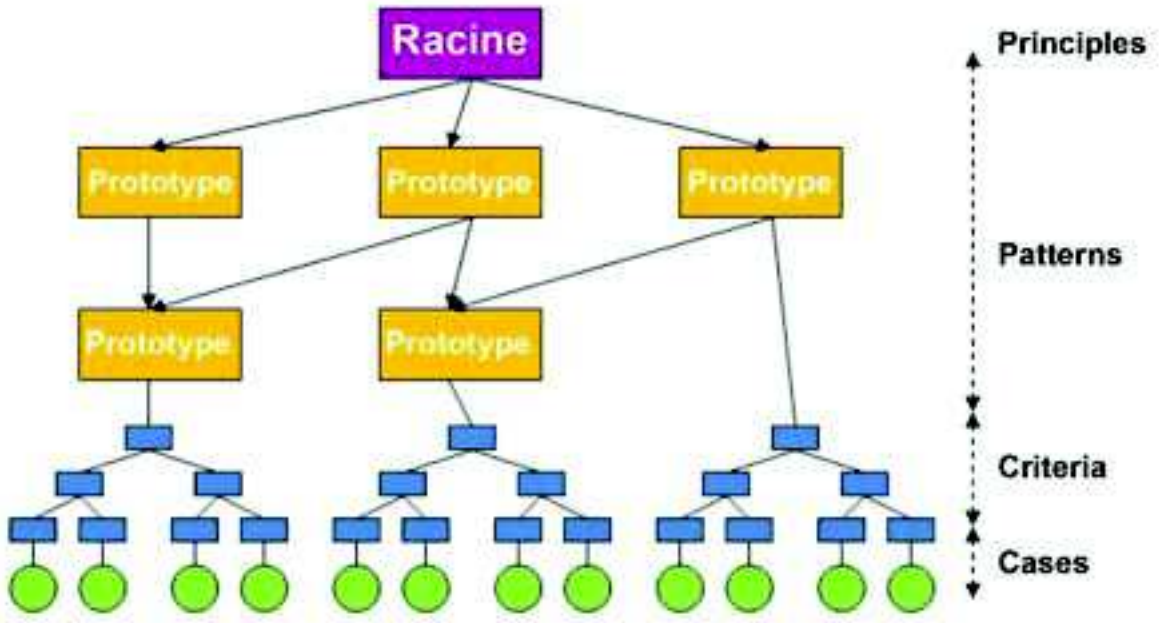


Figure 13: Relation between cases, criteria, patterns and principles in our research (Ghafouri, 2016 based on Nayyeri, 2006 and Alexander et al., 1977)

- **Fundamentals of CBR Methods**

The main tasks of all CBR methods include identifying the current problem's situation, finding a previous situation similar to the new situation, using the previous situation to offer a solution to the current problem, evaluating the suggested solution and updating the current system by training the current experience. How these tasks are carried out? What part of this procedure is more important? What types of problems are solved with these methods? Below, CBR methods are classified into various types with similar characteristics.

- **Main Types of CBR**

If we accept that CBR is actually just a collection of past experiences, which have been organized and disciplined, some CBR methods have large amounts of distributed methods in their databases; whereas, some other CBR methods are based on a limited set of cases. Past cases can be evaluated and retrieved in series or parallel (Veloso & Aamodt, 1998; Ahn, Kim, & Han, 2007).

There are five different ways to organize information in this method. The way used in this study is example-based reasoning in which problem-solving is actually a type of classification, i.e. finding the right class for uncategorized cases. The class of most similar earlier cases is the solution to the classification problem. Classes consist of a set of possible solutions. Revision of the solution is outside the scope of this procedure.

- **CBR Cycle**

Case-based reasoning has an overall cycle (Figure 14), which can be described by the following four procedures:

- Selection of cases and retrieval of patterns (Case Retrieval)
- Reuse of existing patterns and knowledge for problem solving (Case Reuse)
- Revision of the proposed solution (Case Revision)

- Retaining parts of this experience that are likely be useful for future problem solving (Case Retainment-Learning)

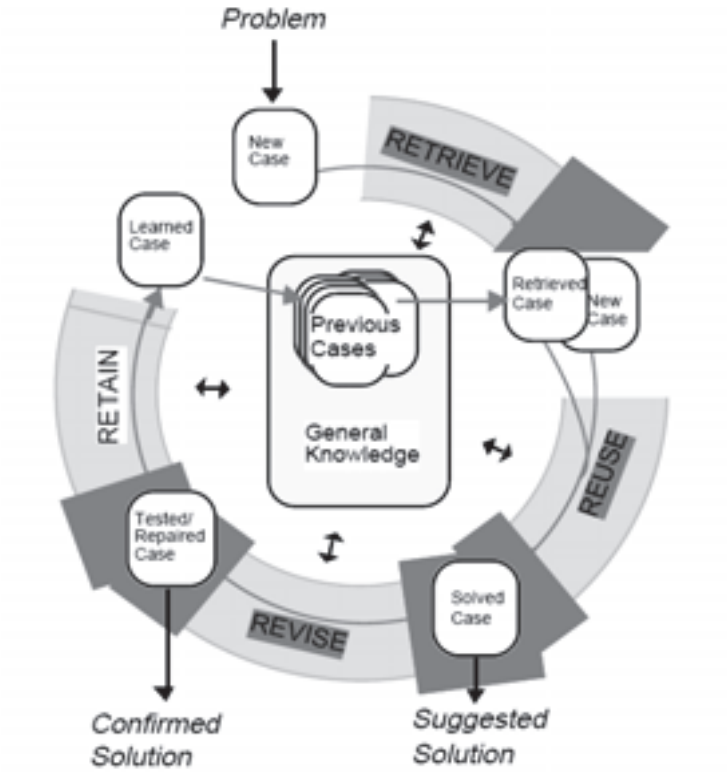


Figure 14: CBR Cycle (Aamodt & Plaza, 1994)

The main idea of CBR is that "similar problems have similar solutions." Thus, when we are looking for certain criteria for a design project in the future, we can use previously used solutions and patterns that have been also approved by the experts.

4.1.3. Pattern Language

In his theory of pattern language, Christopher Alexander proposed the use of former patterns in architecture (Alexander, Ishikawa, & Silverstein 1977). According to Alexander, when a pattern is repeated, its multiple applications indicate its accuracy

and general acceptance. Therefore, such a pattern can be used as a solution for future problems.

The extraction of such patterns and development of their criteria can be done with different techniques. In this study, these criteria (the practices) were extracted through case-based reasoning. Combining it with the theory of "pattern language" of Alexander, it is expected that a comprehensive list of practices can be developed.

According to this theory, the outputs of this model can be converted to the rules to be used by designers in their future projects. While maintaining the creativity of designers, these rules will actually act as instructions that propose a framework to designers to be adhered in their projects.

4.1.4. The Background of Using CBR and Pattern Finding in Architectural Researches

Experimentally and instinctively, architects borrowed from previous cases to repeat suitable patterns. The history of architecture suggests that architects not only learned practiced from their predecessors and existing works in their motherland, but also gained knowledge through communications with other lands and adopted their patterns. This process was experimentally popular among architects in the past. But in the current period that design is subject to legal standards and restrictions, they should go out of intuitive situation and be offered in the form of specific practices.

In the contemporary period, an integral part of architectural studies and research (whether in academic or professional projects) is case studies. Therefore, referring to previous cases and using previous models and experiences have been always a common and reasonable practice. But it is not so clear how to derive lessons and patterns as well as how to implement them in the design (in the form of criteria).

Accordingly, it seems necessary to emphasis on the use of scientific methods used in other sciences. Case-based reasoning was first developed and structured in the field of artificial intelligence and informatics, but its applicability was gradually

appeared in other sciences, especially in the sciences that have multiple information layers and unlike pure sciences have different and non-homogeneous aspects, like architecture.

In the 1980s, the theory of pattern language, introduced by Alexander, tried to theorize the use of former cases in architecture. In the early 1990s, a book entitled “Artificial Intelligence in Design” was published on artificial intelligence and CBR applications, with a chapter devoted to architecture (Domeshek, Kolodner, & Zimring, 1994), to help architects in the design process according to CBR pattern.

Another book was published on the basis of case-based reasoning, entitled “Case-Based Reasoning: Experiences, Lessons and Future Directions” in the mid-1990s. This book recommends the aforementioned method for solving various problems including those in architecture and future designs (Leake, 1996). In the late 1990s another study investigated logical reasoning and its application in architecture (Chiu & Shih, 1997). This article was published in CAAD futures. An independent study was conducted in 2001 to by Heylighen and Neuckermans that improve the design plans based on CBR (de Vries, van Leeuwen, & Achten, 2011; Heylighen & Neuckermans, 2001). This study aimed at comparing the intuitive human activities versus accurate process-based calculations made by computer software.

A thesis entitled “The Case Based Reasoning for Design Composition in Architecture” was conducted on CBR-based architectural design in 2004. This thesis is dedicated to the development of design practices according to the CBR (Mubarak, 2004).

Among recent studies, we can mention a research conducted in France (2011) to develop the practices of sustainable architectural design according to CBR “Collaborative Eco-Design of sustainable buildings“ (Gholipour, 2011). In this project, suitable models for sustainable design were identified, analyzed and recommended for future plans through CBR method.

The most recent research on architecture and CBR is a book that was published in 2014 “Issues and Applications of Case-Based Reasoning to Design” (Maher & Pu, 2014). The book reviews architectural design and applications of CBR.

The above examples are a part of the CBR applications in the field of architecture. With the development of CBR method, broader applications in various fields are recommended for this method. Applications of CBR in architecture are expanding and CBR is currently used for modeling in various studies.

4.2. How did we use these methods in our work?

According to what has been presented before, we can identify a “multifunctional space” with these two characteristics:

- Allow different functions, different actors and different users during different periods of time or have the capacity to accommodate two or more activities at the same time (accept more than a function simultaneously);

- Fulfill the different roles a space might have in line with the environmental, economical and social sustainability.

Toward finding the common qualities of these spaces and evaluate the potential of the multifunctional use of urban spaces, about 80 samples (shown in table 2) have been investigated. As the examples including the definition of multifunctionality are very few, we identified and studied some other spaces which have the capacity to become a multifunctional space and some innovative ideas and Pop-ups which might have some lessons to be held. These examples are extracted from the literature and internet searching from September 2012 until March 2013 on the basis of public spaces. These cases convince us to focus our work on public open spaces. The method of “case-based Reasoning” has been used for the analysis.

As presented before, we had two different searching strategies for finding the cases. 50% of our final selection was currently multifunctional according to our definition:

A multifunctional space is a space which has a primary usage changing into another function in certain times. There is a return to the initial function after a specific period (short or long). We have to consider the function and the time and rhythm at the same time. When a multifunctional space is public to public, it means that the users of the new function can be all the people which were the users of the initial function. The new function has been added to the original platform and it is a public usage.

50% of the cases had the potentials to be multifunctional, included pop-ups, innovations and mixed-use spaces. A mixed-use space is a space which has two or more functions at the same time and all the time without changing the rhythm.

A reflexive approach was developed in which each new case leads to revising the process in order to precise the choice and the criteria of search/analysis.

Our approach is comparative, composed of the study of the experiments initiated all over the world in this field. Toward finding the common qualities of these spaces and evaluate the potential of the multifunctional use of urban spaces, about 80 samples (shown in table 1) have been investigated. As the examples including the definition of multifunctionality are very few, some other spaces which have the capacity to become a multifunctional space and some innovative ideas and Pop-ups which might have some lessons to be held were identified and studied. These examples are extracted from the literature and internet searching from September 2012 until March 2013 on the basis of public spaces. The definition of these urban public spaces also called public spaces consists of “all places open to all”. They are usually in the public community's responsibility or sometimes private law (De Sablet, 1998).These cases convince us to focus our work on public open spaces. The method of “case-based Reasoning” has been used for the analysis (Figure 15). By developing a reflexive approach in which each new case leads to revising the process in order to precise the choice and the criteria of search/analysis. Finally it achieved 30 attributes that are the result of a sweep between the literature review and the case studies. A summary of the overall process is shown in figure 16.

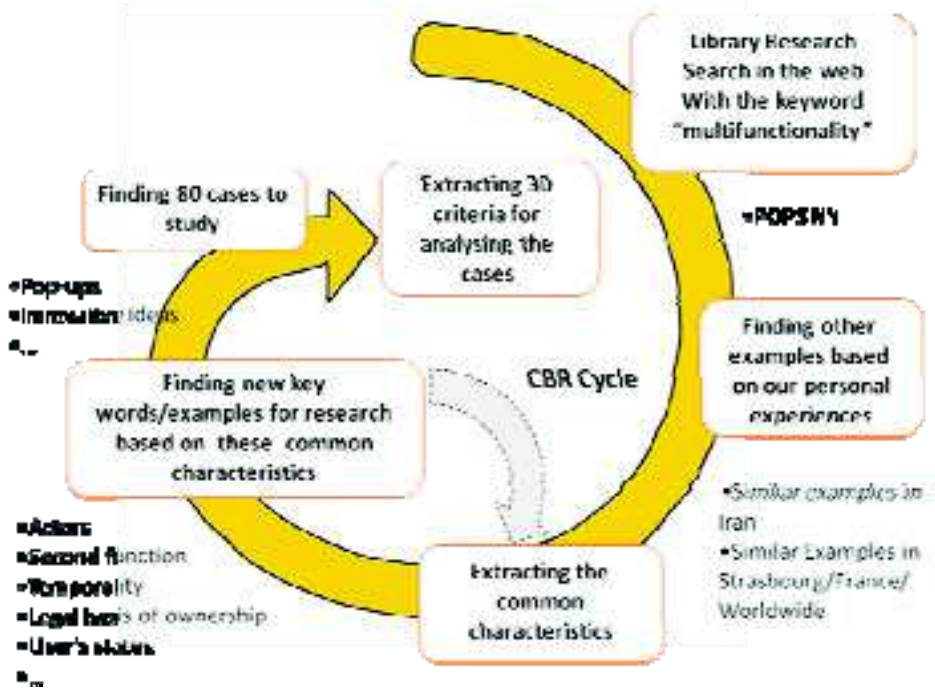


Figure 15: Using CBR method in order to extract the criteria of analysis (Ghafouri, 2016)

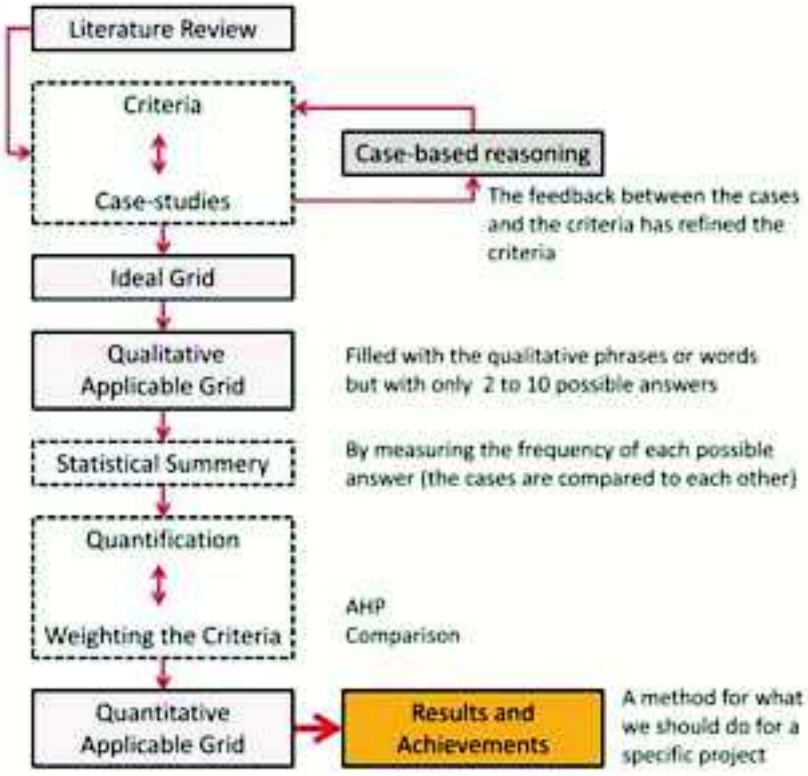


Figure 16: A summary of the overall process (Ghafouri, 2016)

Many examples of such places exist all around the world. Most of these spaces have been created without being specified in the initial planning; but a significant proportion of them have considered legal issues, insurance and prioritizing. Due to the variety in the context and function of these spaces, it is predicted that the concept of multifunctionality can be realized with certain conditions according to the site and the social background of future users. The chart below shows the variety of examples according to geographic dispersion, location and morphology (Figure 17). Concerning the geographic location and scale, the majority of the cases takes place in developed countries, in the downtown and in medium-size areas; however, there are examples of multifunctional spaces all over the world. This indicates that the idea can be implemented spontaneously or in an organized way in every place according to cultural field. In most cases, the spaces that serve people for their necessary requirements are chosen for offering new functions, trying to combine them with people's daily life but for optional or social activities. Due to the variety in the context and function of these spaces, it is predicted that the concept of multifunctionality can be realized with certain conditions according to the site and the socio-economic status of future users.

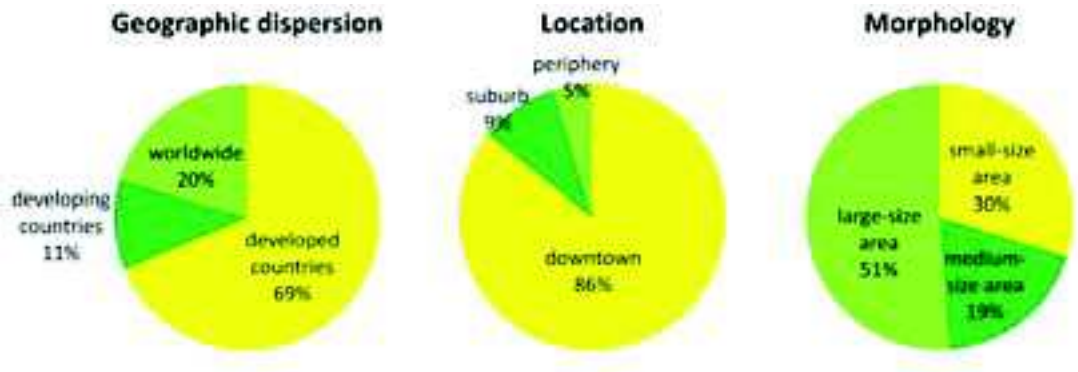


Figure 17: Variety of the case studies according to geographic dispersion, location and morphology (Ghafouri, 2016)

Since urban areas are investigated in the project, the focus was more to understand these spaces and finds the criteria for classifying them as a whole have been studied.

4.2.1. Different categories of urban spaces

The urban public spaces, also called public spaces consist of all places open to all. They are usually in the public community's responsibility or sometimes private law (De Sablet, 1998). The role of urban open space is maintaining the quality of life of citizens. They are not all about passing trough or even leisure. There are different types of activities that take place in urban spaces. The open spaces are valuable because of their role in ecological balance of the city (because of green spaces) and making the city more livable and more beautiful (Gehl, 2010; Muret et al., 1987).

The urban spaces according to different criteria could be classified and characterized according various aspects (De Sablet 1998):

- its degree of site occupation (developed, inhabited area, vacant land,etc)
- its physic (morphology, location, function, actors)
- its place in the urban hierarchy (scale: a town, city, district, neighborhood unit, street, building block, etc.)
- its dynamics (places of interest)
- its main connections in proximity
- the populations concerned
- its climate (sun, rain, wind, heat, cool or warm soils, etc.)
- its emotional power (artistic quality, aesthetic and symbolic)

There are different types of open spaces in the city such as:

- Private or public courtyards;
- Parking lots;
- Open space between buildings ;
- Streets, sidewalks and squares;
- Parks and gardens (green spaces).

According to Matthew Carmona et al. (2006), in their book "Public Places-Urban Spaces", there are 6 different dimensions in urban design: the morphological, perceptual, social, visual, functional and temporal dimensions. Our analysis is based on the physical dimensions rather than perception (Carmona et al., 2006). In order to simplify it, a grouping of these areas and classification of them according to their

main characteristics were made: space (spatial features), function, and time (shown in figure 18).

These are the most important aspects that influence our work for planning for a multifunctional space. The development of the feature “Space” covers the physical aspects -morphology (form) and size- and aspects related to people (users+actors) and context (which is a combination of urban characteristics covering the urban density and social and economic situation of the neighbors and users). These are the general concepts for categorizing the case studies, comparing them with each other and extracting new ideas.

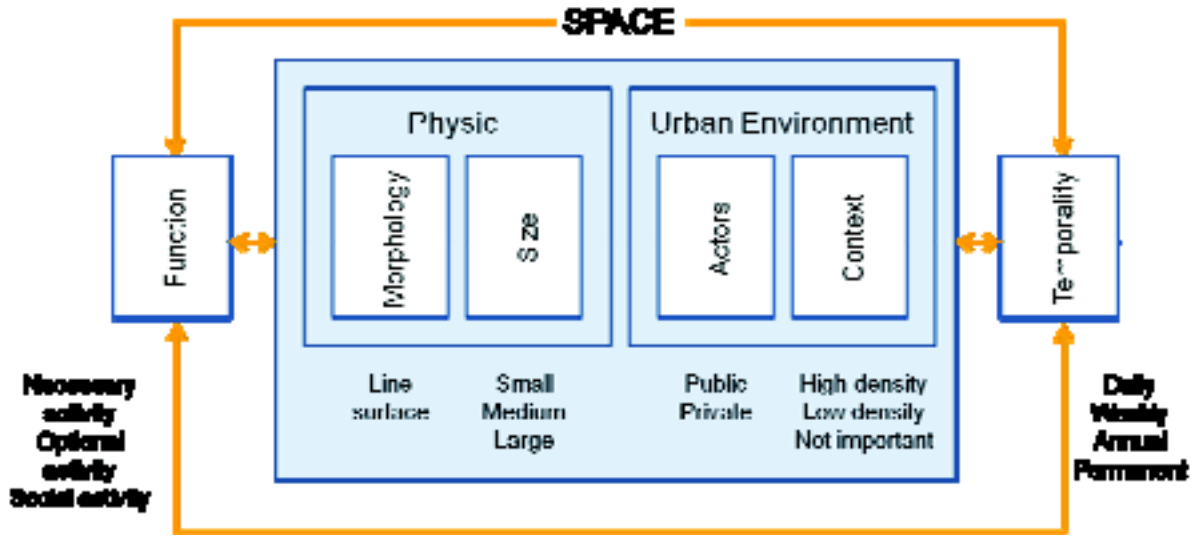


Figure 18: Expansion of the general concept in categorizing the case-studies (Ghafouri, 2016)

4.2.2. The criteria of analysis

Studied cases allowed selecting a set of criteria to be considered specifying actors, uses, specificities of activities and spaces (Table 1) in addition to the general design criteria for public and open spaces (including environmental requirements). These criteria have been completed through a literature review (De Sablet, 1988; Carmona, Heath, Oc, & Tiesdell, 2012; Marcus & Francis, 1997; Kayden et al., 2000; Carr, 1992; Thompson & Travlou, 2007; Francis, 2003; Erell, Pearlmutter, & Williamson, 2012; Gehl, 2010; Ng, 2010).

The three main features (space, function and time) are detailed in thirty (30) attributes to help having a more clear vision and a more accurate analysis. This expansion is the result of a sweep between the literature review (Carmona et al., 2012; Marcus and Francis, 1997; Kayden et al., 2000; Carr, 1992; Thompson and Travlou, 2007; Francis, 2003; Erell et al., 2012; Gehl, 2010; Ng, 2010) and the case studies. These 30 attributes constituted an "*ideal grid*" which is shown in table 3. Possible options for each feature have come together in the right column of the table. The criteria are listed and explained below:

- **General Category**

Is the space currently multifunctional or it has just the potential to be?

- **Type of Initial and secondary actors**

Are the actors public (State / Territorial Collectivity) or private (individuals, parapublics) according to cadastre plan of the city?

- **User status**

Are the users the owner of the space? Have they occupied the space? Do the people that come for this particular activity meet certain conditions (for example: pay money or accept the Inspection by the security guards)? Or, do they meet no conditions?

- **Type of activity**

Is the activity in the space unique (one function changes to another one) or mixed (two or more function changes to two or more others/the space has more than one function in a certain period of time or the space has the initial and second function at the same time)? (cf 3.3.2)

- **Legal basis of ownership and management**

How did the second occupant of the space get the ownership? By renting, for free or illegal?

- **New insurance policy**

Is there a new insurance necessary or not (in case of an accident for the added users or the damage for the space and equipments because of the second activity)? Can the space be treated like other public spaces? Who should be covered by the insurance: the space (owner), the occupiers or the user?

- **Destination of use**

Does the space attract the new users that would not come if this activity has not been existed or it just changes the function for the same users?

- **Term of use**

Is there any priority in using the space? Who has the priority when there is a conflict?

- **Functions**

The functions of the space are of which category: necessary, optional or social?

- **Temporality**

For which time interval the functionality of space changes: for a couple of hours (a short period), for a long period (but voidable), forever or just for an event?

- **Relationship between functional operation and space**

Does this new function occur just in the spaces with the same or similar physical or spatial conditions? Is there any dependence between the activity and the form of the space?

- **Nightlife**

Does the activity continue at night? Does the space have a nocturnal function?

- **Prerequisites**

Are there any prerequisites needed to make the space ready for second function: the equipments, furniture, flooring, lights or vegetation?

- **Risks (of activity)**

Is the second activity leads to additional risks to the users and to the space?

- **Relationship between activity and climate**

Does this new function occur only in a special climate region? Could the activity be planned in any part of the world despite state of climate or it is limited to certain areas?

- **Relationship between activity and weather**

Does this new function occur only when the weather is good (the new function doesn't have more than 50% of its efficiency in the bad weather)? Does it occur non-stop throughout the year? Is there any need to regulating environmental conditions for the second activity?

- **Temperature**

Does this new function needs special weather conditions? Does in occurs in hot or cold temperature? Does the temperature increase because of the activity?

- **Relationship between activity and sunlight**

Does the activity take place only in sunlight or only in shade? Is it important to control the amount of incoming sunlight into the space for this activity? Do the space's mangers need to provide shade for the added activity?

- **Noise pollution**

Is there any adding or special noise pollution because of the activity not due to the presence of people or equipments?

- **Morphology**

What are the form and the size of the space (according to the number of users)? Is it a surface or a line? Is it small (for less than 20 users), medium (for 20-100 users) or large (for more than 100 users)?

- **Accessibility**

Is there a direct access to the space without any gate? Is it accessible through another place or through a gate?

- **Location**

Is the space located in city center or in a special or unique part of the city (touristic part, river, etc.)? Designing such a space everywhere in the city is possible or there should be special considerations according to the urban density? Is it accessible by public transport?

- **Attractiveness (location + activity)**

Is the new function unique or is the place somewhere special? Does the combination (of space and activity) attract people to make an urban trip (short or long)? Is it something that provides a new experience?

- **Risks (without adding the second function)**

Is there any risk from a person against another person or environment? Are there any environmental risks for the users?

- **Change in the legal basis of responsibility of the place**

Who will be the responsible of the space after changing the function: the owner, the tenant, the occupants or the users? Does the legal base change?

- **Protection mode**

How would the users and the equipments be protected against the injuries and damages? Is the system of the security in the space based on the users themselves?

Does each person have to take care of himself or his properties? Are there any physical elements that ensure the security?

- **Lighting**

Is there a need of additional lighting for making the space ready for the second function (for providing security and for expanding the functional hours)? Is it natural light, artificial light or a combination of these two?

- **Nature of ground**

Is the space covered by vegetation or mineral materials? Is it a soft landscape or a hard landscape? This cover provides a safe possibility for which kind of activities?

- **Space covering**

Does the space needs a cover before accepting the additional function? Should it be covered?

The result of this step is the defining an "*ideal grid"* that will allow the confrontation essential considers with the reality (table 3). The objective of the methodological approach is to validate these "ideal" criteria list in reality in order to define an "*applicable grid"* based on the urban practices and observations that encourage the definition of multifunctional spaces or transforming monofunctional urban spaces into multifunctional ones.

Table 3: Synthetic studied cases characteristics (Ideal grid of mandatory criteria of analysis)

Identification	General category	currently multifunctional	private to public, semi-public to public, public to public, public to semi-public, public to private, semi-public to private
		potentially multifunctional	mixed-use, pop-up, innovation
Actors	Type of Initial actors	public (state / territorial collectivity), private (individuals, parapublics)	
	Type of secondary actors	public (state / territorial collectivity), private (individuals, parapublics)	
	User status	owner, tenant occupying, specific group, public (all people)	
Use	Type of activity	unique, mixed	
	Legal basis of ownership and management	owner user, rental use, free use, illegal occupant , mixed	
	New insurance policy	yes, no	
	Destination of use	change the function, change the function and users, change the users , adding new functions for the same users, adding new users by adding new functions	
	Term of use	with priority, without priority, not important	
	Functions (initial and secondary)	necessary activities (moving, work, urban infrastructure, ...) commercial (supermarket, market, retail, ...), administrative, educational, cultural, leisure (sports, hiking, cycling, coffee shop,...), green space, social activities (meeting,	
Characteristics of the activity	Temporality	momentary, permanent (daily full-time), daily part-time, night, weekly, monthly, seasonal, annual, casual, periodic	
	Relationship between functional operation and space	yes (dependent), no (independent)	
	Nightlife	yes, no	
	Prerequisites	no prerequisites, furniture, flooring, equipment, shelter, vegetation, lighting, infrastructure	
	Risks	no risk, accident-prone (risk of fire, risk of flooding, risk of theft, unsafe, insecure)	
	Relationship between activity and climate	yes (dependent), no (independent)	
	Relationship between activity and weather	yes (dependent), no (independent)	
	Temperature	cold, moderate, hot, not important	
	Relationship between activity and sunlight	sunshine needed, shade needed, not important	
	Noise pollution	yes (noisy), no (silent)	
Characteristics of space	Morphology	point (spot) of the surface, point (spot) attached to the surface, small-size area, medium-size area, large-size area, network of spaces, linear small-size area, linear medium-size area, linear large-size area,	
	Accessibility	open, connected (attached to another building / land), closed	
	Location	downtown, suburb, periphery, anywhere	
	Attractiveness (location + activity)	yes (attractive), no (non attractive)	
	Risks (without adding the second function)	no risk, accident-prone, risk of fire, risk of flooding, unsafe, insecure	
	Change in the legal basis of responsibility of the place	yes, no	
	Protection mode	security-protected, secure, self-secure, protected by a management system	
	Lighting	natural, artificial, combined, no extra light needed (no more than usual)	
	Nature of ground	mineral, synthetic, vegetable, combined, not important	
	Space covering	open, covered, semi-open, combined	

4.2.3. Methodological approach

In the next step, the "ideal grid" has been used for analyzing and categorizing the collected case studies. This grid must be confronted to reality through the case studies collected. More than eighty 80 examples from all around the world have been studied and the results have been summarized and represented (cf. 4.2.2). To perform this step we need to quantify our qualitative analysis in order to create an "applicable grid".

4.2.4. Case studies

In order to evaluate the potential of the multifunctional use of urban space, about 80 samples have been investigated. As the examples including the definition of multifunctionality are very few, some other spaces which have the capacity to become a multi functional space and some innovative ideas and Pop-ups which might have some lessons to be held were studied as well.

4.2.4.1. Sources

The difficulty to find case studies leads to complement classic research tools with online research approach on various sites linked to urban projects, architecture or various pop-up cases.

Some criteria have been extracted from literature through libraries and professional magazines :

- Search in classic libraries like sciencedirect.com within these keywords: multifunctional space, multifunctional urban/public space, multi-purpose urban/public space, multi-use urban/public space, mixed-use urban/public space

- Search within the great public Spaces and top 100 public spaces in USA and Canada from www.pps.org, www.publicspace.org, www.asla.org, etc.

- Search in online architectural and landscape magazines (www.dezeen.com, www.arcdaily.com, www.worldlandscapearchitect.com, etc.)

For other cases studies using the previous list of keywords and some others: multifunctional space, multifunctional urban/public space, multi-purpose urban/public space, multi-use urban/public space, mixed-use urban/public space, multiple usage of urban/public space, transformable space, innovative urban/public space, adaptable urban/public space, shared use of urban/public space, diversity in urban/public space, mixed-use urban development, mutual activities in urban/public space, collective achievement across time and space, space-time in urban/public space, cooperative use of urban/public space, temporary public space, temporary city, combining functions, functions synchronization in urban space have been collected through various internet platforms like GOOGLE (March 2012-June 2013).

- Search the pop-ups in urban space within www.popupcity.net with the criteria for selection

- Spaces that may have different functions in different time periods (spaces that have a main function, but in some parts of the activity cycle, it can be replaced with another activity or have the two activities at the same time);
- Spaces that their users that might change over time;
- Uunusual, creative or new ways for using space.

Some collected cases are presented below (Table 4).

Table 4 :10 of 80 cases studied (for full list please see Annex I)

- **POPS (Privately Owned Public Spaces)** **USA, New York**

Privately Owned Public Space: private properties that serve as public spaces. The open complex is restricted to administrative staff in the day and serves the public evenings and weekends.

Multifunctional - private to public *Administrative to recreation*

- **350 White Chairs Pop Up** **Netherlands, Rotterdam**

During Rotterdam's public art festival Wereld van Witte de With, urbanism office M.E.S.T. reanimated this idea. But instead of bikes, the designers left 350 white chairs in public space in Rotterdam. The chairs served as a terrace for all the decentralized performances, and fed a discussion about public space and ownership at the same time. People were allowed to use the white chairs freely and to take them to any other location as long as they remained part of public space. The white chairs were slowly spread across the city. According to the festival organization, they were even spotted at the Central Station of Leiden, a town somewhere between Rotterdam and Amsterdam.

Multifunctional - public to private *Necessary activities to recreation/social*

- **Urban CampScape Pops Up** **Netherlands, Eindhoven**

The initiators of the Urban CampScape aim to research the function of the neglected space under the fly-over as a 'Green Corridor' — a node to connect the city to its green surroundings. Therefore the Urban CampScape will not only be places to sleep during the DDW, but will also offer a temporary cultural program about co-creation and durability. The program includes guerrilla gardening workshops, an exhibition about the Green Corridor, breakfast with products from the Philips Fruit Garden, bicycle tours and much more.

Pop-up – public to private *Necessary activities to pedagogic/cultural*

- **Street Badminton** **Vietnam**

The sidewalks in Vietnam are also a badminton equipped playground.

Multifunctional - public to public *Necessary activities to recreation*

- **Street Cafes (terrasse)** **Worldwide**

The sidewalks allow cafe tables and shop wares to be displayed on the street.

Multifunctional - public to semi-public *Necessary activities to recreation/social*

- **RiverSmart Homes** **USA, Washington DC**

The RiverSmart Homes program offers incentives to homeowners interested in reducing stormwater pollution from their properties. This District-wide program offers incentives to homeowners interested in reducing stormwater runoff from their properties. Homeowners receive up to $1,200 to adopt one or more of the following landscape enhancements:

- Shade Tree Planting Rain Gardens
- Rain Barrels BayScaping
- Pervious Pavers

Multifunctional - private to public *Necessary activities to necessary activities/recreation*

- **Weekly markets (Marché Hebdomadaire)** **France**

The markets for fruits and vegetables once or twice a week in parking lots, squares or plazas

Multifunctional - public to private *Necessary activities to necessary activities/recreation/commercial/social*

- **Friday prayers** **Iran, Tehran (University of Tehran)**

Jumu'ah "Friday prayer" is a congregational prayer that Muslims hold every Friday, In Tehran, The Friday prayer takes part at University of Tehran. In Iran the weekend is on Fridays.

Multifunctional - private to public *Pedagogic to cultural/social*

- **Paris Plages (Paris Beaches)** **France, Paris**

The summer transforms Paris. The cityscape dons greenery and the riverside thoroughfares become car-free resorts. The Paris Plages (Paris Beaches) operation kicks off on or around 20th July and lasts four weeks. It began in 2002. The Seine's banks become pedestrian and the beaches are spread across three spots (Louvre/Pont de Sully, Port de la Gare and Bassin de la Villette).

Multifunctional - public to public *Necessary activities to recreation*

- **Des jardins collectifs & Potagers urbains collectifs (shared gardens)** **France, Strasbourg**

An idea for bringing the nature into the city as a feeding source in all neighborhoods

innovation - public to private *Necessary activities to commercial/recreation/cultural/social*

Table 5: The 80 cases

(* Classification has been done based on: American Planning Association 2012; Urban Design Associates 2013.
** Not important= everywhere (in areas with high or low population density)

Morphology	Size	Type of primary actors	Urban Context (Density)	Example																
line	medium	public	not important	Street Gallery	Woonerf	Street Cafés	Street Classrooms													
line	large	public	not important	Collective Gardens	Mixed use paths (MUPs)	Street Football	Street Badminton													
line	large	public	high density	Broadway	Sirkow and Rees WaveDecks	Narrabeen Lagoon Multi-use Trail Stage	Bloomingdale Trail	La Ramola	A High Line for London	CityArt Walking Sculpture Tour										
				Lafayette Summer Street	Parades & Carnavals	Paris Plages	The High Line													
line	large	public	low density	Chamian Boulevard																
surface	small	private	not important	RiverSmart Homes	Qunose	Roof Orchard	Living Wall	Rooftop Garden												
surface	small	public	not important	Street Music	Meeting Bowls	The Urban Living Room	Park Library	Urban CampScape Pops Up	Park(ing) Day	Street Art										
				Glowing Places	Street Ping-Pong	Street Vendor														
surface	medium	public	not important	Collective urban farms	Union Street Urban Orchard	Outdoor sketching class	Street Theatre	The Circle	Volkerplatz	Street Chess										
				The Glow-In-The-Dark Skate Park	Weekly Markets	Urban farming- Community gardens	POPS													
surface	medium	private	not important	School Farms																
surface	large	public	not important	Luxemburg Garden	Public Farm One															
surface	large	public	high density	Temple Square	Campus Martius Park	Bryant Park	Pittsburgh Market Square	Arts District at Bay Street	Balboa Park	Church Street Marketplace District										
				Jetty Square	Multi Mill	Old Spitalfields Market	FlexCITY	Spanish plazas	Imam Square	Tehran University										
				350 White Chairs Pop Up	Tehran Mosalla	Paramana Square	Gare de Orente	Barkside 1/2/3	Incheon	Alexanderplatz										
surface	large	private	not important	Algonauld	Drive-in Cinema															
surface	large	private	low density	Fairgrounds	Expos															
other	medium	public	high density	Pooseh Bridge Museum	Nature Bridge	Bus Rapids	Library Bus or Book Bus	Bronx Children's Museumbus	Bike-Sharing											

Table 5 summarizes the four types of criteria that are mandatory for urban multifunctional study. The 80 cases are classified based on these main features.

4.3. Analysis

Since the aim of gathering the cases examples is analyzing and using provided solutions in similar cases, for a more understanding of examples, a categorization on a different combination basis of main characteristics (actor, function and time) has been done. As a matter of fact, in this stage, instead of examining independently each factor among other examples, in order to have a better vision to examined examples and also completing the main matrix for secondary criteria with more accuracy only main factors were measured (assessing provided qualitative data in matrix and explicating definitions in the points where there were contradiction). The number of examples in each category illustrates which kind of urban spaces, with which primary functions, in which timescale and what kind of urban context has the potential of transforming into a multifunction space.

The approach is divided into four levels:

In the first level, the classification was based on primary actors: public spaces and private spaces. It is obvious that public spaces in comparison to private spaces could allocate more examples, but the location of these public spaces varied from densely populated parts of the city to the suburb parts. Furthermore, spaces were utilized in different temporality: Variation in multifunction space from hourly rhythms to daily, weekly, monthly, and seasonally and annual rhythms. Nevertheless, spaces which have been transformed permanently from solo-function to multi-function, allocated a more major part to themselves and this great difference could be observed.

In the second level, the classification was based on morphology of urban spaces. On this basis, detected spaces for possessing a secondary function are as follows:
Plazas
Urban markets
Administrative, educational or commercial centers' parking
Courts of public buildings
Side walks
Alleys
Streets and boulevards

Tramway routes, railways, subways
Meeting points, corners
Pedestrian areas
Cycling paths
Higher education campuses, schoolyards
Parks, Gardens, forests, natural green spaces in the city
Sports Complexes
Rivers beaches, Sea shores
Bridges
Flat Roofs
Rooftops of semi-public buildings
Parking lots of semi-public buildings
Courts of semi-public buildings
Fairgrounds

These spaces categorized by their morphology, size and actors are shown in figure 21.

The next step was assortment of the cases studied according to this classification (Table 6-8). By this grouping, one example for each space in order to discover the potentials of multifunctionality for similar spaces could be found. The "reasoning" from previous cases has been done by these different groupings, classifications and comparisons.

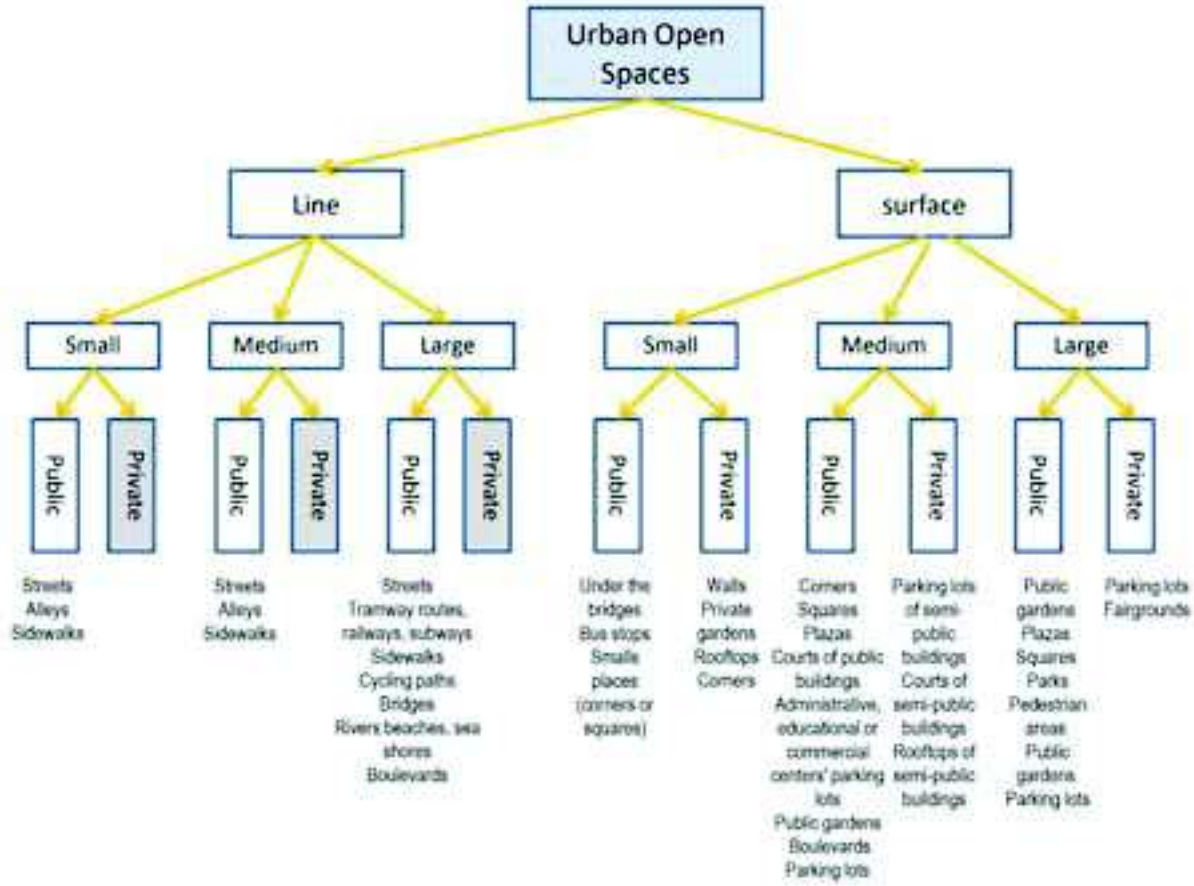


Figure 19: Classification of urban spaces according to their morphology, size and actors (Ghafouri, 2016)

Table 6: Classifying the cases based on their physic, primary actors, urban context, function and temporality in order to make a grouping and find the potentials of each type of urban (open) space (1/3)

Physic		Type of primary actors	Urban Context (Density)	Function			Temporality				Example
Morphology	Size			necessary activities	optional activities	social activities	daily	weekly	yearly	permanent	
line	medium	public	not important	Woonerf Street Cafes (terrasses)	Street Cafes (terrasses) Street Classrooms Street Gallery	Street Cafes (terrasses)	Street Cafes (terrasses)			Street Gallery Woonerf	sidewalks streets
line	large	public	not important	Mixed use paths (MUPs)	Street Football Street Badminton Des jardins collectifs	Des jardins collectifs	Street Football			Des jardins collectifs Mixed use paths (MUPs)	streets sidewalks
line	large	public	high density	Broadway Simcoe and Rees WaveDecks A High Line for London La Rambla Narrabeen Lagoon Multi-use Trail Stage The High Line	Narrabeen Lagoon Multi-use Trail Stage Bloomingdale Trail Lafayette Summer Street Simcoe and Rees WaveDecks Paris Plages CityArt Walking Sculpture Tour Broadway La Rambla The High Line	Broadways La Rambla Parades & carnavals	La Rambla		Lafayette Summer Street Parades & carnavals Paris Plages Broadway	CityArt Walking Sculpture Tour The High Line Simcoe and Rees WaveDecks A High Line for London Narrabeen Lagoon Multi-use Trail Stage Blooming dale Trail	streets tramway routes, railways, subways sidewalks cycling paths bridges rivers, beaches, sea shores boulevards
line	large	public	low density		Charnier Boulevard					Charnier Boulevard	boulevard rivers, beaches, sea shores
surface	small	private	not important	RiverSmart Homes Living Wall Algensold Street Vendor Meeting Bowls	Roof Orchard wall painting Rooftop Garden The Urban Living Room Park Library	Rooftop Garden Roof Orchard Parking Day The Urban Living Room	Street Music		Park Library	RiverSmart Homes Roof Orchard Living Wall Rooftop Garden wall painting Algensold Street Art The Urban Living Room	walls private gardens rooftops corners

Table 7: Classifying the cases based on their physic, primary actors, urban context, function and temporality in order to make a grouping and find the potentials of each type of urban (open) space (2/3)

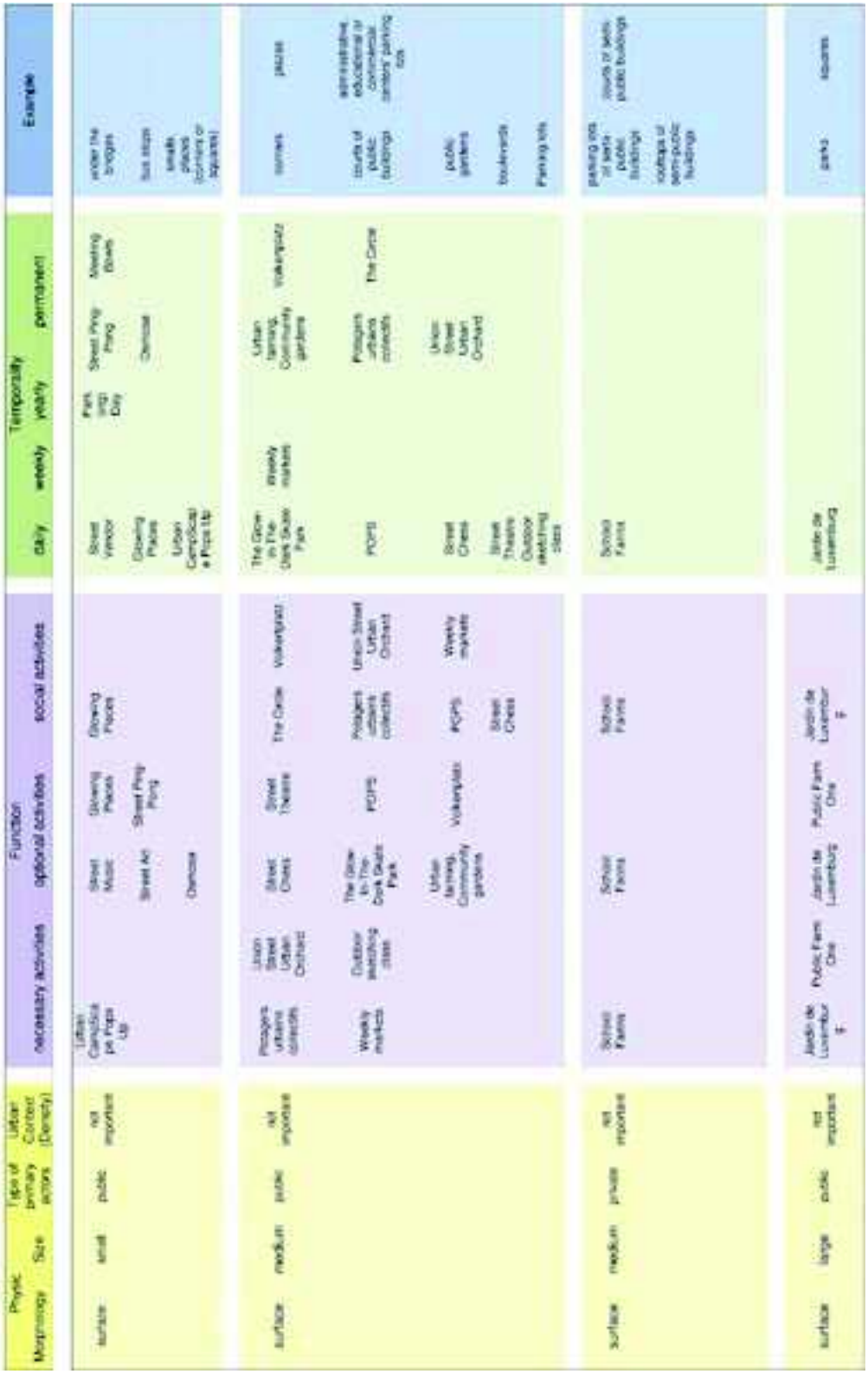
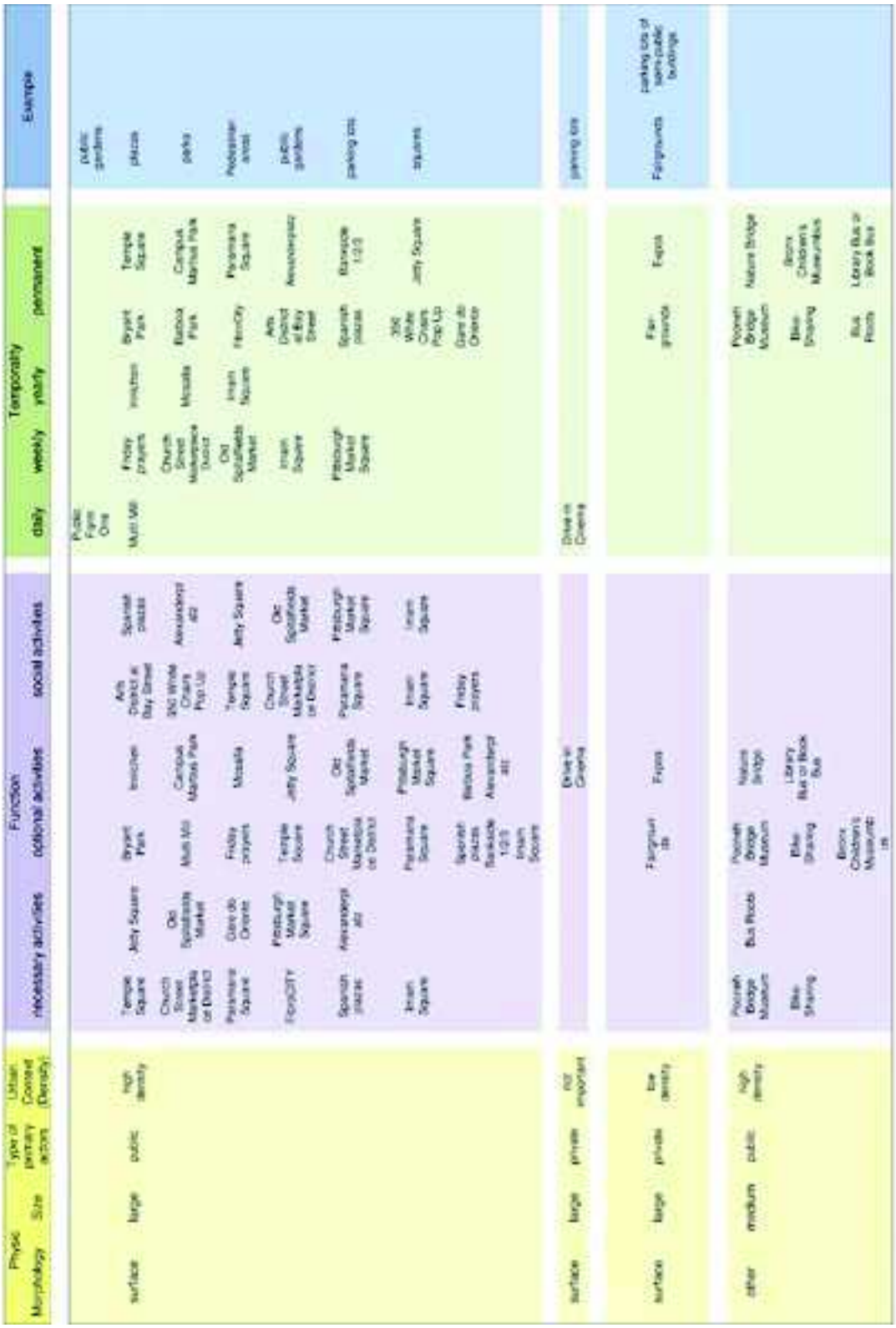


Table 8: Classifying the cases based on their physic, primary actors, urban context, function and temporality in order to make a grouping and find the potentials of each type of urban (open) space (3/3)



In the third level, all main factors were placed along each other. The aim of this level was illustrating spaces with different morphology, actors and location in the city, in different time scales, could allocate which kind of secondary activities. The result was a variation of choices on the basis of space form. By considering a secondary function based on physic, location and temporality, these tables could introduce an appropriate performed example (Tables 9-11).

The aim of the approach is finding an "ideal types" to be able to better characterized the major or essential elements of the spaces through the 80 cases already exist. These groupings may lead to a more clear vision about the possibility of using a space in a multifunctional way and retrieve the main ideas and concepts (cf. CBR Cycle in figure 14). The results would be presented in the final section (conclusion).

Table 9: Classifying the cases based on their physic, primary actors, urban context and temporality in order to find the possible secondary functions (1/3)

Morphology	Size	Type of primary actors	Urban Context (Density)	Temporality	Secondary or added function	Example
line	medium	public	not important	permanent	cultural	Street Gallery
line	medium	public	not important	permanent	necessary activities, recreation	Woonerf
line	medium	public	not important	daily	recreation, social activities	Street Cafes (terrasses)
line	medium	public	not important	daily	pedagogic, cultural	Street Classrooms
line	medium	public	high density	permanent	cultural	Pooneh Bridge Museum
line	large	public	not important	permanent	recreation, cultural, social activities	Des jardins collectifs
line	large	public	not important	permanent	necessary activities	Mixed use paths (MUPs)
line	large	public	high density	permanent	recreation, social activities, commercial, cultural	Broadway
line	large	public	high density	permanent	recreation	Simcoe and Rees
line	large	public	high density	permanent	recreation, ecological	WaveDecks
line	large	public	high density	permanent	recreation, ecological	Narrabeen Lagoon Multi-use Trail Stage
line	large	public	high density	permanent	recreation, ecological	Bloomingdale Trail
line	large	public	high density	permanent	recreation, ecological	The High Line
line	large	public	high density	permanent	recreation, ecological	A High Line for London
line	large	public	high density	permanent	cultural, social activities	CityArt Walking Sculpture Tour
line	large	public	high density	permanent	commercial, recreation, cultural	La Rambla
line	large	public	high density	yearly	recreation, social activities, commercial, cultural	Lafayette Summer Street
line	large	public	high density	yearly	social activities, cultural	Parades & carnavals
line	large	public	high density	yearly	recreation	Paris Plages
line	large	public	low density	permanent	recreation	Chamran Boulevard
line	large	public	low density	permanent	recreation, cultural	Nature Bridge

Table 10: Classifying the cases based on their physic, primary actors, urban context and temporality in order to find the possible secondary functions (2/3)

Morphology	Size	Type of primary actors	Urban Context (Density)	Temporality	Secondary or added function	Example
surface	small	private	not important	permanent		RiverSmart Homes
surface	small	private	not important	permanent	recreation, social activities, commercial, ecological	Roof Orchard
surface	small	private	not important	permanent	ecological	Living Wall
surface	small	private	not important	permanent	recreation, social activities, ecological	Rooftop Garden
surface	small	private	not important	permanent	cultural	Osmose
surface	small	public	not important	permanent	cultural	Street Music
surface	small	public	not important	permanent	social activities	Meeting Bowls
surface	small	public	not important	permanent	recreation, social activities	The Urban Living Room
surface	small	public	not important	permanent	necessary activities, recreation	Bike-Sharing
surface	small	public	not important	permanent	ecological	Bus Roots
surface	small	public	not important	permanent	recreation, cultural	Library Bus or Book Bus
surface	small	public	not important	permanent	recreation, cultural	Bronx Children's Museumbus
surface	small	public	not important	permanent	commercial, social activities	Street Vendor
surface	small	public	not important	permanent	cultural	Street Art
surface	small	public	not important	daily	recreation, social activities	Glowing Places
surface	small	public	not important	daily	recreation, social activities	Street Ping-Pong
surface	small	public	not important	daily	recreation	Street Football
surface	small	public	not important	daily	recreation	Street Badminton
surface	small	public	not important	yearly	cultural, social activities	Park Library
surface	small	public	not important	yearly	pedagogic, cultural	Urban CampScape Pops Up
surface	small	public	not important	yearly	recreation, cultural, ecological, social activities	Parking() Day
surface	medium	public	not important	permanent	recreation, cultural, social activities	Potagers urbains collectifs
surface	medium	public	not important	permanent	recreation, cultural, social activities	Union Street Urban Orchard
surface	medium	public	not important	permanent	pedagogic, cultural	Outdoor sketching class
surface	medium	public	not important	permanent	cultural	Street Theatre
surface	medium	public	not important	permanent	recreation, cultural, social activities	Volkertplatz
surface	medium	public	not important	permanent	recreation, ecological	The Circle
surface	medium	public	not important	daily	recreation, social activities	Street Chess
surface	medium	private	not important	daily	recreation	POPS
surface	medium	public	not important	weekly	commercial, social activities	Weekly markets
surface	medium	public	not important	yearly	recreation	The Glow-In-The-Dark Skate Park

Table 11: Classifying the cases based on their physic, primary actors, urban context and temporality in order to find the possible secondary functions (3/3)

Morphology	Size	Type of primary actors	Urban Context (Density)	Temporality	Secondary or added function	Example
surface	medium	private	not important	permanent	recreation, cultural, social activities	Urban farming, Community gardens
surface	medium	private	not important	permanent	recreation, cultural, social activities	School Farms
surface	large	public	not important	permanent	recreation, social activities	Jardin de Luxembourg
surface	large	public	not important	permanent	recreation, social activities, commercial, cultural, ecological	Public Farm One
surface	large	public	high density	permanent	recreation, cultural	Temple Square
surface	large	public	high density	permanent	cultural	Campus Martius Park
surface	large	public	high density	permanent	cultural, commercial	Bryant Park
surface	large	public	high density	permanent	recreation, cultural, commercial, social activities	Pittsburgh Market Square
surface	large	public	high density	permanent	cultural	Arts District at Bay Street
surface	large	public	high density	permanent	cultural	Balboa Park
surface	large	public	high density	permanent	necessary activities, optional activities	Church Street Marketplace District
surface	large	public	high density	permanent	necessary activities, optional activities	Alexanderplatz
surface	large	public	high density	permanent	optional activities	Paramana Square
surface	large	public	high density	permanent	necessary activities, social activities, optional activities	Old Spitalfelds Market
surface	large	public	high density	permanent	necessary activities, social activities, optional activities	FibreCITY
surface	large	public	high density	permanent	optional activities, social activities	Spanish plazas
surface	large	public	high density	permanent	necessary activities, social activities, optional activities	Jetty Square
surface	large	public	high density	permanent	recreation	Gare do Oriente
surface	large	public	high density	permanent	recreation, cultural	Bankside 1/2/3
surface	large	public	high density	permanent	optional activities	Multi Mil
surface	large	public	high density	weekly	optional activities	Imam Square
surface	large	public	high density	weekly	cultural, social activities	Friday prayers
surface	large	private	not important	yearly	optional activities	Drive-in Cinema
surface	large	public	high density	yearly	social activities	350 White Chairs Pop Up
surface	large	public	high density	yearly	necessary activities, social activities, optional activities	Mosalla
surface	large	public	high density	yearly	optional activities, social activities	Innichen
surface	large	private	not important	permanent	ecological, social activities	Agerisiid
surface	large	private	low density	permanent	recreation, cultural	Expos
surface	large	private	low density	permanent	recreation, cultural	Fairgrounds

In the last stage, with scrutiny in main matrix data the qualitative data could be transformed into quantitative data by calculating the statistical frequency of each option for each criterion. The aim is to have the possibility to compare the importance of different possible options for each criterion. The remarkable points of this statistical analysis are shown in the next section (4.4).

The result of this quantifying (statistical analysis) is illustrated in table 12. Table 13 and the following figures summarize the first results of the criteria analyses (based on the statistical frequency of each option):

Table 12 **:**The results of quantifying the criteria

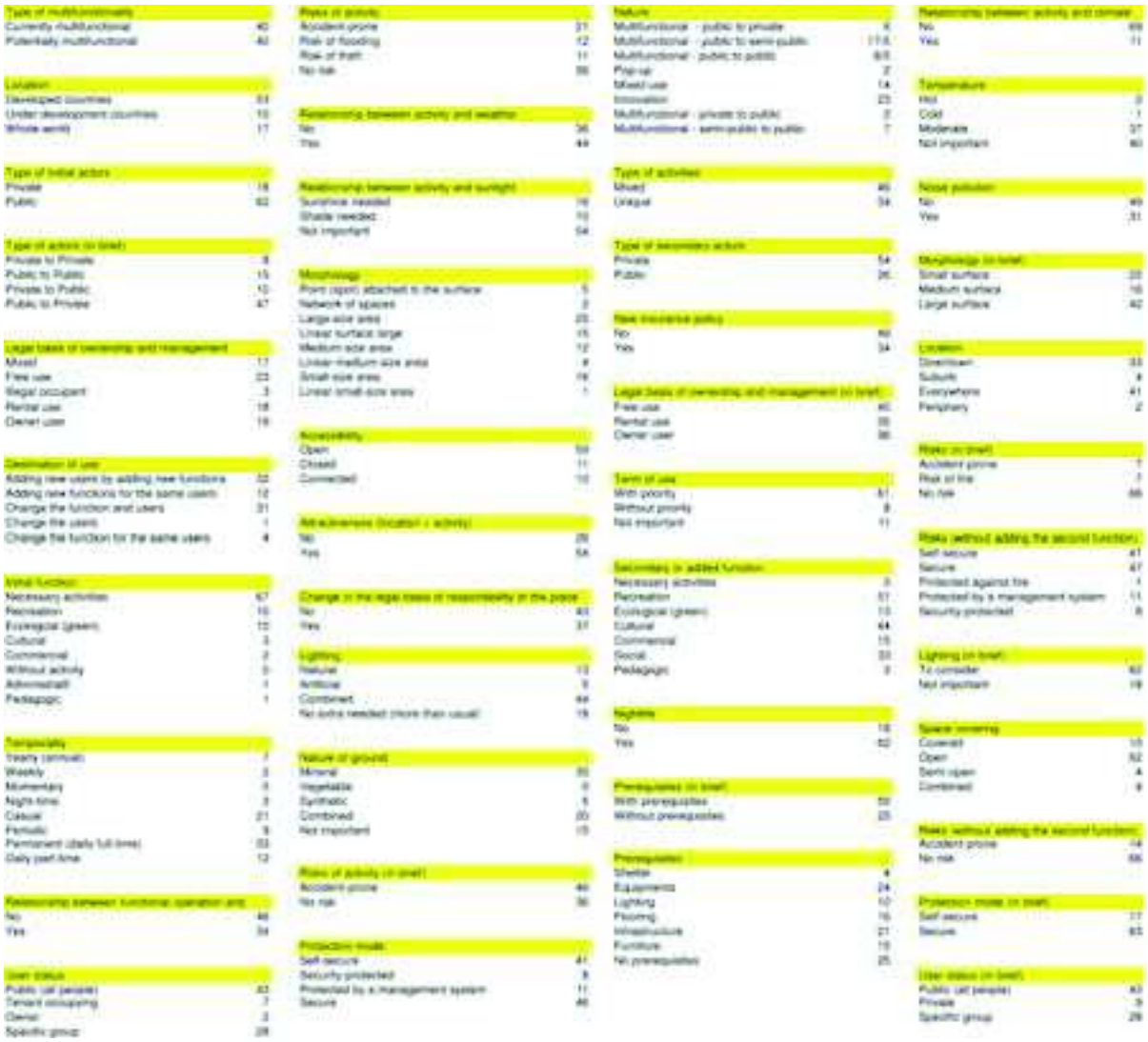


Table 13: A summary of results (the gray lines are the most common possibility for each criterion)

Type of multifunctionality	
Currently multifunctional	0.50
Potentially multifunctional	0.50

Location	
Developed countries	0.67
Under development countries	0.11
Whole world	0.22

Type of initial actors	
Private	0.22
Public	0.78

Type of actors (in brief)	
Private to Private	0.10
Public to Public	0.19
Private to Public	0.12
Public to Private	0.58

Legal basis of ownership and management	
Mixed	0.21
Free use	0.29
Illegal occupant	0.04
Rental use	0.22
Owner user	0.24

Destination of use	
Adding new users by adding new functions	0.40
Adding new functions for the same users	0.15
Change the function and users	0.39
Change the users	0.01
Change the function for the same users	0.05

Initial function	
Necessary activities	0.69
Recreation	0.11
Ecological (green)	0.11
Cultural	0.03
Commercial	0.02
Without activity	0.02
Administratif	0.01
Pedagogic	0.01

Temporality	
Yearly (annual)	0.08
Weekly	0.02
Momentary	0.05
Night time	0.02
Casual	0.23
Periodic	0.10
Permanent (daily full-time)	0.36
Daily part-time	0.13

Relationship between functional operation and space	
No	0.57
Yes	0.43

Prerequisites	
Shelter	0.03
Equipments	0.21
Lighting	0.09
Flooring	0.14
Infrastructure	0.18
Furniture	0.13
No prerequisites	0.22

Type of activities	
Mixed	0.57
Unique	0.43

Type of secondary actors	
Private	0.67
Public	0.33

Risks of activity	
Accident prone	0.25
Risk of flooding	0.16
Risk of theft	0.15
No risk	0.44

Relationship between activity and weather	
No	0.45
Yes	0.55

Relationship between activity and sunlight	
Sunshine needed	0.20
Shade needed	0.12
Not important	0.68

Morphology	
Point (spot) attached to the surface	0.26
Network of spaces	0.03
Large size area	0.31
Linear surface large	0.19
Medium-size area	0.15
Linear medium-size area	0.05
Small-size area	0.20
Linear small-size area	0.01

Accessibility	
Open	0.74
Closed	0.14
Connected	0.12

Attractiveness (location + activity)	
No	0.32
Yes	0.68

Change in the legal basis or responsibility of the place	
No	0.54
Yes	0.46

Lighting	
Natural	0.19
Artificial	0.06
Combined	0.55
No extra needed (more than usual)	0.23

Nature of ground	
Mineral	0.43
Vegetable	0.06
Synthetic	0.07
Combined	0.35
Not important	0.19

Risks of activity (in brief)	
Accident prone	0.56
No risk	0.44

Protection mode	
Self secure	0.39
Security protected	0.08
Protected by a management system	0.10
Secure	0.43

User status	
Public (all people)	0.54
Tenant occupying	0.09
Owner	0.02
Specific group	0.35

New insurance policy	
No	0.57
Yes	0.43

Legal basis of ownership and management (in brief)	
Free use	0.36
Rental use	0.32
Owner user	0.32

Term of use	
With priority	0.76
Without priority	0.10
Not important	0.14

Secondary or added function	
Necessary activities	0.02
Recreation	0.32
Ecological (green)	0.08
Cultural	0.27
Commercial	0.09
Social	0.20
Pedagogic	0.02

Nightlife	
No	0.22
Yes	0.78

Prerequisites (in brief)	
With prerequisites	0.69
Without prerequisites	0.31

Relationship between activity and climate	
No	0.86
Yes	0.14

Temperature	
Hot	0.03
Cold	0.01
Moderate	0.46
Not important	0.50

Noise pollution	
No	0.61
Yes	0.39

Morphology (in brief)	
Small surface	0.27
Medium surface	0.20
Large surface	0.53

Location	
Downtown	0.41
Suburb	0.05
Everywhere	0.51
Periphery	0.03

Risks (in brief)	
Accident prone	0.08
Risk of fire	0.09
No risk	0.83

Risks (without adding the second function)	
Self secure	0.38
Secure	0.44
Protected against fire	0.01
Protected by a management system	0.10
Security protected	0.07

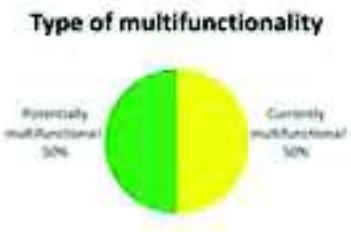
Lighting (in brief)	
To consider	0.77
Not important	0.23

Space covering	
Covered	0.12
Open	0.78
Semi-open	0.05
Combined	0.05

Risks (without adding the second function)	
Accident prone	0.17
No risk	0.83

4.4. Concluding remarkable points extracted from statistical analysis (frequency of answers)

Type of multifunctionality



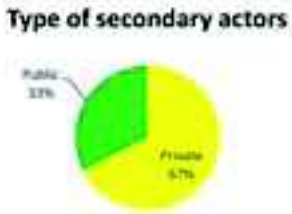
50% of our cases are currently multifunctional and 50% of them have the capacity to be one according to the definition said before.

It's important to spend time for introducing this idea to people. The notion of "sharing use" is something that might be achieved through informing and education.

Type of Initial and secondary actors

Although the initial actors are often public, when the spaces accept a secondary or additional function, they go under the responsibility of a private group.

This shows that the public spaces have a greater potential for multifunctionality than the private spaces.



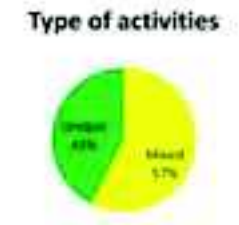
Among the studied examples, most of the cases were those who have given a public space to private groups or a specific person. This seems logical, because firstly the management of public spaces is integrated and secondly, controlling a space which has been given to a specific group is easier.

User status

Although, the percentage of utilized space by a specific group of users is remarkable, most of the spaces have been designed for public use.

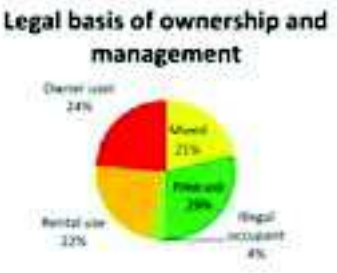
Type of activity

Most of the spaces which have started as multi-functional space had been designed initially in a multi-purpose way. As a matter of fact, the approach of mixed-use to a space incurs the increased function of space potential for maximum use. Even though the number of spaces who have been designed mono-functionally and managed to be allocated to a second function is not ignorable.

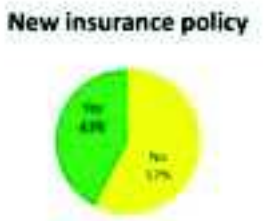


Legal basis of ownership and management

For the legal fundamentals of space occupation and management there are several answers: provision the space as rental or as free possession good, or a way that the owner can personally take the responsibility upon the second function. Sometimes the nongovernmental institutes are involved in order to help running the place



New insurance policy



Although it seems that legal restrictions are of great importance in this field, in most cases, the legal fundamentals in terms of responsibility and insurance have not been changed. With planning, educating and paying more attention along with determining the priorities, a space can be considered as a multifunctional area.

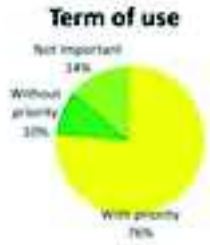
It's important to spend time for introducing this idea to people and encouraging them to look at the space as a "capital" that could be shared, not only between different users, but also between different activities. The notion of "sharing use" is something that might be achieved through informing and education.

Destination of use

In studied cases, with addition of new function, new users have been added to the complex. In fact, the idea of multi-functionality brings the possibility of using spaces by an augmented number of users.

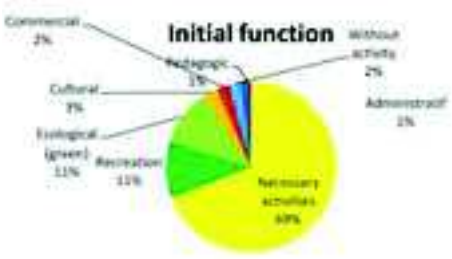
Term of use

The priority in using the space should also be elaborated. This issue is much more important when there is an interaction between two functions or one of the functions reaches to its peak. In these situations, other functions should be flexible enough to be adapted to the new conditions. In addition, preponderant uses have to be already identified with induced priorities in order to clarify the necessary requirements and conditions.



Functions

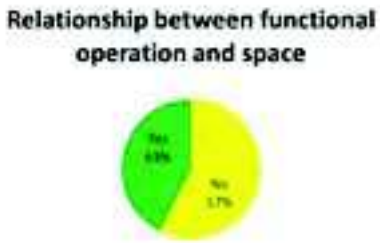
While the process of transforming a mono-functional space to a multi-functional space, in most of the cases which space has been allocated to necessary activities, the number of users augmented. These spaces have been transformed into spaces for recreational, social and cultural activities. The augmentation of these activities in urban public spaces caused the promotion of space quality and citizen's life quality as well.



Temporality

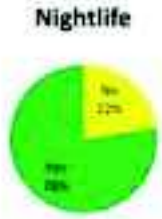
The diversity between studied cases regarding their rhythm and time indicates that the space can be used multifunctional for a period of time from few minutes to several months. Choosing appropriate activity is related to its rhythm and idle hours of the space.

Relationship between functional operation and space



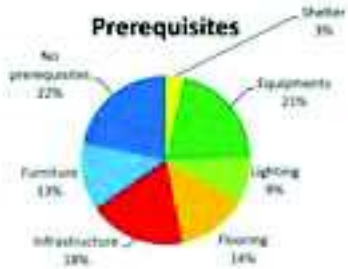
A meaningful relationship between functional operation and space has not been observed. In other words, although, the functionality of space is depended on its form of space but, functional optimization (increasing functional density) could be done for various forms.

Nightlife



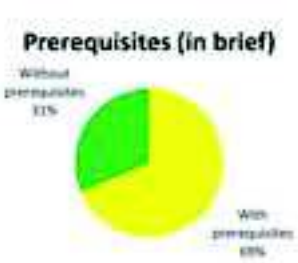
In most of the cases, it has been tried to use the capability of space to the outermost during the night. In fact, space not only changes daily life of citizens it enriches nightlife. Here, a relationship between multi-functional with a 24-hours spaces, could be observed. In fact, a 24-hours space could be the promoted and completed form of a multi-functional space.

Prerequisites



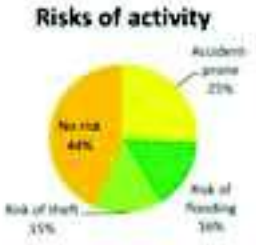
Usually, in adding new functions to a space, there exist prerequisites such as furniture and equipment. In most of the cases, prerequisites such as equipment, flooring, lighting and infrastructure should be taken into account. Depending on the function,

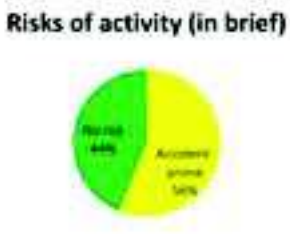
these prerequisites could be different. The best and efficient method is putting those spaces on priority that are in a less need to equipment and new infrastructure.



Risks of activity

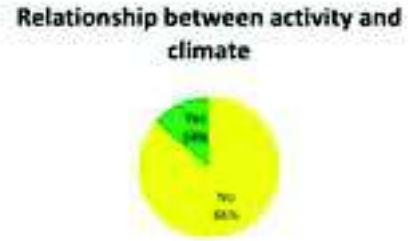
Adding a new function to space augments the possibility of risk and danger in the space. Recognizing these dangers and predicting demarches for preventing the risks is an important factor in viability of space in a long period. In some cases, spaces which their function has been augmented to be used by a great number of users, due to lack of risk management have encountered problems and had to cease their second activity.





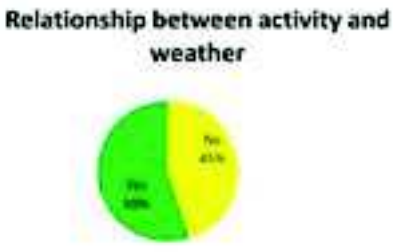
Relationship between activity and climate

A remarkable and meaningful relationship does not exist between the capability of transforming a space to a multi-functional space and the climate which the space belongs to it. In other words, this concept could be applied in anywhere in the world.



Relationship between activity and weather

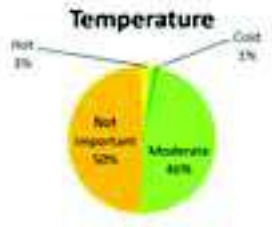
Since in our studies, open spaces have been examined, it is normal to have a meaningful relationship between activity and weather condition. Of course, considering environmental conditions is an



important point while designing the primary function.

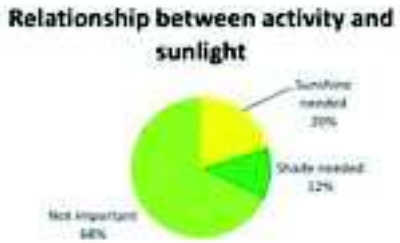
Temperature

A notable relationship between defined activity and temperature of space could not be observed. In fact, in most of the cases those functions have been selected that do not need specific temperature and could be occurred in normal conditions.



Relationship between activity and sunlight

A notable relationship between defined activity and sunlight could be observed. In cases of secondary function, that there is a need for shade, parasols or coverage for protecting users from sunlight have been predicted.



Noise pollution

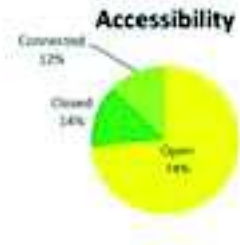
The augmentation of new users leads to the augmentation of noise pollution. Although in studied cases, designers have tried to control the increased noise pollution.

Morphology

From morphology point of view, a notable variety in form and size which has been used multi-functionally could be observed. Each space, based on its capabilities, presents different potentials for new users. Creativity of planners in looking for new facilities in a new space has led to different and varied incomes- which are all successful in their own context.

Accessibility

The chosen spaces are the directly accessible spaces. In other words, direct access to most of them is possible. Nevertheless, the frequency of spaces that are controlled by an entrance gate or access to them is possible through another space, is remarkable, the direct access provides a greater potential for making a multifunctional space.

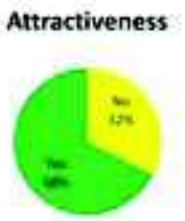


Location

Most of spaces, from location point of view, have not been restricted to a specific zone. Although with this idea, a notable number of spaces in downtown and high density parts of the city had experienced the growth of function but, this question is not restricted only to downtowns.

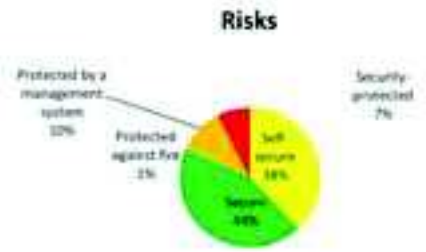
Attractiveness (location + activity)

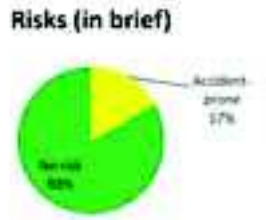
Usually, those spaces have been chosen for a secondary function that, initially, had peculiar attractiveness (e.g. location) for public. This potential (connecting to attractive points) has increased the percentage of success as a multi-functional space.



Risks (without adding the second function)

The chosen spaces for having secondary or added function, from location and proximity point of view, were low risks spaces. In fact those spaces that their security was provided whether by physical barriers or manpower had been chosen.



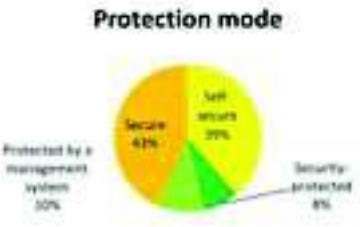


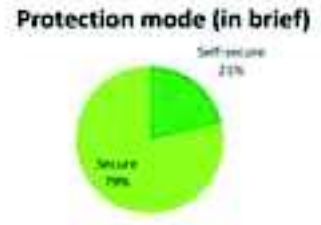
Change in the legal basis of responsibility of the place

The frequency of change in the responsibility of the space with deficiency of change in responsibility is relatively equal. This illustrates, that change in responsibility or deficiency of change, could be examined from different point of views and also be presented by different solutions. Each city and zone, depending on its culture and laws, have peculiar conditions that could be different from the adjacent zone or city.

Protection mode

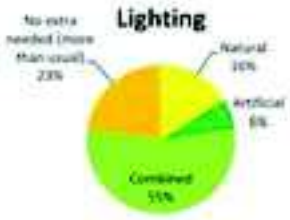
In most cases, prerequisite basis for providing security of people and space equipment have been predicted. In a remarkable part of studied cases, the responsibility for protecting people and goods is the responsibility of users.

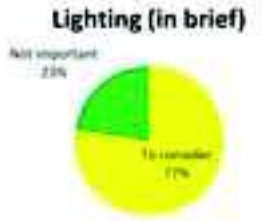




Lighting

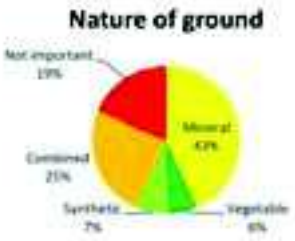
Since, the main purpose of increasing the functional hours of a space is having more efficiency and extended working hours, in most cases there is a need for preparation of extra lighting.





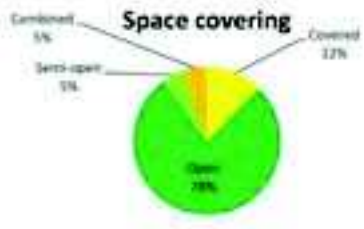
Nature of ground

The variety of studied spaces, from grounding point of view, illustrates that creation of multi-functional spaces in natural and artificial environments is possible.



Space covering

The examined spaces were open spaces. These spaces, normally, in their secondary function remained opened and the need for preparing a cover or parasol has not been observed.



4.5. Results

While assessing these results, the next level of analysis based on AHP method (Analytical Hierarchy Process) was entered. Because of the increased number of criteria in planning and designing in multifunctional spaces there is a need to use Multiple-criteria decision-making method. [5] The analytic hierarchy process is the most common method of MCDM (Multi-Criteria Decision Making) which is applied usually by architects and urbanists (Groat and Wang 2002; Asgharpour 2010). The benefit of AHP is its comprehensive and rational framework in solving problems and the evaluation of different solutions.

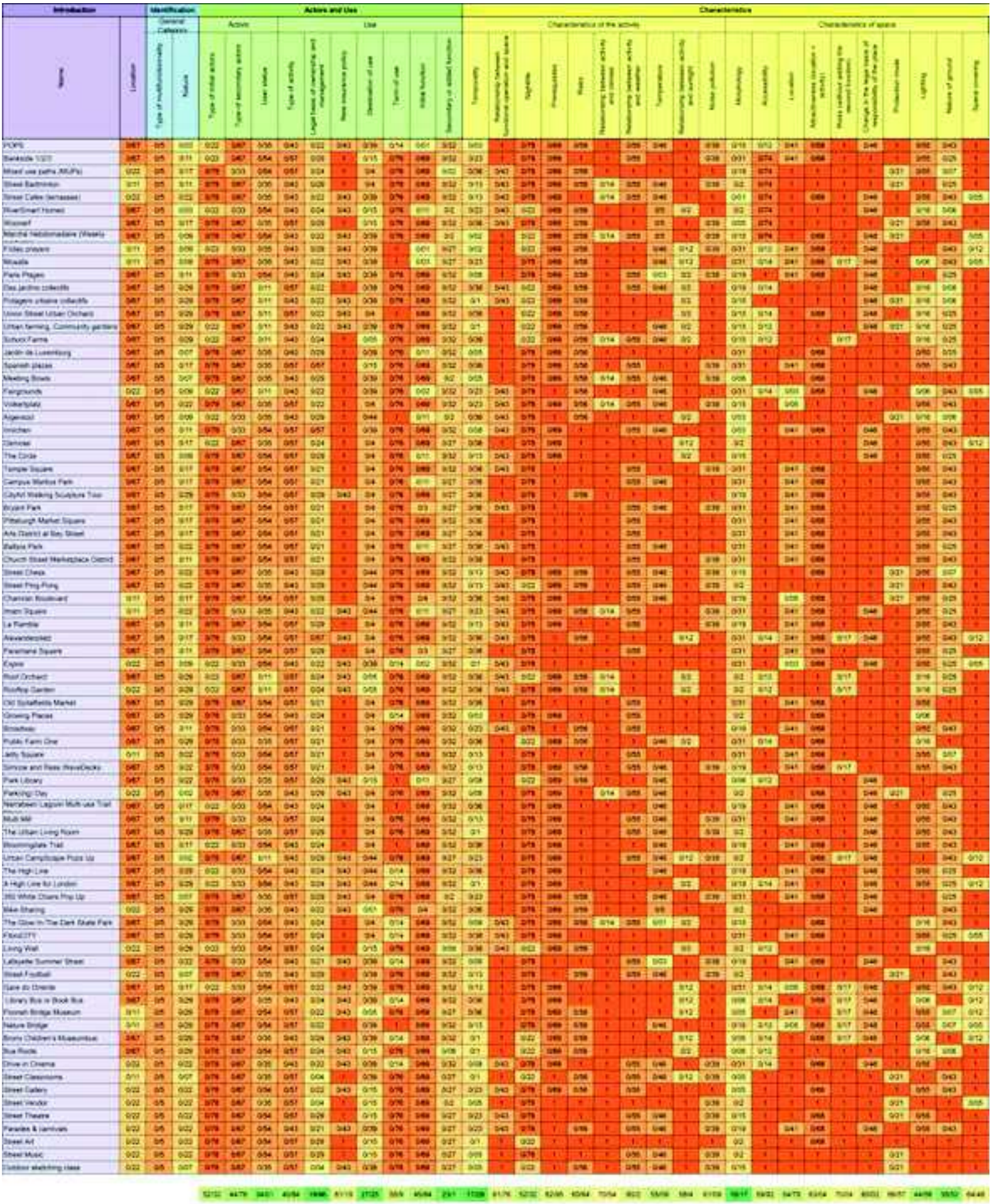
4.5.1. Criteria weighting

In this step, in order to have the possibility to compare the value (importance) of the criteria among each other, it is attempted to transform the collected data of the main matrix (applicable grid) into quantity shown in table 14. This means, with examining the amount of effectiveness of each criterion, it has been tried to recognize the importance of the criteria. For all the thirty criteria the percentage obtained for each criterion (according to their statistical frequency of the possible options) has been transformed.

[5] The calculations are done based on: M.J. Asgharpour (2010) Multiple Criteria Decision Making - 7th edition, Tehran university Press, Tehran (in Persian)

The color affected to the cells corresponds to the level of abundance of criteria values (statistical frequency of each option shown in table 13). The dark cells gather those options which have more abundance and brighter cells are those options that have less abundance. Although the bright cells are conceivable in future projects, they would not be introduced as available option being considered as less effective regarding the example.

Table 14: Quantifying the qualitative data of the main matrix



At the next level, intended to have the absolute feasibility of each option, the criteria are weighted. This has been done by the Analytical Hierarchy Process (AHP) for transforming quantitative assessments into qualitative assessments. AHP compares pairwise the importance of different criteria among (within the same level of importance) and makes it possible to describe a complex structure in hierarchical levels, to identify priorities and to verify the consistency in judgments (Saaty, 1990). The AHP converts these evaluations to numerical values that can be processed and compared over the entire range of the problem. A numerical weight or priority is derived for each element of the hierarchy, allowing diverse and often incommensurable elements to be compared to one another in a rational and consistent way. This capability distinguishes the AHP from other decision making techniques (Saaty, 1980; Saaty & Peniwati, 2013). These criteria, according to their importance, have been classified in 5 levels and have been allocated a scale value from 1 to 9, given based on the pairwaise comparison method (Asgharpour 2010). Pairwise comparison generally is any process of comparing entities in pairs to judge which of each entity is preferred, or has a greater amount of some quantitative property, or whether or not the two entities are identical. When two criterions are equal, in the comparison they obtain number 1. Scale 3 is for when one criterion is more important than the other but the level of importance is law. Scale 5 is when the level of importance is medium. 7 shows a high level of importance and 9 represents the absolute importance of one compared to another (Asgharpour 2010). These numbers will be normalized from zero in a matrix.

The calculations are shown in table 15 and 16 and the important numbers (results) are summarized in table 17.

Table 15 **:**scoring the criteria from 1 to 9 based on the pairwise comparison method

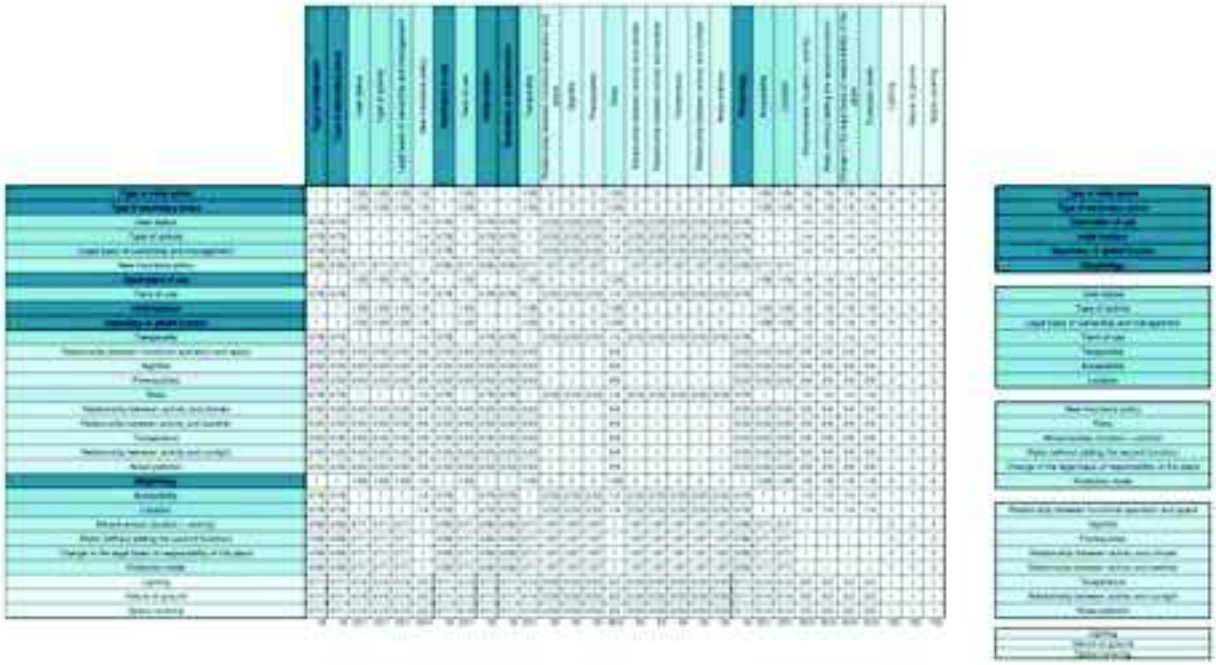
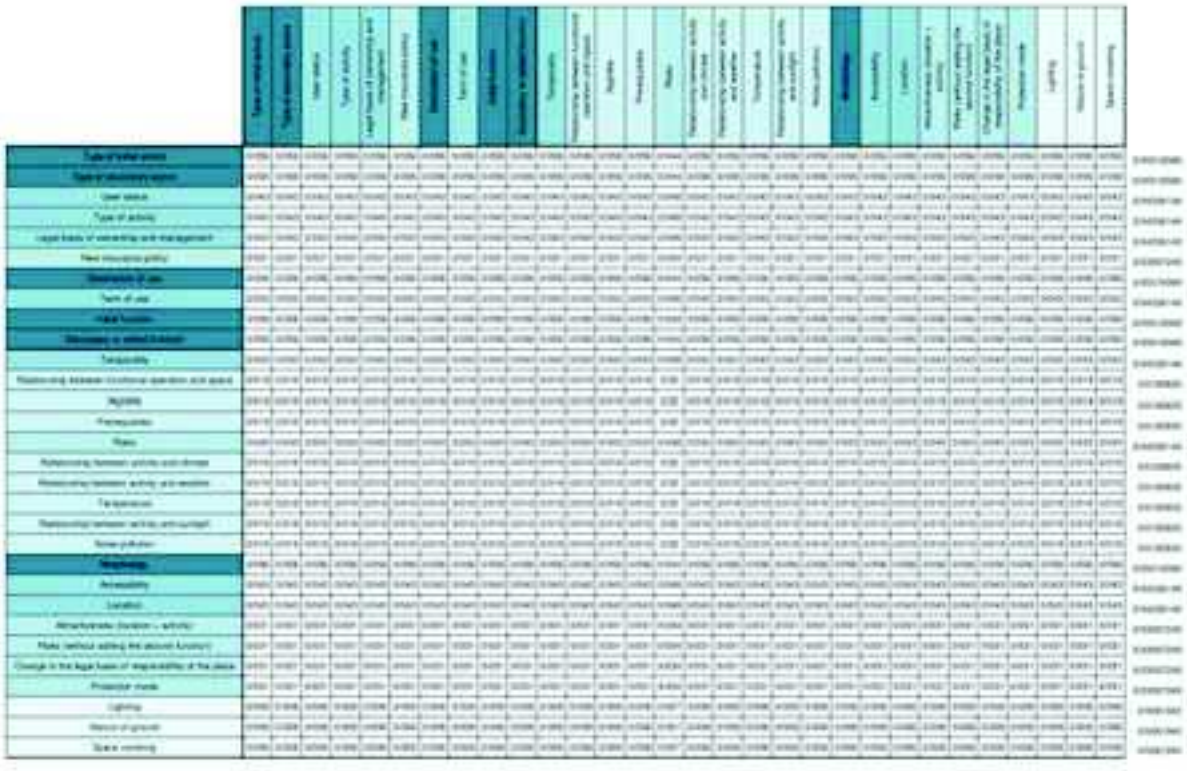


Table 16: Calculating the normalized value (from 0 to 1) of each criterion



From the combination of weighting criteria (Table 17) and the table in which options for each criterion are evaluated with numbers (Table 14) table 18 has come out. In other words, the numbers of each cell from table 15 has been multiplied to the criteria value (first row of table 18) and the attained number illustrates the relative worth of each option regarding the weight of criteria. The final table (Table 18) shows the potential of repetition (frequency) for each example in relation to other examples.[6]

Table 17: The value of each criterion from 1 to 9 and normalized values

Type of initial actors	9	0.056
Type of secondary actors	9	0.056
Destination of use	9	0.056
Initial function	9	0.056
Secondary or added function	9	0.056
Morphology	9	0.056

User status	7	0.043
Type of activity	7	0.043
Legal basis of ownership and management	7	0.043
Term of use	7	0.043
Temporality	7	0.043
Accessibility	7	0.043
Location	7	0.043

New insurance policy	5	0.031
Risks	5	0.031
Attractiveness (location + activity)	5	0.031
Risks (without adding the second function)	5	0.031

[6] The calculations are done based on: M.J. Asgharpour (2010) Multiple Criteria Decision Making - 7th edition, Tehran university Press, Tehran (in Persian)

Change in the legal basis of responsibility of the place	5	0.031
Protection mode	5	0.031
Relationship between functional operation and space	3	0.019
Nightlife	3	0.019
Prerequisites	3	0.019
Relationship between activity and climate	3	0.019
Relationship between activity and weather	3	0.019
Temperature	3	0.019
Relationship between activity and sunlight	3	0.019
Noise pollution	3	0.019
Lighting	1	0.006
Nature of ground	1	0.006
Space covering	1	0.006

With the aid of AHP the case studies were analyzed more accurately and classified on the basis of their feasibility. The total score for each space (a number between 0 and 1) is related to the capacity of the space to become multifunctional. Moreover, comparing the scores of different cases studied conducted us to a more clear vision to the feasible ideas suitable for our experimental site. This method could be used to score the capacity of being multifunctional for a space which is tended to be studied.

In table 18, the most difficult cases to conduct are the red ones and the most feasible are the blue ones (See Annex.II). This table can help us choose the appropriate cases to apply the approach to Strasbourg or any other specific sites. The dark colors columns show the most important features; the features that need more attention.

Table 18: The feasibility of reproduse of different cases according to relative value of each criteron

The importance of each criterion in theory (our ideal grid) is shown in table 19.

Table 19: The highest impact of each criterion might have in the feasibility of the whole project

(in ideal grid)

	Value based on normalized value	The most feasible possibility	Frequency among cases	Absolute impact in feasibility
Type of initial actors	0.056	Public	0.78	0.04368
Initial function	0.056	Necessary activities	0.69	0.03864
Type of secondary actors	0.056	Private	0.67	0.03752
Destination of use	0.056	Adding new users by adding new functions	0.40	0.02240
Secondary or added function	0.056	Recreation	0.32	0.01792
Morphology	0.056	Large-size area	0.31	0.01736
Term of use	0.043	With priority	0.76	0.03268
Accessibility	0.043	Open	0.74	0.03182
Type of activity	0.043	Mixed	0.57	0.02451
User status	0.043	Public (all people)	0.54	0.02322
Location	0.043	Everywhere	1	0.043
Temporality	0.043	Permanent (daily full-time)	0.36	0.01548
Legal basis of ownership and management	0.043	Free use	0.23	0.00989
Attractiveness (location + activity)	0.031	Yes	0.68	0.02108
New insurance policy	0.031	No	1	0.031
Change in the legal basis of responsibility of the place	0.031	No	0.54	0.01674
Risks	0.031	No risks	1	0.031
Risks (without adding the second function)	0.031	Secure	0.44	0.01364
Protection mode	0.031	Secure	0.43	0.01333
Relationship between activity and climate	0.019	No	1	0.019
Nightlife	0.019	Yes	0.78	0.01482
Relationship between activity and sunlight	0.019	Not important	1	0.019

Noise pollution	0.019	No	1	0.019
Relationship between functional operation and space	0.019	No	1	0.019
Relationship between activity and weather	0.019	Yes	1	0.019
Temperature	0.019	Not important	1	0.019
Prerequisites	0.019	No prerequisites	1	0.019

Space covering	0.006	Open	1	0.006
Lighting	0.006	To consider	0.77	0.00462
Nature of ground	0.006	Mineral	0.43	0.00258

According to this table, the criteria based on their absolute weight in 80 real projects as listed below in table 20. It should be kept in mind that the augmentation of the cases studies might change the order in this table.

Table 20: The sorted criteria with their most feasible option upon their impact in the feasibility of the whole project (in applicable grid)

	Value based on normalized value	The most feasible possibility	Frequency among cases	Absolute impact in feasibility
Location	0.043	Everywhere	1	0.043
Type of initial actors	0.056	Public	0.78	0.04368
Accessibility	0.043	Open	1	0.43
Initial function	0.056	Necessary activities	0.69	0.03864
Type of secondary actors	0.056	Private	0.67	0.03752
Term of use	0.043	With priority	0.76	0.03268
New insurance policy	0.031	No	1	0.031
Risks	0.031	No risks	1	0.031
Type of activity	0.043	Mixed	0.57	0.02451
User status	0.043	Public (all people)	0.54	0.02322

Destination of use	0.056	Adding new users by adding new functions	0.40	0.02240
Attractiveness (location + activity)	0.031	Yes	0.68	0.02108
Relationship between activity and sunlight	0.019	Not important	1	0.019
Noise pollution	0.019	No	1	0.019
Relationship between functional operation and space	0.019	No	1	0.019
Relationship between activity and weather	0.019	Yes	1	0.019
Relationship between activity and sunlight	0.019	Not important	1	0.019
Relationship between activity and climate	0.019	No	1	0.019
Secondary or added function	0.056	Recreation	0.32	0.01792
Morphology	0.056	Large-size area	0.31	0.01736
Change in the legal basis of responsibility of the place	0.031	No	0.54	0.01674
Nightlife	0.019	Yes	0.78	0.01482
Risks (without adding the second function)	0.031	Secure	0.44	0.01364
Protection mode	0.031	Secure	0.43	0.01333
Legal basis of ownership and management	0.043	Free use	0.23	0.00989
Temperature	0.019	Not important	0.50	0.00950
Space covering	0.006	Open	1	0.006
Lighting	0.006	To consider	0.77	0.00462
Prerequisites	0.019	No prerequisites	0.22	0.00418
Nature of ground	0.006	Mineral	0.43	0.00258

4.5.2. Results

As it can be seen, the existence of different options (possibilities) would cause the reduction in some criteria's effects. This means, looking at an absolute way to the criteria, a criterion like the *site's morphology* would be among primary criteria, but in a real regard since there are spaces with different forms in different parts of the world have been allocated to multifunctional spaces it is changed to the secondary criteria. This would reduce the effect of morphology criteria in the time of defining a real and

possible project. Besides that, the effect of criteria such as weather, environmental condition, cover and ground and prerequisites are so down that makes them deniable. Furthermore, a criterion such as Legal basis of ownership and management of space, although at the beginning was among the barriers, but in reality regarding the variety of options is easy to be solved.

This list (Table 20) helps us to select the appropriate criteria in the level of taking decision for transforming a mono-functional site into a multifunctional site. Regarding the increased number of criteria and effective factors on taking decision, taking into account of criteria could be stopped in the level of important criteria or just to be continued till the secondary and the third category of criteria (See table 12).

4.5.3. Activity exchanges

The tables below (Tables 21-24) show the relation between different activities as the primary and secondary functions. It's obvious that in the most of studied cases, the spaces with the function for necessary activities are the starting point and these spaces are now dedicated to the recreation, cultural and green activities at the same time or as a substitute in their idle hours as multifunctional spaces.[7]

[7] Most of our 80 cases had a mixity of various kinds of activities. In some cases, thye nature of activity did not change but because of changing (or adding) users, they became multifunctional (For more details see Annex II).

Table 21: Initial and secondary functions

Initial function	Secondary or added function	Number of related cases
necessary activities	necessary activities	3
necessary activities	commercial	14
necessary activities	cultural	37
necessary activities	ecological	11
necessary activities	recreation	45
necessary activities	pedagogic	3
necessary activities	social	29
administrative	recreation	1
commercial	cultural	2
commercial	recreation	2
cultural	commercial	1
cultural	cultural	2
cultural	recreation	2
ecological	ecological	3
ecological	commercial	2
ecological	cultural	5
ecological	recreation	3
ecological	social	3
recreation	necessary activities	1
recreation	cultural	7
recreation	ecological	1
recreation	recreation	4
recreation	social	4
pedagogic	cultural	1
pedagogic	social	1

Table 22: Classifying the studied cases according to their initial and secondary functions (1/3)

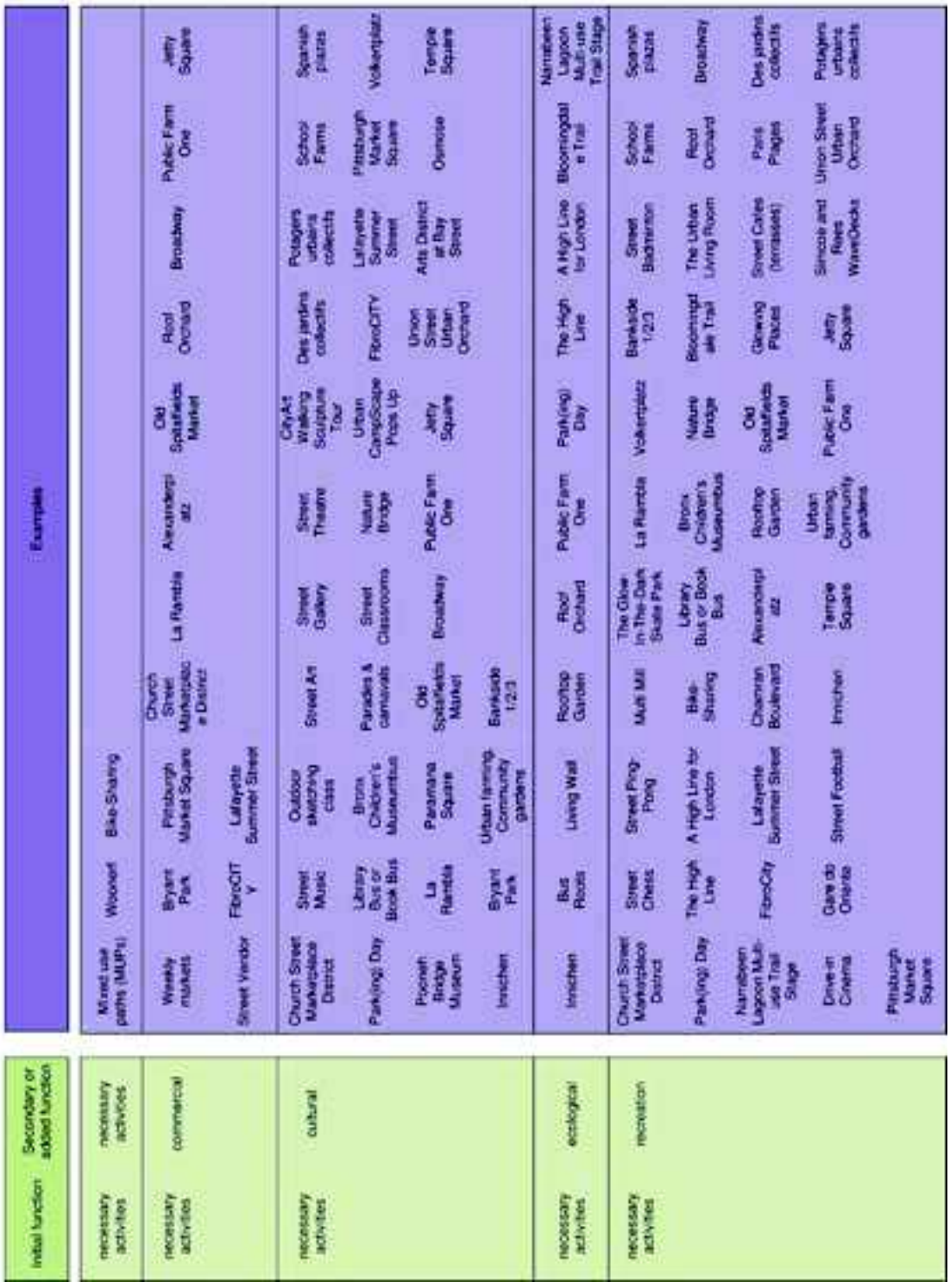
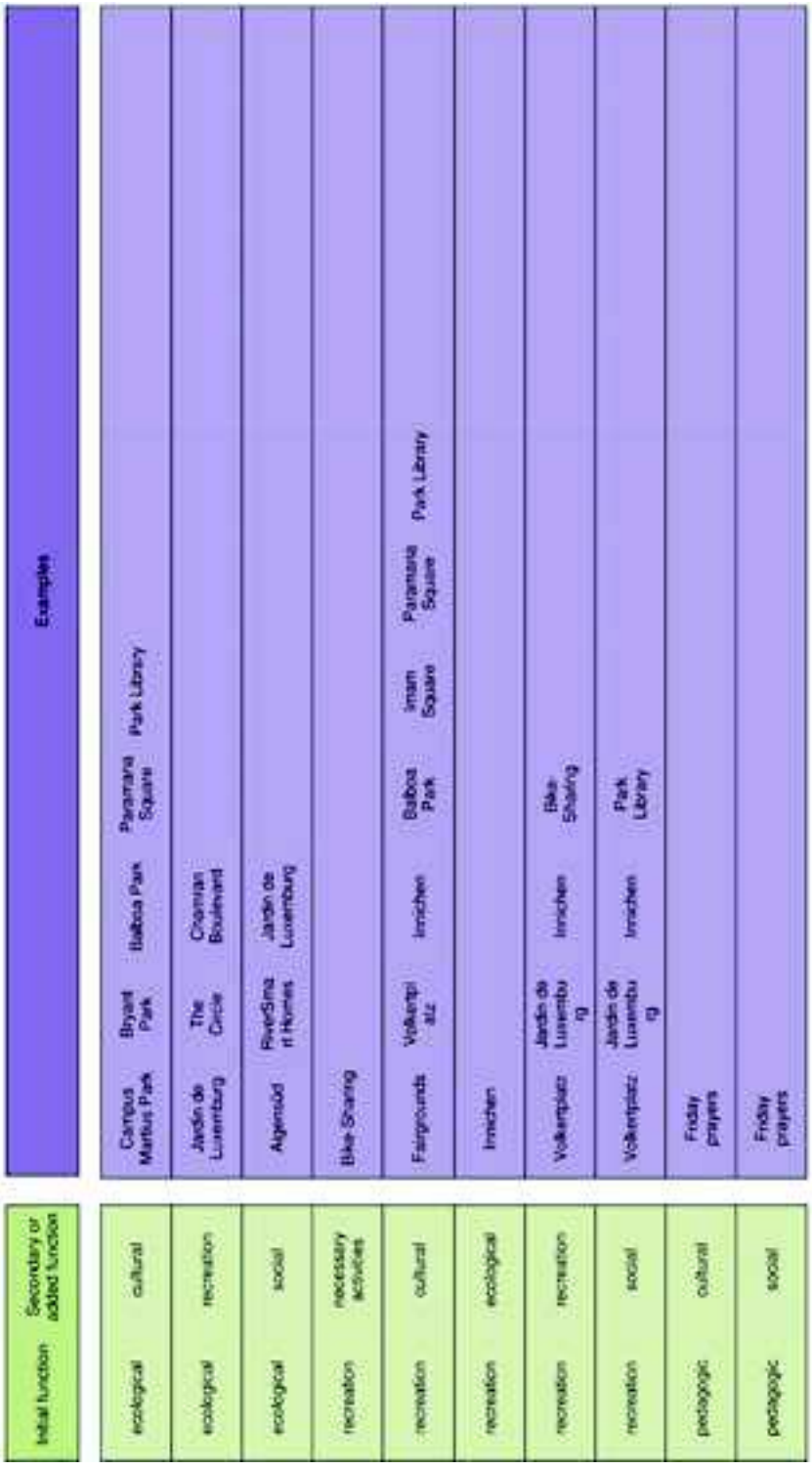


Table 23: Classifying the studied cases according to their initial and secondary functions (2/3)

Initial function	Secondary or added function	Examples																		
necessary activities	pedagogic	Outdoor sketching class	Street Classrooms	Urban CampScape Pop Up																
necessary activities	social	Street Chess	Street Ping Pong	Rooftop Garden	Old Spitalfields Market	Glowing Plants	Weekly markets	Des jardins collectifs	Potagers urbains collectifs	Union Street Urban Orchard	Urban farming, Community gardens	School Farms								
		Broadway	Jetty Square	Parades & carnivals	Public Farm One	Parking) Day	350 White Chairs Pop Up	Street Vendor	The Urban Living Room	ForeCITY	Spanish plazas	Innichen								
		Lafayette Summer Street	Roof Orchard	Street Cafes (terrasses)	Meeting Bowls	CityArt Walking Sculpture Tour	Pittsburgh Market Square	Volksmplatz												
administrative	recreation	POPS																		
commercial	cultural	Fairgrounds	Expos																	
commercial	recreation	Fairgrounds	Expos																	
cultural	commercial	Mosaïa																		
cultural	cultural	Mosaïa	Expos																	
cultural	recreation	Fairgrounds	Expos																	
ecological	ecological	Agensiad	RiverSmart Homes	The Circle																
ecological	commercial	Bryant Park	Park Library																	

Table 24: Classifying the studied cases according to their initial and secondary functions (3/3)



Initial function	Secondary or added function	Examples									
ecological	cultural	Campus Martius Park	Bryant Park	Balboa Park	Panama Square	Park Library					
ecological	recreation	Jardin de Luxemburg	The Circle	Cromran Boulevard							
ecological	social	Algemold	RiverSmart Homes	Jardin de Luxemburg							
recreation	necessary activities	Bike Sharing									
recreation	cultural	Fairgrounds	Volksmpl atz	Irmichen	Balboa Park	Imam Square	Panamara Square	Park Library			
recreation	ecological	Irmichen									
recreation	recreation	Volksmplatz	Jardin de Luxembu rg	Irmichen	Bike Sharing						
recreation	social	Volksmplatz	Jardin de Luxembu rg	Irmichen	Park Library						
pedagogic	cultural	Friday prayers									
pedagogic	social	Friday prayers									

As it has been shown in figure 20, transforming mono-functional spaces into multifunctional spaces, along a better utilization of spaces which has existed in the urban area as spaces for mandatory activities, would create potentials rooms for having cultural and recreational activities. This question is in the way of our initial hypothesis on promoting the quality of spaces with applying the idea of multifunctionality. In fact, the most conceivable method is the utilization of mandatory activities sites for optional activities. This graph has been drawn based on the statistical frequency of activities in 80 cases (shown in table 21) and with GEPHI software intended to show how effective multifunctional spaces are in increasing the possibility for optional and social activities. The size of each arrow is proportional to the number of relationships between source and target activities. As presented in table 21, the spaces for necessary activities in our 80 cases are mostly dedicated to recreational and cultural (optional) activities at the firs level and then to the social ones. The examples for each "exchange" are shown in tables 23-35 (For more details see Annex II).

Figure 20: Source and target functions in the studied cases (Ghafouri, 2016)

5. How to create a multifunctional space

5.1. Decision-making process

Our main objective in this step is to know if an urban planner can take into account the concept of "multifunctionality" as a start point of his decision making process. This research tries to find an answer for this question: *"according to all the cases studied and the analysis, how can the "multifunctionality" be considered as a general concept in revitalizing urban spaces?"*

In this section, designing has a two-level process: first as presentation of the idea (conceptual design) and planning, second as presentation of the design as a plan. In defining the concept of multifunctionality, the patterns that have been reached by examining the samples, were introduced as the priority of must-noticed criteria. The idea of scheduling (calculating the notion of functional operation or efficiency by an index based on functioning time of the space) seems to be interesting. In the last step, considering the numerous numbers of criteria and effective factors while decision-making, the conceptual data model for using in GIS software is proposed. A step by step process for choosing the appropriate sites for specific functions is presented below.

5.1.1. Conceptual design using Pattern

According to what has been developed before, a “multifunctional space” could be identified with these two characteristics.

- Allow different functions, different actors and different users during different periods of time or have the capacity to accommodate two or more activities at the same time (accept more than a function simultaneously)

- Fulfill the different roles a space might have, in line with the environmental, economical and social sustainability.

A multifunctional space should be a place for users with various ages, multiple needs and expectations.

In the conceptual design level, utilizing patterns in the examined cases could be helpful to planners and designers. Therefore, eight patterns have been identified repeated most in the examined cases. A schematic process of this extraction is showed in figure 21.

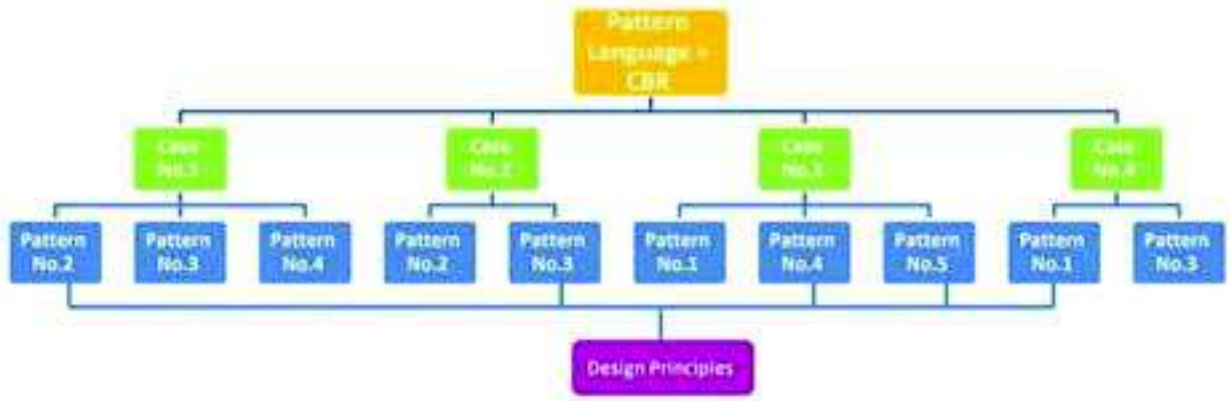


Figure 21: From cases to patterns (Ghafouri, 2016)

The repetition of each pattern (frequency) is variable. If the frequency of each pattern could be considered as equal to its feasibility (possibility to be repeated), the amount of designer's attention to each pattern could be extracted in a quantitative form. Figure 22 illustrates the frequency (percentage of repetition) of each pattern in all the eighty examined cases. The similar patterns in the left chart are grouped in the right one in order to achieve a more coherent result.

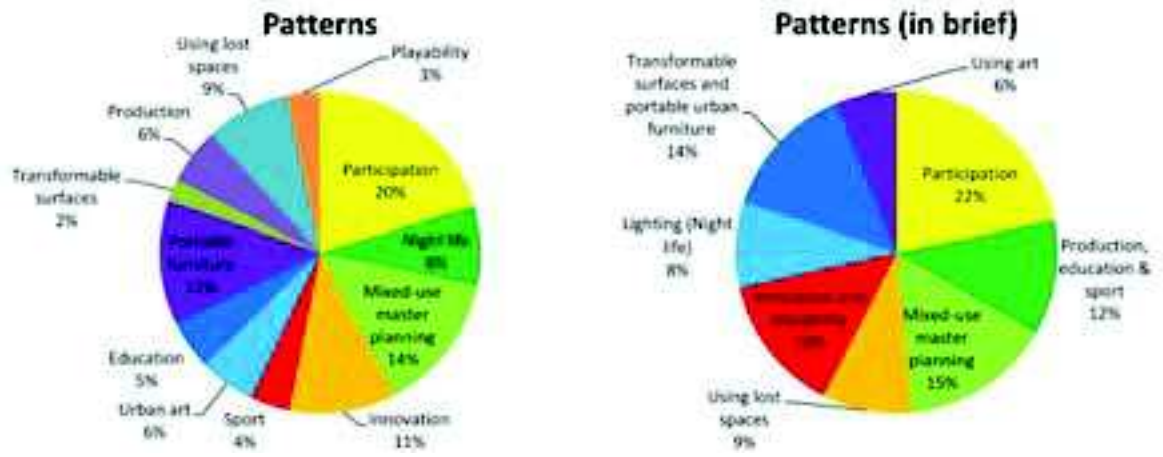


Figure 22: The frequency (percentage of repetition) of each pattern in all cases (Ghafouri, 2016)

There are 8 conceptual patterns extracted from analyzing the cases. These patterns could help the architects and urban designers find their concept as the starting point of their concepts as the starting point of the design process.

- **Participation** : bringing all the actors and future users into the step of decision making, trust them and give them the sense that the space belongs to them, education of those concepts related to citizenship and urban life, changing the meaning of public space in citizens minds from a space who does not belong to anyone to a space which belongs to everybody, ; increasing the scene of belonging to spaces with interfering them in planning changing and managing the space;

- **Production, education and sport**: using the space for producing agriculture products, educational or sportive activities; e.g. the secondary function of space would not be restricted to mere recreational activities;

- **Mixed-use master planning, Network of activities** : having a multi-purpose approach to the design, considering space not only as an island but as a part of net activity that can be efficient in changing the life of its zone or neighborhood;

- **Using lost, dead or forgotten spaces** : using dead and forgotten spaces like rooftops and undergrounds (vertical city) and also vacant lands that, in addition to an efficient use of existing spaces, in order to help solving social problems and providing security;

- **Innovation and playability** : using forms, combination and functions that are attractive for kids -or in a creative way leads to their involvement with the environment, applying innovative solutions that are new for citizens or having a different approach toward the question;

- **Lighting** : planning for an active night life, expanding working hours of a space along modern lifestyle leads to overriding of nightlife and thereupon, lighting for providing security and aesthetical purposes;

- **Using art** : involving art in everyday life as media and as aesthetical elements;

- **Transformable surfaces and portable urban furniture**: providing the possibility of personalizing the space based on users' needs by portable furniture, adding specific characters to the space or using space in peculiar occasions by designing transformable surfaces.

5.1.2. Planning Process using criteria evaluation

Criteria are important while entering from the level of concept to planning of the site. Since the number of criteria is numerous, considering priority based on weight, criteria value, cultural and social exclusivity of the region and users' needs has a significant importance.

In general, some of our criteria are of a higher importance than the others. The feedback of analyzing the cases led us to classify the criteria in 3 degrees of importance (Table 22). These criteria should be analyzed in the phases of *feasibility study*, *programming* and *conceptual design*. The first degree criteria gather the essential criteria that the project cannot be started without taking them into consideration. The second degree relates to the criteria which have a wide variety of attributes and must necessarily be considered, but in case of any problems or limits, many different solutions might be put into test. The third degree criteria are recommended in each project of urban design (in a mono-functional as well as a multifunctional space). This classification could be considered as a basis of feasibility study for changing a mono-functional space to a multifunctional one.

It should be kept in mind that these first criteria should be completed with socioeconomic, legal and cultural criteria associated especially to responsibility and insurance.

According to previous analyses, the most important criteria could be classified in 3 degrees:

1- Most important criteria

Type of Initial actors, Type of secondary actors, Primary and secondary functions, Destination of use, Site morphology

2- Important criteria

User status, Type of activity, Legal basis of ownership and management, Accessibility, Location, Temporality, Terms of use

3- Criteria highly recommended to be considered

Attractiveness (location + activity), Risks (without /with adding the second function), Protection mode, Legal basis of responsibility of the place, Insurance policy

Another important point to be considered is that the amount of criteria's importance is different in general, and also in various phases of planning and designing. Some of the criteria are more important in the time of problem defining, some in planning, some at the time of providing the concept and design, and some should be noticed at the time of management and maintenance of space. Table 25 illustrates the main criteria that should be considered at each step. Since the numerous numbers of criteria leads to increasing the amount of time in decision making, considering all of them in all stages may not be possible. It is in this step that the importance of grouping and considering the exact time for entering in a process, takes importance. It should be noted also, if appropriate planning for management and maintenance of a functional space from priority approach and insurance does not take place, possible dangers would lead to failure of the space.

Table 25: The phases in which each criterion enters the design process

Problem definition	Location Temporality Secondary function
Planning and feasability study	Morphology Location Initial function Risks Type of actors Accessibility Attractivness Prerequsites
Finding the concept, desicion making and design	Legal basis of the possession and management User status Temporality Type of actors Destination of use Terms of use Type of activities Protection mode Insurance Thermal comfort Nightlife Noise pollution Prerequisites Lighting Nature of ground Space covering
Management and maintenance	Terms of use Protection mode Insurance

5.1.3. Scheduling by the "TIME" factor

In addition to patterns and criteria that have been uttered in previous level, it should be born on mind that designing a multi-functional space, is indeed the question of space scheduling for activities. As a result, understanding the behavior of space in different periods and the relationship of activity with time has a great importance.

In fact, it should be kept in mind that beside the functions, time (temporality) is also a key factor in planning for multi-functional spaces; because this idea defines a different relationship between activity and time.

The tables 26 and 27 classify our 80 cases according to their temporality.

Table 26: Classifying the cases according to their temporality (1/2)

Type of primary actors	Urban Context (Density)	Temporality	Example								
public	not important	permanent	Street Gallery	Wooner							
public	not important	daily	Street Cafes (terrasses)	Street Classrooms							
public	high density	permanent	Pooneh Bridge Museum								
public	not important	permanent	Des jardins collectifs	Mixed use paths (MUPs)							
public	high density	permanent	Broadway	Simcoe and Rees WaveDecks	Narrabeen Lagoon Multi-use Trail Stage	Bloomingdale Trail	La Rambla	A High Line for London	CityArt Walking Sculpture Tour	The High Line	
public	high density	yearly	Lafayette Summer Street	Parades & carnavals	Paris Plages						
public	low density	permanent	Chamran Boulevard	Nature Bridge							
private	not important	permanent	RiverSmart Homes	Osmose							
public	not important	permanent	Street Music	Meeting Bowls	The Urban Living Room	Bike-Sharing	Bus Roots	Library Bus or Book Bus	Bronx Children's Museumbus	Street Vendor	Street Art
private	not important	permanent	Living Wall	Rooftop Garden							
public	not important	daily	Glowing Places	Street Ping Pong	Street Football	Street Badminton					
public	not important	yearly	Park Library	Urban CampSculpe Pops Up	Park(ing) Day						
public	not important	permanent	Potagers urbains collectifs	Union Street Urban Orchard	Outdoor sketching class	Street Theatre	The Circle	Volkertplatz			

Table 27 **:**the cases according to their temporality (2/2)

Type of primary actors	Urban Context (Density)	Temporality	Example								
public	not important	daily	Street Chess	POPS							
public	not important	weekly	Weekly markets								
public	not important	yearly	The Glow-In-The-Dark Skate Park								
private	not important	permanent	Urban farming Community gardens	School Farms	Roof Orchard						
public	not important	permanent	Jardin de Luxemburg	Public Farm One							
public	high density	permanent	Temple Square	Campus Martius Park	Bryant Park	Pittsburgh Market Square	Arts District at Bay Street	Balboa Park	Church Street Marketplace District	Alexanderplatz	Paramana Square
			Jetty Square	Muti Mil	Old Spitalfields Market	FibroCITY	Spanish plazas				
public	high density	weekly	Imam Square	Friday prayers							
private	not important	yearly	Drive-in Cinema								
public	high density	yearly	350 White Chairs Pop Up	Mosalla	Innichen						
private	not important	permanent	Algenslid								
private	high density	permanent	Bankside 1/2/3								
private	low density	permanent	Fairgrounds	Gare do Oriente	Expos						

To be able to measure this relationship in a quantitative form, therefore an index named **TEMP** is proposed which can help to estimate the capacity of the space to be multifunctional or for comparing the two situations: using the space as a classical mono-functional space and having the possibility to share the space for different activities or among different groups of users (eq. 2). TEMP: is the coefficient of the functional performance (based of functioning time) of a space during a period of activity that could be considered as equal (or closed) to the functional efficiency.

$$TEMP = \frac{\text{Current Functional Time (hour, day, month, ...)}}{\text{Optimal Functional Time (hour, day, month, ...)}}$$

(eq.3)

This index shows the co-relationship between the current and the optimal functional performance of the space. When this index is low, the space has a greater potential for being multifunctional. However this index is not the only effective factor. TEMP might be calculated separately for the week, the weekend and holidays and for a day, a month or a year. It can be different for each area to another, depending on the users' lifestyle in summer and winter. But for transforming a space from mono-functional to multi-functional, besides increasing the TEMP, the functional density (diversity of activities) should not be neglected.

5.1.3.1. Calculation of the coefficient (TEMP)

1. For spaces that are connected to one another, (e.g. such as parking lots of semi-public buildings) the TEMP can be calculated based on the operation of this main space working hours.

2. For the streets, squares and sidewalks, the TEMP can be calculated on the basis of lifestyle of residents and rush hours, the time of going to work and coming back home.

3. For residential buildings, the TEMP can be calculated based on the number of residents who have the car and go to work by car or who use public transportation or other types of mobility media.

Based on this index, the graphic of space functionality (functional efficiency) in different periods could be drawn (cf. Figure 8) and existing potentials for increasing functional efficiency of space from timing point of view could be identified.

For example, in the section 3.3.1, with measuring the number of users in peak and empty hours, the precise functional graphic could be drawn. Based on this functional graphic, all the possible secondary or extra functions would be specified.

5.2. Finalizing the choices using similar existing cases (case-based reasoning)

For using the examples and the analysis in this research in a project (using the previous solutions in solving new problems) first the question should be clearly defined. If the site and the genre of secondary function have been specified beforehand, by refereeing to groupings in chapter 4, similar cases could be found for inspiration. In those cases for specifying the appropriate site for a multi-function space among various sites, the best way is eliminating the weak options (in various steps) from different points of view. This means that by studying the graph of spaces' function, measuring TEMP index and comparing them together, the potential of spaces from time's point of view for having secondary function would be evaluated. Those options that have less potential would be deleted. Afterwards, based on criteria of first level, the weak options are deleted. For remained options - considering form, actors and primary option- the possible secondary functions can be found. Inspired by them, assessing and giving priority to remained options based on their positive and weak points, cultural particularities and residences' needs could be define. This process has been explained in figure 23. It is a schematic process for selecting suitable spaces with the potential of multifunctionality and then choosing the alternative function.

The assumption that secondary function is specified and the choice of an appropriate site from city or region's plan for this activity and its defined period, by refereeing to the chart of examples, the kind of space from form's point of view could defined based on the actors and primary activities.

Afterwards, by identifying the spaces and deleting the options that have a remarkable potential to accept an additional function, possibilities might be restricted and the number of choices might decrease. The next level is the point of scrutinizing the morphology and scheduling based on the needed scope and similar functions. In other words, those options that do not have an appropriate surface or form, or are adjacent to a space that could provide the needed function, would be deleted. The space, in terms of scheduling, should have the potential of accepting a new function in the specified period.

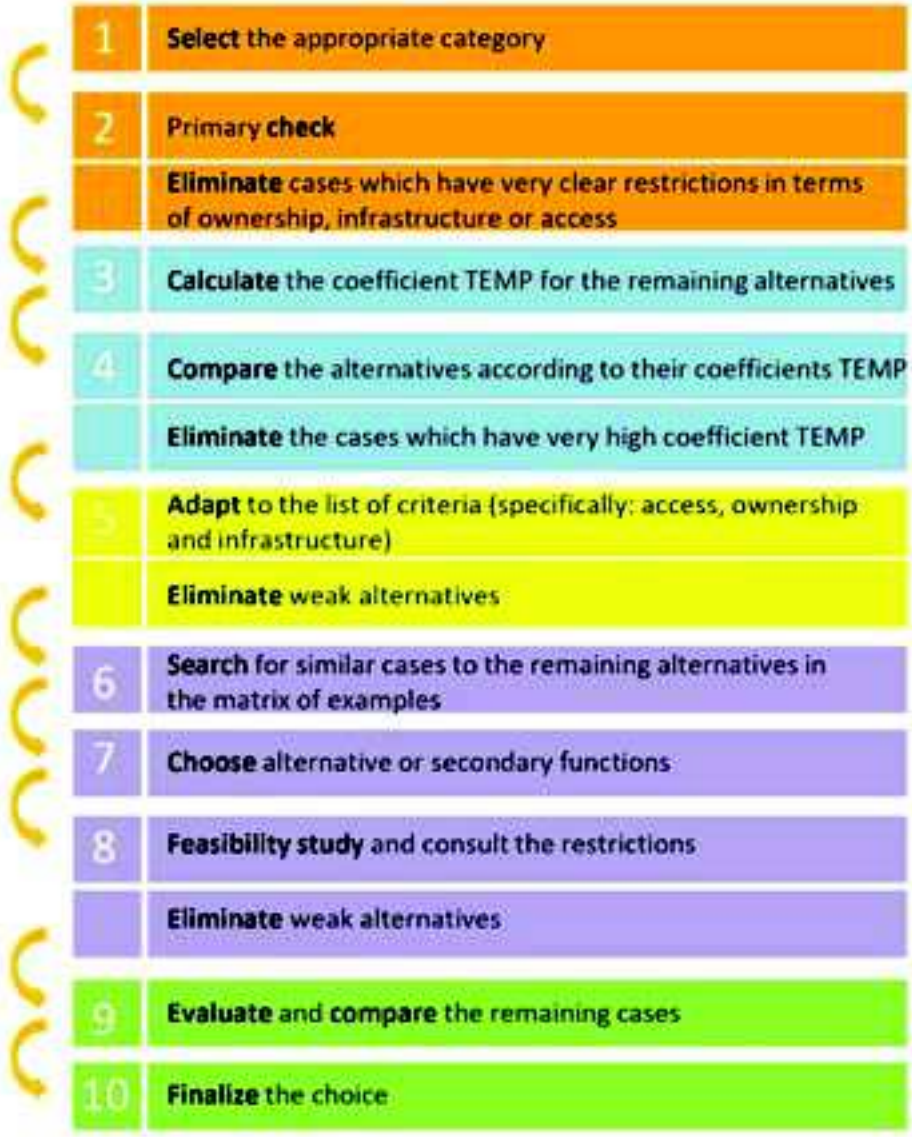


Figure 23: Schematic process for changing a mono-functional space to a multifunctional one (Ghafouri, 2016)

Next, considering the access, appropriate options have been chosen and weaker options have been deleted. This assessment and reducing the number of options could be continued based on less important criteria. Those factors that should be considered, based on giving priority to criteria and provided patterns in previous sections, have been classified in table 28:

Table 28: The different level of importance of each type of data in planning and design process

Land-use, Functions, Forms Actors (public / private) TEMP Ownership / Responsibility of spaces Density / Population
Public transport Routes
Insurance Risks
Attraction points
Infrastructures Public lighting

In fact, the important point to be noticed is that for simplifying the process of decision making, the criteria should be entered respectively by importance. In other words, those criteria that are more important would be studied beforehand. The reason behind is that, if because of complication or lack of time the possibility of noticing does not exist, the designer would be insured that the space could reach a certain level of success, this part is illustrated in figure 24. This diagram can be used to choose an alternative function for a specific space within the most similar cases and in the most feasible (and even the most simple) way.

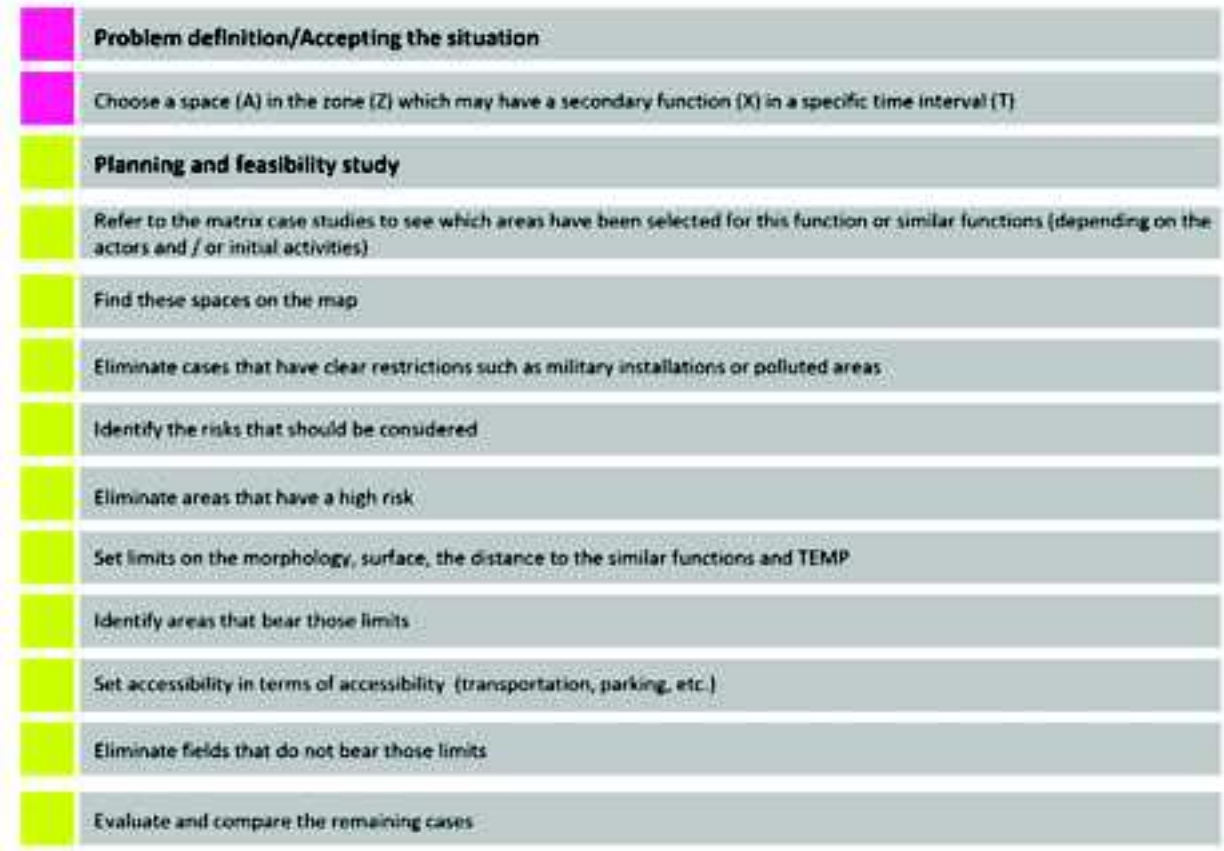


Figure 24: A schematic process for choosing a space (A) in the zone (Z) which may have a secondary function (X) in a specific time interval (T) (Ghafouri, 2016)

5.3. Creating a GIS database

Without planning on different levels, the integration of multifunctional goals into land use cannot be successful (Meyer & Degorski 2010). Therefore, the concept of multifunctionality involves an interdisciplinary approach (Tress, et al. 2001). As this is a multidimensional concept, considering all effective layers and dimensions simultaneously is of great importance. Therefore, GIS can help to adopt more appropriate decisions by gathering all these layers (Meyer & Degorski 2010).

In order to identify and select an area in the city to create a multifunctional space or choose an alternative function for a space, several characteristics needs to be identified allowing collecting data:

- **Morphology, scale and size**: There is a direct relationship between the space size and the scale of activity or the number of users. Small spaces are used for activities with local scale, while easily accessible sites with near to attractive points (spaces or functions) can be allocated for regional or even city scale planning. Thus spaces can be defined as neighborhood scale, local scale, and city scale (American Planning Association 2006).

- **Activity rhythm**: Operating rhythm of usage for each activity cycle in order to identify the free hours to plan for (cf. 5.1.3);

- **Land-use plan and proximate activities**: outlining similar activities in one space should be avoided in order to increase activity diversity in the whole field;

- **Access and public transport**: substitute activity should be available for the space with respect to its accessibility, position in the town. A great deal of attention should go to public transportation ease of access because it can guarantee the presence of people for the activities offered in the place which is beyond the neighborhood scale (Moreover, when it comes to downtown projects this matter would be of a great importance);

- **Infrastructures and urban facilities**: Some activities are required to have an access to certain facilities such as electricity, water and waste-water network, and even Internet;

- **Night plan, lighting installations**: The district's lighting plan should be analyzed in order to be able to determine potentially appropriate spaces for night activities.

These characteristics are essentially linked to built-up areas. They are gathered to identify the appropriate area or the proper alternative use to provide the outcome of all this information.

For example, the sidewalks could have a variety of different functions according to their locations and size. The pedestrianism in the city requires attractive places. Person should be able to enjoy their time and their route (Moughtin 2012). Due to the width of the sidewalk, various spaces could be created that have the capacity to satisfy these issues (Table 29).

Table 29: The potentials for multifunctional use of a sidewalk and the required characteristics according to the second chosen activity

	Width			Function Rhythm				Location			Requirements						
	small	medium	large	daily	weekly	yearly	permanent	city center	neighborhood center	everywhere	insurance	lighting	infrastructures	Equipments , furniture	flooring	guide signs	Access to public transport
Mixed-use paths	✓	✓	✓				✓			✓	✓				✓	✓	
Café		✓	✓	✓						✓				✓			
Street badminton			✓	✓						✓				✓			
Sculpture gallery		✓	✓				✓	✓	✓			✓					
Gallery			✓	✓			✓	✓	✓			✓		✓			✓
Street classroom			✓	✓						✓					✓	✓	
Innovative furniture		✓	✓	✓			✓			✓		✓		✓			
Street theatre			✓	✓				✓	✓								✓
Street music		✓	✓	✓				✓	✓								
Street vendor		✓	✓	✓	✓			✓	✓								
Market			✓	✓	✓	✓		✓	✓		✓			✓		✓	✓
Parking	✓	✓	✓	✓	✓		✓			✓						✓	

5.3.1. Creating conceptual GIS data model

If would have the intention of identifying the existing potentials in the city for creating multi-functional spaces- considering the identified criteria in previous chapter, the most common method is having a GIS software and layer approach. The process of

classifying criteria based on subject as information layers along the relationship that these layers have together, have been specified in figure 25. The conceptual schema has been designed in order to determine the relationships between layers. One of the limits of usual GIS development and use is that, the process of finding appropriate options is long and does not give the possibility of viewing the result of interactive requests at the same time. In addition to the question of time, some other points make the using of GIS in a simple and classic way insufficient and illogical. These points would be studied in the next section.

5.3.2. Discussion: Does GIS software have all capacities needed in the decision-making process?

The combination of these analysis and the urban GIS databases can lead to map some parts of a city that have the potential to be used multifunctional with higher efficiency. However, all the information needed don't come directly from existing databases. Each site should be analyzed according to its potentials and characteristics and be planned like an urban design project. Some information like legal or insurance issues is somehow difficult to introduce spatially into GIS layers. Each country provides unique possibilities and limitations according to its own internal regulations and its cultural background and administrative systems. For instance, in some countries the rules related to insurance and responsibility of urban spaces are more easygoing; despite some others in which they make the huge restrictions. Moreover, the various definitions of space and function in different cultures lead to a wide diversity in making multifunctional spaces.

Besides all the previously mentioned points, it should be noted that the other functions of the space must not be neglected. Economical performance makes the space survive and the identity and historical issues enable the space to interact with its users. In fact the success factor of a collective urban space is the public presence.

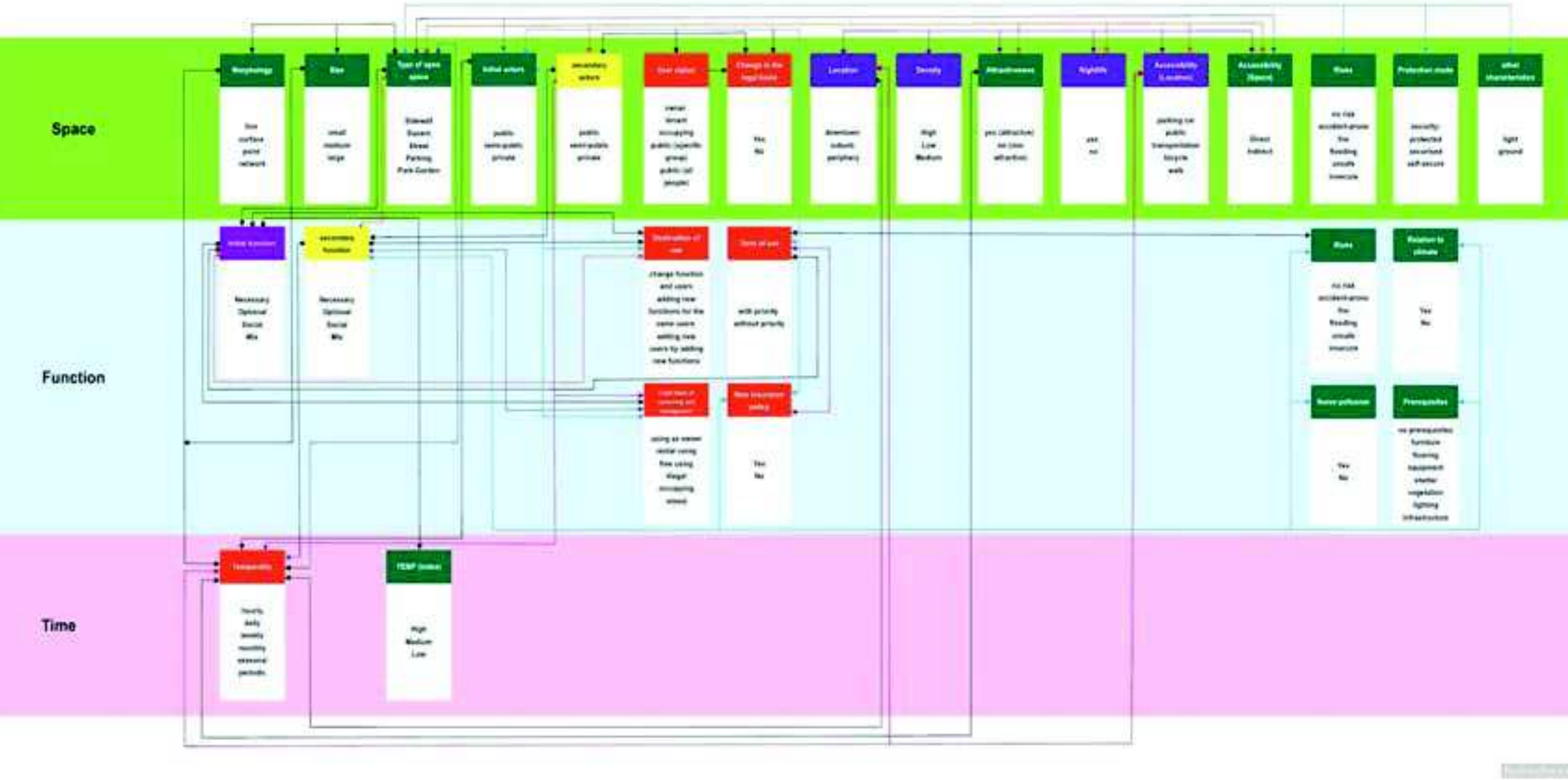

Space
Function
Time

Figure 25: conceptual GIS data model based on 30 criteria (Ghafouri, 2016)

But it should be kept in mind that in the multi-functional vision to urban space, function is further than just “use”. It must go beyond this meaning as it was done in multifunctional agriculture or landscape. Urban space, as part of the urban landscape, can have ecological, historical, cultural, social, economical, and aesthetical roles and all these roles should be considered in a comprehensive totality. In fact designing and choosing functions should be in proportion to requirements and deficiencies identified in the project site.

GIS approach might help us to derive existing potentials for multifunctional spaces in town. However, considering the fact that this concept is multi-dimensional and interdisciplinary, the outcome should result from series of meetings and discussions between experts or even representatives involved. Interactive device can propose any changes and proffers quickly, so it can be more effective on debates. However existing GIS software do not have this capability and any changes would be so time consuming. Thus, it seems that interactive software based on previously accounted data such as SOLAP (Spatial On-Line Analytical Processing) can play an effective role in this process. SOLAP has been specifically designed to support the rapid and interactive exploration of spatio-temporal data in the context of making decision (Bédard, Rivest & Proulx 2006). The next steps of the study (as a perspective of this research) could be putting into practice such tools and test some situations in order to deepen our insight on the concept of multifunctionality.

6. Experimentation

6.1. Strasbourg, urban characteristics and needs

The important remark to be noted is that, citizens for each activity need a defined space. The Public space belongs to the municipality and for each minuscule change, their permission should be obtained. So there are not that much people, especially those who do urban art, to occupy these spaces. Furthermore, citizens would like to have the same facilities in each neighborhood and commune.

The definition of public space in Strasbourg –like many other spots in Europe- is based on this theory that it does not belong to anyone. In addition, even if private territory be attached continuously and without hinder and physical border to public space, the permission for accessing this territory does not exist.

These complexities from cultural point of view leads to this question that there is a great need to “define” urban spaces in a multi-functional method.

Strasbourg is the capital and largest city of the Grand Est region in eastern France; it is the capital of the Bas-Rhin département. In 2013, the city proper had 275,718 inhabitants, Eurométropole de Strasbourg (Greater Strasbourg) had 475,934 inhabitants and the Arrondissement of Strasbourg had 482,384 inhabitants. With a population of 768,868 in 2012, Strasbourg's metropolitan area (only the part of the metropolitan area on French territory) is the ninth largest in France and home to 13% of the Grand Est region's inhabitants. The transnational Eurodistrict Strasbourg-Ortenau had a population of 915,000 inhabitants in 2014 (eurodistrict.eu, 2015).

Strasbourg is the capital of Alsace province and situated in the department of Bas-Rhin. Its situation in the heart of Europe (has border with Germany, Switzerland and Belgium), being the siege of European Council and European Parliament, has transformed the city into a Eurométropole. Strasbourg along Brussels and Luxembourg is one of the European capitals. Rather than having a French identity, it has a European identity.

City transportation in Strasbourg includes the futurist-looking Strasbourg tramway that opened in 1994 and is operated by the regional transit company, Compagnie des Transports Strasbourgeois (CTS), consisting of 6 lines with a total length of 55.8 km (34.7 mi). The CTS also operates a comprehensive bus network throughout the city that is integrated with the trams. With more than 500 km (311 mi) of bicycle paths, biking in the city is convenient and the CTS operates a cheap bike-sharing scheme named Vélhop'. In 2015 gained the prize for the best city in France for its urban transportation system and biodiversity as well. Transportation system characteristic has made the accessibility for special functions and recreational spots, even in long distance, so easy.

Many waterways (the Rhine and its tributaries) run through the area, offering a great choice of walks along their banks. Strasbourg manages 3,771 ha of forestland (including two protected forests within the built-up areas) and 344 ha of parks and public gardens. Biodiversity is one of the major development issues for the Eurométropole of Strasbourg.

In fact, there are enough spaces and facilities in cities, and in Strasbourg but, most often their usage demands permission and scheduling that they would not be used until they have been issued and re-claimed to people – even if the entry be completely open.

Another important matter to be remarked is the question of insurance. This means that, although the social responsibility insurance is obligator – and it includes the existing dangers in urban spaces- the need, from psychological point of view, for a greater coverage is deeply felt and claimed. Regarding the space responsibility matter, nobody would take the responsibility voluntarily, till someone would be introduced as the responsible for the space. This phenomenon is relatively normal in United States of America, Middle East and South America.

During the ADEUS[8] program[9] which was held on the subject of public space and citizens (October 2012), designers and urban directors were present; the citizens focused on their needs for having spaces with more variation of functions in local scale.

For instance weekly markets or collective farms close to Strasbourg. These actions have been accomplished on a scheduled basis. In our work each of them get a feasibility rate from 0.52 to 0.54; thus they convey the ideas that their performance is relatively easy and are among the possible ideas to be set around different parts of the world (cf. Table 18).

6.2. Defining the scenario: schoolyard playgrounds

As it has been said, Strasbourg, regarding its urban facilities, is among the most equipped and richest cities in France. Nevertheless, in some parts of the city some playgrounds for kids are fare to be accessible. By identifying the existing playgrounds in the GIS database of the city and give a buffer of 400 meter, the chart below (Figure 26) would be achieved.

[8] L'agence de développement et d'urbanisme de l'agglomération Strasbourgoise (The agence for development and urban planning of the Agglomeration of Strasbourg)

[9] Espaces publics-espaces partagés à l'Odyssée (Strasbourg Magazine, No.237, November 2012)

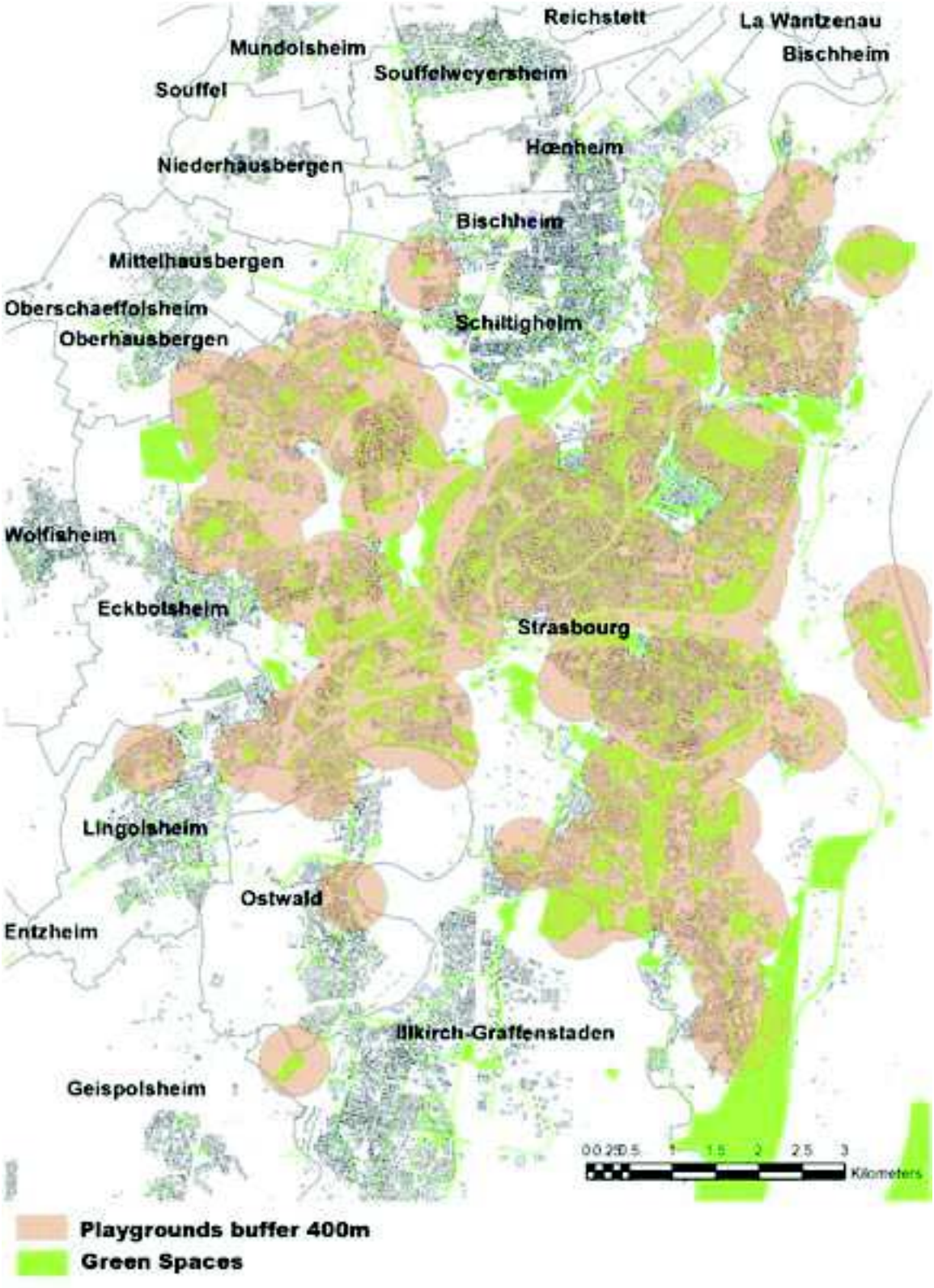


Figure 26: The playgrounds in the GIS database of the agglomeration with a 400 m buffer (Ghafouri, 2016)

Younger children, in particular, need places near their homes where they can play freely and where they and their parents can walk to with ease. As they get older and more independent it is essential for all children to have access to play spaces they can reach by foot and bicycle; this may require investment in safe, attractive pedestrian and cycle routes to help overcome parental fears about road traffic.

Access to a space which is 400 meter radial around the starting point, by walking with a three years old kid is not possible. A 3 years old kid can walk 20 minutes (going and coming) which would be 800-1000 m (Association, Steiner, & Butler, 2012; Goodridge et al., 2008). In fact, for a mature human being the access to an open space or a green space with a ten to fifteen minutes to their living location is possible but for kids firstly, because of their pace and less capability, the distances should be lessen and secondly, those spots like river edges and canals-because of their probable dangers - could not be utilized as a secure playground.

Our proposed scenario for increasing the possibility of kid's access to proper playgrounds, is opening school's yards to the public out of school hours and turning them into a recreational space for kids -3 years old to 11 years- in a local scale. Since based on kid's access by walking, these schools have been spotted, theoretically they increase the kid's access to playgrounds and eventually a greater surface of city would be covered.

The calculation of the feasibility of this idea with the methodology used in examples, the rate 0.56 would be achieved that it is a medium and upward number. In other words, this idea, from the feasibility of its application point of view, is relatively simple.

The question is, if Strasbourg has the inclination and preparation for accepting this plan- with its medium possibility- or not? Studying alike successful and failed examples in France and outside of France, help us to identify the positives and negative point and also have a reply for those questions that are vague.

6.2.1. Project to be implemented

The main idea is reviving the schools as a playground for neighborhood children beyond their opening hours (Schoolyard Park). The benefits (for our work) are in three folds: problem solving / organizational boundaries, institutional, cultural.

For this purpose, the yards of nursery and elementary schools (114 schools in Strasbourg) have been chosen for the examination. The education of this age category is under the supervision of Strasbourg municipality's department of Children and education[10] and it is a public domain. In recent years, a remarkable number of yards of these schools have been enhanced and secured regarding the standards, for each class There exists a 200 meter yard (that is remarkable surface). Furthermore, schools' playgrounds are gradually repaired and renovated by the municipality. Most of the schools have proper yards which could be observed in the photos below (Figure 27):

Figure 27: some examples of schoolyards in Strasbourg (www.Robertsau.eu, 2016)

[10] Direction de l'enfance et de l'éducation

6.2.2. The benefits of this project

The most important advantage of this project is providing access to the well-equipped playgrounds nearby that are totally suitable for the conditions and kid's needs from 3 years old to 11 years. Furthermore, since these spaces are familiar for the kids, they can easily get connected with.

The impact of this scenario (schoolyard parks) on functional performance of the schoolyards is shown for day and week time period in the figure 28.

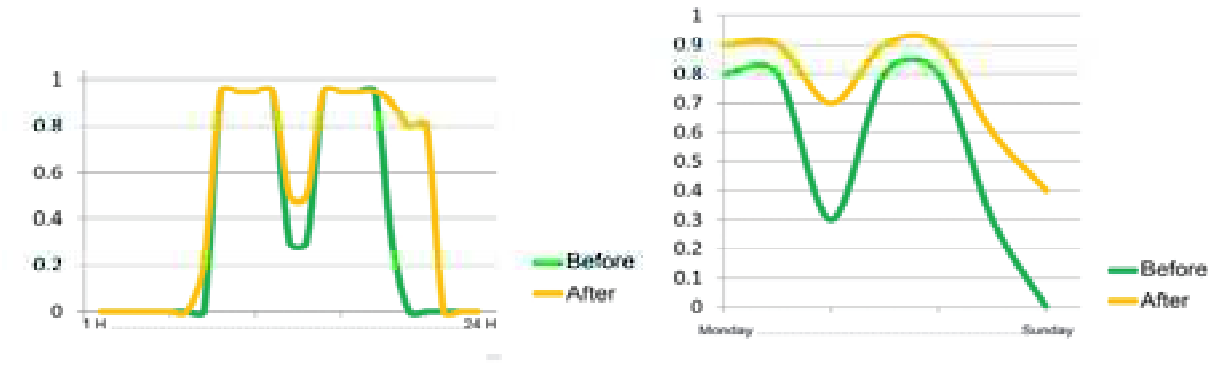


Figure 28: A schematic diagram of the improvement of functional performance of the space in the second scenario in daily (left) and weekly (right) cycle (Ghafouri, 2016)

6.2.3. Requirements to set up the experiment

It should be noted that, beside all these benefits, there are other factors that could stop the plan. For example:

- lack of staff to open and close the schoolyard at the appropriate times every day of the week;
- concerns about safety and vandalism;
- collaboration of the school's stuff and neighbors
- kids' injuries during playing

If a proper answer would not be given to these questions by the planners and managers, in the long-term, this would lead to fail or deficiency of the plan.

6.2.4. Background in France: an unsuccessful experience

School, yard and school's path are those kinds of spaces that the priority of their usage is with kids. Usually, school is closed to the public. In the past, schools had high walls. Today, they have fence. After the school hours, the yard is closed to the kids and the students do not have a space to evacuate their energy. In France, the guidance school of Louise Michel (ZUP de Perseigne à Alençon) was designed, in 1981, like a village and it has been never closed. The school was opened to the public and some parts of the installations and school's buildings-under the supervision of students- outside the school hours have been given services such as restaurant, activity hall, music hall… to the city and public (De Sablet, 1988). The school has been separated from the city by rails with 2 meters height due to an accident in the cafeteria in 2003. Cameras have been also installed. Apparently, social conditions of this neighborhood due to the presence of foreigners, cultural difference, economic and security situation were not suitable for such an experience.

6.2.5. The New York City's experience: schoolyards to playgrounds program

This phenomenon has happened in a decentralized and outspread way in different parts of the world, but New York's experience that was centralized, is remarkable. The Schoolyards to Playgrounds program, a part of PlaNYC 2030, provides communities with greater access to open space by making schoolyards open to the public from eight AM to dusk on non-school days and after school until dusk on school days (www.nyc.gov 2013).

Goals and objectives

The Schoolyards to Playgrounds Program helps fulfill Mayor Bloomberg's goal of bringing all New Yorkers within a 10-minute walk of a park and provides proper play space for more than 360,000 children by 2030. The addition of both active and passive open space in neighborhoods with few existing parks provides a host of benefits:

- Public Health
- Reduced obesity
- Improved air quality

Environmental benefits:

- Addition of more permeable surfaces for stormwater capture
- Reduced urban heat island effect
- Reduced noise pollution
- Environmental education opportunities with gardens, painted games, and outdoor classrooms

Social benefits:

- Creates public space for community gathering
- Design process teaches kids about landscape architecture

In order for the program to effectively address the health and fitness of children, however, each participating school must have the following: 1) a school employee present to unlock the playground at eight AM on non-school days and to lock the playground at dusk, which can be as late as eight PM in the summer; 2) cooperative school administrators who will instruct the custodial staff to carry out these tasks, and 3) a schoolyard in good enough condition and with sufficient amenities to foster physical activity.

According to the PlaNYC report, the city developed the Schoolyards to Playgrounds program by first identifying 290 schoolyards in neighborhoods lacking open space.

Those 290 schoolyards were then organized into three categories. Schoolyards in Category 1 were found to need no improvements and were scheduled to open to the public immediately as part of the program. The 150 schoolyards in Category 2 required new equipment and/or landscaping. The remaining 71 schoolyards were included in Category 3, meaning that in addition to requiring new equipment and/or landscaping, they also require new fencing, safety improvements, and/or asphalt repair (Figure 30).

In neighborhoods with few or no alternatives, an empty lot with a fence around it cannot provide the recreational or green space necessary to reduce childhood obesity and asthma. Children who lead a sedentary lifestyle may need more than a basketball backboard to encourage physical activity. Parents may be unwilling to bring young children to a playground that offers no shade or place for them to sit while their children play. Spaces with no amenities will fail to become successful community gathering places where residents of all ages feel safe.

Schoolyards that have no equipment at all or have only basketball backboards should be counted in category 2 and 3 and receive capital improvements (www.nyc.gov 2013).

Figure 29: Two examples of the schoolyards participating in the PlaNYC Program (www.nyc.gov, 2013)

Program partners and their role

Department of Parks & Recreation (DPR) manages design, bid and award, and construction of 137 sites before turnover to DOE for maintenance, provides landscape architecture and park management advice to program partners.

Department of Education manages design, bid and award, and construction of 30 sites, school custodial staff responsible for ongoing site maintenance and daily operations for all playgrounds (www.nyc.gov 2013).

The Trust for Public Land (TPL)

Drawing on experience in converting schoolyards in New York City and other metropolitan areas, TPL leads a participatory design (PD) process with 123 sites at the beginning of each schoolyard renovation that brings together school administration, children, parents, neighbors, and community groups. Three meetings are held, including a “Design Day” charette where the community and school come to consensus on schoolyard design. TPL also leads workshops for school custodians and principals to promote programming and stewardship of recently completed sites. TPL manages design and construction of 28 sites, where TPL leads schools in a longer-form PD process that engages with the community and four classes once a week for three months (www.nyc.gov 2013).

6.2.6. A successful open schoolyard playground experiment in Strasbourg

In Bischhiem’s central school, this happened impromptu. The space for a short period of time during a construction operation has been used in a multi-functional way. This building has been designed combinatorial, to be a nursery school and a musical school at the same time. On Wednesdays, it functions as a musical and dance school for the kids of the neighborhood. This provided service is under the supervision of the Municipality. During the time that kids were busy in the classrooms learning, the schoolyard was open to parents. The schoolyard was functioning as a public space: a space for social relations for parents and a playground for those kids whom were with their parents. Furthermore, since while designing this building, different entrances with different functions have been planned, those spaces that had no functional use at that moment were locked and closed and as a result the possibility of damage has reached to zero.

The key point of this plan is that the playground of kids is separated by an alley and it has a separated entrance. Since this space is completely separated from the school’s space, it has potentially the function to be open out of school hours to the public. Even though, this did not happen even after the completion of construction operation. In fact, after the completion of construction operation, a public living space

became like other classical school spaces in Strasbourg, without any specific incident came to its end. This could be prevented by a good planning, education and attention.

The following photos have been taken on a Wednesday afternoon, when the Nursery School was closed but there were lessons in music school and the playground was open and children can play on the surveillance of their parents (Figure 31).

Figure 30: Central school at Bischheim, Strasbourg at Wednesday afternoon (Ghafouri, 2014)

They solved the security problems with many doors (separate access and different entrances for each facility). Even access to the yard is not possible on the ground floor from some doors. Each part is open in different periods of time (depending on how each space works).

⇨ It's a good example to show that opening schoolyards is possible even for France despite the very real limits of insurance and liability.

Effects and impacts

To be able to observe if the opening of such spaces, (in addition to the augmentation of social relations between the adults), might have some impact on the kid's access to the playground. We have simulated the situation using Strasbourg's municipality Database (BD-TOPO[11]) where nurseries and elementary schools have been

[11] BD TOPO® version 2 1 – Description of content – may 2013 (Strasbourg Ville et Eurométropole)

A-RESEAU ROUTIER (ROAD NETWORK)
CLASSE ROUTE; CLASSE ROUTE NOMMEE; CLASSE CHEMIN; CLASSE ROUTE_PRIMAIRE; CLASSE ROUTE_SECONDAIRE; CLASSE SURFACE_ROUTE; CLASSE TOPONYME_COMMUNICATION
B-VOIES FERREES ET AUTRES (RAILWAYS AND OTHER)
CLASSE AIRE_TRIAGE; CLASSE GARE; CLASSE TRONCON_VOIE_FERREE; CLASSE TRANSPORT_CABLE;
CLASSE TOPONYME_FERRE
C-TRANSPORT-ENERGIE (TRANSPORT-ENERGY)
CLASSE CONDUITE; CLASSE LIGNE_ELECTRIQUE; CLASSE POSTE_TRANSFORMATION; CLASSE PYLONE
D-HYDROGRAPHIE (HYDROGRAPHY)
CLASSE POINT_EAU; CLASSE RESERVOIR_EAU; CLASSE SURFACE_EAU; CLASSE CANALISATION_EAU;
CLASSE TRONCON_COURS_EAU; CLASSE TRONCON_LAISSE; CLASSE HYDRONYME
E-BATI (BUILDINGS)
CLASSE BATI_INDIFFERENCIE; CLASSE BATI_REMARQUABLE; CLASSE BATI_INDUSTRIEL; CLASSE CONSTRUCTION_LEGERE; CLASSE CIMETIERE; CLASSE PISTE_AERODROME; CLASSE RESERVOIR; CLASSE TERRAIN_SPORT; CLASSE CONSTRUCTION_LINEAIRE; CLASSE CONSTRUCTION_PONCTUELLE; CLASSE CONSTRUCTION_SURFACIQUE
F-VEGETATION (VEGETATION)
CLASSE ZONE_VEGETATION
G-OROGRAPHIE (OROGRAPHY)
CLASSE LIGNE _OROGRAPHIQUE; CLASSE ORONYME
H-ADMINISTRATIF (ADMINISTRATION)

specified and a 400 meter buffer has been added (Figure 31). Afterwards, the obtained map has been compared with the one obtained with the playgrounds (Figure 28). The result is shown in figure 32. This comparison shows that a remarkable surface of the communes around Strasbourg, while have the potential to have their yards open to the public and kids whom living nearby, is deprived from this possibility. Furthermore, in some parts of Strasbourg with high-density (Avenue des Vosges, quartier conseil des XV), there is no access to the recreational spaces for kids.

The result could be different if we reduce the 400 meter buffer to a 300 meter buffer (Figure 33). By adding schoolyards to the kid's recreational spaces, more than 90% of the area would be accessible, in less than 10 minutes walking to the recreational spaces. This possibility could transform Strasbourg to a model city for its facilities – having optional activities for its citizens.[12]

CLASSE COMMUNE; CLASSE ARRONDISSEMENT; CLASSE CHEF_LIEU

I-ZONE D'ACTIVITE (ACTIVITY ZONES)

CLASSE SURFACE_ACTIVITE; CLASSE PAI_ADMINISTRATIF_MILITAIRE; CLASSE PAI_CULTURE_LOISIRS; CLASSE PAI_ESPACE_NATUREL; CLASSE PAI_SCIENCE_ENSEIGNEMENT; CLASSE PAI_GESTION_EAUX; CLASSE PAI_INDUSTRIEL_COMMERCIAL; CLASSE PAI_RELIGIEUX; CLASSE PAI_SANTE; CLASSE PAI_SPORT; CLASSE PAI_TRANSPORT; CLASSE PAI_ZONE_HABITATION; CLASSE PAI_HYDROGRAPHIE; CLASSE PAI_OROGRAPHIE

J-TOPONYMES

CLASSE LIEU_DIT_HABITE; CLASSE LIEU_DIT_NON_HABITE; CLASSE TOPONYME_DIVERS

[12] Significant speed differences were found between children in kindergarten through sixth grade. The mean speed to walk 50 ft used by kindergarten line leaders was 13.5 seconds, and the speed increased to 50 ft in 10.6 seconds for sixth grade lines. Teacher "good enough" times were significantly different from the children's times at every grade level (David, 2005).

The speed of walking of an adult (and children +12 years old) is 5 km/h (3 miles/hours). For the kids under 8, this speed is up to 3.2 km/h (2miles/hours). For these children the speed may reduce to 1/3 according to their age and their height. (Müller, Müller, Baur, & Mayer, 2013). The distance an adult can walk in 10 minutes is 830 meters (that leads to a 830 m linear walking or a 2×415 m radial walking (av. 585 m as the crow flies distance). For an 8 year old kid, these distances reduce to 530 m linear and 2×265 m: av. 375 m as the crow flies distance). For younger children these distances are 175 m linear (for a child that just starts walking). According to these rates, a 3 years old kid can walk 300 m linear in 10 minutes. In 11 years of the life, this distance increases to 770 m (av. 535 m). if there was

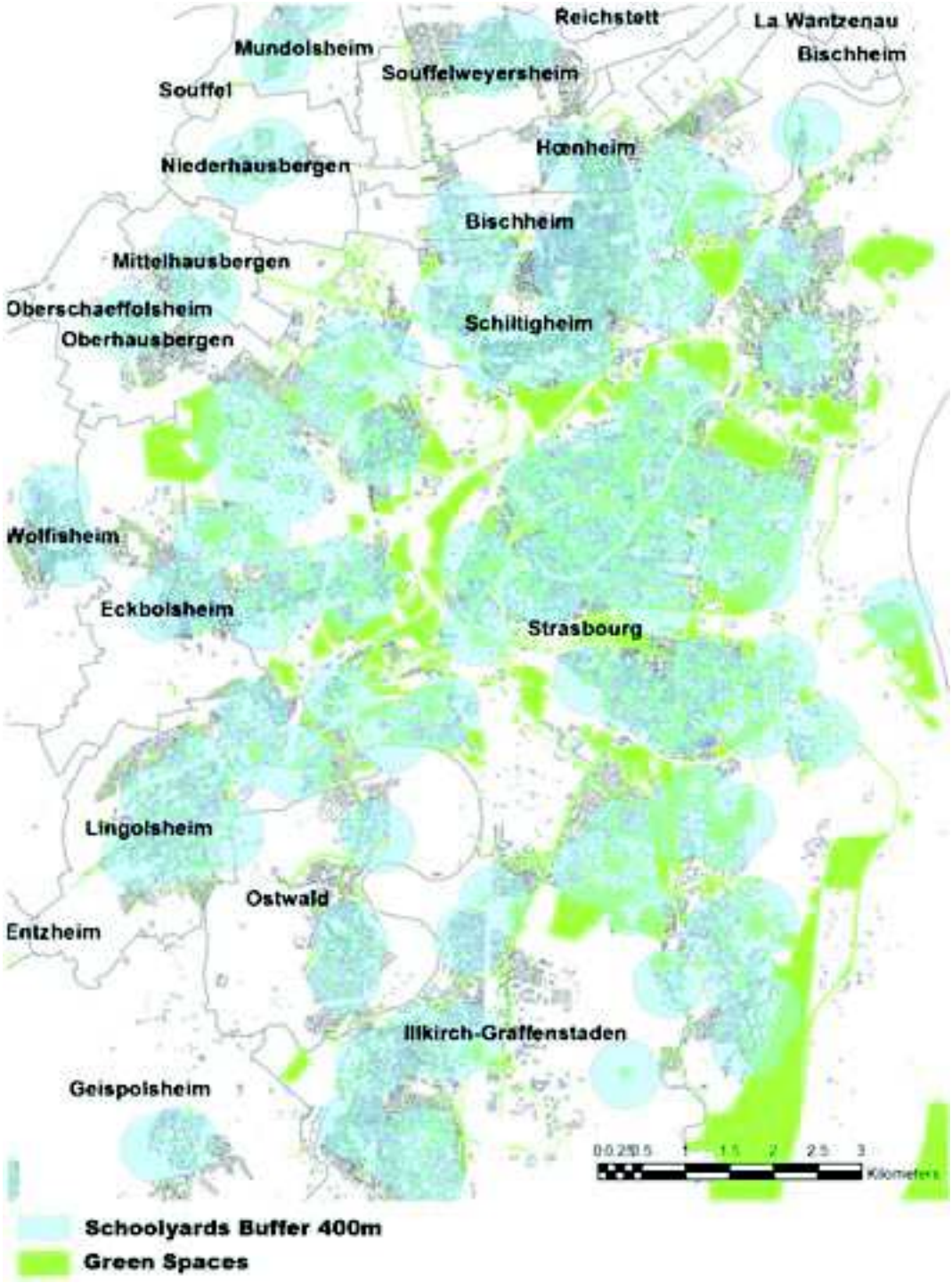


Figure 31: The schoolyards in the GIS database of the agglomeration with a 400 m buffer (Ghafouri, 2016)

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not a direct linear path from the starting point to the destination, the arial distance reduces to 210-545 m (av. 375 m). In this research, a 400 m buffer is selected for adults and children +4 years old (according to linear and aerial distance). But if want to have a result that covers a whole family (with children from 2 to 4 years old), the buffer reduces 100 m.

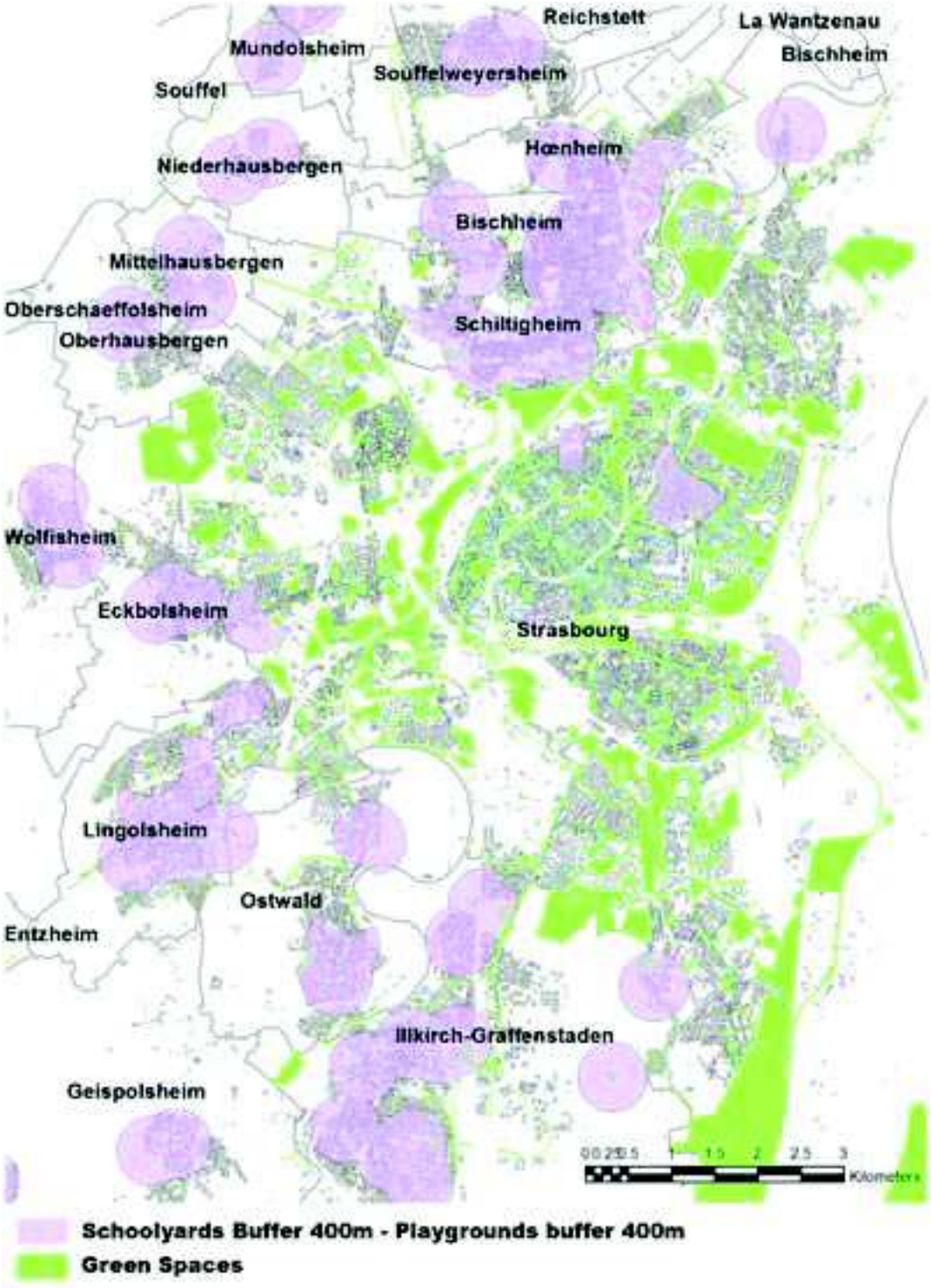

Figure 32: The comparison of Fig. 32 and Fig. 29: the spaces that do not have access to a playground in a 400 m radial distance unless the schoolyards become open to public out of school hours (Ghafouri, 2016)

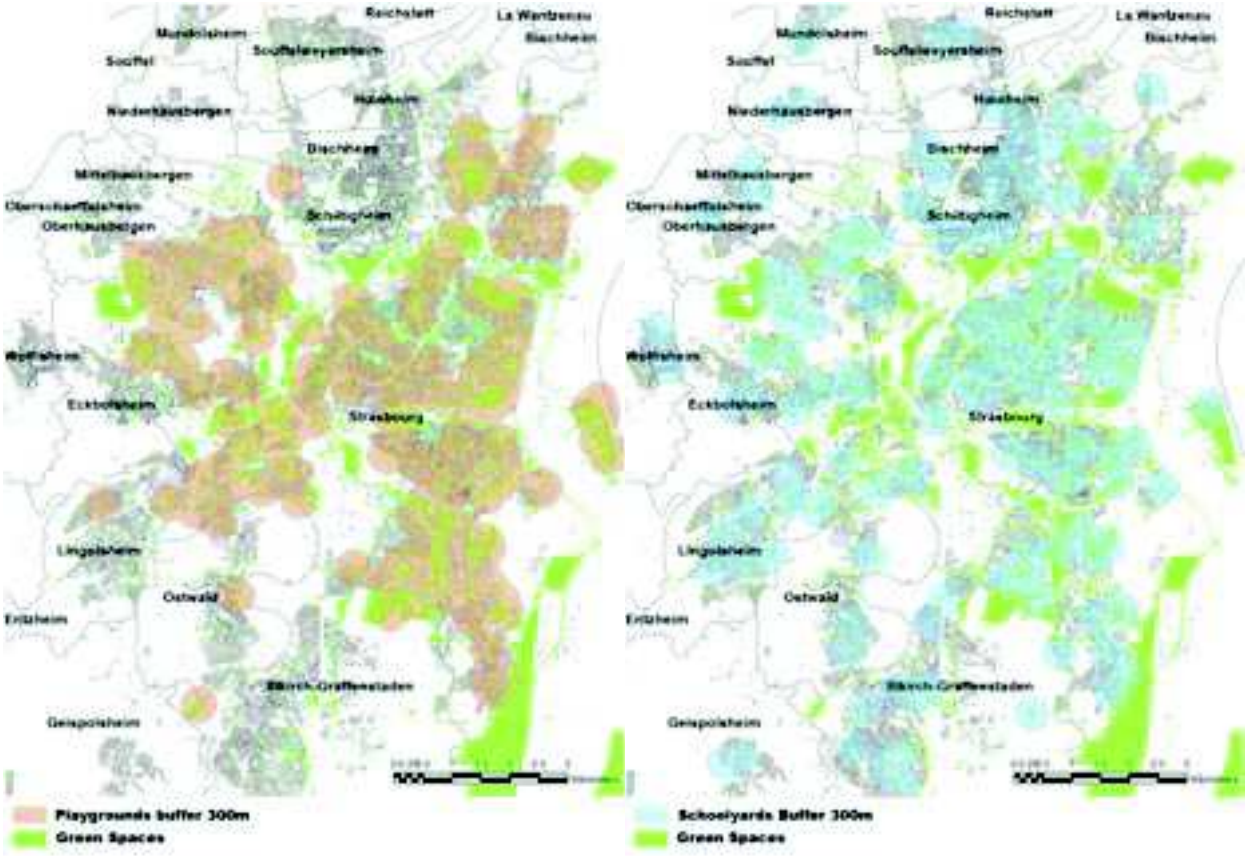

Figure 33: Left: The playgrounds in the GIS database of the agglomeration with a 300 m buffer. Right: The schoolyards in the GIS database of the agglomeration with a 300 m buffer (Ghafouri, 2016)

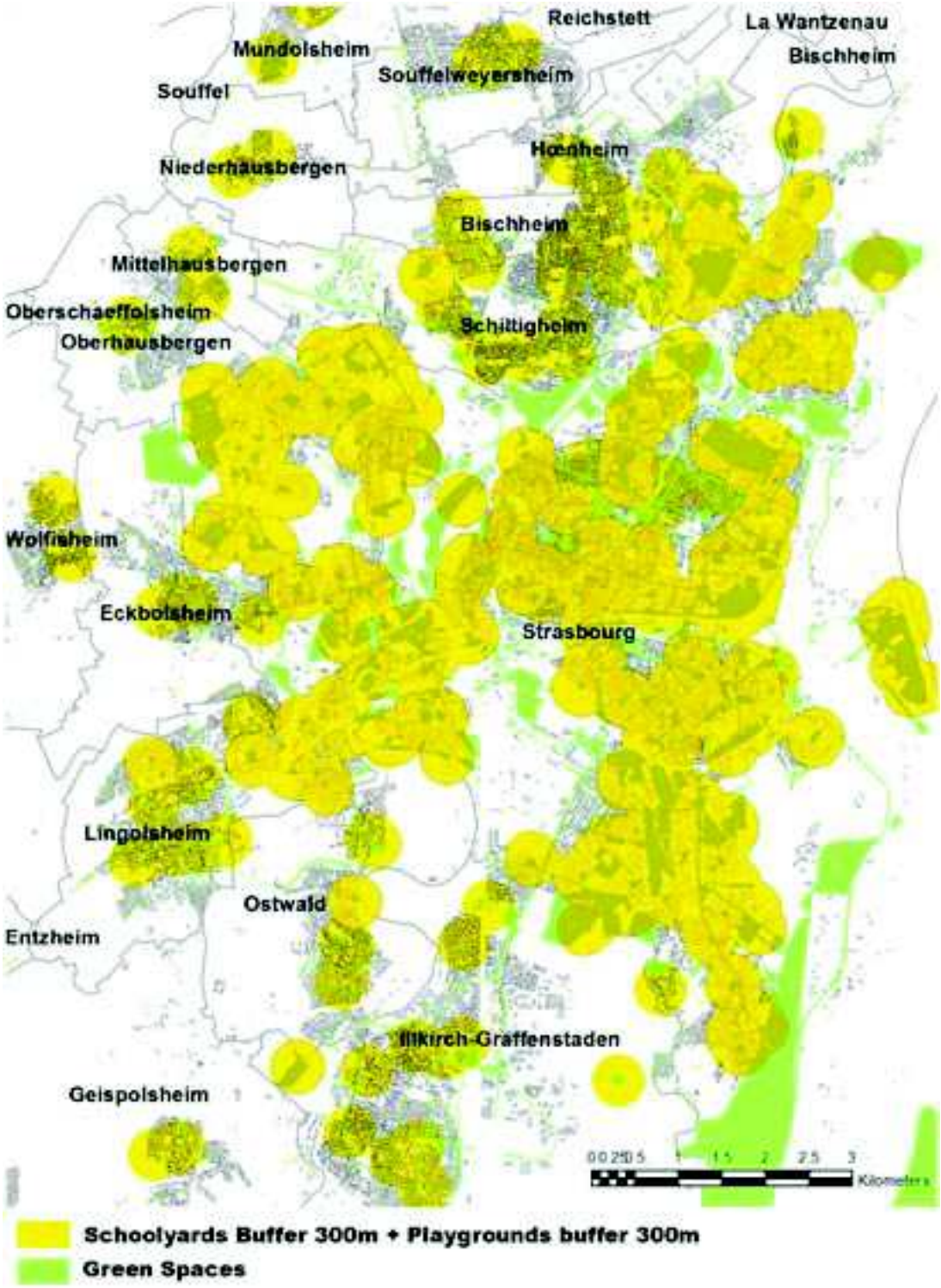

Figure 34 **:**The combination of schoolyards + playgrounds in the GIS database of the agglomeration with a 300 m buffer (Ghafouri, 2016)

As it could be observed in figure 34, even with the performance of this plan, still some communes are faced with deficiency. In order to transform this idea from theory to practice, the first step would be guessing: in which kind of occasions the idea could not be performed practically, what are the most important concerns for the responsible and which factors would lead to having a difficult situation. Referring to the criteria charter and to the Matrix of cases, the main criteria need to be considered in this case are solutions to the questions of:

- Ownership
- Security
- Insurance
- Responsibility

The next step would be, providing solutions for these concerns. In order to have the solution and run the idea, two phases could be proposed:

- The first phase for performing this plan is that to be executed experimentally in one or two areas, especially in those that the lack of space for children's play exists. Existed experience of this space would help to identify a more domestic method for Strasbourg and would give the possibility of a step by step performance in other parts of the city.

- In the second phase, to be classified like schools in New York and to be performed by the municipality in the pattern of a detailed plan while considering the general criteria in multi-functional spaces and specific criteria for the playgrounds plus the neighborhood’s needs (according to what has proposed at the previous section. Cf. 5.2). Since some nurseries and elementary schools are managed under musicality’s or others activities, no changes would be happen in the possession of space- and there would be no problem as a result. On the other hand, public liability insurance is the compensation for potential damages to the building of school and its equipment, and academic activities insurance is the coverage for potential dangers to the kids. For managing, opening and closing the space in specified hours the help of school’s staffs, NGOs related to children activities or retired volunteers whom live nearby could be demanded.

7. Conclusion and perspective

According to what has been presented, a “multifunctional space” could be identified with these two characteristics.

- Allow different functions, different actors and different users during different periods of time or have the capacity to accommodate two or more activities at the same time (accept more than a function simultaneously)

- Fulfill the different roles a space might have in line with the environmental, economical and social sustainability

In this case, this idea would have positive social, economic and environmental consequences that overall, their action would lead to the promotion of citizen’s life quality due to augmentation of time for doing recreational and social activities, a more interaction with natural environment due to preventing the irregular spread of the city, living in an environment that is far from pollution because of the reduction in the need for construction and finally, citizens would have a more healthier spirit and body. These effects have been shown, in summary, in figure 35.

Figure 35: The different effects and benefits of applying the concept of "Multifunctionality" in urban planning and design (Ghafouri, 2016)

But, the access to these conclusions is only possible with a general approach to the city as a totality. In other words, till the time that this idea has not been considered as a concept in starting a primary design or regional planning, their effects would be short and limited.

Figure 36 shows the idea in the scale of a neighborhood unit. If a part of the space in a residential complex could be allocated for social or recreational functions for all the residents of the neighborhood unit, the need for constructing new facilities and spaces for these activities would decrease. These small cells would enrich the diversity of activities and the choices in the whole area.

In the initial situation, all the area serves as a space for necessary activities. If a part of free spaces could be released (in a specific time interval) as a space for optional and therefore social activities, the quality of the whole area will be optimized. But this recovery is not always possible or the released space is not always sufficient for the increasing population. In this case, another solution is to find the small portion of space in each parcel that has the potential to be used for a different function in its idle hours. The different optional or social activities could be spread in these small cells. The final result is a vast range of choices for optional and social activities and a greater mixed-use area which can serve a greater number of residents or people from the whole community. In other words, this spatial structure affects each parcel as an independent area at the landscape level, as well as the behavior and functioning of the landscape community (neighborhood unit) as a whole.

In this scale, it should be noted that when the multifunctional cells are put together, with a comprehensive vision, the benefits much more significant of the sum of the advantages of each cell would be achieved. By looking at the area as a network of spaces while creating a collection of several multifunctional spaces (in a neighborhood or a district), a substantial area of land and create a diversity of activities could be released which attract a large number of citizens and make them return to the space several times. In addition, improve the functional performance of an area, makes it more efficient economically.

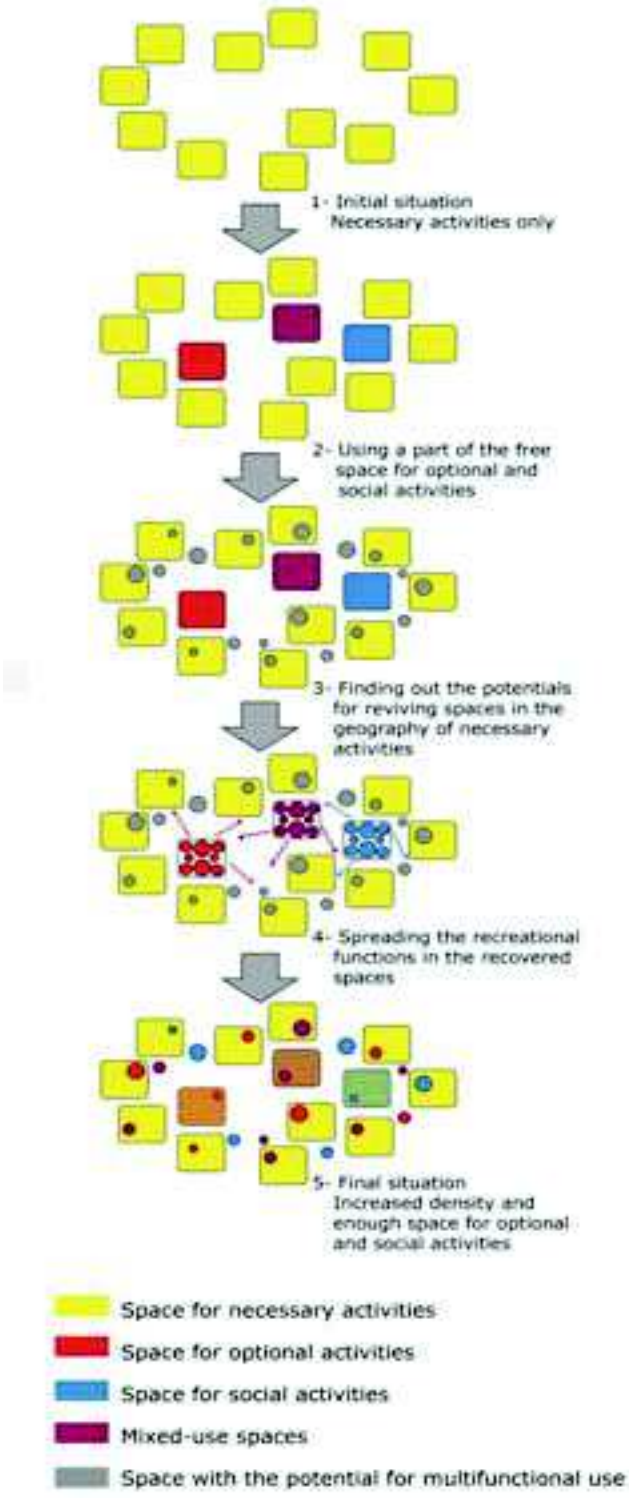

Figure 36: Combination of activities in the scale of a neighborhood unit (Ghafouri, 2016)

Thus the concept of multifunctionality can inter in the architectural and urban design from the beginning by designing the master plan of a city based on mixed-use areas and sharing functions (design a network of activity) (Figure 37). By using undergrounds, rooftops or vacant lands or designing portable convertible furniture that can adapt to new situations, the scene would may be open to the new innovative ideas. The sustainability issues in urban areas place this work in another dimension, connecting with densification of land use and land cover and moreover to the future cities transformation trends.

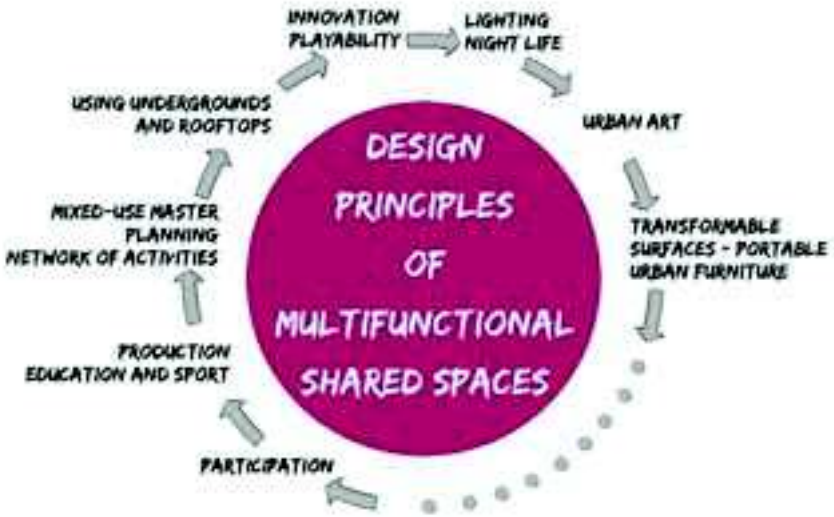

Figure 37: 8 conceptual patterns extracted from analyzing the cases (Ghafouri, 2016)

In the research the potentials of multifunctional use of urban space and its capability to sustainable urban form was studied. The criteria defined would help to find the appropriate areas of the city in the phase of programming.

For this, 80 samples that had similar definitions were examined. This study has been done based on three factors: location, function (+time) and actors. Expanding these factors and the exchange among samples and criteria, finally, led to 30 criteria that were the basis for studying and examining the cases.

By analyzing the cases it was found that some of the criteria are of a higher importance than the others. The feedback of analyzing the cases led us to classify the criteria in 3 degrees of importance (Table 30). These criteria should be analyzed in the phases of feasibility study, programming and conceptual design. The first degree criteria gather the essential criteria that the project cannot be started without taking them into consideration. The second degree relates to the criteria which have a wide variety of attributes and must necessarily be considered, but in case of any problems or limits, many different solutions might be put into test. The third degree criteria are recommended in each project of urban design (in a mono-functional as well as a multifunctional space). This classification could be considered as a basis of feasibility study for changing a mono-functional space to a multifunctional one.

Table 30: Three levels of criteria

Level 1	Level 2	Level 3
Most important criteria	***Important criteria***	***Criteria highly recommended to be considered***
Type of initial actors Type of secondary actors Primary and secondary functions Destination of use Site morphology	User status Type of activity Legal basis of ownership and management Accessibility Location Temporality Terms of use	Attractiveness (location + activity) Risks (without /with adding the second function) Protection mode Legal basis of responsibility of the place Insurance policy

An experimental scenario for Strasbourg was defined: turning the schoolyards to playgrounds open to public out of school hours.

The combination of classification or multi-criteria analyses on urban GIS databases of Strasbourg led us to maps of the schools in the agglomeration that have the potential to be used multifunctional with higher efficiency. However, all the information needed don't come directly from existing databases. Each site should be analyzed according to its potentials and characteristics and b planned like an urban design project.

To be able to transform this idea from theory into practice, in addition to the obtained information from GIS's databases, the decisions should be based on specific trait of each site. In fact, most of the decisions are not based on GIS's data, but have been taken based on designer's observation and its analyses. Furthermore, to be able to understand who the actors (owners) in each site are, there is a need to have Cadastre plans. The elements that need information and the sources for reaching to these information for Strasbourg, has been shown in table 31. The green marked information are the ones which are achievable through the GIS data bases, Cadastre plans, laws, urban rules and regulation or even by visiting the site but the orange marked are the ones about which we need to make decisions and come through the analysis and studies to be done for each site and the selected secondary functions. In fact, changing our decision for the secondary or added function will vary the result.

Table 31: The different information needed for making decisions and study and their source

Multifunctional Spaces	Space	Morphology	Form	✓ GIS Databases (BD_TOPO)
			Protection mode	! Field visit
			Lighting	✓ Public lighting plan
			Nature of ground	! Field visit
			Space covering	! Field visit
		Urban Context	Location	✓ GIS Databases (BD_TOPO)
			Attractiveness (location + activity)	✓ GIS Databases (BD_TOPO)
			Risks (without adding the second function	✓ GIS Databases (BD_TOPO)
			Change in the legal basis of responsibility of the place	! GIS Databases (BD_TOPO) + Cadastre+ Laws and regulations
		Accessibility		✓ GIS Databases (BD_TOPO) + Public transportation Plan
	Function	Activity	Type of activity	✓ GIS Databases (BD_TOPO)
			Initial function	✓ GIS Databases (BD_TOPO)
			Secondary or added function	! To define
			Legal basis of ownership and management	✓ GIS Databases (BD_TOPO) + Cadastre
			New insurance policy	● Laws and regulations
			Destination of use	Analysis
			Term of use	Analysis
			Relationship between functional operation and space	Analysis
			Nightlife	✓ Field visit+ Public lighting plan
			Prerequisites	Analysis
			Risks of activity	✓ GIS Databases (BD_TOPO)
			Relationship between activity and climate	Analysis
			Relationship between activity and weather	Analysis
			Temperature	Analysis
			Relationship between activity and sunlight	Analysis
			Noise pollution	! Field visit+ GIS Databases (BD_TOPO)
		Temporality		● Calculation
	Actors		Type of initial actors	! Cadastre
			Type of secondary actors	! Cadastre
			User status	! Cadastre

In addition, it should be kept in mind that this problem doesn't have a global answer. Some information like legal or insurance issues is somehow difficult to introduce spatially into GIS layers. Each country provides unique possibilities and limitations according to its own internal regulations and its cultural background and administrative systems. For instance, in some countries the rules related to insurance and responsibility of urban spaces are more easygoing; despite some others in which they make the huge restrictions. Moreover, the various definitions of space and function in different cultures lead to a wide diversity in making multifunctional spaces.

It's important to spend time for introducing this idea to people and encouraging them to look at the space as a "capital" that could be shared, not only between different users, but also between different activities. The notion of "sharing use" is something that might be achieved through informing and education.

It is obvious, by adding non-material layers related to the interferer in forming the city such as activities and life, history and culture, values and meanings to this information, explanation of these data is not possible through GIS. The necessity of using other tools in different fields in taking decisions, analyzing and classifying big data, could be used in planning for the city.

One of these methods is OLAP and Data warehouses that are used for management of the large amounts of data. This system classifies the data as cubes and all the information are analyzed before entering to the data warehouses. As a result, the time for their analyzing and taking a decision is needed would reach to its minimum. The combination of OLAP with GIS has led to the creation of the software named SOLAP.

Researches related to spatial data warehousing and spatial OLAP show that SOLAP can be useful in spatial decision-making. SOALP had been experienced in forestry, traffic engineering, environmental health and some other domains. The perspective of this research could be putting into test the capability of using SOLAP in urban design toward sustainable urban form. According to the previous experiences, SOLAP might be useful in sustainable urban design. It supports different types of

information which relate to both sides “urban form” and “sustainability”. But in using SOLAP, like all other tools, the vision of the user affects the results. Therefore, it has to be a system helping the user in selecting, sorting and entering data in order to achieve the best result.

The result of the comparison between the abilities of SOLAP with adding the capabilities of OLAP in classifying non-spatial data to the GIS has been illustrated in the table below (Table 32):

Table 32**:** SOLAP’s ability in completing the GIS’s capabilities in designing the form of a sustainable city

SOLAP		GIS				OLAP	
data		Spatial				Non-Spatial	
		Point	Line	Surface	Volume	Discriptive	Numeric
Urban Form	Natural Elements	✓	✓	✓	✓	✓	✓
	Man-made Elements	✓	✓	✓	✓	✓	✓
	Life & Activities	✓	✓	✓	-	✓	✓
	History & Culture	✓	✓	✓	-	✓	✓
	Values & Meanings	-	-	-	-	✓	✓
Sustainable City	Environmental Aspects	✓	✓	✓	✓	✓	✓
	Economical Aspects	✓	✓	✓	-	✓	✓
	Socio-cultural Aspects	✓	✓	✓	-	✓	✓

An OLAP Datacube for finding the potential to create multifunctional spaces has been illustrated in figure 38.

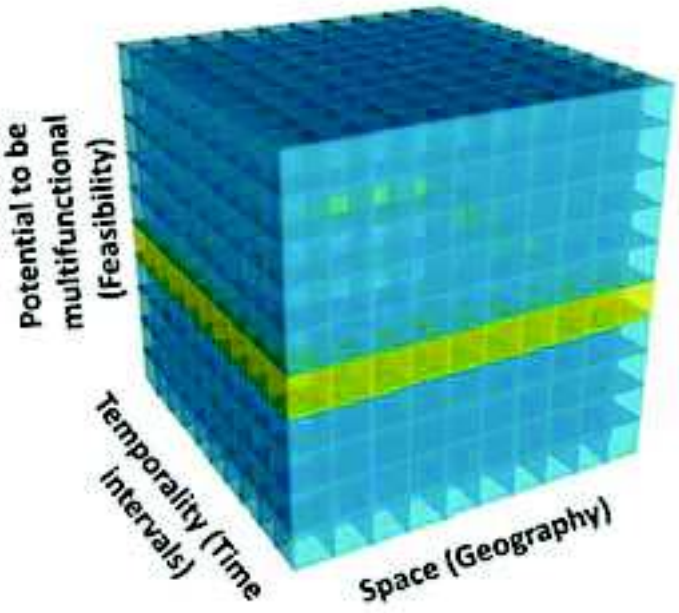

Figure 38: An OLAP Datacube for finding the potential to create multifunctional spaces

As a perspective of this research, the utilization of SOLAP for a space or a specific scenario would be proposed. How these capabilities in theory would be de facto? Is our prognosis practical or not? Does the utilization of SOLAP make the complication of the decision process easier? How different aspects of sustainable design by using SOLAP could be integrated? Is SOLAP an interesting tool for decision-making in urban design?

Besides putting SOLAP into test, as propositions for further researches, there are two more ideas that could be considered:

- Regarding what has been done for this thesis, a general method for a rational design of urban spaces is to be provided (by applying the methods used in industrial design for assessing the products and optimizing the choices for evaluating the concepts for urban planning).

- Since each new case will change all the values in the matrix, it is proposed an application or software to be designed in order to update the data basis regarding each new case.

I, with a background in architecture and landscape architecture, by performing this research got to this result that the multifunctional concept is an appropriate manner in increasing the quality of the architectural and urban spaces. In other words, if we look at the design as a resultant of the form and functionality (accountability to the requires of the users in terms of physical and psychological needs) and at the same time considering social, cultural, economic, identical and esthetical aspects in the framework of time, different layers could be determined. The significant point and idea is: all these aspects to be considered simultaneously along each other and that too much attention to one aspect does not lead to the ignorance of the other ones.

By this mindset, even a simple element like a chair in an urban space could be designed in a way that in addition to its usual functionality e.g. a place for sitting, in a certain period of time or out of the its usual functioning periods, perform ecological, social, cultural, economic or identical roles. This kind of thinking while designing, multiplies the value of “each decision” or “each choice”. One would may think that designing could be more difficult by having this point of view, but if this would turn into a way of thinking for the decision makers, planners and designers, by making simple changes or at least intervention, it could lead to a more sustainable, effective and high-quality consequences and results; the subject that the future world needs strongly.

8. References

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Annex I: Studied Cases

POPS (Privately Owned Public Spaces) **USA, New York**

Multifunctional

Privately Owned Public Space: private properties that serve as public spaces. The open complex is restricted to administrative staff in the day and serves the public evenings and weekends.

Source(s):
http://nyc.gov/html/dcp/html/priv/priv.shtml
(2012)

Bankside 1/2/3 **UK, London**

Multifunctional

Bankside 1/2/3 represents the next logical step in the transformation of the South Bank, building on the success of nearby Tate Modern. It consists of three buildings

on a prime site between Tate Modern and Southwark Street. Together, they span 378,889 of office space and 37,673 square feet of retail accommodation, all linked by a series of pedestrian thoroughfares and public spaces. In keeping with the spirit of the area, we have made a major investment in public art, including the Monument to the Unknown Artist, an animatronic artwork that mimics the body language of passing pedestrians. A series of imaginative events, including our Great British Summer, has also helped inject a sense of energy and community into the area.

Source(s):
http://landsecuritieslondon.com/portfolio/bankside-123
(2012)

Mixed use paths (MUPs) **Worldwide**

Mixed-use

Paths for pedestrians+cyclists

Source(s):
http://lovelybike.blogspot.fr/2012/06/sharing-space-with-pedestrians.html
(2012)

Street Badminton **Vietnam**

Multifunctional

The sidewalks in Vietnam are also a badminton equipped playground.

Source(s):
http://tnhvietnam.xemzi.com/en/group/show/144/Badminton
(2016)

Street Cafes (terrasse) **Worldwide**

Multifunctional

The sidewalks allow cafe tables and shop wares to be displayed on the street.

Source(s):
www.lecafeparisien.com/
https://en.wikipedia.org/wiki/Parisian_café
(2016)

RiverSmart Homes **USA, Washington DC**

Multifunctional

The RiverSmart Homes program offers incentives to homeowners interested in reducing stormwater pollution from their properties. This District-wide program offers incentives to homeowners interested in reducing stormwater runoff from their properties. Homeowners receive up to $1,200 to adopt one or more of the following landscape enhancements.

Source(s):
http://ddoe.dc.gov/riversmarthomes
(2012)

Netherland

Woonerf

Mixed-use

A woonerf is a living street where pedestrians and cyclists have legal priority over motorists as implement in the Netherlands and in Flanders. Techniques include

shared space, traffic calming, and low speed limits. Under Article 44 of the Dutch traffic code, motorized traffic in a woonerf or "recreation area" is restricted to walking pace. In the UK these are called home zones. In the USA complete streets are a similar concept where equal priority is given to all modes of transportation including automobiles, bicycles, and pedestrians.

Source(s):
http://en.wikipedia.org/wiki/Woonerf
http://streetswiki.wikispaces.com/Woonerf
(2012)

Weekly markets (Marché Hebdomadaire) **France**

Multifunctional

The markets for fruits and vegetables once or twice a week in parking lots, squares or plazas

Source(s):
http://marchedefrance.org/agenda-marches-weekly-a.asp
(2012)

Friday prayers **Iran, Tehran (University of Tehran)**

Multifunctional

Jumu'ah "Friday prayer" is a congregational prayer that Muslims hold every Friday, In Tehran, The Friday prayer takes part at University of Tehran. In Iran the weekend is on Fridays.

Source(s):
Ghafouri (2013)

Mosalla **Iran, Tehran**

Multifunctional

Located in the capital city of Iran, the Imam Khomeini Mosque (Mosalla) is considered as one of the better venues for hosting various kinds of business and academic events and conferences. Easy to reach and connected to the major destinations by The Imam Khomeini International Airport, which is around 50 kilometers away from the center of the city. In addition to providing a huge space for accommodating corporate programs, the mosque also boasts of technologically

advanced equipments which make it convenient for the organizers to arrange events. State of the art audio visual systems along with wireless connectivity aid to the successful implementation of such programs. The Imam Khomeini Mosalla also forms one of the most popular tourist attractions for the visitors to Tehran.

Source(s):
http://biztradeshows.com/venues/imam-khomeini-mosalla.html
http://abasabad.tehran.ir/default.aspx?tabid=170
(2015)

Paris Plages (Paris Beaches) **France, Paris**

Multifunctional

The summer transforms Paris. The cityscape dons greenery and the riverside thoroughfares become car-free resorts. The Paris Plages (Paris Beaches) operation kicks off on or around 20th July and lasts four weeks. It began in 2002. A Seine-side holiday. That, in a nutshell, is what Paris Plages is all about – complete with sandy beaches, deckchairs, ubiquitous ice cream sellers, and concerts for French and foreign guests. Holidaymakers at the Bassin de la Villette (Paris 19) can also borrow books free of charge, play beach volley, take an aqua gym class in a mini pool, or kayak around the lake – or, of course just chill and enjoy. The Seine's banks become pedestrian and the beaches are spread across three spots (Louvre/Pont de Sully, Port de la Gare and Bassin de la Villette).

Source(s):
http://pps.org/great_public_spaces/one?public_place_id=997
http://en.wikipedia.org/wiki/paris-plages
(2012)

Des jardins collectifs & Potagers urbains collectifs (shared gardens) **France, Strasbourg**

Innovation

An idea for bringing the nature into the city as a feeding source in all neighborhoods

Source(s):
http://strasbourg.eu/environnement-qualite-de-vie/biodiversite-en-ville/jardins-nourriciers/les-differentes-facons-de-jardiner
http://strasbourg.eu/environnement-qualite-de-vie/biodiversite-en-ville/jardins-nourriciers/les-jardins-familiaux/louer-faq
http://cuej.info/blogs/le-potager-urbain-collectif-prend-racine
(2013)

Union Street Urban Orchard **UK, London**

Innovation

Producing food in a garden in the heart of a neighborhood that offers fruits and vegetables to the neighbors

Source(s):
http://dezeen.com/2010/07/11/union-street-urban-orchard-by-heather-ring/
http://unionstreetorchard.org.uk/
(2013)

Urban farming, Community gardens **USA**

Innovation

Producing food in urban spaces by the residents of the neighborhood

Source(s):
http://urbaneatin.com/about-urban-eatin-gardeners-winnipeg
http://cityfarmer.info/2009/02/09/nuestras-raices-promotes-urban-agriculture-in-holyoke-massachusetts/

(2013)

School Farms **USA**

Innovation

Producing food in school yards by children

Source(s):

http://childrensfarm.org/

https://www.wholekidsfoundation.org/resources/school-garden-resources/

(2016)

Jardin de Luxemburg **France, Paris**

Multifunctional

Portable shared chairs

Source(s):
https://en.wikipedia.org/wiki/Luxembourg_Palace
(2014)

Spanish plazas **Spain**

Mixed-use

Highly mixed-use areas active 24/7

Source(s):
www.totallyspaintravel.com/2015/03/30/best-plazas-in-spain/
https://en.wikipedia.org/wiki/Plaza
(2015)

Meeting Bowls **USA, New York**

Multifunctional

Spanish collaborative has created a new street furniture installation which creates an intimate conversation environment in the center of Manhattan's busiest plaza.

Source(s):
http://psfk.com/2011/08/meeting-bowls-nyc-street-furniture-for-spontaneous-dialog-pics.html
(2013)

Fairgrounds **Worldwide**

Multifunctional

The permanent venue of expositions in different cities in the times that it does not hold expositions could be used for other functions and activities.

Source(s):
https://en.wikipedia.org/wiki/Parque_das_Na%C3%A7%C3%B5es
http://jds.fr/strasbourg/parc-expo-alsace/parc-des-expositions-du-wacken-4589_L
(2015)

Volkertplatz **Austria, Vienna**

Multifunctional

The square's centre provides space for setting up a temporary stage

Source(s):
http://central2013.eu/fileadmin/user_upload/Downloads/outputlib/Urbspace_3.2.6_Design_architectural_aspects_PR2.pdf
(2013)

Aigensüd **Austria, Salzburg**

Multifunctional

Within the master plan of the housing construction the protagonists articulated following organizational principles for the open space: The deficits of green space supply for the surrounding quarters are to be considered during the planning. By means of a differentiated system of public paths, half-public areas and private

gardens not only to form a vital residential project but also to pass this impulse to adjacent city quarters.

Source(s):
http://central2013.eu/fileadmin/user_upload/Downloads/outputlib/Urbspace_3.2.6_Design_architectural_aspects_PR2.pdf
http://europeangreencities.com/cityBuilding/austria.asp
(2013)

Innichen **Italy, San Candido**

Multifunctional

Pedestrian Zone Innichen by AllesWirdGut; Depending on season / mid-season the atmosphere of the pedestrian zone changes a lot. The open space and the surfaces are designed “reactively”, so the commune can react to the occurring seasonal changes and modify the appearance of the village.

Source(s):
http://landezine.com/index.php/2010/10/pedestrian-zone-innichen/
(2013)

Osmose **France**

Mixed-use

Building the bus station of the future

Source(s):
http://ratp.fr/en/ratp/r_65980/osmose-building-the-bus-station-of-the-future/print/
(2013)

The Circle **USA, IL, Normal**

Multifunctional

It’s a multifunctional shared space that provides entertainment and activities for the community and visitors alike all year long. The Circle also recycles stormwater, recirculating it into the public drinking fountains and irrigation system. It’s a pleasant place to sit and relax and its home to a farmers market as well. The Circle collects stormwater from the surrounding streetscapes where it is filtered for excess debris. Ultra violet light energy helps destroy micro-organisms without using harmful chemicals before it is pumped up through the Circle’s “bog” plants. These plants also help to clean the water by filtering excess sediments and absorb toxins in the water.

Like ancient Roman aqueducts, gravity moves the water through four bog pools where it eventually terminates into the fountain turbulence pool. Here, it can be enjoyed by the public as a water feature.

Source(s):
http://pps.org/blog/your-picks-for-the-top-100-public-spaces-in-the-u-s-and-canada/
(2013)

Temple Square **USA, CT, New Haven**

Mixed-use

Located in the heart of downtown New Haven, CT, Temple Plaza was created in the 1990s by hollowing out the crumbling interior of a large city block. Small and irregularly-shaped, it is bordered by utilitarian concrete structures, metal fire stairs and walkways, brick walls, concrete columns and a dramatic corkscrew exit ramp from the parking garage. Tightly enclosed and with vistas obstructed by long, narrow passageways, the plaza contains outdoor cafes, stairs to perch on, fountains, cascading steps, and a small lawn for picnics or a lunchtime nap. The dramatic sculptural presence of the curving concrete ramp of the parking garage inspired Swiss artist Felice Varini, whose 'Square with four circles' installation opened in Temple Plaza in June, 2010.

Source(s):
http://pps.org/blog/your-picks-for-the-top-100-public-spaces-in-the-u-s-and-canada/
http://planetizen.com/toppublicspaces

(2013)

Campus Martius Park **USA, Detroit, Michigan**

Mixed-use

Because of a revitalized Campus Martius, people are coming back to downtown Detroit -- to hear concerts, watch outdoor movies, admire the ever-changing flower gardens, delight in the fountains, meet a date at the Park Cafe, or simply sit and relax. A key accomplishment of Campus Martius has been its ability to attract visitors of all kinds. Campus Martius is located in the center of Detroit's Central Business District, a roughly one-mile-square area framed by three major roads and the Detroit River. It contains grassy lawns, gravel walkways, and informal seating for more than 2,000 people on walls, benches, steps, and movable chairs. Two retractable stages with light and sound equipment can be moved into position for events. An ice skating rink fills much of the park from November to March. An Au Bon Pain offers café food year-round, with both inside and outside seating, and wireless Internet is available throughout the park. Pétanque and bocce ball courts provide active uses; a central fountain with water walls and the restored Soldiers and Sailors Monument add their own flavors. The space is designed to maximize the number and types of activities that can take place, and is sufficiently flexible to allow changes to and evolution of the space.

Source(s):
http://pps.org/blog/your-picks-for-the-top-100-public-spaces-in-the-u-s-and-canada/
http://planetizen.com/toppublicspaces

(2013)

CityArt Walking Sculpture Tour **USA, Minnesota, Mankato**

Innovation

Not unlike the more au courant practice of tactical urbanism, art fairs and competitions are enlivening spaces across the U.S., most notably in Grand Rapids, Michigan. Mankato, Minnesota's CityArt Walking Sculpture tour is cultivating a lively and active street life in the city center. This project has been warmly received for its improvement to sidewalk aesthetics and highly regarded for its ability to attract visitors to shops and restaurants on or near the tours path. Launched in the Spring of 2011, twenty-five sculptures by artists from around the world are arranged on pedestals and are displayed for a full year. Maps and ballots along the 6-block route and the public are encouraged to vote for their favorite. The winner is purchased and placed in the public art collection of the City Center.

Source(s):
http://pps.org/blog/your-picks-for-the-top-100-public-spaces-in-the-u-s-and-canada/
http://planetizen.com/toppublicspaces
http://cityartmankato.com/lazy_days
(2013)

Bryant Park **USA, New York**

Mixed-use

Since its restoration in the 1980s, Bryant Park – originally built 100 years earlier – has become one of the best "new" urban parks in the world. Its overall design and elements support a range of activities and uses for people who work, shop, or live nearby, as well as those who are just visiting. Located in the heart of midtown Manhattan, adjacent to the New York Public Library main branch and dozens of high-rise corporate offices and headquarters, the quiet lawns and tree-lined paths provide a critical respite from the buzz, stress and energy of the city. The park's center is a three-acre open green surrounded by tall, arching trees. Kiosks at its northwest corner offer coffee and light meals. More than 1,000 lightweight chairs can be moved throughout the park during good weather; visitors can rent pieces for chess and backgammon tables from the New York Chess and Backgammon Club. Other attractions include flower gardens, a fountain at the west end of the park, ping-pong, and a variety of vantage points from which to just sit and watch the world goes by. In the winter, ice skating takes over the lawn area; the rink is popular with tourists and New Yorkers (citycinema).

Source(s):
http://pps.org/blog/your-picks-for-the-top-100-public-spaces-in-the-u-s-and-canada/
http://planetizen.com/toppublicspaces
http://en.wikipedia.org/wiki/Bryant_Park
(2013)

Pittsburgh Market Square **USA, Pennsylvania, Pittsburgh**

Mixed-use

Market Square is a unique space in the heart of downtown Pittsburgh with a storied past. It's been the central square in Pittsburgh's downtown since the 18th century, and was the site of a public space known as the Diamond, or Diamond Square, that was demolished in 1962. To keep the historic scale and style of the downtown intact, Market Square was designated as Pittsburgh's first historic district in 1972. Several redesign projects followed suit. Given its history and central location, the place should have been an active, sociable destination, but even after several redesigns, the square floundered as the central area in downtown. In more recent decades, the square was characterized by drug use, heavy bus traffic and loitering, and especially after 5 p.m., dreary emptiness. The refurbished 68,000 square foot plaza combines the four quadrants of the old square into one large pedestrian-only center island. Raised curbs and planters were eliminated and the square re-graded to one, consistent plane. The red brick paving and withering plants were replaced by modern paving material and a lighter-colored large circular ring that draws visitors to the center of the square. The new trees were planted in four organized clusters, nodding to the historical street patterns and the previous four quadrants. Temporary seating and bistro tables are also spread out through the plaza. In addition to seating in the square itself, new brick sidewalks were extended on the streets around the square, allowing for expanded café seating.

Source(s):
http://pps.org/blog/your-picks-for-the-top-100-public-spaces-in-the-u-s-and-canada/
http://planetizen.com/toppublicspaces
http://virtourist.com/america/pittsburgh/13.htm
(2013)

Arts District at Bay Street **USA, WA, Bellingham**

Mixed-use

Bellingham's downtown Arts District spans the area between the civic center to the north and commercial core to the south, and also connects to the Old Town district and the Bellingham Bay waterfront. The city of Bellingham has done a number of streetscape improvements to make the district more walkable and community-oriented -- including the removal of high-volume parking and newly widened sidewalks for a safer, more pleasant pedestrian experience. Restaurants and retailers have been encouraged to spill out onto the sidewalks, and the addition of benches and plantings makes the streetscape attractive and functional. Public plazas are being created at the Art & Children's Museum, the library, and key intersections in the downtown district, linking cultural institutions to the cityscape and promoting multi-use community gathering places. Revitalization in and around Maritime Heritage Park, including cleanups, landscaping, and increased attention to local activities and parking, have already made the park a safer, more effective community destination.

Source(s):
http://pps.org/blog/your-picks-for-the-top-100-public-spaces-in-the-u-s-and-canada/
http://planetizen.com/toppublicspaces
(2013)

Balboa Park **USA, CA, San Diego**

Multifunctional

Balboa Park is one of the city's most prized attractions, beloved by both residents and visitors. The 1,200-acre park, opened in 1868, is organized around a system of internal paths leading to its cultural attractions. It is home to one of the best collections of Spanish Colonial Revival architecture in the United States, legacy of the city's decision to host a Panama-California Exposition in 1915. Balboa Park draws 10-14 million visitors annually and attracts a diverse group of users. The edges of the park are well-integrated into the surrounding neighborhoods, attracting a large number of locals, and the amazing cultural, conservation, and recreation organizations within its boundaries draw visitors from all over the world. The lively atmosphere and flexibility of recreational space allow for numerous activities to take place, including weddings, festivals, performances, painting, and parades.

Source(s):
http://pps.org/blog/your-picks-for-the-top-100-public-spaces-in-the-u-s-and-canada/
http://planetizen.com/toppublicspaces
http://missionbayvacationrentals.com/san_diego/mission_beach/top_destinations
(2013)

Church Street Marketplace District **USA, VT, Burlington**

Multifunctional

Historic Church Street Marketplace is part of a National Register Historic District, with Victorian and Art Deco structures as well as modern infill buildings. It was built in 1981 with the involvement of forward-thinking planners who saw a need for a strong city center for a strong identity. Building heights are restricted to preserve the appearance of historic structures and maintain great views of Lake Champlain, the Adirondack Mountains and the First Unitarian Universalist Society church with its clock tower steeple built in 1816. Zoning promotes ground floor retail and upper-story office and residential uses. The Marketplace, with fountains, public art, street entertainers and vendor carts, is a central gathering place for festivals such as the Magic Hat Mardi Gras parade in February, and the Discover Jazz Festival in summer. During the holiday season, more than 200,000 white lights illuminate the four-block-long, bricked mall. The Marketplace attracts nearly three million visitors a year.

Source(s):
http://pps.org/blog/your-picks-for-the-top-100-public-spaces-in-the-u-s-and-canada/
http://planetizen.com/toppublicspaces
(2013)

Street Chess **Canada**

Multifunctional

Designed fields for playing collective chess in urban spaces

Source(s):
http://innerself.com/content/personal/happiness-and-self-help/performance/8572-community-celebrations-and-dancing-in-the-streets.html
http://alamy.com/stock-photo/street-party-montreal-canada.html
(2015)

Street Ping-Pong **Germany, Tubingen**

Multifunctional

The portable tables for playing ping-pong between the buildings (squares)

Source(s):
http://jugendherberge.de/en/youth-hostels/tuebingen113/leisure%20activities
http://newsday.com/travel/5-spots-to-play-ping-pong-in-nyc-1.3291548
(2015)

Chamran Boulevard **Iran, Shiraz**

Mixed-use

Sidewalk of a main street in Shiraz with different possibilities for recreation or social activities (like a linear park)

Source(s): Ghafouri (2008)

Imam Square **Iran, Isfahan**

Multifunctional

Naqsh-e Jahan Square known as Imam Square, formerly known as Shah Square, is a square situated at the center of Isfahan city, Iran. Constructed between 1598 and 1629, it is now an important historical site, and one of UNESCO's World Heritage Sites. It is 160 meters wide by 508 meters long (an area of 89,600 m2). The square is surrounded by buildings from the Safavid era. The Shah Mosque is situated on the south side of this square. On the west side is the Ali Qapu Palace. Sheikh Lotf Allah Mosque is situated on the eastern side of this square and the northern side opens

into the Isfahan Grand Bazaar. Today, Namaaz-e Jom'eh (the Muslim Friday prayer) and other social and political protests are held in the Shah Mosque.

Source(s):
http://pps.org/great_public_spaces/one?public_place_id=672
https://en.wikipedia.org/wiki/Naqsh-e_Jahan_Square
(2013)

La Rambla **Spain, Barcelona**

Multifunctional

Las Ramblas is the monumental centerpiece of life in the Catalan Capital. It throbs with Activity, as crowds at all hours of the day file past vendors, food markets, cafes and historic buildings, including the great Liceu Opera House. Subdivided into five separate Ramblas, each of the different character and attractions are a lively succession of newspaper kiosks, fresh flower stands, bird sellers and crowd friendly human statues in elaborately conceived costumes and face paint.

Source(s):
http://en.wikipedia.org/wiki/La_Rambla,_Barcelona
(2013)

Alexanderplatz **Germany, Berlin**

Mixed-use

Alexanderplatz is a large public square and transport hub in the central Mitte district of Berlin, near the Fernsehturm. In 1993 plans for a major redevelopment including the construction of several skyscrapers were published, but due to a lack of demand it is unlikely these will be constructed. However, beginning with the reconstruction of the Kaufhof department store in 2004, and the biggest underground railway station of Berlin, some buildings will be redesigned and new structures built on the square's south-eastern side. The Alexa shopping mall, with approximately 180 stores opened nearby during 2007 and a large Saturn electronic store was built and is open on Alexanderplatz since 2008.

Source(s):
https://en.wikipedia.org/wiki/Alexanderplatz
http://stadtentwicklung.berlin.de/bauen/baubilanz/en/alexanderplatz.html
(2013)

Paramana Square **Greece, Thermi, Thessaloniki**

Multifunctional

The design of the central square responds to the social and programmatic demands of a complex urban core and creates a new identity for the city. From the initial stages of design process digital animation techniques were introduced. The proposal is based on dynamic ‘formation' of two overlapping and interactive network-fields: a ‘path network' of the possible pedestrian movements and a ‘programmatic network' of the potential activities on the surface of the square. Further on, additional processing optimized their correlation and synergy and generated the final form. The square, from a 2D surface is transformed into a 3D surface, articulated by six freeform stripes of variable size, height and material, resulting in a rich spatial quality. The informal architecture of the oblique and the imbalance is tempting its users to interact with its folded surfaces and provokes new behaviors and unexpected programs.

Source(s):
http://greekarchitects.gr/en/landscape/%E2%80%9Cparamana%E2%80%9D-square-id4363
http://architravel.com/architravel/building/paramana-square-in-thermi
(2013)

Expos **Worldwide**

Multifunctional

Those Spaces that are designed for Expos, after the termination of the Expos could have a different function. The pavilions of different countries that have been designed by the best architects of that country, in addition to its function as an architecture exposition could continue to other activities or even be a recreational space.

Source(s):
http://urbanchoreography.net/2011/04/28/swa-group-design-mixed-use-fairgrounds-in-california/
https://en.wikipedia.org/wiki/World%27s_fair
(2013)

Roof Orchard **Australia**

Multifunctional

Cities gardens can be more than a decorated landscape. Like the built environment, green spaces can work with us to make an integrated urban environment rather than isolated pockets of manicured greenery. We propose a garden that contributes a

SOCIAL space, creates a low impact and sustainable ECONOMIC model, beautifies the URBAN landscape and improves our urban areas impact on the ENVIRONMENT. We propose that rather than only producing a beautiful, green rooftop space, we also create a greater and achievable urban gesture. We propose a working garden that is wonderful to visit, great to have events at, while also producing food much like Cuba's Market Gardens.

Source(s):
http://cityfarmer.info/2010/02/07/urban-orchard-prizing-winning-concept-for-the-growing-up-design-competition-2009/
http://maynardarchitects.com/Site/houses/Pages/Urban_Orchard.html
(2013)

Rooftop Garden **Worldwide**

Innovation

Roof garden is a garden on the roof of a building. Besides the decorative benefit, roof plantings may provide food, temperature control, hydrological benefits, architectural enhancement, habitats or corridors for wildlife, recreational opportunities, and in large scale it may even have ecological benefits. The practice of cultivating food on the rooftop of buildings is sometimes referred to as rooftop farming.

Source(s):
https://en.wikipedia.org/wiki/Roof_garden

(2014)

Old Spitalfields Market **UK, London**

Innovation

Inspired by the increasingly unimaginative and utilitarian approach to modern public furniture, Spitalfields interiors store, The Lollipop Shoppe, invited 11 influential furniture designers – the likes of JDS Architects, Freshwest and Decode – to create 11 distinctive, innovative and remarkably unique versions of the humble bench. Dotted around Old Spitalfields Market – until 30th September – the 11 benches form an engaging micro-exhibition as part of this year's London Design Festival, encouraging those who view and use the benches to imagine the possibilities of public furniture as both functional and as innovative and captivating pieces of public art. We loved the slick little map available in-store, and there was something of a childlike pleasure in seeking out the pieces, if it hadn't have been the worst weather of the week – also our excuse for the erratic photography – on the day we visited then we would loved to have enjoyed a little more time with each of the works… perhaps it'll give town planners food for thought and we can all enjoy a more enlightening break from the crowds in future.

Source(s):
http://weheart.co.uk/2010/09/27/bench-10-by-the-lollipop-shoppe/
(2013)

Glowing Places **UK, London**

Innovation

Glowing Places is a concept from an investigation into innovative ways for people to interact with light in public spaces. The plastic seating, embedded with LED (light-emitting diode) strips and sensors, measure the presence of people over time. Both the number of people sitting and the length of time they stay create a 'social interactive pattern' that is translated by patented software into lighting effects in the furniture. Many people sitting for brief periods of time result in lighting activity expressing a busy period, whereas one or two people sitting for a longer period trigger mellow lighting.

Source(s):
http://interactivearchitecture.org/2005/12/12
http://hhc.rca.ac.uk/archive/hhrc/programmes/ra/2004/ra04p8.html
(2013)

Broadway **USA, New York**

Multifunctional

Broadway theatre commonly known as Broadway refers to the theatrical performances presented in the 40 professional theatres with 500 or more seats located in the Theater District and Lincoln Center along Broadway, in Midtown Manhattan, New York City. Along with London's West End theatres, Broadway theatres are widely considered to represent the highest level of commercial theatre in the English-speaking world. The Theater District is a popular tourist attraction in New York City. According to The Broadway League, Broadway shows sold a record US$1.36 billion worth of tickets in 2014, an increase of 14% over the previous year. Attendance in 2014 stood at 13.13 million, a 13% increase over 2013. The great majority of Broadway shows are musicals. Historian Martin Shefter argues, "'Broadway musicals,' culminating in the productions of Richard Rodgers and Oscar Hammerstein, became enormously influential forms of American popular culture" and helped make New York City the cultural capital of the nation.

Source(s):
https://en.wikipedia.org/wiki/Broadway#In_New_York_City
http://nyc.gov/html/dot/html/about/broadway.shtml
(2013)

Public Farm One **USA, New York**

Multifunctional

P.F.1 will combine playful programs with educational ones, creating a sense of community around the shared experience of growing food. Bringing sustainable construction together with sustainable agriculture, P.F.1 will be built entirely of recyclable materials, be 100% solar-powered and will utilize rain collection for irrigation. P.F.1 is formed as a folded plane made from cardboard tubes, designed to hold planters for vegetables, herbs and fruit. While most of the tubes create an elevated canopy for shade, some tubes extend to the ground to become columns. Each column holds a different program, from seating to sound environments to a mobile phone charging column and even a juice bar at the farmers market.

Source(s):
http://publicfarm1.org/index.php?/ongoing/about/
http://plataformaarquitectura.cl/cl/02-7673/public-farm-1-en-el-ps1-work-ac
(2013)

Jetty Square **South Africa, Cape Town**

Multifunctional

Alongside Pier Place sits another public space in the middle of the Foreshore, Jetty Square. The square is notable for its installation of ghost shark sculptures created by artist Ralph Borland using digital technology called physical computing. The shark skeleton structures have infrared sensors in their noses which respond to pedestrians passing beneath them and swivel in accordance with the movements below. As the square on which they are located is land reclaimed from the sea, the shark sculptures pivoting above a brick work motif of swirling water seems appropriate. With the creation of stylish bistros and coffee shops around Jetty Square and Pier Place, the Foreshore area of Cape Town is becoming an attractive middle ground between the city and the Cape Town Convention Centre, as well as being close to the hub of the city's financial, business and publishing worlds. The nearby Convention Centre has recently opened Convention Towers, a tower of grade An office accommodation. Nearby is the Icon Building, an 18 storey mixed-use development (and Cape Town's first 100% black empowerment development), which opened in 2007.

Source(s):
http://capetownpartnership.co.za/old-programmes/public-space-for-public-life/jetty-square/
(2013)

Simcoe and Rees WaveDecks **Canada, Toronto**

Multifunctional

The Toronto Waterfront Wavedecks are a series of wooden structures constructed on the waterfront of Toronto, Canada as part of the revitalization of the central waterfront. Waterfront Toronto committed to constructing a series of unique wooden wavedecks along the water's edge for the 3.5 km area running from Bathurst Street to Parliament Street. The wavedecks are new public spaces that vary in shape, articulation and design to reflect the movement of Lake Ontario. Each is artistic and functional and has proven to be major public attractions along the harbourfront.

Source(s):
https://en.wikipedia.org/wiki/Toronto_Waterfront_WaveDecks
(2013)

Park Library **France, Strasbourg**

Multifunctional

Library next to the playground, the Orangerie Park

Source(s):
http://cedarcitylibrary.org/
(2012)

Park(ing) Day **Worldwide**

Pop-up

PARK(ing) Day is an annual worldwide event where artists, designers and citizens transform metered parking spots into temporary public parks.

Source(s):
http://parkingday.org/
http://parkingday.fr/
(2013)

Narrabeen Lagoon Multi-use Trail Stage **Australia, Sydney**

Mixed-use

ASPECT Studios designed and documented a new multi-use trail for Narrabeen Lagoon. The Narrabeen Lagoon walk is one of Sydney's beautiful bush trails and a unique, recreational asset for the northern beaches. Through the design and placement of its lookouts and boardwalks, the trail connects Deep Creek to Middle Creek and provides a series of new experiences along this sensitive landscape setting. The new 2.5 kilometer section of trail is the first installment of a shared pedestrian and cycle pathway that will eventually complete the entire loop around Narrabeen Lagoon. A new timber boardwalk has been designed with seating and innovative look out points take you from the bush to the lagoon edge. The look outs are sculptural elements and were carefully designed to minimize impact on threatened vegetation fringing the lagoon foreshore.

Source(s):
http://archdaily.com/181431/narrabeen-lagoon-multi-use-trail-stage-1-aspect-studios/ (2013)

Multi Mill **Netherlands, Amsterdam**

Multifunctional

Seeing to port of Amsterdam as being in “a perpetual process of transformation,” the architects wanted the new step to respond to that constant change. The three wings which branch from a central platform each possess a different form fit for their usage. “The design will evoke varied programming; besides the evident ways to deploy the object, it hopes to catalyze unexpected ‘inhabitation’. The idea is to develop an adaptable object that can be used both as a step and as a stand,” explained the architects.

Source(s):
http://archdaily.com/74079/multi-mill-nl-architects/
(2013)

The Urban Living Room **Netherlands, Rotterdam**

Innovation

The Urban Living Room is a small living room in public space. Completely painted blue (FYI: RAL 5015), the projects aims to give people a more homely experience in

public space as well as stimulate spontaneous meetings and conversations.

Source(s):
http://popupcity.net/2012/09/the-urban-living-room/
http://urbanlivingroom.org/urban_living_room/home.html
(2013)

Bloomingdale Trail **USA, Chicago**

Mixed-use

By this project, the Bloomingdale Trail will be 2.7 miles of rail-to-park conversion, making it double the length of the High Line. It will also be wider, incorporate bicycle lanes, and act as a connector for its many adjacent parks. The length of the park runs through four different Chicago neighborhoods of diverse socio-economic levels, including the rough-and-tumble Humboldt Park. Community participation is highlighted at each step of the planning process, with involvement in projects such as mural art. The park will be the culmination of almost a decade of revitalization efforts from local communities and concerned citizens. Completion of the park 2014.

Source(s):
http://popupcity.net/2012/05/chicagos-elevated-park-ready-to-bloom/
(2013)

Urban CampScape Pops Up **Netherlands, Eindhoven**

Pop-up

The initiators of the Urban CampScape aim to research the function of the neglected space under the fly-over as a 'Green Corridor' — a node to connect the city to its green surroundings. Therefore the Urban CampScape will not only be a place to sleep during the DDW, but will also offer a temporary cultural program about co-creation and durability. The program includes guerrilla gardening workshops, an exhibition about the Green Corridor, breakfast with products from the Philips Fruit Garden, bicycle tours and much more.

Source(s):
http://popupcity.net/2012/05/chicagos-elevated-park-ready-to-bloom/
(2013)

The High Line **USA, New York**

Innovation

The High Line project stimulates thinking about creative solutions for re-using city space and also contributes to what we would call the ‘Age of Experience’. The Age of Experience forms an important part of nowadays metropolitan culture, in which the creation of extraordinary experiences becomes more and more important for contemporary cities in order to attract spoilt cosmopolitans and develop an innovative atmosphere.

Source(s):
http://popupcity.net/2009/01/the-high-line/
(2013)

A High Line for London **UK, London**

Innovation

A mushroom garden in an old railway tunnel beneath Oxford Street.

Source(s):
http://popupcity.net/2012/10/high-line-for-london-competition-has-a-winner/
(2013)

350 White Chairs Pop Up **Netherlands, Rotterdam**

Multifunctional

During Rotterdam's public art festival Wereld van Witte de With, urbanism office M.E.S.T. reanimated this idea. But instead of bikes, the designers left 350 white chairs in public space in Rotterdam. The chairs served as a terrace for all the decentralized performances, and fed a discussion about public space and ownership at the same time. People were allowed to use the white chairs freely and to take them to any other location as long as they remained part of public space. The white chairs were slowly spread across the city. According to the festival organization, they were even spotted at the Central Station of Leiden, a town somewhere between Rotterdam and Amsterdam.

Source(s):
http://popupcity.net/2012/09/350-white-chairs-pop-up-in-rotterdam/
(2013)

Bike-Sharing **Worldwide**

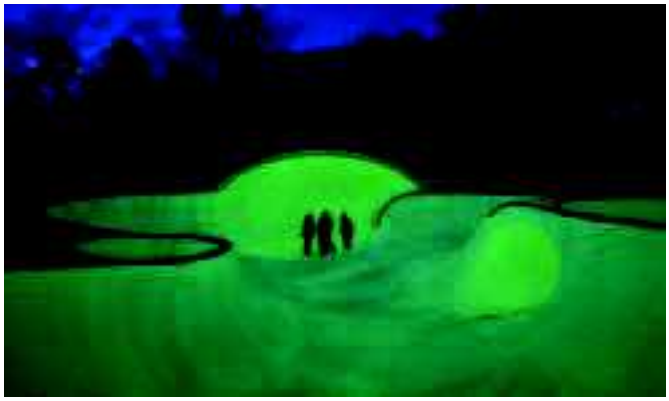
Innovation

Back in the 60s, the innovative Dutch counterculture movement Provo launched their ideas for a so-called ‘Witte Fietsenplan’, a ‘White Bicycle Plan’ for Amsterdam. The idea was simple — instead of urbanites who all own a bicycle, the system wanted to introduce 2,000 collective white-painted bikes that everyone can use. One could easily take a bike, use it and leave it on the spot of arrival for a next user. This revolutionary idea inspired many bike-sharing plans that were launched in global cities decades later (Example: Velhop in Strasbourg).

Source(s):
https://en.wikipedia.org/wiki/Bicycle-sharing_system
http://radioeurodistrict.com/clin-d-oeil-augenblick/le-velhop-a-la-rentree.html
(2016)

The Glow-In-The-Dark Skate Park **France, Vassivière Island**

Innovation



Korean artist Koo Jeong-A designed the so-called Otro, a glow-in-the dark skate sculpture. During daytime you won't see anything special, but as soon as it gets dark the structure transforms into a beautiful, glowing skating oasis. The Otro enables fanatic skateboarders to practice their tricks also when it gets dark. The structure can also be used for BMX and rollers. In addition, it gives good vibes to the environment.

Source(s):
http://popupcity.net/2012/08/the-glow-in-the-dark-skate-park/
(2013)

FibroCITY **USA, Texas, Houston**

Innovation

FibroCITY is a proposal by Perkins+Will that operates as a restorative catalyst for communities that have been segregated by 20th century superhighways and the environment built around the car. FibroCITY is a template that restores urban voids with places for people, activities, and interactions.

Source(s):
http://archdaily.com/135808/fibrocity-perkinswill/
(2013)

Living Wall **Worldwide**

Innovation

A green wall is a wall, either free-standing or part of a building that is partially or completely covered with vegetation and, in some cases, soil or an inorganic growing medium. The concept of the green wall dates back to 600 BC with the Hanging Gardens of Babylon. The larger green walls concept has been utilized with innovative hydroponics technology. The vegetation for a green façade is always attached on outside walls; with living walls this is also usually the case, although some living walls can also be green walls for interior use. For living walls there are many methods including attaching to the air return of the building to help with air filtration. They are also referred to as living walls, biowalls, vertical gardens or more scientifically VCWV (vertical vegetated complex walls).

Source(s):
https://en.wikipedia.org/wiki/Green_wall
(2013)

Lafayette Summer Street **USA, New York**

Multifunctional

Car-Free Summer Streets: With the near 5.5 mile stretch of road closed between Park Avenue at 72nd Street and the Brooklyn Bridge closed for New York's Summer Streets campaign, lower Manhattan took on an unfamiliar soundtrack. You could still hear the cars on Broadway a block over, but the lack of idling engines and tourist buses was unsettling in a good way. After the requisite euphoria subsided it felt like a natural oddity in a city that was doing most things right by way of transportation policy.

Source(s):
http://radialsblog.com/tag/summer-streets/
www.nyc.gov/summerstreets/
(2013)

Street Football **Worldwide**

Multifunctional

Playing footballs on the pedestrians and streets is a common habitude from the past. Adapting the traffic of the automobiles with the teams in different societies based on their culture is different.

Source(s):
http://en.wikipedia.org/wiki/Street_football
(2015)

Gare do Oriente **Portugal, Lisbon**

Mixed-use

Gare do Oriente or Lisbon Orient Station is one of the main transport hubs in Lisbon, Portugal. It was designed by the Spanish architect Santiago Calatrava and built by Necso. It was finished in 1998 for the Expo '98world's fair in Parque das Nações, where it is located. It encompasses a Lisbon Metro station, a high-speed, commuter and regional train hub, a local, national and international bus station, a shopping centre and a police station. Oriente Station is one of the world's largest stations, with

75million passengers per year which makes it as busy as NY Grand CentralTerminal.

Source(s):
https://en.wikipedia.org/wiki/Gare_do_Oriente
(2013)

Library Bus or Book Bus **Sweden, Kiruna & New-Zealand, Dunedin (and some other developed countries)**

Innovation

The function of the new bus is to supply a larger service, where new digital media is presented as well as traditional printed material. Except from distributing media the bus will also function as a place for people to communicate on the web and enable meetings between different groups in the society. Because of the lack of sunlight during most of the year in the north the bus will be like a lantern when dark to attract people and light up the surroundings. The bus includes a library, a small cinema, computer games, a music listening couch, internet station and personal service. The graphics are made by fellow designers Fredrik Forsberg at THEY GRAPHICS.

Source(s):
http://dezeen.com/2008/11/01/library-bus-by-muungano/
http://dunedinlibraries.govt.nz/your-library/locations-and-hours/book-bus
(2015)

Pooneh Bridge Museum **Iran, Tehran**

Innovation

A pedestrian bridge on one of the main and busy streets in the city center of Tehran, has transformed into a gallery for exposing artworks.

Source(s):
http://shahrsazy85.blogfa.com/post-11.aspx
http://jozeph.blogfa.com/post/136
(2014)

Nature Bridge **Iran, Tehran**

Innovation

The biggest pedestrian bridge in Iran connects two parks. This bridge could have been only a pass -way, but by giving functions such as coffee shops and restaurants to this place which is normally to be a place to ponder, they have been transformed into alive spaces.

Source(s):
https://en.wikipedia.org/wiki/Tabiat_Bridge
https://structurae.net/structures/tabiat-bridge
(2016)

Bronx Children's Museumbus **USA, New York**

Innovation

The idea is using the spaces inside a bus as a museum-exposition space for kids. It could also move around the city and between schools.

Source(s):
http://cityroom.blogs.nytimes.com/2011/05/20/bronx-childrens-museum-rolls-out-and-

we-do-mean-rolls/
(2015)

Bus Roots **USA, New York**

Innovation

Bus Roots is a living garden planted on the roofs of city buses. It's an effort that rose out of New York City designer Marco Antonio Castro Cosio's graduate thesis at the NYU. The project aims to reclaim the forgotten space on the tops of city buses, while enhancing the quality of urban life by proliferating green spaces on these unused bus roofs. A prototype of the rolling gardens has been installed on the roof of the BioBus, a mobile science laboratory and the first bus with an extensive green roof system. It has been growing for five months while travelling around New York City and as far as Ohio.

Bus Roots joins the ranks of mobile gardens planted on trucks, trains, and other roving sites. Cosio explains his project as an exercise in "nomadic urban agriculture."

Source(s):
http://treehugger.com/cars/bus-roots-public-bus-doubles-as-mobile-green-roof.html
http://wakeup-world.com/2012/02/27/gardens-thrive-on-top-of-city-busses/
(2014)

Drive-in Cinema **Worldwide**

Multifunctional

With the widespread use of cars in middle of twenties, the cinemas provided this facility to watch a movie without coming out of their cars- a space that could be a parking.

Source(s):
https://en.wikipedia.org/wiki/Drive-in_theater
www.westwinddi.com/locations/las-vegas
(2016)

Street Classrooms **Bangladesh**

Multifunctional

Street children learn on the streets of Bangladesh

Source(s):
http://demotix.com/news/1650653/street-children-learn-streets-bangladesh#media-1650610

(2014)

Street Gallery **Worldwide**

Multifunctional

The idea is using the width of the streets or the squares for exposing (permanent or temporary) artworks.

Source(s):
http://co-operative.coop/2012/latest-news/category12/street-gallery/
http://london-insider.co.uk/2010/06/care-international-street-gallery-world-photography-exhibition-thames/
(2014)

Street Vendor **Worldwide**

Multifunctional

In developed countries, having street vendors in the pattern of weekly markets for those whom have an authorization is a normal phenomenon. In developing countries, the vendors occupy illegally a great part of the pedestrians and use it as a place in order to offer and sell their items. This phenomenon has two sides: firstly, by occupying a part of the pedestrian, the traffic of citizens would face with difficulty. Secondly, because it leads to the presence of people in the late hours of the night in the streets, it helps in providing the security. As a result, in different countries there exist different politics to these vendors. In Iran, the vendors could have their activity after 10 P.M.

Source(s):
https://en.wikipedia.org/wiki/Yangon
(2013)

Street Theatre **Worldwide**

Multifunctional

Street theatres are not only a self-motivated work, but also are a part of the artistic festivals in many countries.

Source(s):
http://jezebel.com/5272506/rumples-stilts-skin
(2014)

Parades & carnivals **Worldwide**

Multifunctional

Using main streets for marches or carnivals on special occasions

Source(s):
http://gettyimages.com/photos/bastille-day?sort=mostpopular&excludenudity=true&mediatype=photography&phrase=bastille%20day
https://en.wikipedia.org/wiki/Bastille_Day_military_parade

(2016)

Street Art **Worldwide**

Multifunctional

The main idea is to use the surface of floors and walls of public spaces for painting.

Source(s):

http://hdwallpaperia.com/street-3d-art-7.html

(2015)

Street Music **Worldwide**

Multifunctional

The artists, whom are self-motivated or organized, perform music in the pedestrians Individually or in a group.

Source(s):

http://fashiononstreet.de/category/allgemein/
(2015)

Outdoor sketching class **Worldwide**

Multifunctional

A part of art and architecture students courses passes not only in the ateliers but also in public spaces and by sketching people or buildings.

Source(s):
http://pencilandchai.com/
(2013)

Schoolyard playground **USA, New York**

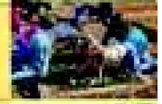
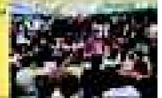
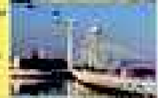
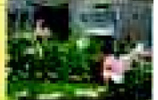
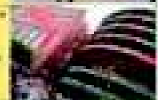
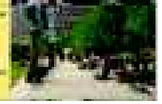
Multifunctional

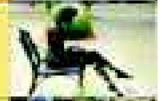
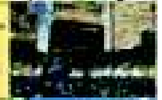
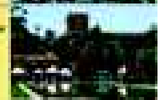
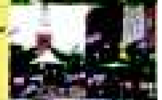
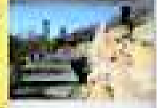
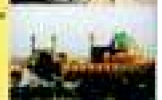
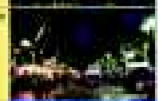
Hundreds of schoolyards have been renovated and opened to the public during non-school hours through the Schoolyards to Playgrounds program in NYC.

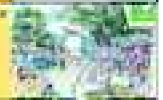
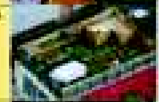
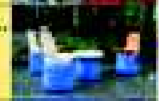
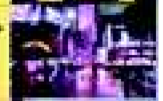
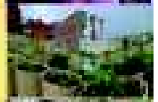
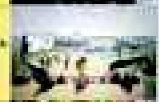
Source(s):
www.nycgovparks.org/greening/planyc/schoolyards
(2015)

Annex II: Applicable Grid

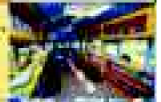
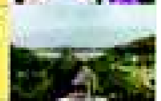
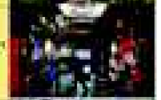
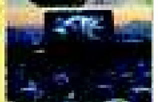
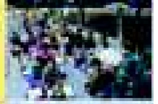
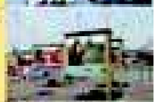
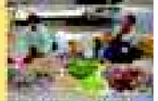
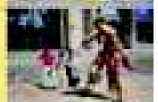
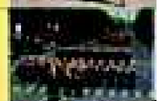
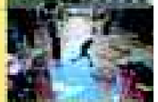
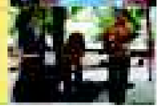
Introduction		Identification		Actors and Use										Characteristics																						Pattern description	Photos
		General Categories		Actors			Use							Characteristics of the activity										Characteristics of space															
Name	Location	Type of modification activity	Function	Type of actor	Type of activity actors	Main Actors	Scale of activity	Legal basis of ownership and management	Time	Description of use	Function	Social functions	Secondary or added functions	Temporality	Temporal flexibility between functions + overlaps in space	Regularity	Participation	Activity	Relations between activity and activity	Relations between activity and spotlight	Temporal limit	Relation with actors	Area value	Accessibility	Location	Relevance within the area (+ accessibility)	Role / territorial validity (the perceived function)	Change in the legal form of ownership (entry of the actor)	Presence in season	Lighting	Nature of ground	Space ownership		
Hyde	USA, New York	Current	Multifunctional private to public	private	private	specific group	unique	rented out	yes	change the function and users	not negotiated	ephemeral use	recreation	night time	yes	yes	furniture, lighting	accident prone	no	yes	mixed use	yes	medium size area	community	beneficial	yes	no risk	yes	presence of low to mid high trees	combined	mineral	open	Partic pation, night life, portable furniture	
Battersea (2)	UK, London	Current	Multifunctional public to public	private	private	public (all people)	mixed	free use	no	adding new functions, (i.e. the same user)	with priority	necessary activities	non-artistic, cultural	mixed	no	yes	furniture, lighting	no risk	no	yes	no mixed use	no negotiation	yes	large size area	open	beneficial	yes	no risk	no	sensors	combined	combined	open	mixed use master planning (network of activities), night life, portable furniture	
Mixed use public (Activity)	Worldwide	Extended	Mixed use	public	public	public (all people)	mixed	owner used	no	adding new users by adding new functions	with priority	necessary activities	necessary activities	perceive as place of full value	yes	yes	Planting	accident prone	no	no	no mixed use	no negotiation	no	Green large size area	open	accessible	no	no risk	no	soft texture	combined	combined	open	mixed use master planning (network of activities)	
Street Maintenance	Worldwide	Current	Multifunctional public to public	public	private	specific group	unique	free use	no	adding new users by adding new functions	with priority	necessary activities	recreation	daily part time	yes	yes	furniture, lighting	accident prone	yes	yes	mixed use	no negotiation	yes	small size area	open	accessible	no	no risk	no	soft texture	no stone, fiber, wood	seasonal, synthetic	open	Partic pation, work	
Street Cafes (removed)	Worldwide	Current	Multifunctional public to semi public	public	private	specific group	unique	rented out	yes	change the function and users	with priority	necessary activities	non-artistic, social	daily part time	yes	yes	furniture, lighting	no risk	yes	yes	mixed use	no negotiation	no	Green small size area	open	accessible	yes	no risk	yes	texture	combined	mineral	semi open	Partic pation, night life, portable furniture	
Apartment Homes	USA, Washington DC	Current	Multifunctional private to public	private	public	public (all people)	unique	owner used	yes	adding new functions, (i.e. the same user)	with priority	monopolist	multiple, social	mixed	yes	no	wheelchair, stairs	risk of flooding	no	no	no negotiation	restriction needed	no	small size area	open	accessible	no	no risk	yes	texture	mineral	organic	open	Partic pation, Relaxation	
Basement	Netherland	Extended	Mixed use	public	private	specific group	mixed	free use	no	adding new functions, (i.e. the same user)	with priority	necessary activities	recreation, cultural, recreation	perceive as place of full value	yes	yes	Planting	accident prone	no	no	no negotiation	no negotiation	no	Green medium size area	open	accessible	no	no risk	no	soft texture	combined	mineral	open	mixed use master planning (network of activities)	
Visit the observatory in Greenwich mountain	Ireland	Current	Multifunctional semi public to public	public	private	public (all people)	unique	rented out	yes	change the function and users	with priority	temporary activities	commercial, social	weekly	no	no	shelter	accident prone	no	no	mixed use	no negotiation	no	medium size area	open	accessible	yes	no risk	yes	soft texture	no stone, fiber, wood	not negotiated	semi open	Partic pation, portable furniture	
Video players	Iran, Tehran, various university	Current	Multifunctional semi public to public	private	public	specific group	unique	free use	yes	change the function and users	without priority	endangered	cultural, social	weekly	no	no	shelter	accident prone	no	no	mixed use	shade needed	no	large size area	accessible	beneficial	yes	no risk	yes	presence of low to mid high trees	no stone, fiber, wood	mineral	mixed fall	Partic pation	
Mosque	Iran, Tehran	Current	Multifunctional semi public to public	public	private	specific group	unique	rented out	yes	change the function and users	without priority	cultural	cultural, commercial	mixed	no	yes	Business, shopping etc.	accident prone	no	no	mixed use	shade needed	no	large size area	closed	beneficial	yes	no risk / fire	yes	presence of low to mid high trees	artificial	mineral	combined	Partic pation	
Alma Mater	France, Paris	Current	Multifunctional public to public	public	public	public (all people)	unique	owner used	yes	change the function and users	with priority	necessary activities	recreation	weekly	no	yes	restaurant, cafe, Planting	accident prone	no	no	Hall	restriction needed	no	Green large size area	open	beneficial	yes	no risk	yes	presence of low to mid high trees	no stone, fiber, wood	combined	open	Partic pation, portable furniture	
Der perfekte Lichtstrahl	France, Strasbourg	Extended	Innovation	public	private	forward, scrapping	mixed	rented out	no	change the function and users	with priority	necessary activities	non-artistic, cultural, social	perceive as place of full value	yes	no	wheelchair, stairs, supplier etc., Planting	risk of flooding	no	yes	mixed use	restriction needed	no	Green large size area	closed	accessible	yes	no risk	yes	texture	mineral	organic	open	Partic pation, Relaxation	
Pilzgericht schwarz (Lauch)	France, Strasbourg	Extended	Innovation	public	private	forward, scrapping	unique	rented out	yes	change the function and users	with priority	necessary activities	non-artistic, cultural, social	perceive as place of full value	yes	no	wheelchair, stairs, Stores	risk of flooding, risk of theft	no	no	no negotiation	restriction needed	no	medium size area	open	accessible	yes	no risk	yes	soft texture	mineral	organic	open	Partic pation, Relaxation, Education	
Mixed-Used Urban Orchard	UK, London	Extended	Innovation	public	private	forward, scrapping	mixed	rented out	yes	adding new users by adding new functions	without priority	necessary activities	non-artistic, cultural, social	perceive as place of full value	no	no	Planting, wheelchair, stairs	risk of flooding, risk of theft	no	no	no negotiation	restriction needed	no	medium size area	closed	accessible	yes	no risk	yes	texture	mineral	combined	open	Partic pation, Relaxation, Education	

Introduction		Identification		Actors and Use										Characteristics																				Pattern extraction	Photo
		General Category		Actors			Use							Characteristics of the activity										Characteristics of space											
Name	Location	Type of multifunctionality	Focus	Type of initial actors	Type of secondary actors	User status	Type of activity	Legal form of ownership and management	New structures / actors	Destination of use	Form of use	Initial function	Secondary or added function	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Lighting	[illegible]	Space covering		
Urban farming, Community gardens	USA	Potential	Innovation	private	private	[illegible]	unique	[illegible]	yes	change the function and users	with priority	necessary activities	recreation, cultural, social	[illegible]	no	no	[illegible]	[illegible]	no	no	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	yes	[illegible]	natural	[illegible]	open	Participation, Promotion	
School Farms	USA	Potential	Innovation	private	private	[illegible]	unique	[illegible]	no	change the function for the same users	with priority	necessary activities	recreation, cultural, social	[illegible]	no	no	[illegible]	[illegible]	yes	yes	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	no	[illegible]	natural	[illegible]	open	Participation, Promotion, Education	
Jardin du Luxembourg	France, Paris	Current	Multifunctional public to private	public	private	specific group	unique	free use	no	change the function and users	with priority	ecological recreation	recreation, social	[illegible]	no	yes	[illegible]	[illegible]	no	no	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	open	Flexible urban furniture, Participation	
[illegible]	Spain	Potential	Mixed use	public	private	specific group	mixed	mixed	no	adding new functions for the same users	with priority	necessary activities	recreation, cultural, social	[illegible]	no	yes	[illegible]	[illegible]	no	yes	[illegible]	[illegible]	yes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	open	Mixed use master planning, Network of activities, Participation	
[illegible]	USA, New York	Potential	Multifunctional public to private	public	private	specific group	unique	free use	no	change the function and users	with priority	necessary activities	social	[illegible]	no	yes	[illegible]	[illegible]	yes	yes	[illegible]	[illegible]	yes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	open	Innovation, participation	
[illegible]	[illegible]	Current	Multifunctional from public to public	private	private	[illegible]	unique	[illegible]	no	change the function and users	with priority	[illegible]	recreation, cultural	[illegible]	yes	yes	[illegible]	[illegible]	no	no	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	yes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	Current	Multifunctional public to semi-public	public	private	specific group	mixed	[illegible]	yes	adding new users by adding new functions	with priority	[illegible]	recreation, cultural, social	[illegible]	yes	yes	[illegible]	[illegible]	yes	yes	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	open	[illegible]	
[illegible]	[illegible]	Current	Multifunctional from public to public	private	public	specific group	unique	free use	no	change the function and users	without priority	ecological	ecological, social	[illegible]	yes	yes	[illegible]	[illegible]	no	no	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	no	[illegible]	natural	[illegible]	open	Participation, promotion	
[illegible]	[illegible]	Current	Multifunctional public to public	public	public	[illegible]	mixed	mixed	no	change the function and users	with priority	[illegible]	recreation, cultural, ecological, social	[illegible]	yes	yes	[illegible]	[illegible]	no	yes	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	yes	[illegible]	[illegible]	[illegible]	open	[illegible]	
[illegible]	France	Potential	Mixed use	private	private	specific group	mixed	[illegible]	no	adding new users by adding new functions	with priority	necessary activities	cultural	[illegible]	no	yes	[illegible]	[illegible]	no	no	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	yes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	USA, [illegible]	Current	Multifunctional from public to public	public	private	[illegible]	mixed	free use	no	adding new users by adding new functions	with priority	ecological	recreation, ecological	[illegible]	yes	yes	[illegible]	[illegible]	no	no	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	yes	[illegible]	[illegible]	[illegible]	open	[illegible]	
Temple Square	USA, CT, New Haven	Potential	Mixed use	public	private	[illegible]	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities	recreation, cultural	[illegible]	yes	yes	[illegible]	[illegible]	no	yes	[illegible]	[illegible]	yes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	open	[illegible]	
Campus Martius Park	USA, Detroit, Michigan	Potential	Mixed use	public	private	[illegible]	mixed	mixed	no	adding new users by adding new functions	with priority	ecological recreation	cultural	[illegible]	no	yes	[illegible]	[illegible]	no	yes	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	no	[illegible]	[illegible]	[illegible]	open	[illegible]	

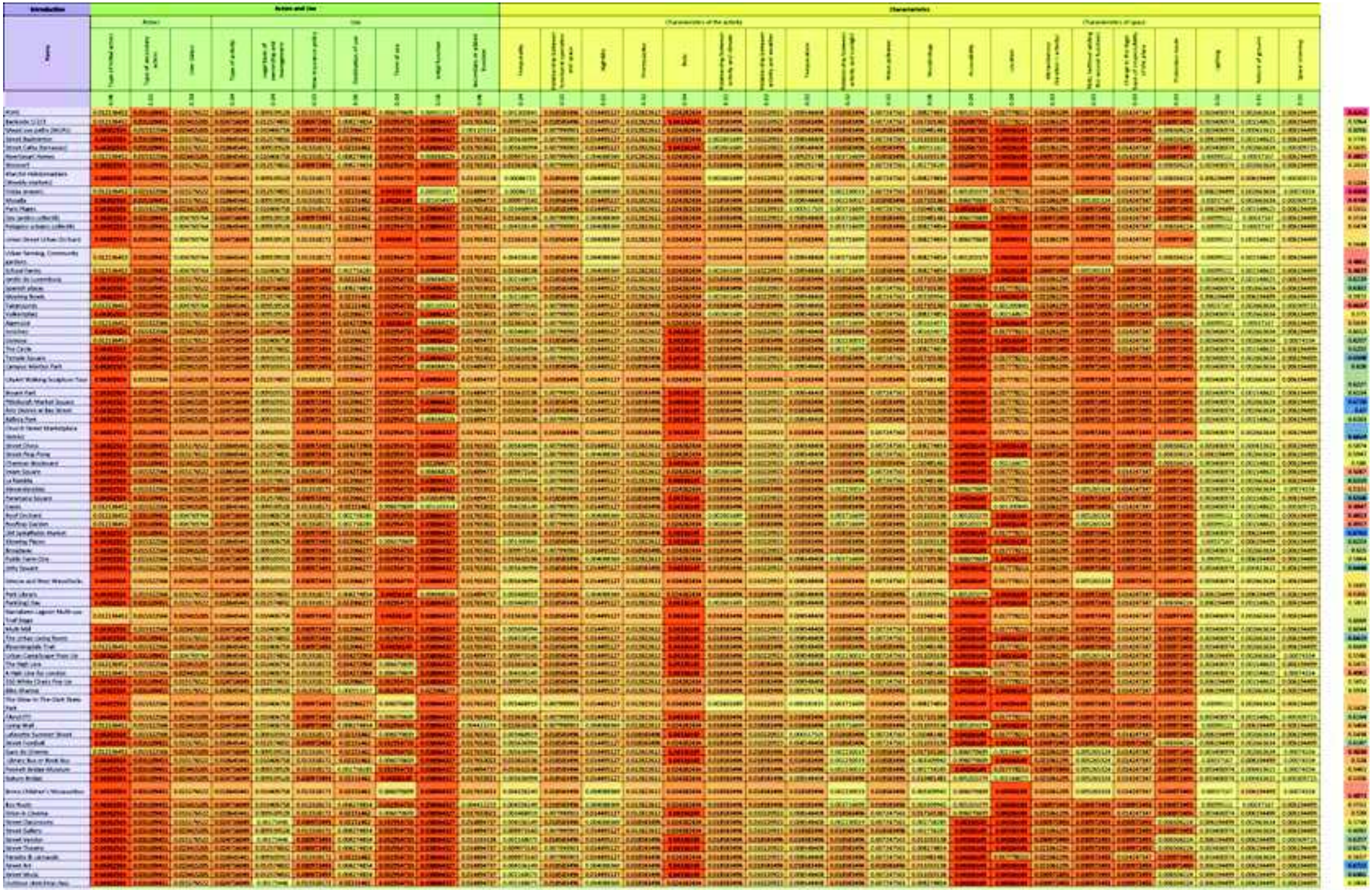
Introduction		Identification		Actors and Use										Characteristics																				Pattern extraction	Photo
		General Category		Actors			Use							Characteristics of the activity										Characteristics of space											
Name	Location	Type of multifunctionality	Variant	Type of initial actors	Type of secondary actors	User status	Type of activity	Legal frame of ownership and management	New economic activity	Destination of use	Time of use	Initial function	Secondary or added function	Temporality	Relationship between functions – specific time span	[illegible]	[illegible]	Flow	Relationship between activity and climate	Relationship between activity and weather	Temporary frame	Relation of the individual activity and strength	Noise pollution	Dimension size	Accessibility	Location	[illegible]	Activities continue during the second function	Change in the legal form of ownership of the space	Protection means	Lighting	Nature of ground	Space covering		
[illegible] Walking Sculpture Tour	USA, Minnesota, Mankato	Potential	Innovation	public	public	public (all people)	mixed	free use	yes	adding new users by adding new functions	with priority	necessary activities	cultural, social	permanent (Daily full time)	no	yes	no demographic bias	[illegible]	no	no	not important	not important	no	green large size area	open	determined	no	[illegible]	no	[illegible]	combined	mineral	open	urban art, mixed use master planning, overlap of activities	
Bryant Park	USA, New York	Potential	Mixed use	public	private	public (all people)	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities, ecological, recreation	cultural, commercial	permanent (Daily full time)	yes	yes	no demographic bias	[illegible]	no	yes	[illegible]	not important	yes	small size area	open	determined	no	[illegible]	no	secure, self secure	combined	combined	open	participation, mixed use master planning, overlap of activities, urban art, night life	
Pittsburgh Market Square	USA, Pennsylvania, Pittsburgh	Potential	Mixed use	public	private	public (all people)	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities	recreation, cultural, commercial	permanent (Daily full time)	no	yes	no demographic bias	[illegible]	no	yes	not important	not important	no	large size area	open	determined	no	[illegible]	no	secure, self secure	combined	mineral	open	mixed use master planning, overlap of activities	
[illegible]	USA, [illegible]	Potential	Mixed use	public	private	public (all people)	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities	cultural	permanent (Daily full time)	no	yes	no demographic bias	[illegible]	no	yes	not important	not important	no	large size area	open	determined	no	[illegible]	no	secure, self secure	combined	mineral	open	participation, mixed use master planning, overlap of activities	
Balboa Park	USA, CA, San Diego	Current	Multifunctional public to semi-public	public	private	public (all people)	mixed	mixed	no	adding new users by adding new functions	with priority	ecological, recreation	cultural	permanent (Daily full time)	yes	yes	no demographic bias	[illegible]	no	yes	[illegible]	not important	no	large size area	open	determined	no	[illegible]	no	secure, self secure	combined	combined	open	participation, mixed use master planning, overlap of activities	
Church Street Marketplace District	USA, VT, Burlington	Current	Multifunctional public to public	public	private	public (all people)	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities	recreation, cultural, commercial	permanent (Daily full time)	no	yes	no demographic bias	[illegible]	no	yes	not important	not important	yes	large size area	open	determined	no	[illegible]	no	secure, self secure	combined	mineral	open	participation, mixed use master planning, overlap of activities	
[illegible]	Canada	Current	Multifunctional public to semi-public	public	private	specific group	unique	[illegible]	no	change the function and users	with priority	necessary activities	recreation, social	daily, part time	yes	yes	[illegible]	[illegible]	no	yes	[illegible]	not important	yes	medium size area	[illegible]	everywhere	no	[illegible]	no	self secure	combined	[illegible]	open	sport, participation, portable furniture	
Street Ping Pong	Germany, Tübingen	Current	Multifunctional public to semi-public	public	private	specific group	unique	free use	no	change the function and users	with priority	necessary activities	recreation, social	daily, part time	yes	no	[illegible]	accident prone	no	yes	[illegible]	not important	yes	small size area	open	everywhere	no	[illegible]	no	self secure	[illegible]	mineral	open	sport, portable furniture	
[illegible] Boulevard	Iran, [illegible]	Potential	Mixed use	public	private	public (all people)	mixed	free use	no	adding new users by adding new functions	with priority	necessary activities, ecological	recreation	permanent (Daily full time)	yes	yes	lighting	[illegible]	no	yes	[illegible]	not important	no	green large size area	open	[illegible]	no	[illegible]	no	self secure	combined	combined	open	urban art, mixed use master planning, overlap of activities, night life	
Imam Square	Iran, Isfahan	Current	Multifunctional public to semi-public	public	public	specific group	unique	[illegible]	yes	change the function and users	with priority	[illegible]	cultural	[illegible]	yes	yes	[illegible]	accident prone	yes	yes	not important	not important	yes	large size area	open	determined	no	[illegible]	yes	[illegible]	combined	combined	open	mixed use master planning, overlap of activities	
La Rambla	Spain, Barcelona	Current	Multifunctional public to public	public	private	public (all people)	mixed	free use	no	adding new users by adding new functions	with priority	necessary activities	commercial, recreation, cultural	daily, part time	yes	yes	[illegible]	[illegible]	no	yes	not important	not important	yes	green large size area	open	determined	no	[illegible]	no	secure, self secure	combined	mineral	open	mixed use master planning, overlap of activities, participation, night life	
Alexanderplatz	Germany, Berlin	Potential	Mixed use	public	public	public (all people)	mixed	mixed	yes	adding new users by adding new functions	with priority	necessary activities	commercial, recreation	permanent (Daily full time)	yes	yes	no demographic bias	accident prone	no	no	not important	[illegible]	no	large size area	closed	determined	no	[illegible]	yes	secure, self secure	combined	mineral	covered	[illegible]	
[illegible]	Greece, [illegible], Thessaloniki	Current	Multifunctional public to public of some public	public	private	public (all people)	mixed	free use	no	adding new users by adding new functions	with priority	necessary activities, ecological, recreation	cultural	permanent (Daily full time)	no	yes	no demographic bias	[illegible]	no	yes	not important	not important	no	large size area	open	determined	no	[illegible]	no	secure	combined	combined	open	Flexibility	

Introduction		Identification		Actors and Use										Characteristics																				Pattern extraction	Photo
		General Category		Actors			Use							Characteristics of the activity										Characteristics of space											
Name	Location	Type of multifunctionality	Nature	Type of initial actors	Type of secondary actors	User status	Type of activity	Legal form of ownership and management	New insurance policy	Destination of use	Form of use	Initial function	Secondary or added function	Temporality	Relation between functions - operation and space	Hygiene	[illegible]	Stay	Relation between activity and climate	Relation between activity and weather	Temporality	Relation between activity and sunlight	Noise pollution	Dimensions	Accessibility	Location	[illegible]	[illegible] defining the second function	Change in the legal form of ownership of the space	Protection measures	Lighting	Nature of ground	Space covering		
Expo	Worldwide	Current	Multifunctional (semi public to public)	private	public	public (all people)	unique	rental use	yes	change the function and users	not important	commercial, cultural	recreation, cultural	periodic	yes	yes	be arranged [illegible]	flexible	no	no	not important	not important	no	large distances	open	permanent	yes	no shift	yes	secure, security services	combined	permanent	permanent	mixed use master planning (network of activities), innovation	
[illegible]	Australia	Potential	innovation	private	private	owner	mixed	owner use	yes	change the function for the same users	with priority	necessary activities	recreation, social, commercial, ecological	permanent (daily functions)	yes	no	housing, industry, offices	lots of flooding	yes	no	not important	sunshine needed	no	small distances	controllable	everywhere	no	constant change	no	secure	natural	controlled	open	innovation, participation, education	
Rooftop Garden	Worldwide	Potential	innovation	private	private	owner	mixed	owner use	yes	change the function for the same users	with priority	necessary activities	recreation, social, ecological	permanent (daily functions)	yes	yes	housing, industry, offices, functions	lots of flooding	yes	no	not important	sunshine needed	no	small distances	controllable	everywhere	no	constant change	no	secure	natural	controlled	open	using lost spaces, promotion, innovation	
[illegible] Market	UK, London	Potential	innovation	public	private	public (all people)	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities	recreation, social, commercial, cultural	permanent (daily functions)	no	yes	be arranged [illegible]	flexible	no	yes	not important	not important	no	large distances	open	determined	no	no shift	no	secure self [illegible]	combined	not important	open	innovation, portable functions	
[illegible] Place	UK, London	Potential	innovation	public	public	public (all people)	unique	owner use	no	adding new users by adding new functions	not important	necessary activities	recreation, social	night time	no	yes	industry, offices	flexible	no	yes	not important	not important	no	small distances	open	everywhere	no	no shift	no	secure self [illegible]	artificial	not important	open	night life, innovation	
Broadway	USA, New York	Current	Multifunctional (public to public)	public	public	public (all people)	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities	recreation, social, commercial, cultural	casual	yes	yes	be arranged [illegible]	accidental [illegible]	no	yes	not important	not important	no	Small, large distances	open	determined	no	no shift	no	secure self [illegible]	combined	mineral	open	Collaboration, night life, mixed use master planning (network of activities)	
Public Farm One	USA, New York	Potential	innovation	public	public	specific group	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities	recreation, social, commercial, cultural, ecological	permanent (daily functions)	no	no	industry, offices	lots of flooding	no	no	resolved	sunshine needed	no	large distances	closed	everywhere	no	no shift	no	secure	natural	not important	open	Education, Promotion	
[illegible] square	South Africa, Cape Town	Current	Multifunctional (public to semi public)	public	public	public (all people)	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities	recreation, social, commercial, cultural	daily, part-time	no	yes	be arranged [illegible]	flexible	no	yes	not important	not important	no	large distances	open	determined	yes	no shift	no	secure self [illegible]	combined	[illegible]	open	Flexibility	
Simcoe and [illegible] WaveDecks	Canada, Toronto	Current	Multifunctional (public to semi public)	public	public	public (all people)	mixed	mixed	no	adding new users by adding new functions	with priority	necessary activities	recreation	daily, part-time	yes	yes	floating	accidental [illegible]	no	yes	resolved	not important	yes	Small, large distances	open	determined	yes	constant change	no	secure self [illegible]	combined	mineral	open	Innovation, Flexibility	
Park Library	France, Strasbourg	Current	Multifunctional (public to semi public)	public	public	specific group	mixed	free use	yes	adding new functions for the same users	without priority	ecological, recreation	cultural, social	rarely	no	no	shelter, [illegible]	lots of [illegible]	no	no	resolved	not important	no	point [illegible]	controllable	everywhere	no	no shift	yes	[illegible]	no more than usual	not important	covered	participation, portable functions	
Parking Day	Worldwide	Potential	Pop up	public	private	specific group	unique	free use	yes	adding new users by adding new functions	with priority	necessary activities	recreation, cultural, ecological, [illegible]	rarely	no	yes	furniture, lighting	flexible	yes	yes	resolved	not important	no	small distances	open	everywhere	no	no shift	yes	self-reliant	no more than usual	controlled	open	Innovation, participation, portable functions, transformable surfaces	
[illegible] Lagoon [illegible] Stage	[illegible], Sydney	Potential	Mixed use	private	public	public (all people)	unique	owner use	no	adding new users by adding new functions	without priority	necessary activities	recreation, ecological	permanent (daily functions)	no	yes	floating	flexible	no	no	resolved	not important	no	Small, large distances	open	determined	no	no shift	yes	secure self [illegible]	combined	mineral	open	Mixed use master planning (network of activities), using lost spaces	
[illegible]	Netherlands, [illegible]	Current	Multifunctional (public to public)	public	public	public (all people)	mixed	owner use	no	adding new users by adding new functions	with priority	necessary activities	recreation	daily, part-time	no	yes	[illegible]	flexible	no	yes	resolved	not important	yes	large distances	open	determined	no	no shift	yes	secure	combined	mineral	open	Innovation, transformable surfaces, night life	

Introduction		Identification		Roles and Use										Characteristics																				Pattern solution	Photo
		General Categories		Access			Use							Characteristics of the activity									Characteristics of space													
Name	Location	Type of (multifunctional) facility	Nature	Type of visitor actors	Type of secondary actors	User status	Type of activity	Type/level of ownership and management	How	Destination of use	Term of use	Initial function	secondary or added functions	Temporal rhythm	Relations the between activities - (specific zone, space)	Aggregation	Municipal fee	Risk	Relations the between activities and people	Relations the between activities and weather	Temporal form	Relations the between activities and sunlight	Noise conditions	Maximum size	Accessibility	Location	Relation to street (Extroverted - introverted)	Easy identification adding the second function	Change in the legal form of supporting body of the project	Protection to nature	Lighting	Natural or grouped	Space ownership		
Chinatown Living Room	Netherlands, Rotterdam	Potential	Innovation	public	private	specific group	mixed	Free use	no	adding new users by adding new functions	with growths	necessary activities	necessary, social	permanent	no	yes	Furniture	no risk	no	yes	residential	not important	yes	small	modern	medium	no	no risk	yes	permeable (like a drainage water system)	combined	romantic	open	Portable furniture, participation	
Rivertempled a Trail	USA, Chicago	Potential	Mixed use	private	public	public (all people)	unique	owner user	no	adding new users by adding new functions	without growths	necessary activities	necessary, ecological	permanent (in Daily Activities)	no	yes	Housing	no risk	no	yes	residential	not important	no	large, small	modern	diversified	yes	no risk	yes	Nature, self-cleaned	combined	romantic	open	mixed-use master planning (network of activities), using local species	
Urban Campfulness Pop-Up	Netherlands, Rotterdam	Potential	Pop-up	public	private	repeat occupancy	unique	free use	yes	change the function and users	with growths	temporary activities	ecological, cultural	values	no	yes	no fixed, only furniture	no risk	no	yes	residential	small	yes	small	urban	anonymous	yes	accident prone	yes	permeable (like a drainage water system)	no fixed (Pool, sand)	minimal	conserve	using not spaces, innovation, education, portable furniture	
The High Line	USA, New York	Potential	Innovation	private	public	public (all people)	unique	owner user	no	change the function and users	not important	necessary activities	recreation, ecological	permanent (in Daily Activities)	no	yes	Planting	no risk	no	no	residential	not important	no	linear, large	open	diversified	yes	no risk	yes	Nature, self-cleaned	combined	combined	open	using not spaces, innovation, planning (network of activities)	
A High Line for London	UK, London	Potential	Innovation	private	public	public (all people)	unique	owner user	no	change the function and users	not important	necessary activities	recreation, ecological	partially	no	yes	Infrastructures, Planting	no risk	no	no	not important	Auxiliary material	no	linear, large	closed	diversified	yes	no risk	yes	Nature, self-cleaned	combined	combined	closed	using not spaces, innovation, education, privatization	
100 Wilds (Face the Ice)	Netherlands, Rotterdam	Current	Multifunctional public to private	public	private	specific group	mixed	Free use	no	adding new users by adding new functions	with growths	necessary activities	mixed	values	no	yes	Furniture	risk of death	no	no	residential	not important	yes	large	open	diversified	yes	no risk	yes	no fixed (Pool, sand)	combined	combined	open	Portable furniture, participation, innovation	
Jelly Skating	Worldwide	Potential	Innovation	public	private	specific group	unique	market use	yes	change users	with growths	necessary activities, recreation	necessary activities, recreation	permanent (in Daily Activities)	no	yes	equipment	risk of death	no	no	not important	not important	no	small	open	diversified	yes	no risk	yes	permeable (like a drainage water system)	no fixed (Pool, sand)	minimal	open	participation, sport	
The Observatory: The Dark Skate Park	France, Tautavel, Island	Potential	Innovation	public	public	public (all people)	unique	owner user	no	adding new users by adding new functions	not important	necessary activities	recreation	mainly	yes	yes	infrastructures, furniture, equipment	accident prone	yes	yes	social	qualitative location	no	medium, small	open	diversified	yes	no risk	no	Nature, self-cleaned	natural	minimal	open	night life, innovation, accessibility, sport	
DIVERCITY	USA, Texas, Houston	Potential	Innovation	public	public	public (all people)	mixed	owner user	no	adding new users by adding new functions	not important	necessary activities	recreation, social, commercial, cultural	permanent (in Daily Activities)	yes	yes	infrastructures, furniture, equipment	no risk	no	no	not important	not important	no	large	open	diversified	yes	no risk	no	unsure	combined	combined	open, semi-open	using not spaces, entertainment	
Living Wall	Worldwide	Futuristic	Innovation	private	public	public (all people)	mixed	owner user	no	adding new functions for the same users	with growths	necessary activities	ecological	permanent (in Daily Activities)	yes	no	infrastructures, plants	risk of flooding	no	no	not important	qualitative location	no	small, medium	sustainable	monument	yes	no risk	no	unsure	natural	not important	open	using not spaces, innovation	
Lafayette Greenline Street	USA, New York	Current	Multifunctional public to semi-public	public	public	public (all people)	unique	mixed	yes	change the function and users	not important	necessary activities	maintenance, social, commercial, cultural	mainly	no	yes	no permanent fixtures	no risk	no	yes	fast	not important	yes	mixed, large	open	diversified	yes	no risk	yes	Nature, self-cleaned	no fixed (Pool, sand)	minimal	open	sport, participation, portable furniture	
Street Football	Worldwide	Current	Multifunctional public to private	public	private	specific group	unique	free use	no	change the function and users	with growths	necessary activities	recreation	mainly sometimes	no	yes	no permanent fixtures	accident prone	no	yes	residential	not important	yes	small	open	monument	no	no risk	no	soft, natural	no fixed (Pool, sand)	minimal	open	public garden, sport	
Rain Co-Centric	Portugal, Lisbon	Potential	Mixed use	private	public	public (all people)	mixed	market use	yes	change the function and users	with growths	necessary activities	recreation	mainly sometimes	no	yes	furniture, equipment	no risk	no	no	not important	crowd-avoided	no	large	closed	suburbs	yes	natural fire	yes	natural	combined	minimal	conserve	network innovation planning (network of activities)	

Introduction		Identification		Actors and Use										Characteristics																				Pattern extraction	Photo
		General Category		Actors			Use							Characteristics of the activity										Characteristics of space											
Name	Location	Type of multifunctionality	Nature	Type of initial actors	Type of secondary actors	User status	Type of activity	Legal form of ownership and management	Time structure priority	Destination of use	Form of use	Initial function	Secondary or added function	Temporality	Relationship between functions - operating in one space	Legibility	Prerequisites	Risk	Relationship between activity and climate	Relationship between activity and weather	Temporary form	Relation to the individual activity and program	Noise pollution	Minimum size	Accessibility	Location	Interaction between functions	Basic condition solving the second function	Change in the legal form of ownership of the place	Enclosure	Lighting	Nature of ground	Space covering		
[illegible]	[illegible]	Potential	Innovation	public	private	specific group	unique	[illegible]	yes	change the function and users	not important	necessary activities	recreation, cultural	permanent (daily, full-time)	no	yes	furniture, equipment	[illegible]	no	no	not important	[illegible]	no	[illegible]	closed	[illegible]	no	[illegible]	yes	[illegible]	artificial	not important	covered	innovation, portable furniture	
[illegible]	Iran, Tehran	Potential	Innovation	public	private	public (all people)	mixed	[illegible]	yes	change the function for the same users	with priority	necessary activities	cultural	permanent (daily, full-time)	no	yes	equipment	[illegible]	no	no	not important	[illegible]	no	[illegible]	open	[illegible]	no	[illegible]	yes	[illegible]	combined	synthetic	covered	using lost spaces, urban art, portable furniture	
Nature Bridge	Iran, Tehran	Potential	Innovation	public	private	public (all people)	mixed	[illegible]	no	change the function and users	[illegible]	necessary activities	recreation, cultural	daily	no	yes	furniture, equipment	accident prone	no	no	[illegible]	not important	no	[illegible]	[illegible]	[illegible]	no	[illegible]	yes	[illegible]	combined	synthetic	[illegible]	using lost spaces, [illegible]	
[illegible] Children's Museum	USA, New York	Potential	Innovation	public	private	specific group	unique	[illegible]	yes	change the function and users	not important	necessary activities	recreation, cultural	periodic	no	no	equipment	[illegible]	no	no	not important	[illegible]	no	[illegible]	closed	[illegible]	no	[illegible]	yes	[illegible]	artificial	not important	covered	innovation, participation, portable furniture	
Bus Roots	USA, New York	Potential	Innovation	public	private	public (all people)	mixed	[illegible]	yes	adding new functions for the same users	with priority	necessary activities	ecological	periodic	no	no	[illegible]	[illegible]	no	no	not important	[illegible]	no	[illegible]	[illegible]	[illegible]	no	[illegible]	no	[illegible]	natural	original	open	innovation, using lost spaces	
[illegible]	Worldwide	Current	Multifunctional public to semi public	public	private	specific group	unique	rental use	yes	change the function and users	not important	necessary activities	recreation	daily	yes	yes	equipment, [illegible]	[illegible]	no	yes	[illegible]	not important	yes	large [illegible]	closed	[illegible]	no	[illegible]	yes	[illegible]	combined	not important	open	using lost spaces, innovation, night life, portable furniture	
Street Classroom	Bangladesh	Current	Multifunctional public to public	public	private	specific group	mixed	illegal occupant	no	change the function and users	with priority	necessary activities	pedagogic, cultural	periodic	no	no	[illegible]	accident prone	no	yes	[illegible]	[illegible]	yes	[illegible]	open	[illegible]	no	[illegible]	no	self [illegible]	[illegible]	[illegible]	open	using lost spaces, education	
Street Gallery	Worldwide	Current	Multifunctional public to semi public	public	private	public (all people)	mixed	rental use	yes	adding new functions for the same users	with priority	necessary activities	cultural	casual	yes	yes	equipment, lighting	[illegible]	no	yes	not important	not important	no	[illegible]	open	[illegible]	no	[illegible]	no	[illegible]	combined	[illegible]	open	using lost spaces, urban art	
Street Vendor	Worldwide	Current	Multifunctional public to semi public	public	private	specific group	mixed	illegal occupant	no	adding new functions for the same users	with priority	necessary activities	commercial, social	[illegible]	no	yes	[illegible]	[illegible]	no	no	not important	not important	yes	small [illegible]	open	[illegible]	no	[illegible]	no	self [illegible]	[illegible]	not important	semi open	participation	
Street Theatre	Worldwide	Current	Multifunctional public to semi public	public	private	public (all people)	mixed	free use	no	adding new functions for the same users	with priority	necessary activities	cultural	casual	yes	yes	[illegible]	[illegible]	no	yes	[illegible]	not important	yes	[illegible]	open	[illegible]	no	[illegible]	no	self [illegible]	combined	not important	open	urban art	
Parades & carnivals	Worldwide	Current	Multifunctional public to semi public	public	private	public (all people)	unique	[illegible]	yes	change the function and users	with priority	necessary activities	social, cultural	casual	yes	yes	[illegible]	accident prone	no	yes	[illegible]	not important	yes	[illegible] large [illegible]	open	[illegible]	no	[illegible]	yes	[illegible]	combined	[illegible]	open	participation	
Street Art	Worldwide	Current	Multifunctional public to semi public	public	private	public (all people)	mixed	free use	no	adding new functions for the same users	with priority	necessary activities	cultural	periodic	no	no	[illegible]	[illegible]	no	no	not important	not important	no	small [illegible]	open	[illegible]	no	[illegible]	no	[illegible]	[illegible]	not important	open	urban art, [illegible]	
Street Music	Worldwide	Current	Multifunctional public to semi public	public	private	public (all people)	mixed	free use	no	adding new functions for the same users	with priority	necessary activities	cultural	[illegible]	no	yes	[illegible]	[illegible]	no	yes	[illegible]	not important	yes	small [illegible]	open	[illegible]	no	[illegible]	no	self [illegible]	[illegible]	not important	open	urban art, participation	

Introduction		Identification		Rules and Use											Characteristics																				Pattern extraction	Photo
		General Category		Access			Use								Characteristics of the activity										Characteristics of space											
Name	Location	Type of multifunctionality	Nature	Type of initial actors	Type of secondary actors	User status	Type of activity	Legal form of ownership and management	New structures added	Destination of use	Time of use	Initial function	Secondary or added function	[illegible]	Relationship between functions / specific to one space	Agility	Flexibility	Scale	Relationship between activity and climate	Relationship between activity and weather	Temporary form	Relationship between activity and sunlight	Noise pollution	Morphology	Accessibility	Location	[illegible]	[illegible]	Change in the basic form of the object	Protection	Lighting	Nature of ground	Space covering		
Outdoor learning class	Worldwide	Current	Multifunctional public to private	public	private	specific group	recent	legal occupant	yes	change the function and users	with priority	necessary activities	pedagogical, cultural	momentary	no	no	for [illegible]	[illegible]	no	yes	[illegible]	not important	yes	medium size area	small	[illegible]	no	[illegible]	no	soft covering	no more than usual	not important	open	education	
Adventure playground	USA, New York	Current	public to public	public	public	public (all people)	unique	owner user	no	adding new users by adding new functions	with priority	pedagogical recreation	recreational social	daily	yes	no	for [illegible]	[illegible]	no	yes	not important	not important	yes	medium size area	closed	[illegible]	yes	[illegible]	no	soft covering	no more than usual	[illegible]	open		



Annex III: A brief summary in French

1. Introduction et problématique

Selon le groupe d'experts intergouvernemental (GIEC) sur l'évolution du climat, le changement conduirait à une augmentation de la température moyenne mondiale de 1,1 à 6,4°C et il affecterait tous les continents. Le changement climatique et le réchauffement climatique ont conduit la communauté internationale à s'interroger et tenter de réduire les émissions de gaz à effet de serre (Da Cunha, 2005). Outre les questions d'énergie, les défis liés aux systèmes urbains et notamment à la construction et aux transports jouent un grand rôle dans cette situation. La forme urbaine a en effet un impact considérable sur ces évolutions, que ce soit à l'échelle globale par des politiques mises en place sur l'ensemble d'un territoire ou à l'échelle locale dans le cadre d'opérations à l'échelle du bâti (isolation et réduction de la consommation d'énergie dans les bâtiments, utilisation de matériaux durables ou utilisation d'énergies renouvelables), tous les efforts sont pertinents et nécessaires.

D'autant plus que la moitié de la population mondiale vit dans les villes et que cette proportion ne cesse d'augmenter (U.N., 2007). Par conséquent, les paysages et les formes des villes sont en constante évolution, accentuant un développement et une expansion à la fois horizontale et verticale. En plus de, l'étalement urbain reconnu comme un processus dangereux, en raison de l'élévation des émissions de CO2 associée, l'augmentation de l'artificialisation des sols et la fragmentation des paysages dans les zones périurbaines participent aussi à de tels processus (Ng, 2009) entrainant des coûts importants dans les transports, les infrastructures et l'urbanisation des zones périphériques. A noter que la croissance verticale et l'augmentation des densités entrainent une dégradation de la qualité de vie des citoyens et une vulnérabilité accrue de la population (Squires, 2002; Soule, 2006).

De nombreux experts ont tenté de répondre à cette situation complexe (interaction entre les aspects sociaux, environnementaux et économiques) à partir de différents points de vue. Le concept de « l'urbanisme durable » tente de répondre à ces enjeux au travers de diverses entrés: les questions sociales (mobilité et d'équité), les questions techniques (infrastructures et forme urbaine), la mobilité (déplacements et infrastructures) et les ressources (énergie, les ressources alimentaires et des

matériaux). Il implique par ailleurs des objectifs tels que la démocratie participative ou locale, la protection sociale, la préservation des ressources naturelles et de l'environnement, la viabilité économique ou le transport. Envisager cette complexité nécessite un cadre conceptuel qui puisse englober tous ces aspects (Favet et Gauzin-Müller, 2002, Farr, 2012, Haas, 2012). La multifonctionnalité des espaces urbains peut en offrir un, abordant les formes urbaines et leurs usages.

Jabareen (2006) résume une forme urbaine durable selon trois ensembles de caractéristiques (Jabareen, 2006):

- **Aspects formels et physiques**: la compacité et la densité de la population se référant à l'augmentation de la compacité structurelle dans le développement urbain ceci se traduisant par une augmentation de la densité de la population et des bâtiments, un développement urbain structurel compact, des lignes rapides de transport en commun et la création de plusieurs centres urbains dans la région métropolitaine. Cette augmentation de la compacité structurelle repose sur la prise en considération de la proportion de la population et des possibilités d'emploi dans chaque région, en se tournant vers des modèles de « village urbain » pour les quartiers résidentiels, afin de minimiser l'étalement en créant la zone à usage mixte Ceci entraine une structure polycentrique avec des densités variées (dans le centre-ville, zone intermédiaire et banlieue), une forme urbaine facilitant la mobilité active (marche, vélo, patin, etc.) avec des quartiers piétonniers, enfin l'adaptation d'un plan de zonage par une utilisation des terres flexible.

- **Aspects sociaux**: une mixité trans-générationnelle et une adaptation aux générations favorisant une certaine diversité sociale.

- **Aspects environnementaux**: l'intégration de la nature et la conception de bâtiments adaptés au changement climatique (matériaux, forme compacte, les couloirs de ventilation, etc.)

Ce positionnement, si on le retient, requiert une prise en considération globale de ces aspects de durabilité urbaine (aspects environnementaux et sociaux) et la nécessité de favoriser une certaine conception urbaine, soutenant une mixité des usages et des activités, des choix de transport et l'identification et la détermination

d’espaces pour les activités «non nécessaires» (optionnelles, sociales et récréatives) afin de garantir une qualité de vie des résidents (Gehl 2011). La qualité de vie est un concept multiforme qui englobe non seulement les aspects matériels de la vie (tels que le niveau de vie et la disponibilité d’équipements sociaux et d'infrastructure physiques) mais aussi des aspects moins tangibles tels que la santé ou les possibilités de loisirs et d’activités ludiques (Lim, Yuen et al., 1999). *Ceci pose la question de l’extension des fonctionnalités des espaces urbains existants afin d’optimiser leur efficacité*.

Dans notre thèse, notre hypothèse est enracinée dans l'idée de la «multifonctionnalité» des espaces afin de proposer des pistes conduisant à une telle optimisation Ce concept a d'abord été utilisée dans le domaine de l'agriculture et nous supposons que le transfert aux systèmes urbains est possible et que la multifonctionnalité des espaces urbains peut optimiser leur taux d'exploitation et améliorer la qualité de vie des citoyens. Notre hypothèse envisage la réduction des inconvénients cités précédemment : l'étalement urbain et la densité urbaine excessive. Il ne s’agit pas d’un concept nouveau (en particulier dans l'agriculture et les études paysagères), mais cette recherche tente de l'adapter en tant que réponse au dilemme de la nécessité d’un niveau de compacité des villes futures pour éviter l’étalement et celle de la préservation d’un niveau de qualité de vie des citoyens.

1.1. L'objectif de la recherche

Notre objectif est d'explorer les possibilités de faire revivre les espaces urbains, semi-publics et privés publics pour d'autres fonctions que leur fonction principale pendant leurs heures creuses par exemple, afin de créer des espaces de partage multifonctionnels.

Pour atteindre ce but, la compréhension de ce type d'espaces, de leurs fonctions et des utilisations supplémentaires possibles est d'une importance primordiale. Pour cet objectif, il est impératif de déterminer les possibilités mais aussi les limites de l'espace urbain en tenant compte des restrictions légales et/ou culturelles, ainsi que les besoins des utilisateurs potentiels.

Cette recherche approfondit d'abord la définition de la multifonctionnalité des espaces, l'approche développée est décrite dans la deuxième partie et la troisième partie présente des propositions et des modèles conceptuels et des réalisations d'illustration. La section suivante, repose sur un exemple de scénario expérimental pour la ville de Strasbourg. Cette recherche se termine en proposant une perspective d'ouverture par l'introduction d'un outil nommé SOLAP (Spatial On-Line Analytical Processing) en tant que possibilité de simplification du processus de prise de décision.

1.2. Questions de recherche

Cette recherche vise à trouver des réponses aux questions suivantes:

Peut-on étendre les fonctionnalités de nos espaces urbains existants, avec une plus grande efficacité et sur des plages horaires plus importantes ? Peut-on utiliser des zones ouvertes privées ou semi-publiques pour des fonctions publiques? Comment est-ce possible? Quel genre d'espaces répond à ce besoin? Quelles sont les caractéristiques de ces espaces potentiels ? Quelles sont les conséquences de la mise en place d'un tel concept?

1.3. Hypothèse de recherche

Afin de rendre nos villes plus adaptées pour l'avenir en ce qui concerne l'augmentation de la population urbaine et les enjeux mondiaux, l'hypothèse est enracinée dans l'idée de la multifonctionnalité des espaces urbains. Nous tentons de définir une méthode adaptée à cet objectif, qui soit en mesure d'accompagner la démarche notamment dans le choix des zones appropriées (dans l'agglomération) en mettant en avant les critères d' un espace urbain multifonctionnel.

1.4. Socle de recherche

Le concept de multifonctionnalité a été introduit dans de nombreuses négociations internationales depuis 1992 pour permettre à l'agriculture de bénéficier de l'aide publique en légitimant les compensations gouvernementales distribuées aux agriculteurs prenant appui sur les fonctions supplémentaires qu'ils assurent notamment envers la demande sociétale. L'agriculture multifonctionnelle, à côté de la production alimentaire, permet ainsi de considérer les rôles économiques et écologiques mais aussi socioculturels, historiques et esthétiques remplies dans ce cadre.

À cet égard, la multifonctionnalité correspond à la capacité des espaces ruraux à remplir plus d'une fonction en même temps, notamment en se fondant sur les services écosystémiques fournis par la nature (support, production, patrimonial ou esthétique). Ce concept nécessite à la fois une planification et une gestion écologique des territoires afin d'optimiser ces fonctions. Ce point de vue holistique créé une relation directe entre multifonctionnalité comme processus axé sur les activités et durabilité comme processus axé sur les ressources (Brandt et Vejre, 2004).

Cela est bien entendu un peu différent en architecture et en urbanisme. En architecture le terme «fonction» est un terme clés et fait référence à l'objectif de la construction et aux activités effectuées par les utilisateurs à l'intérieur de l'espace considéré. Ce mot est toujours utilisé dans la littérature architecturale à côté des mots «la forme, l'espace, la stabilité et la beauté". Par conséquent, les termes "espaces multifonctionnels" ont été utilisés pour des bâtiments à usage mixte, polyvalents et multi-usages et ceci souvent sans aucune distinction ou différence.

En conception urbaine, ce concept a une définition plus précise. Ziedler (Zeidler 1985), relie le concept de multi-usage des constructions aux anciennes constructions grecques ou médiévales. Dans son livre, « multi-usages, architecture et contexte urbain » (Zeidler, 1985), il mentionne que la ville devrait être un motif (pattern) de différentes utilisations et activités. Le meilleur exemple pour de tels espaces, est celui de « l'Agora". L'Agora en tant qu'espace central des cités de la Grèce antique,

était le centre de la vie sportive, artistique, spirituel et politique de la ville (Madanipour, 2003).

Dans cette recherche, notre définition de la multifonctionnalité, renvoie à la synergie entre différentes fonctions qui sont combinées dans un espace. Cette synergie est due à l'interaction entre ces activités.

1.5. Réalisations et résultats

Bien que le concept d'espace multifonctionnel existe en l'architecture, la définition a du être clarifiée (en utilisant la définition de la multifonctionnalité des études en agriculture et en analyse des paysages). Nos travaux plaident pour des espaces multifonctionnels urbains comme étant des éléments essentiels pour une conception urbaine durable. Ils décrivent le développement du concept de multifonctionnalité, et définissent son utilisation dans la pratique du design urbain.

Sur la base de cette définition clarifiée, cette thèse propose un cadre structuré pour l'analyse et la conception d'espaces urbains multifonctionnels, avec divers indicateurs et outils de mesure à prendre en compte selon les activités et fonctions qui se déroulent au sein d'un espace urbain. L'originalité de cette recherche repose aussi sur l'analyse de cas empiriques recueillis pour élaborer une typologie et la caractérisation des possibilités multifonctionnelles qui peuvent contribuer à une re-discussion sur le rôle de tels espaces multifonctionnels dans la création de formes urbaines durables.

2. La définition de la "multifonctionnalité"

Selon ce qui a été présenté dans les parties précédentes, un «espace multifonctionnel» peut être identifié par deux caractéristiques :

- Permettre des fonctions différentes, proposées par des acteurs divers pour une large gamme d'utilisateurs au cours de périodes de temps variables ou avoir la

capacité d'accueillir deux ou plusieurs activités en même temps (accepter plus d'une fonction à la fois) ;

- Satisfaire plusieurs rôles pour un même espace afin d'assurer une durabilité environnementale, économique et sociale plus importante.

Les conséquences sociales, économiques et environnementales de la création de tels espaces s'avèrent positives dans l'ensemble. De telles réalisations devraient favoriser une amélioration de la qualité de vie des citoyens en raison de l'augmentation de la durée permettant des activités récréatives et sociales, une plus grande interaction avec l'environnement et une diminution de la pollution liée au trafic due à l'harmonisation des projets urbains. La figure 1 résume les principes qui régissent la multifonctionnalité des espaces urbains selon nous. La santé urbaine est un défi majeur pour l'avenir (OMS, 1998).

Figure 1: Les différents effets et les avantages de l'application du concept de «multifonctionnalité» dans la planification et la conception urbaine (Source: auteurs)

Ces conclusions ne sont envisageables que si une approche globale de la ville est définie. En d'autres termes, un tel concept ne peut être efficace que s'il est pris en compte au démarrage de la conception d'un aménagement du territoire.

3. Les avantages de la multifonctionnalité dans l'architecture et l'urbanisme

Les espaces multifonctionnels aux petites échelles (groupe de bâtiments, ilots) présentent de nombreux avantages parmi lesquels: la diminution du temps de transport, l'augmentation du temps effectif d'activité et la réduction des coûts d'entretien, de réparation ou de mise en sécurité, ceci en raison de la concentration des activités, des installations et des infrastructures en un même espace (Pourbakht et Fujii, 2009).

Aux grandes échelles, sur des projets d'urbanisme et d'aménagement du territoire, la multifonctionnalité peut réduire l'étalement urbain, augmenter la densité, promouvoir la qualité environnementale et spatiale, économiser de l'espace en intensifiant son utilisation, en améliorant la performance économique et créant des zones attractives et vivantes (Iveson, 1998 ; Lloyd et Auld, 2003; Rodenburg, et al., 2003; Vreeker et al., 2004).

L'interprétation mathématique du concept de multifonctionnalité des espaces et des activités est résumée figure 2. Si on classe les activités selon la typologie proposée par Jan Gehl (2011), trois types d'activités peuvent être reconnus: les activités nécessaires, optionnelles et sociales[13]. Il serait ainsi possible d'utiliser tout ou une

[13] Jan Gehl dans son livre, «La vie entre les bâtiments» (2011) établit une distinction entre différents types d'activités qui se produisent dans un espace extérieur: activités nécessaires / fonctionnelles, activités optionnelles / loisirs et des activités sociales dans les espaces publics. Alors que les activités nécessaires ont lieu indépendamment de la qualité de l'environnement physique, les activités facultatives ou optionnelles dépendent dans une large mesure de ce que l'endroit a à offrir et du comportent des usagers et de leur perception. L'activité sociale est le fruit de la qualité des lieux et de la durée des d'activités, car les interactions se produisent spontanément quand les gens se réunissent dans un lieu

partie des zones dédiées aux activités nécessaires (marcher/randonner, travailler ou shopping), pour les autres fonctions qui elles peuvent se dérouler durant les heures creuses ou bénéficier d'espaces multifonctionnels.

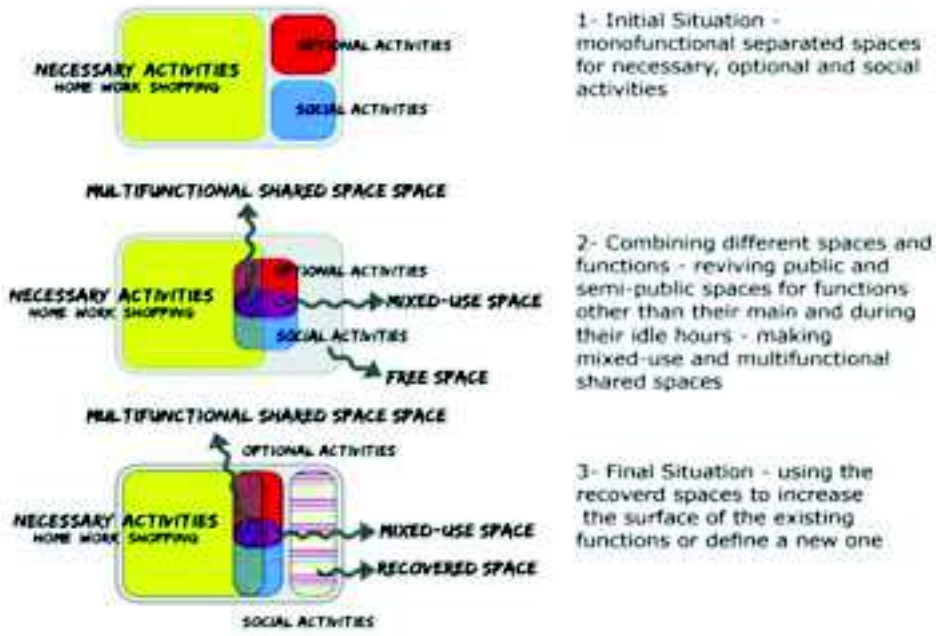


Figure 2: La libération des sols pour les nouvelles fonctions liée à la combinaison des activités (Source: auteurs)

A l'échelle d'une unité de voisinage[14] (échelle locale), si une partie de l'espace, peut être allouée à des fonctions sociales ou récréatives pour tous les résidents de l'unité de voisinage, la nécessité de construire de nouvelles installations dédiées à ces

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particulier. Les activités de loisirs ou sociales comprennent celles gravitant autour des places de jeu pour enfants, dans le cadre de salutations et de conversations ou encore lors d'activités collectives.

[14] En urbanisme, le concept d'unité de voisinage a été développé au cours des années 1930 aux États-Unis. Il s'agit d'un ensemble d'habitations groupées autour d'une école primaire et formant l'unité de base du développement des banlieues nord-américaines.

activités diminuerait. Ces petites cellules enrichiraient la diversité des activités et les choix urbanistiques dans tout le quartier.

4. Typologie: Les potentiels pour l'utilisation multifonctionnelle des espaces urbains

4.1. Démarche

L'approche comparative définie lors de ce travail a consisté à évaluer des expériences similaires initiées au niveau international afin d'identifier les conditions préalables à la détermination d'espaces multifonctionnels. Nous avons relevé différents types d'espaces urbains et analysé leurs fonctionnements pour trouver les nouvelles opportunités permettant une utilisation partagée et mutualisée, tout en tenant compte des restrictions légales, culturelles et organisationnelles.

Nous avons utilisé une combinaison de raisonnement à partir de cas (une méthode de recherche commune dans le design industriel et de l'intelligence artificielle) en se fondant sur la théorie du "Pattern Language" de Christopher Alexander (Alexander, Ishikawa et al., 1977) pour analyser les cas (80). Nous avons développé une approche réflexive dans laquelle chaque nouveau cas nous fait revoir notre processus afin de préciser le choix et les critères de recherche / d'analyse (figure 3). Nous avons utilisé ces critères pour proposer un schéma conceptuel de données facilitant ensuite l'utilisation d'un SIG. Sur la base des cas que nous avons analysés, nous avons défini un scénario pour mettre nos résultats en pratique sur Strasbourg en travaillant sur les terrains de jeux d'école primaire. Dans ce scénario expérimental, nous utilisons le SIG pour visualiser et évaluer l'impact de ce concept sur la vie des résidents.

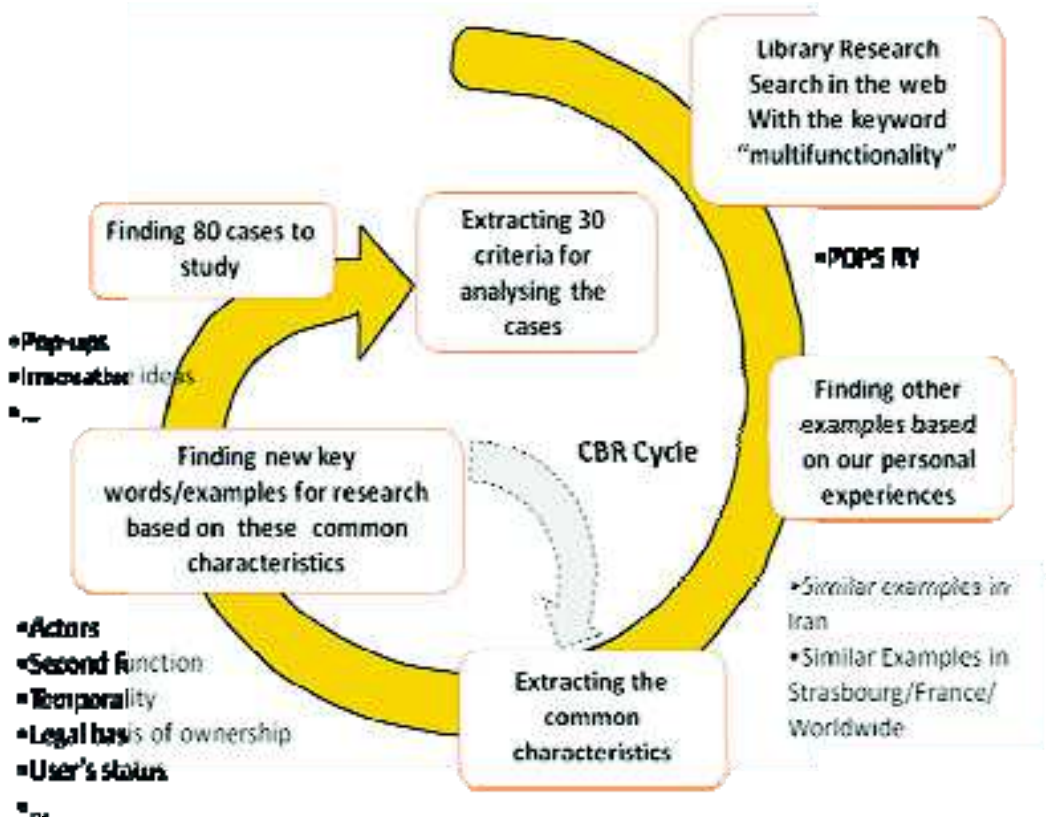
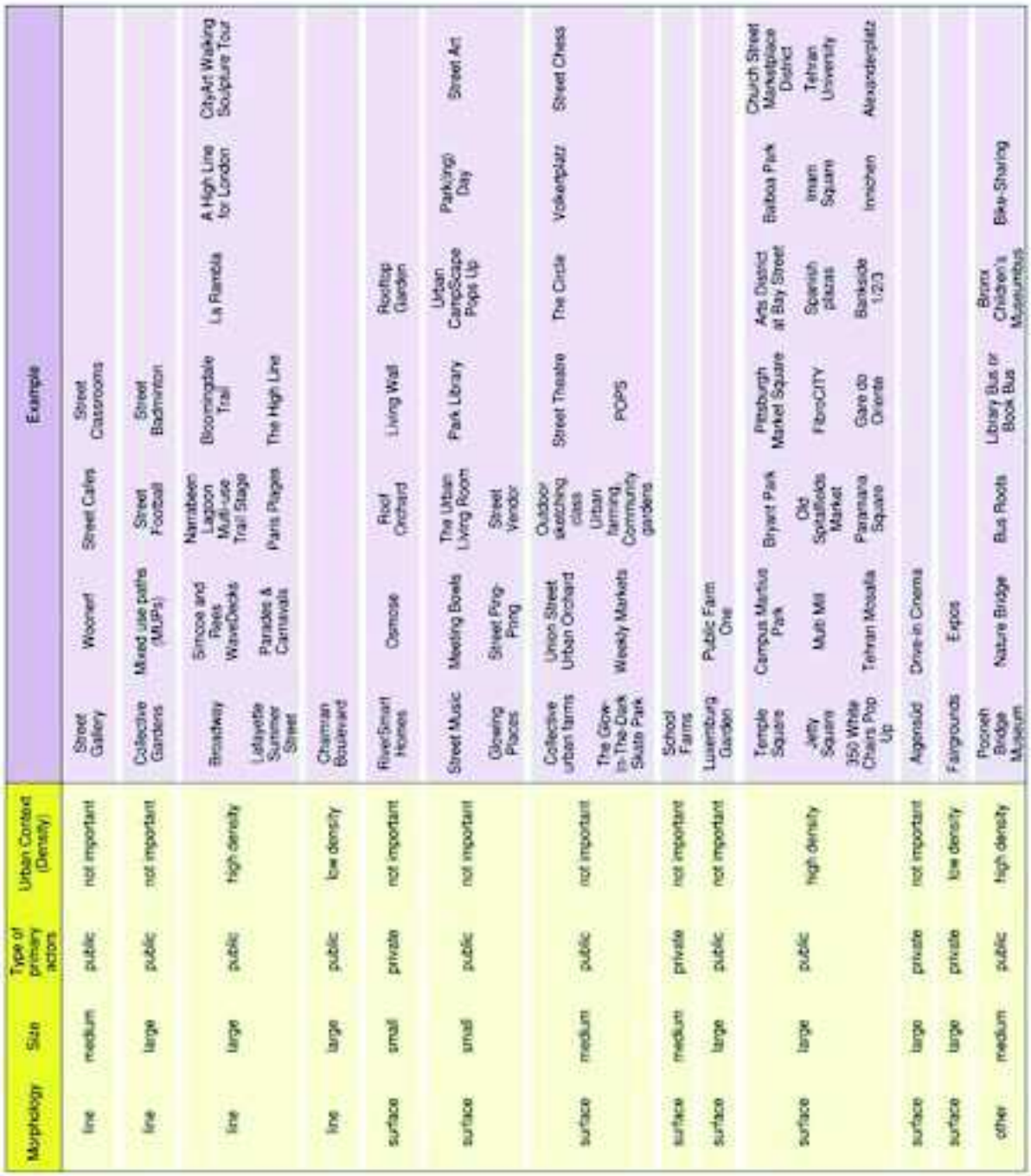


Figure 3: Méthodologie - raisonnement à partir de cas (Source: auteurs)

4.2. Les cas d'étude

Afin d'évaluer le potentiel d'utilisation multifonctionnelle des espaces urbains, environ 80 exemples (Tab.1) ont été étudiés. Nous avons aussi identifié d'autres espaces ayant la capacité de devenir multifonctionnel, des idées innovantes et des pop-ups qui pourraient être des leçons à retenir. Ces exemples sont extraits d'une analyse de la littérature et de travaux de recherche réalisés entre septembre 2012 et mars 2013.

Tableau 1 **:**Les cas d’étude



Morphology	Size	Type of primary actors	Urban Context (Density)	Example														
line	medium	public	not important	Street Gallery	Woonerf	Street Cafés	Street Classrooms											
				Collective Gardens	Mixed use paths (MUPs)	Street Football	Street Badminton											
line	large	public	not important															
				Broadway	Simcoe and Rees WaveDecks	Narrabeen Lagoon Multi-use Trail Stage	Bloomingdale Trail	La Rambla	A High Line for London	CityArt Walking Sculpture Tour								
line	large	public	high density	Lafayette Summer Street	Parades & Carnivals	Paris Plages	The High Line											
				Chairman Boulevard														
line	large	public	low density															
				RiverSmart Homes	Osmose	Roof Orchard	Living Wall	Rooftop Garden										
surface	small	private	not important															
				Street Music	Meeting Bowls	The Urban Living Room	Park Library	Urban CampScape Pops Up	Parking(s) Day	Street Art								
surface	small	public	not important	Glowing Places	Street Ping-Pong	Street Vendor												
				Collective urban farms	Union Street Urban Orchard	Outdoor sketching class	Street Theatre	The Circle	Volkerplatz	Street Chess								
surface	medium	public	not important	The Glow-In-The-Dark Skate Park	Weekly Markets	Urban farming Community gardens	POPS											
				School Farms														
surface	medium	private	not important															
				Luxemburg Garden	Public Farm One													
surface	large	public	not important															
				Temple Square	Campus Martius Park	Bryant Park	Pittsburgh Market Square	Arts District at Bay Street	Balboa Park	Church Street Marketplace District								
				Jetty Square	Multi Mill	Old Spitalfields Market	FibreCITY	Spanish plazas	Imam Square	Tehran University								
surface	large	public	high density	350 White Chairs Pop Up	Tehran Mosalla	Paramaribo Square	Gare do Oriente	Bankside 1/2/3	Incheon	Alexanderplatz								
				Agorslüd	Drive-in Cinema													
surface	large	private	not important															
				Fairgrounds	Expos													
surface	large	private	low density															
				Pooneh Bridge Museum	Nature Bridge	Bus Roots	Library Bus or Book Bus	Bronx Children’s Museumbus	Bike-Sharing									
other	medium	public	high density															

De nombreux exemples existent partout dans le monde. La plupart de ces espaces ont été créés sans planification initiale ; cependant une proportion significative d'entre eux tient compte de questions juridiques ou d’assurances (Fig. 5). En raison de la variété des contextes, il semble que le concept de multifonctionnalité puisse être considéré, sous certaines conditions, selon le site et le contexte social des futurs

utilisateurs. La figure 4 montre la variété des exemples selon la dispersion géographique, la localisation dans un contexte urbain et la morphologie des lieux (Fig.4). En ce qui concerne la localisation géographique et l'échelle, la majorité des cas se situe dans les pays développés, au centre-ville et dans des aires de taille moyenne. Néanmoins, il y a des exemples d'espaces multifonctionnels dans le monde entier. Cela indique que l'idée peut être mise en œuvre soit spontanément, soit de façon organisée selon son contexte culturel. Dans la plupart des cas, les espaces utiles à de nouveaux besoins ont été choisis pour offrir de nouvelles fonctions, en essayant de les combiner avec les activités de la vie quotidienne.

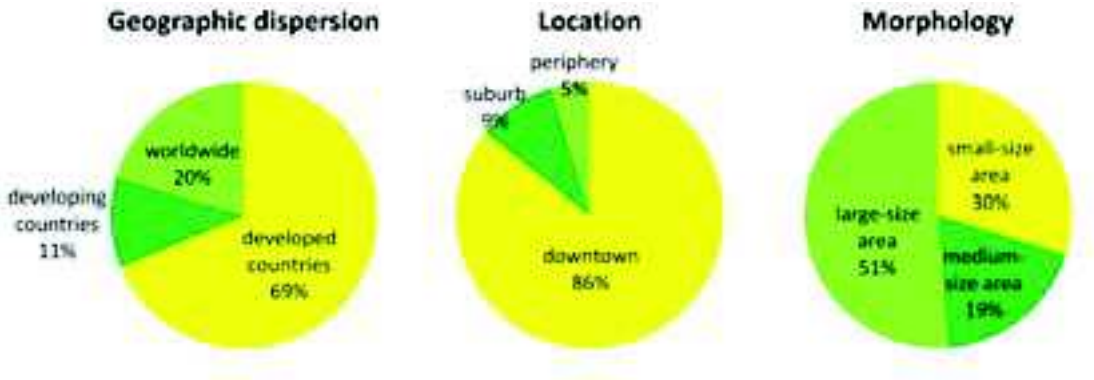


Figure 4: Variété de cas d'étude en fonction de la dispersion géographique

Les cas étudiés ont permis de sélectionner un ensemble de critères à prendre en considération basée sur les acteurs, les usages, les caractéristiques des activités et des lieux (Tab.2). Ces critères ont été identifiés grâce à un balayage rassemblant cas et revue de la littérature (Carmona, Heath, Oc, & Tiesdell, 2012; Marcus & Francis, 1997; Kayden, 2000; Carr, 1992; Thompson & Travlou, 2007; Francis, 2003; Erell, Pearlmutter, & Williamson, 2012; Gehl, 2010; Ng, 2010)

Certains de ces critères sont plus importants que d'autres. Deux catégories ont été créées : les critères obligatoires (durée d'utilisation des lieux, mode de protection, accessibilité, par exemple) et les critères optionnels qui améliorent la qualité

(température, revêtement de l'espace, pollution sonore,…). Cette recherche porte sur la détermination des critères obligatoires.

Tableau 2: Les caractéristiques synthétiques des cas étudiées (Les critères d'analyse)

Identification	Catégorie générale	multifonctionnelle actuelle	privé à public, semi-public à public, public à public, public à semi-public, public à privé, semi-public à privé
		multifonctionnelle potentielle	l'usage mixte, pop-up, ' l'innovation
Acteurs	Type d'acteurs initiaux	public (Etat / Collectivité Territoriale), privé (particuliers, parapublics)	
	Type d'acteurs secondaires	public (Etat / Collectivité Territoriale), privé (particulières, parapublics)	
	Statut des utilisateurs	propriétaire occupant, locataire occupant, public-particulier, grand public (tous les gens)	
Usage	Type d'activité	unique, mixte	
	Base juridique de la possession et de la gestion	usager propriétaire, usage locatif, occupant à titre gratuit, occupant illicite	
	Nouveau contrat d'assurance	oui, non	
	Destination de l'usage	changement de la fonction, changement de la fonction et des utilisateurs, changement des utilisateurs, ajoutant des nouvelles fonctions pour les mêmes utilisateurs, ajoutant des nouveaux utilisateurs en ajoutant des nouvelles fonctions	
	Modalité réglementaire d'usage	avec priorité, sans priorité	
	Fonctions	sans activité, activité nécessaire (passage, travail, infrastructures urbains, ...), administratif, pédagogique, culturel, loisirs (sportif, randonnée, cyclisme, café-restaurant, ...), commercial (supermarché, marché, vente au détail, ...), écologique (espace vert, system de l'eau, ...), social (meeting, rencontre les gens, ...)	
Caractéristiques de l'activité	Temporalité	momentané, permanent (quotidien à temps plein), quotidien à temps partiel, nocturne, hebdomadaire, mensuel, saisonnier, annuel, occasionnel, périodique	
	Relation entre le fonctionnement et l'espace	oui (dépendant), non (indépendant)	
	Activité nocturne	oui, non	
	Pré-requis	pas de pré-requis, meubles, revêtement de sol, équipements, abri, végétation, éclairage, infrastructure	
	Risques	pas de risque, accidentogène, risque de l'incendie, risque de l'inondation, risque de vol, non sécurisante, non sécurisé	
	Relation entre l'activité et le climat	oui (dépendent), non (indépendant)	
	Relation entre l'activité et le temps	oui (dépendent), non (indépendant)	
	Température	froid, modéré, chaud, pas important	
	Relation entre l'activité et le rayonnement solaire	ensoleillé, ombragé, pas important	
	Nuisances sonore	oui (bruyant), non (silencieux)	
Caractéristiques des lieux	Morphologie	ligne, point (spot) de la surface, point (spot) attaché à la surface, surface petite, surface moyenne, surface grande, réseau d'espaces (en taille petit ou moyenne)	
	Accessibilité	ouvert, connecté (attaché a un autre bâtiment /terrain), fermé	
	Localisation	au centre-ville, faubourg, périphérique, partout	
	Attractivité (lieu+activité)	oui (avec attraction), non (sans attraction)	
	Risques (sans avoir la seconde fonction ajoutée)	pas de risque, accidentogène, risque de l'incendie, risque de l'inondation, risque de vol, non sécurisante, non sécurisé	
	Changement de la base juridique de la responsabilité des lieux	oui, non	
	Mode de protection	protégé par la sécurité, protégé par un système de gestion, protégé contre l'incendie, sécurisé, auto sécurité	
	Eclairage	naturel, artificiel, combiné, pas plus que normal (ce qui existe normalement)	
	Nature de sol	minéral, synthétique, végétal, combiné, pas important	
	Couvre de l'espace	ouvert, couvert, semi-ouvert, combiné	

La distribution statistique de chaque critère a été étudiée pour quantifier l'analyse qualitative. Pour chaque critère, nous avons défini deux à dix types de réponse possibles. La fréquence de chaque réponse montre comment il est possible d'en définir un parmi tous les autres choix. Nous avons regroupé les réponses similaires pour les critères qui comptaient plus de cinq réponses possibles.

La figure 5 résume les premiers résultats des analyses selon les critères.

- Juridiquement les espaces font l'objet d'une location ou d'un accès à titre gratuit. Mais le propriétaire peut également personnellement prendre la responsabilité d'une seconde fonction (comme l'échange d'un bien, ou la mise à disposition d'un temps d'usage, ou encore la location d'un lieu de séjour privé). Parfois, des ONG sont impliquées pour aider à l'utilisation de l'endroit ou apportent leur soutien pour y accéder (Fig.5-A).

- Bien que les restrictions juridiques semblent d'une grande importance dans ce domaine, dans la plupart des cas, les fondements juridiques en matière de responsabilité et d'assurance n'ont sensiblement pas été modifiés. Avec une bonne planification, ainsi qu'une définition claire des priorités, un espace peut se transformer en un espace multifonctionnel (Fig.5-B).

- La priorité d'utilisation de l'espace est une question importante quand il y a une interaction entre deux fonctions ou lorsqu'une des fonctions atteint son apogée. Dans ces situations, il faut que les autres fonctions soient suffisamment flexibles pour s'adapter aux nouvelles conditions. En outre, les usages prépondérants doivent être identifiés tout comme les priorités induites afin de clarifier les exigences et les conditions nécessaires à une gestion harmonieuse de cette multifonctionnalité (Fig.5-C).

- La diversité des cas étudiés en ce qui concerne le rythme et la durée indique des périodes d'utilisation multifonctionnelle allant de quelques minutes à quelques mois. Toute activité est soumise à un rythme et à des déroulés chronologiques (Fig.5-D).

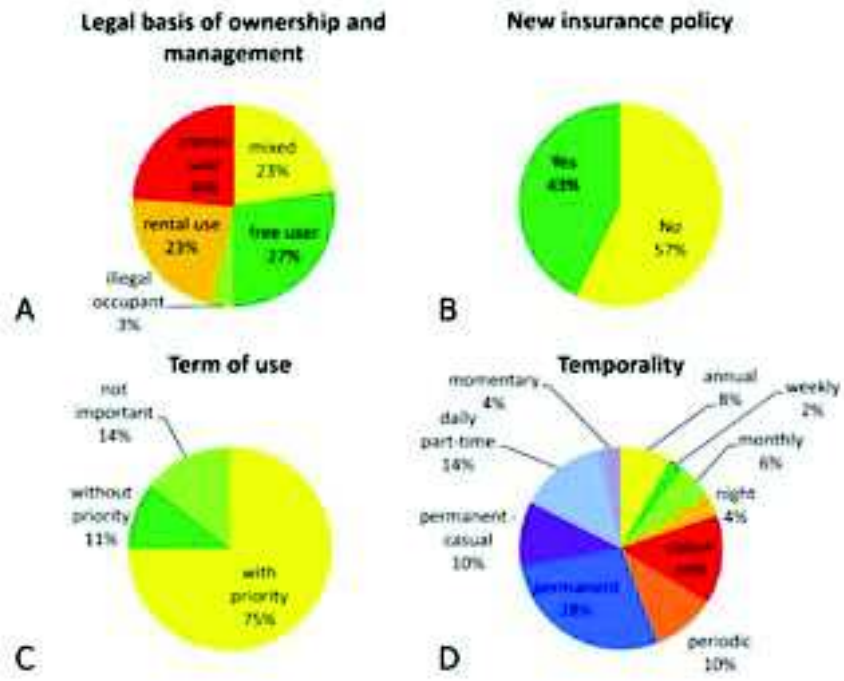


Figure 5: La classification des espaces selon différents critères

5. Créer une base de données SIG

Sans planification à différents niveaux, l'intégration des objectifs multifonctionnels dans l'utilisation du sol ne peut être réussie (Meyer & Degorski, 2010). Le concept de multifonctionnalité requiert une approche interdisciplinaire (Tress, et al., 2001) du fait de la nécessaire prise en compte simultanée des nombreuses dimensions exposées ci-dessus. Le SIG peut, par ses capacités de structuration et de requête, aider à l'adoption de décisions appropriées en rassemblant et combinant différentes couches d'information sur les espaces concernés.

Afin d'identifier les espaces potentiellement multifonctionnels dans une ville ou choisir une autre fonction pour un espace donné, différentes caractéristiques des espaces urbains et des activités doivent être collectés :

- La morphologie, l'échelle et la taille: il existe une relation directe entre la taille de l'espace et l'importance de l'activité ou le nombre d'utilisateurs. Les petits espaces sont utilisés pour des activités locales, tandis que les sites facilement accessibles peuvent être attribués à des activités ayant un plus large rayonnement à l'échelle du quartier ou de toute la ville;

- Le rythme d'activité: le rythme de l'utilisation des espaces pour chaque cycle d'activité doit être relevé afin d'identifier leur échelle temporelle;

- La diversité des activités: il s'agit d'éviter l'implantation d'activités similaires dans un même espace afin d'accroître la diversité des activités d'un site;

- L'accessibilité et la proximité aux moyens de transport en commun: l'activité secondaire de chaque espace doit être choisie en fonction de son accessibilité et sa localisation dans la ville. Ce critère est essentiel pour le développement d'activités ayant un potentiel d'attraction au-delà du quartier;

- L'accès à des infrastructures et services urbains: certaines activités nécessite un raccordement à des réseaux d'électricité, de télécommunication (connexion Internet), d'eau…;

- Les installations d'éclairage public: le plan d'éclairage le l'espace urbain doit être analysé afin d'être en mesure de déterminer les espaces potentiellement appropriées pour les activités nocturnes.

Ces caractéristiques sont essentiellement liées à des zones bâties. Elles permettent d'identifier la zone appropriée ou l'utilisation d'alternatives acceptables. La collecte d'information doit donc couvrir l'ensemble de ces aspects. Par exemple, la déambulation dans une ville nécessite des endroits attrayants. La population devrait être en mesure de profiter du temps et d'itinéraires libres. Les trottoirs par exemple, pourraient offrir une variété de fonctions selon leur localisation et leur taille (Moughtin 2012). En raison de la largeur du trottoir, différents espaces peuvent être créés pour répondre à ces enjeux (Tab.3).

Tableau 3: Les potentiels pour une utilisation multifonctionnelle d'un trottoir et les caractéristiques nécessaires selon l'activité secondaire choisie

	Taille			Rythme de fonctionnement				Localisation			Pré- requises						
	Petit	Moyen	Grand	Quotidien	Hebdomadaire	Annuel	Permanant	Centre-ville	Contre du quartier	Partout	Assurance	Eclairage	Infrastructures	Equipements, meubles	Revêtement de sol	Panneaux de signalisation	Accès aux transports en commun
Voies à usage mixte	✓	✓	✓				✓			✓	✓				✓	✓	
Café-terrasses		✓	✓	✓						✓				✓			
Badminton de rue			✓	✓						✓				✓			
Galerie de sculptures		✓	✓				✓	✓	✓			✓					
Galerie d'art			✓	✓			✓	✓	✓			✓		✓			✓
Salle de classe dans la rue			✓	✓						✓					✓	✓	
Mobilier urbain innovant		✓	✓	✓			✓			✓		✓		✓			
Théâtre de rue			✓	✓				✓	✓								✓
Musique de rue		✓	✓	✓				✓	✓								
Vendeur de rue		✓	✓	✓	✓			✓	✓								
Marchés			✓	✓	✓	✓		✓	✓		✓			✓		✓	✓
Parkings	✓	✓	✓	✓	✓		✓			✓						✓	

Ces premiers critères devraient être combinés avec des critères socio-économiques, juridiques et culturels associés en particulier à la responsabilité et l'assurance (Tab.2).

6. Classification des critères et les modèles conceptuels (patterns)

Le concept de multifonctionnalité peut entrer dans la conception architecturale et urbaine dès le début par la conception du plan directeur de la ville en fonction des zones à usage mixte et des fonctions de partage à valoriser (concevoir un réseau d'activité) (Fig.6). En utilisant les métros, les toits ou les terrains vacants ou la conception de meubles transformables portable qui peut adapter de nouvelles situations, la scène serait peut-être ouverte à des idées novatrices.

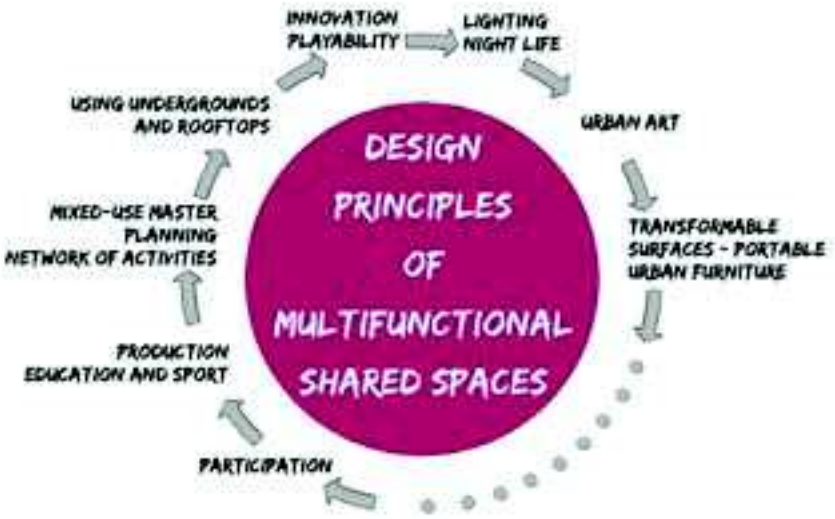


Figure 6: 8 modèles conceptuels (patterns) extraits de l'analyse des cas (Source: auteurs)

Dans cette recherche, les potentiels de l'utilisation multifonctionnelle de l'espace urbain et leur adaptation à la forme urbaine durable a été étudiée. Les critères définis aideraient à trouver les domaines appropriés de la ville dans une phase de programmation.

En analysant les cas, il a été constaté que certains critères sont d'une importance plus grande que les autres. Les commentaires de l'analyse des cas nous a conduit à classer les critères en 3 degrés d'importance (Tab. 4). Ces critères doivent être analysés dans les phases : d'étude de faisabilité, de programmation et de conception. Les premiers critères d'études réunissent les critères essentiels à la réalisation du projet sans lesquels celui-ci ne peut pas démarrer. Le second degré concerne les critères qui ont une grande variété d'attributs et doivent nécessairement être pris en considération, mais en cas de problèmes ou de limites, de nombreuses solutions différentes pourraient être mis en test. Les critères du troisième degré sont recommandés dans chaque projet de design urbain (tant pour un espace monofonctionnel qu'un espace multifonctionnel). Cette classification pourrait être considérée comme une base pour une étude de faisabilité pour la modification d'un espace monofonctionnel à un espace multifonctionnel.

Tableau 4: Trois niveaux de critères

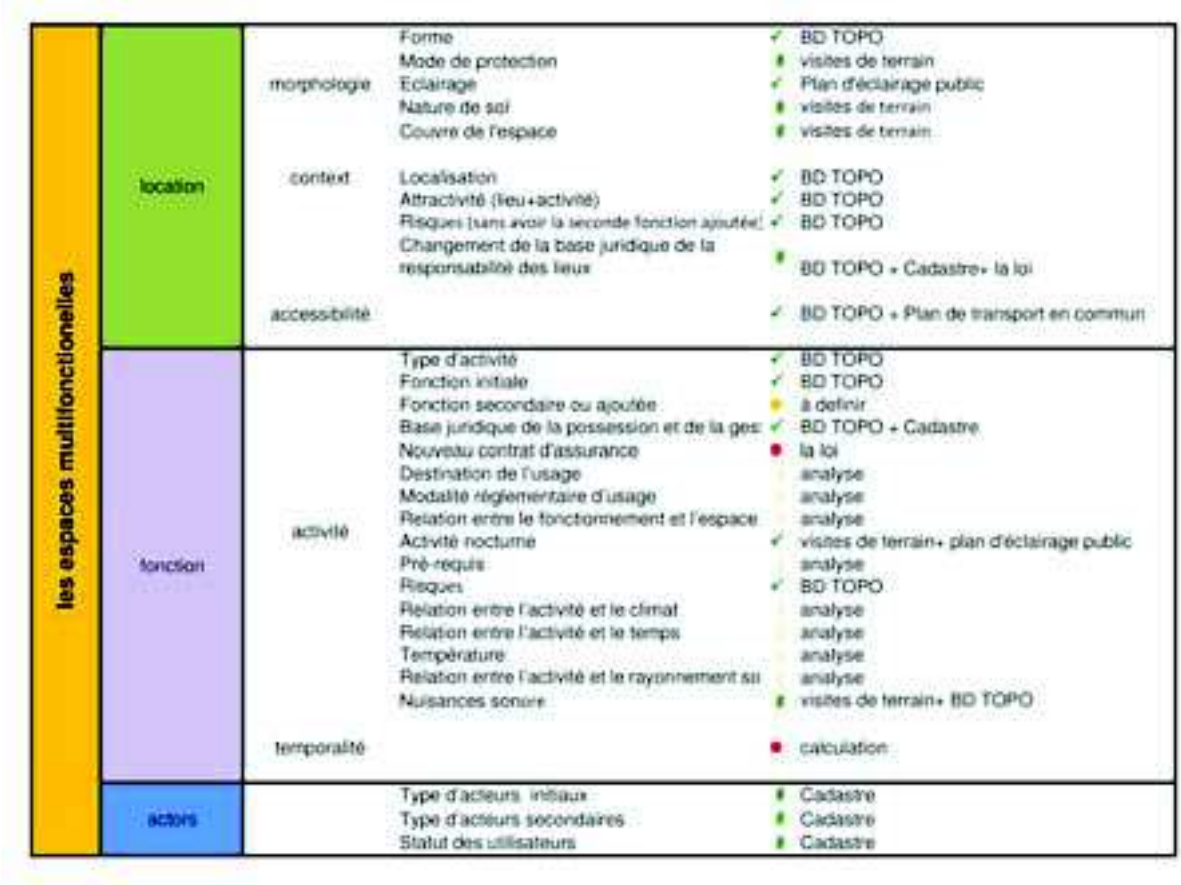
Niveau 1	Niveau 2	Niveau 3
Critères essentiels	***Critères importants***	***Critères recommandés pour être considéré***
Type d'acteurs initiaux Type d'acteurs secondaires Fonctions initiales et secondaires Destination d'usage Morphologie du site	Statut des utilisateurs Type d'activité Base juridique de la possession et de la gestion Accessibilité Localisation Temporalité Modalité réglementaire de l'usage	(Attractivité (lieu + activité) Risques (avec ou sans avoir la (seconde fonction ajoutée Mode de protection Base juridique de la responsabilité des lieux Nouveau contrat d'assurance

7. Application

Un scénario expérimental pour Strasbourg a été défini pour illustrer ces travaux: transformer les cours d'école en aires de jeux ouverts aux publics en dehors des heures d'école.

Pour être en mesure de passer de la théorie à la pratique, il nous a semblé nécessaire d'appliquer cette démarche sur un cas réel. Pour cela un ensemble d'informations a été collecté complété par l'observation de terrain du concepteur. . Les informations collectées et les sources d'information pour Strasbourg, sont présentées dans le tableau 5. Les informations marquées en vert sont celles qui sont facilement collectées en utilisant des bases de données courantes pouvant être aisément rassemblées dans un SIG : cadastre, plans divers, règles urbaines et réglementation et peuvent être complétées en visitant le site. Les informations en orange sont celles dont nous avons besoin pour prendre des décisions, réaliser les analyses et les études de design pour les sites et les fonctions secondaires sélectionnées. Elles doivent pouvoir être adaptées aux divers scénarios envisagés, la décision d'introduire une fonction secondaire ou ajoutée, entraine un nouveau résultat.

Tableau 5: Les différentes informations nécessaires à la prise de décisions et leur source



les espaces multifonctionelles	location	morphologie	Forme	✓ BD TOPO
			Mode de protection	! visites de terrain
			Eclairage	✓ Plan d'éclairage public
			Nature de sol	! visites de terrain
			Couvre de l'espace	! visites de terrain
		context	Localisation	✓ BD TOPO
			Attractivité (lieu+activité)	✓ BD TOPO
			Risques (sans avoir la seconde fonction ajoutée)	✓ BD TOPO
			Changement de la base juridique de la responsabilité des lieux	! BD TOPO + Cadastre+ la loi
		accessibilité		✓ BD TOPO + Plan de transport en commun
	fonction	activité	Type d'activité	✓ BD TOPO
			Fonction initiale	✓ BD TOPO
			Fonction secondaire ou ajoutée	● à definir
			Base juridique de la possession et de la ges	✓ BD TOPO + Cadastre
			Nouveau contrat d'assurance	● la loi
			Destination de l'usage	analyse
			Modalité réglementaire d'usage	analyse
			Relation entre le fonctionnement et l'espace	analyse
			Activité nocturne	✓ visites de terrain+ plan d'éclairage public
			Pré-requis	analyse
			Risques	✓ BD TOPO
			Relation entre l'activité et le climat	analyse
			Relation entre l'activité et le temps	analyse
			Température	analyse
			Relation entre l'activité et le rayonnement so	analyse
			Nuisances sonore	! visites de terrain+ BD TOPO
		temporalité		● calculation
	actors		Type d'acteurs initiaux	! Cadastre
			Type d'acteurs secondaires	! Cadastre
			Statut des utilisateurs	! Cadastre

Il convient de garder à l'esprit que ce problème n'a pas de réponse globale. Certaines informations, comme les questions juridiques ou d'assurance sont difficiles à introduire spatialement dans les couches SIG. Chaque pays offre des possibilités et des limites spécifiques en fonction de règlements propres, de systèmes administratifs et d'éléments culturels. Par exemple, dans certains pays, les règles relatives à l'assurance et à la responsabilité sont moins restrictives que dans d'autres. En outre, les différentes définitions de l'espace public et de sa fonction dans différentes cultures conduisent à une grande diversité dans la fabrication des espaces multifonctionnels.

Il est important de prendre du temps pour introduire ce type de concept auprès des acteurs (décideurs et population) et de les encourager à regarder l'espace comme un «capital» qui pourrait devenir mutualisé (partagé), non seulement entre différents

utilisateurs, mais aussi entre différentes activités. La notion «d'usage de partage» est quelque chose qui pourrait être atteint grâce à l'information et à l'éducation.

8. Conclusion

Fondée sur la base de nos connaissances en architecture et en architecture du paysage, cette recherche conforte nos hypothèses initiales sur le concept de multifonctionnalité des espaces. Il participe à l'augmentation de la qualité des espaces architecturaux et urbains. En d'autres termes, si l'on regarde la conception comme une résultante de la forme et la fonctionnalité (prendre en compte les attentes des utilisateurs en termes de besoins physiques et psychologiques) et en même temps, si l'on tient compte des aspects sociaux, culturels, économiques et esthétiques dans un cadre temporel adapté, cette approche peut s'avérer pertinente et efficace pour répondre aux exigences s'un développement urbain durable.

Dans cet état d'esprit, même un élément simple comme une chaise dans un espace urbain pourrait être conçu de manière à permettre en plus de sa fonctionnalité habituelle, dans un certain laps de temps ou hors des périodes de fonctionnement habituel, en intégrant d'autres rôles : écologique, social, culturel, économique. Ce genre de vision lors de la conception, multiplie la valeur de «chaque décision» ou de «chaque choix». On pourrait penser que la conception serait plus difficile en adoptant ce point de vu, mais une telle transformation conceptuelle peut être riche pour les décideurs, les planificateurs et les concepteurs, en apportant des propositions de changements simples ou nécessitant le moins d'interventions possibles. Ceci pourrait conduire à des conséquences et des résultats durables, efficaces et de haute qualité allant dans le sens d'un futur meilleur.