

Systemic Triangulation, a Tool for Complex Urban Diagnosis. The Case of Horsh Beirut

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Abstract

Perceived as a complex system, public space could be examined through the means of complexity thinking. Complexity thinking not only offers a new urban terminology delivering interesting insights on the city and its public space, it also offers new tools that could deepen our understanding of their major issues. In this paper, the complex case of Horsh Beirut is diagnosed with one of these tools: Systemic Triangulation. As a trans disciplinary tool for relational diagnosis, Systemic Triangulation acknowledges the inscription of urban problems in structural, functional and dynamic continuums, establishing the relationships between them, and projecting interactions between the system and its environment. This paper searches for the implication of this method, based on non-linear representations of urban reality, in public space design and management. And explores to what extent the systemic approach could give us fresh answers on classic urban problems such as dysfunctional green public spaces and spatial segregation.

Keywords: complex systems, Horsh Beirut, public space, complexity, systemic triangulation, urban diagnosis

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Introduction: Horsh Beirut diagnosis with Systemic Triangulation

What is there in common between the ecology, a company, a city, an elephant, a cell? Nothing, if we content ourselves with examining them with the classic instrument of knowledge, the analytical approach. But a lot, however, if we go beyond this conventional approach to highlight the specific rules of organization and regulation of these systems, and observe their analogous complexity.

The analytical approach, also known as the positivist approach, is mainly focused on breaking down systems to their constituent parts to analyse them and, then trying to understand the entire system as the sum of these individual components. This approach works well when we deal with sets of things that have few, simple and linear internal relations, such as a machine, a chair, a group of people waiting for the bus. However, by increasing the connectivity between the elements, it's the connections that begin to define the system, and this method doesn't work best. In those cases, such as the study of brains, gardens, companies, beehives and cities, we can adopt the systemic approach, a relational method which supports the understanding of systems in their totality, interactivity, organization and openness (Leloup, 2010: 689). The systemic approach is particularly interested in complex objects of study that are characterized by:

imprecision on the constitution and the limits of the object, randomness and instability in time, ambiguity, related to the presence of antagonistic logics, uncertainty and unpredictability (Cambien, 2007: 25). Consequently, problematic urban contexts seem to be adequate cases to experiment with this approach. However, it should be noted that the analytical and the systemic approaches are more complementary than opposed "though irreducible to one another" (De Rosnay, 1975: 107); the systemic approach must therefore be interpreted not as an anti-positivist revolution, but rather as an evolution of the latter. The theoretical shift of urban systems analysis, moving from an analytical mechanism to complexity sciences - from the equilibrium of the system to complex adaptive systems - also requires an alternative thinking from the point of view of planning (Batty, Morphet, Masucci, & Stanilov, 2008; Moine, 2006).

We truly need to rethink the way we understand and design our cities. After thousands of years of progress in urban development, we are falling behind on many subjects. To say the least, cities are not thriving regarding safety, health, efficiency, public life and cohesion issues. Could this be because of how we perceive our cities? Back in the 1950's, when Jane Jacobs was writing *Death and Life of Great American Cities*, she arrived at a conclusion that city planning was a problem of "organized complexity" which meant "dealing simultaneously with a sizeable number of factors which are interrelated into an organic whole" (Jacobs, 1961: 432). In fact, this is the essence of complexity thinking as a relational way of understanding how systems perform in the real world. Theories of complexity have provided a framework for understanding the city's complexity, unpredictability and chaotic nature (Fontana, 2005: 1; Portugali, 2009: 2). Viewing cities, as complex adaptive systems, complexity thinking discourages approaches that are linear, bounded and overtly analytical. In any complex adaptive system, no one is truly in control of the system, no one has all the information about the system, and patterns of order emerge through self-organization among agents. Individual cells self-organize to form differentiated organs, ants interact and organize to form colonies, and individuals interact to form social networks. This property called self-organization is among many other emergent properties of the urban system that we will search for in our diagnosis of public space, in this case, Horsh Beirut.

Within the urban system, public space is a versatile, multipurpose and adaptable territory, very dependent of the urban practices on the adjacent territories (Poutchytixier & Peigne, 2005: 53), therefore it combines many systemic properties. Accordingly, a city is not only a system. It is a system of systems, where we can identify many urban subsystems like: public space system, transportation system, energy system, social system, communication system, education system, health system, governance system. Information science has been used to improve these working subsystems in the context of *Smart Cities*. In considering these subsystems, managing and regulating their interrelations, each of them can be made smarter, and the city, the system of systems, smarter (Laugier, 2013 :5). But could some urban problems, such as fragmentation or violence in public space for example, be addressed with information science tools alone? Considering the technical limitations, especially on the social plan, what alternative approaches do we have? In fact, the real challenge is to specify tools of complexity thinking that can help us identify complex urban problems and address them. In the paper, we aim to test Systemic Triangulation as a tool for urban diagnosis, and the case of Horsh Beirut serves as a prototype of a complex urban situation.

Horsh Beirut is a problematic park in the heart of Beirut, the capital of Lebanon, with a turbulent history of openings and closers, armed clashes, renovations and advocating for its reopening. It is positioned on the former demarcation line, surrounded by three heterogeneous neighborhoods (Badaro, Chiah, and Qasqas), politically, economically and socially. (**Errore. L'origine riferimento non è stata trovata.**) During the Ottoman Empire occupation and the French Mandate, Horsh Beirut was a large open pine forest surrounding the growing city. Then, after the Lebanese independence in 1943, it took the name of "Horsh el Eid", or the forest of holidays, for fostering public holiday reunions and celebrations in the heart of the growing city. Later, during the Lebanese civil war which started in 1975, the park took part of the demarcation line, a buffer zone separating East and West Beirut. After being bombed and burned during the Israeli invasions in 1982, it was conceived as a city park in 1992 during the reconstruction phase of Beirut, right after the end of the war in 1990. Throughout its history, why did Horsh Beirut mainly fail to play its role as a public space aiming to connect people, their neighborhoods and the city as a whole? As a complex urban problem, can we still study this case with the classic analytical approach? To what extent can the systemic approach provide efficient methods and tools aiming to achieve greater urban coherence and a "smart" connected city? And what fresh insights could Systemic Triangulation in particular provide us?

The knowledge of Horsh Beirut as a system is gained by examining its *structure*, *function* and *dynamics*, establishing the relationships between them, and projecting interactions between the system and its immediate environment. The "structure" means the multi-scalar physical, spatial and territorial composition of Horsh Beirut. The "function", or purpose, refers to its ability to provide and maintain the protection, comfort and enjoyment of its visitors (Gehl, 2010) and sustain *life order* (Alexander, 2002: 3). The "dynamic" represents its evolutionary process, given the system's environment constraints. The toolbox of complexity thinking is today rich of several instruments of thought. Remarkably adapted to the phase of diagnosis, Systemic Triangulation observes the system through these three different but complementary angles, each one linked to a particular point of view of the observer (Donnadiou & Karsky, 2002: 87). (Figure 1)

Systemic Triangulation, a Tool for Complex Urban Diagnosis

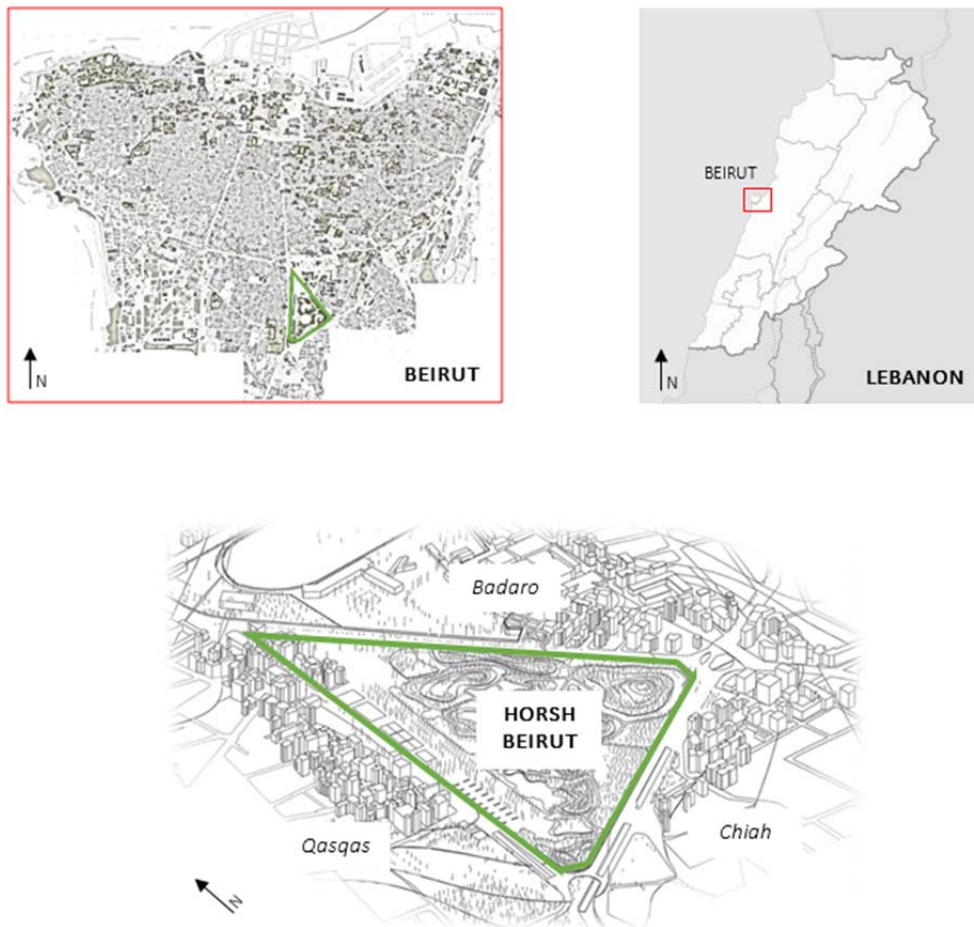


Figure 1. Urban context of Horsh Beirut. Source: Joumana Stephan, 2019

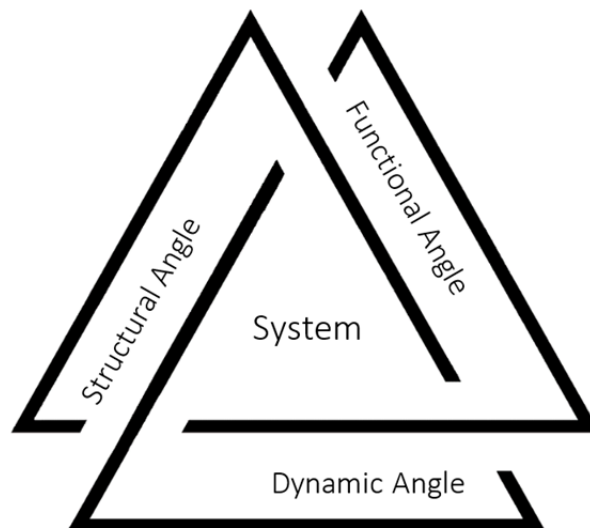


Figure 1. System diagnosis with Systemic Triangulation's three angles: structural, functional and dynamic. Source: Joumana Stephan, 2019

Since modeling is fundamental for systemic analysis, and in order to achieve a satisfactory yet intuitive understanding of Horsh Beirut, we propose *mind maps* as a system modeling tool. Each of the three angles is followed by a mind map providing us with a particular perspective of the entire system. This gives us a chance to be more objectively aware of the system organization from different perspectives. All the statistics in the paper are produced by the author Joumana Stephan as the results of a survey conducted in June 2017 within her thesis on Horsh Beirut¹. Furthermore, the boundary of our studied system is shown in red on the map below (Figure 2), representing the current fenced area of the park. In green, we see the surface of the official lot of Horsh Beirut (Lot 1925) assembling the surrounding neighborhoods where all constructions are actually violations of law. This constitutes the environment of the system.



Figure 2. System boundary and environment.
Source: Joumana Stephan, 2019

¹ PhD thesis of Joumana Stephan (2014 until present) co-supervised by Nada Chbat and Nouha Ghosseini from the LU (Lebanon) and Philippe Potié and Paolo Amaldi from UVSQ (France)

The structural angle or how the system is composed

It is first necessary to carry out the structural analysis which aims to describe the structure of the system and the arrangement of its various components. The accent is placed much more on the relations between components than on the components themselves, more on the structure than on the element. (

Figure 3) The geometric features and territorial environment of a public space could be relatively simple to describe; but what happens there is not predefined and multiple actors will use this space in the most varied ways. Therefore, what's interesting about the structural angle is its relational, vibrant and unpredictable aspect.

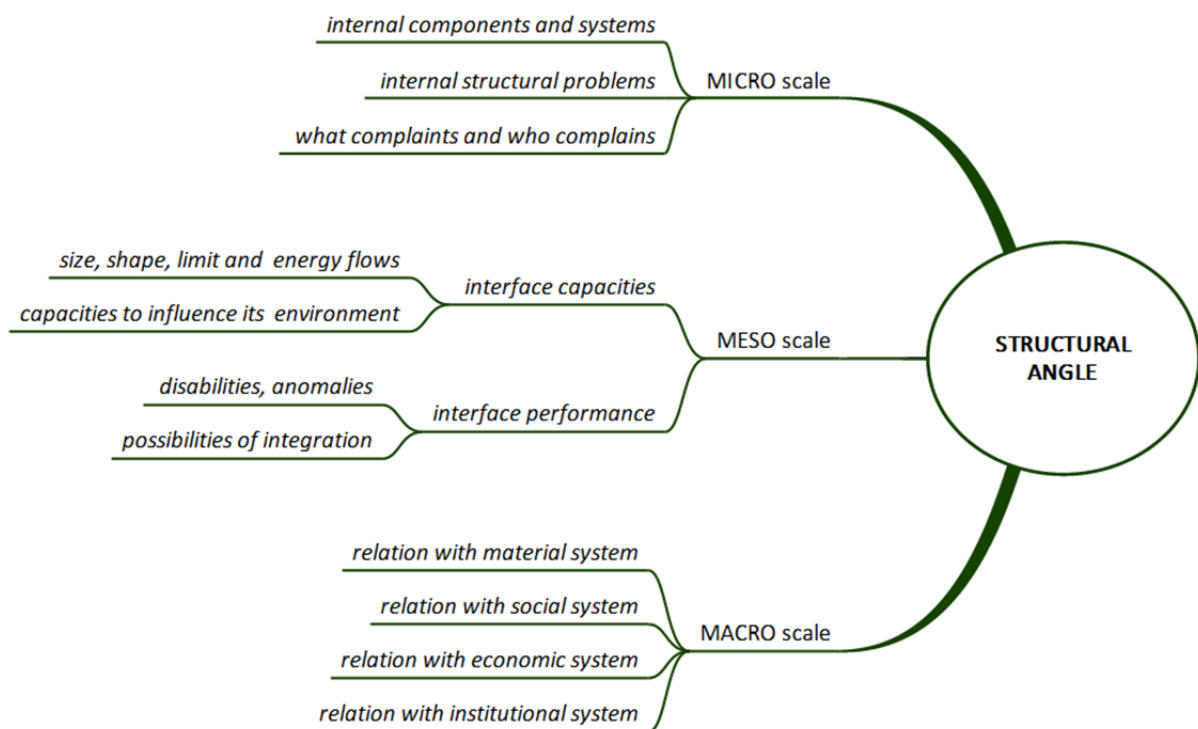


Figure 3. Structural angle model. Source: Joumana Stephan, 2019

Three scales are adopted:

1. On the Micro scale: Internal structure
Refers to the "mechanical" dimension of the system, its internal components and systems. What structural problems are there inside the park? What are the complaints and who complains?
2. On the Meso scale: Interface
Refers to the interface between the system and all that surrounds it: the size of Horsh Beirut, its shape, limit, information, energy flows, and capacities to act on the environment and to receive visitors. What are the identified overall disabilities of Horsh Beirut as an entity?
3. On the Macro scale: Within the environment
Refers to the human, social, material, legal and economic systems with which the public space is interrelated. What are the broken relations that Horsh Beirut has with its environment?

The functional angle or what the system does

The functional angle is especially sensitive to both the relational and vocational levels of Horsh Beirut, where we search for the system's purpose. Not aiming for an exhaustive description, we identify useful knowledge and select clues that are valuable for our analysis, answering: What urban need does the park fulfill? What function does it have in the urban ecological system? And the socio-economic system? And the political system?

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Figure 4)

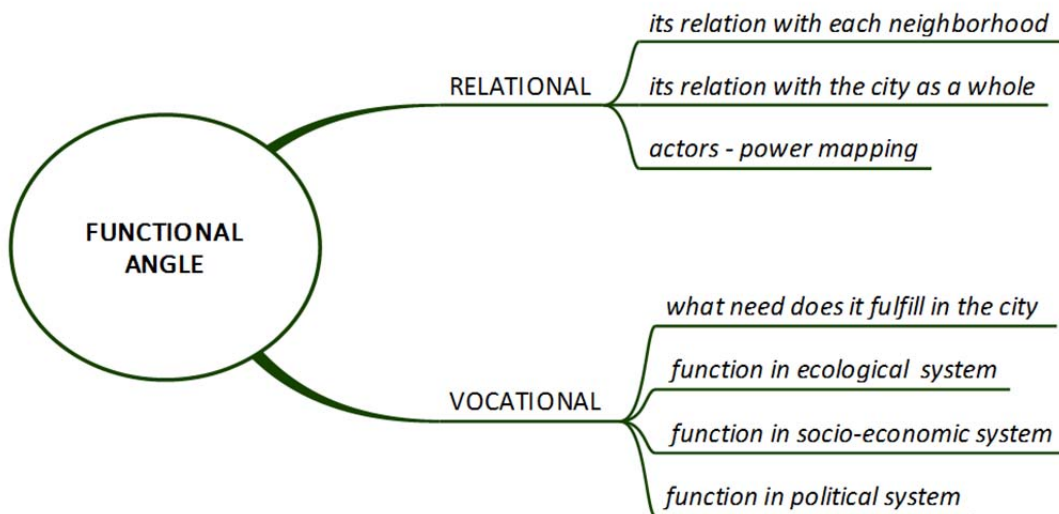


Figure 4. Functional angle model.
Source: Joumana Stephan, 2019

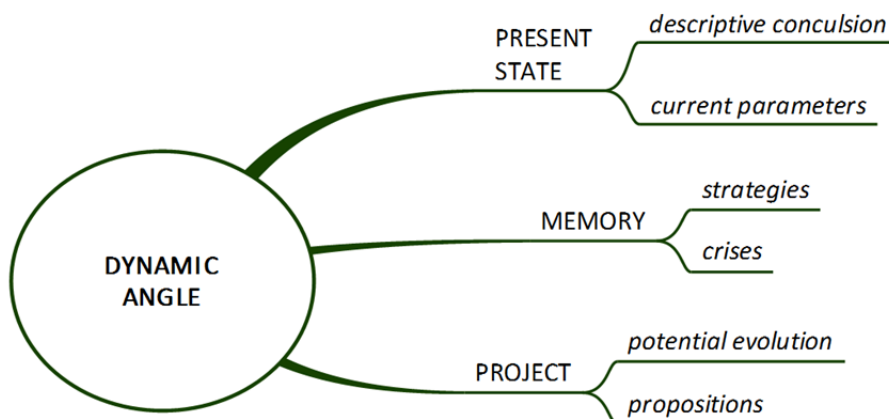


Figure 5. Dynamic angle model.
Source: Joumana Stephan, 2019

The dynamic angle or *what the system becomes*

The dynamic angle (or historic or genetic) is related to the evolutionary nature of the system. (

Figure 5) Classic urban studies usually tend to build upon historical data in order to understand the development of a certain urban entity. This has obviously led to interesting results. In that case, the observer should have to forge a knowledge of the system's history sufficient to be able to understand its evolution. Nonetheless, given the cyclical and non-linear aspect of the evolution of public space, we study the evolutionary nature of the system, as an entity endowed with a memory and a project, and capable of self-organization (Gérard Donnadieu et al., 2003: 7). In order to do so, we must consider the following questions: What's the current situation of Horsh Beirut? Which objective actions have mainly influenced it and how did we arrive to this current state? Were there any major past crisis and what policies were used? What events provoked the separation of Horsh Beirut from its direct environment and the city as a whole? All in all, systemic triangulation thrives by combining these three angles. We move from one aspect to another during a spiral process which allows each angle to gain more depth, but without ever believing that we have exhausted this comprehension. It would be wise to always consider each angle of the triangle - and their relevant observations, concerns, and judgments - in the light of the other two. And also it would be good to question if new facts become relevant when we expand the boundaries of our classic reference system. The novelty of this method is that it is intuitive focusing on the links between dysfunctions, uses and vocations. This makes it a *dynamic-oriented* diagnosis rather *event-oriented*, where we search for the complex, circular and multi-scalar interactions and the underlying dynamics of the system.

The entire systemic triangulation tool with its three angles is modelled in the following mind map (Figure 6).

Three angles of the complex and problematic situation of Horsh Beirut.

In Beirut, public space is rare. The only large green public space is Horsh Beirut. Making up to 70% of the city's green space (Shayya & Arbid, 2010: 118). This triangular park situated along the old demarcation line, at the intersection of three neighborhoods, has been mostly closed to the public since the end of the civil war. Between the diversity of its bordering neighborhoods, their recent and ongoing armed clashes, the disinterest of the local authorities and political actors in reviving the park, the continuous threats of private investments inside its borders, the fight of many NGOs for its reopening, and the need for it as a green getaway inside a heavily crowded city, how to perceive the complex situation of Horsh Beirut and how to understand it?

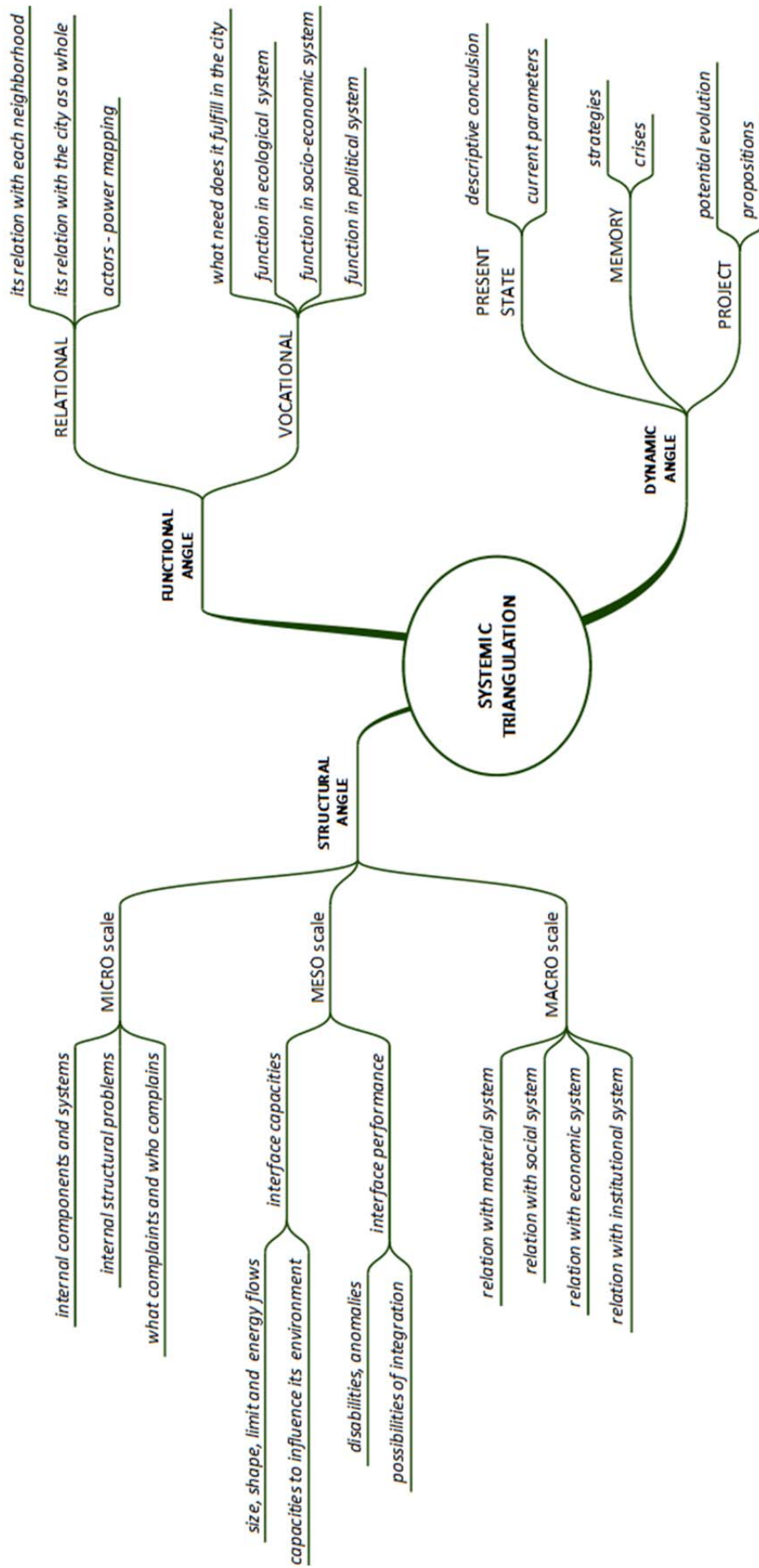


Figure 6. The systemic triangulation tool model. Source: Joumana Stephan, 2019

I. Structural Angle: the system's composition

1.1 ON THE MICRO SCALE: system's internal structure

Today the park is divided in two parts. The smaller part is open to the public and called Qasqas Garden. The other part (66% of the total surface) has been closed to the public and only accessible by "special authorization" from the mayor of Beirut since 2002, up until June 2016, when it was re-opened to the public for the first time. Fences of steel bars, wire mesh, and barbed wire or trees and shrubs still separate the two parts and their visitors, which creates a kind of social segregation even inside the park. The latter is also threatened by an ongoing illegal construction of a field hospital inside of its limits.

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Figure 7) Today, despite the fact that the park is classified as a protected natural site since 1940 and is part of the general inventory of archaeological buildings and public landscapes, the municipality of Beirut is continually taking decisions which spark outrage among the park's visitors and local NGOs working on protecting public spaces. Protests mainly cover issues like the loss of public green spaces in Beirut, public policies and decisions such as discrimination based on social class in the access to the park, and the lack of security measures.

1.2 ON THE MESO SCALE: system's interface

Horsh Beirut is a 30-hectare triangle bordered on the west by the Qasqas neighborhood (Sunnite majority), to the north-east by the "La Résidence des Pins" (residence of the French ambassador), the racecourse and Badaro (Christian majority) and, in the South-East, by Chiah (Shiite majority). Its location is peripheral, at the edge of the municipal boundary of Beirut, and alongside the old demarcation line. A high fence surrounds the park which has three main entrances, one from each neighborhood. Qasqas entrance is open, Badaro entrance has recently been opened (May 2015), and Chiah entrance gate has been closed to the public since the end of the civil war for security reasons. 75% of park users access the park from the Badaro entrance while the majority of them actually lives in Chiah (19%). Which means that Chiah residents choose to access from Badaro instead of Qasqas, although Qasqas's has been closed to the public very rarely while Badaro's experienced long periods of closure. This can be explained by the current Sunnite/Shiite socio-political tension. (Figure 8)

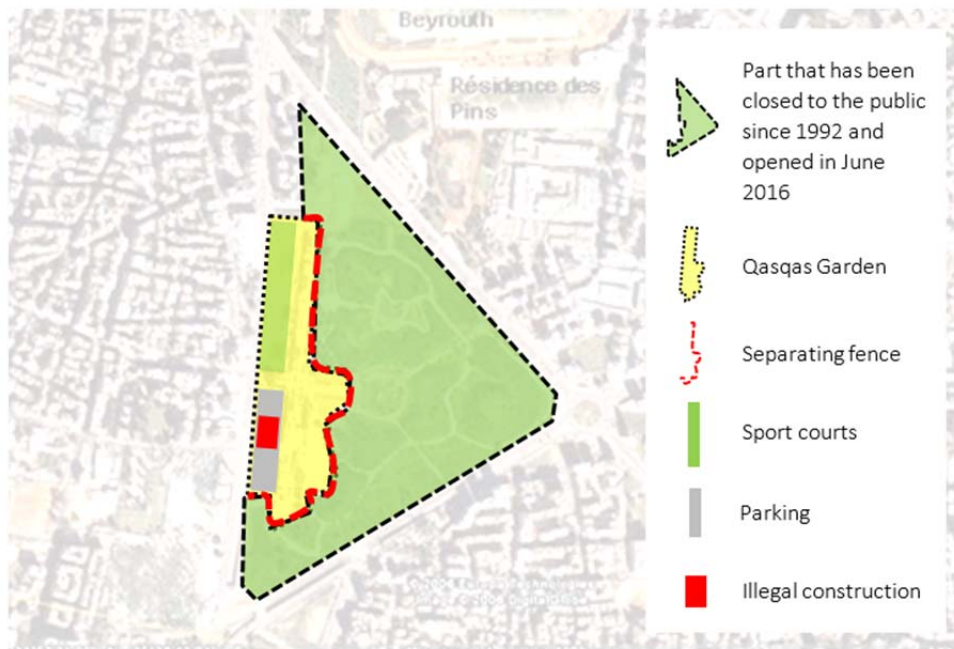


Figure 7. Internal structure of Horsh Beirut. Source: Joumana Stephan, 2019



Figure 8. Park accessibility from each neighborhood. Source: Joumana Stephan, 2019

Also, the park is surrounded by a strip of wide streets, not equipped for pedestrians, forming a physical barrier between the park and its immediate surroundings (Figure 9).



Figure 9. Detachment caused by large avenues. Source: Joumana Stephan, 2019

1.3 ON THE MACRO SCALE: system within its environment

What's its relation with the material system?

Green spaces in Beirut vary between public and private, accessible and not accessible. Ranging from private to public gardens, school gardens and cemeteries, the following map (

Figure 10) shows the main green spaces in Beirut listed in three major categories: blue represents spaces open to the public, orange represents public spaces not accessible to the public, and purple represents private spaces.



Figure 10. Green spaces in Beirut. Source: Joumana Stephan, 2019

In short, green spaces that are accessible to the public are rare. 47 green spaces include only 7 accessible green spaces which are often undeveloped, small and rarely isolated from noise and automobile pollution. Consequently, Horsh Beirut could be considered as part of a dysfunctional public green spaces system in the city.

Its relation with the social system?

Badaro is a neighborhood of Christian majority. Qasqas is of Sunnites majority, and Chiah is of Shiites majority. As shown in the map below, the social system around Horsh Beirut is highly segregated based on confessions. (Figure 11) Since the Sunnites and Shiites conflict happens to be also a political, the resulting urban segregation is both confessional and political.

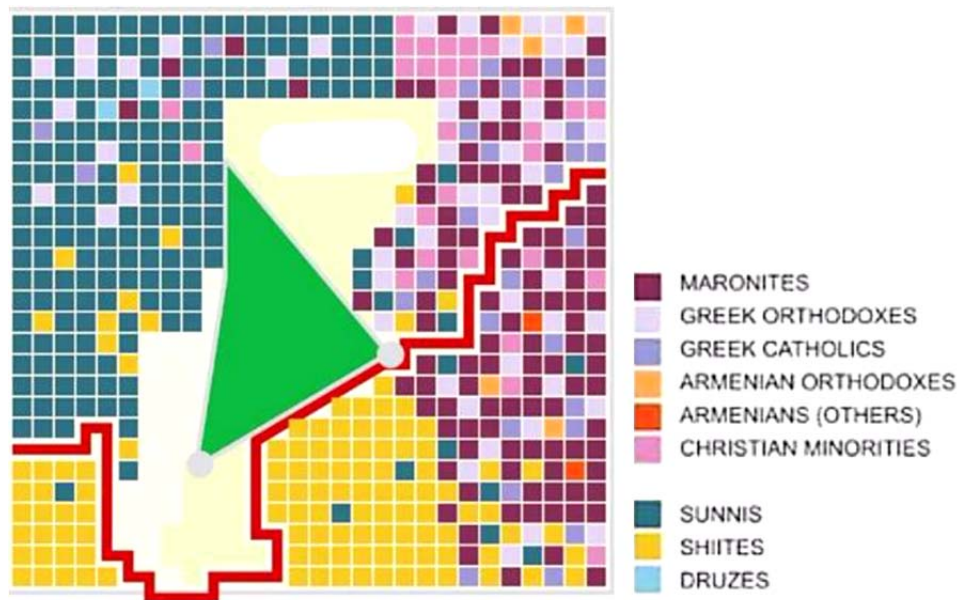


Figure 11. Confessional distribution around Horsh Beirut. Source: Shayya F., & Arbid, G. (2010). *At the edge of the city: reinhabiting public space toward the recovery of Beirut's Horsh Al-Sanawbar. Discursive Formations.*

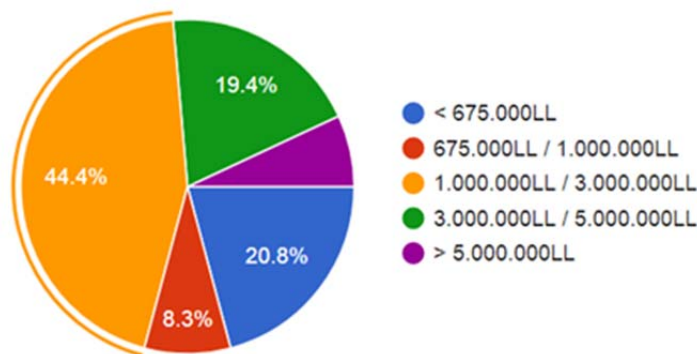


Figure 12. Income averages of park users. Source: Joumana Stephan, 2017

Its relation with the economic system?

The majority of park users belong to the middle class ($\approx 44\%$)², directly followed by the class below the poverty line ($\approx 21\%$)³.

While, in addition to the planned central gentrification of the Beirut city center, gentrification at the level of neighboring regions is spontaneously emerging. One of the axial extensions of this phenomenon is currently the axis of the old demarcation line, which starts with the city center passing through Sodeco and arriving at Horsh Beirut. (Figure 13).



Figure 13. Luxurious high rise buildings and gentrification. Source: Joumana Stephan, 2019

² The average monthly salary in Lebanon according to the World Bank in 2014 is $\approx 1.500.000$ LL

³ The minimum monthly wage in Lebanon is 675.000 LL

Also, the largest percentage of respondents usually spend their free time during the day in restaurants ($\approx 29\%$), with lower percentages going for choices such as a green public space like Horsh Beirut ($\approx 24\%$), a mall ($\approx 17\%$), a gym ($\approx 11\%$), among others. This shows the role of consumerism at the heart of leisure activities of Beirut, by choice or by lack of alternatives.

Its relation with the institutional system?

Horsh Beirut is surrounded by a multitude of cultural and educational facilities, both public and private. It is also surrounded by a large number of religious facilities divided between Muslim and Christian neighborhoods. (

Figure 14)



Figure 14. Institutions around Horsh Beirut. Source: Joumana Stephan, 2019

In conclusion, Horsh Beirut is modelled via the structural angle in the map below (Figure 15).

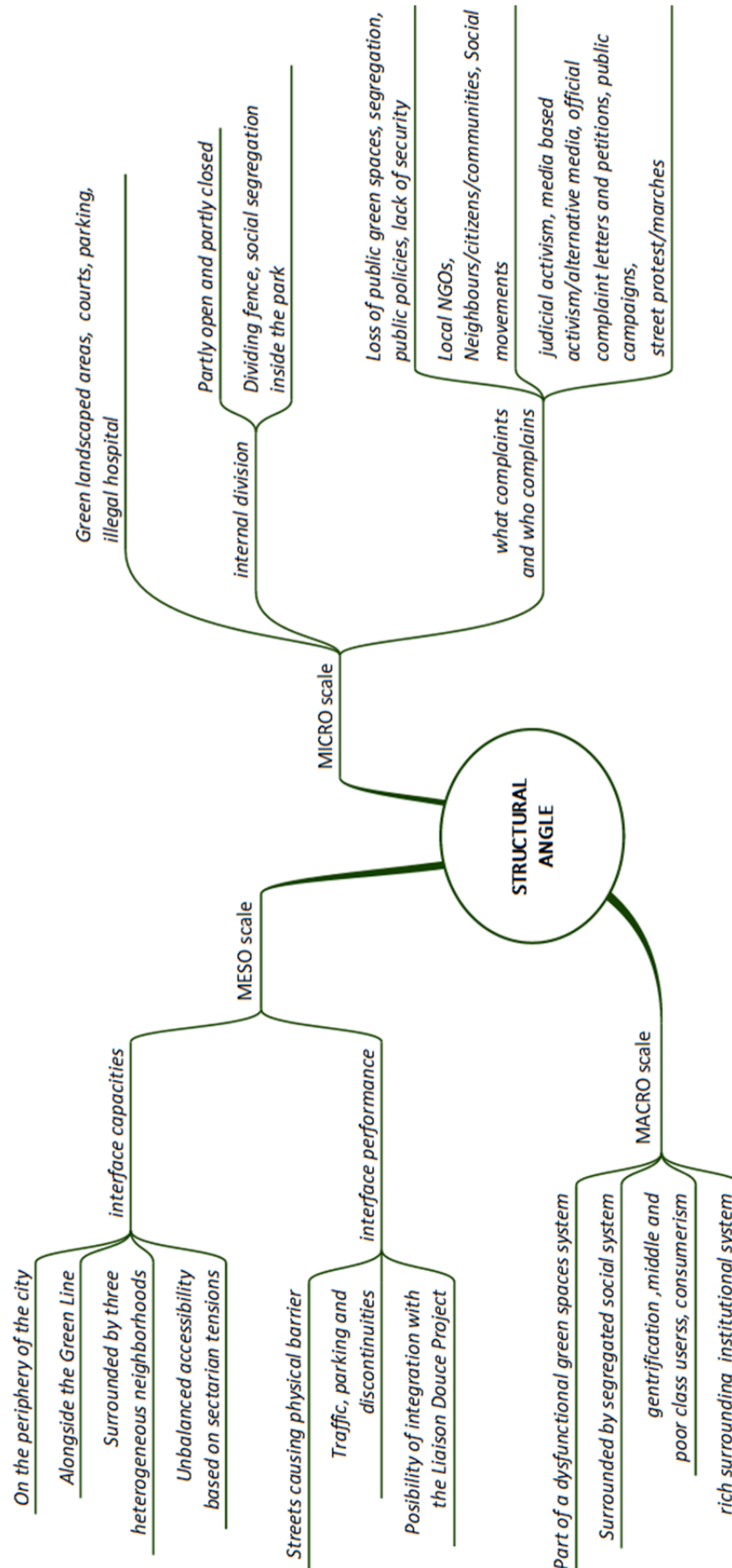


Figure 15. Structural angle model of Horsh Beirut. Source: Joumana Stephan, 2019

2. Functional Angle: the system's contribution

2.1 RELATIONAL: its relation with each neighbourhood

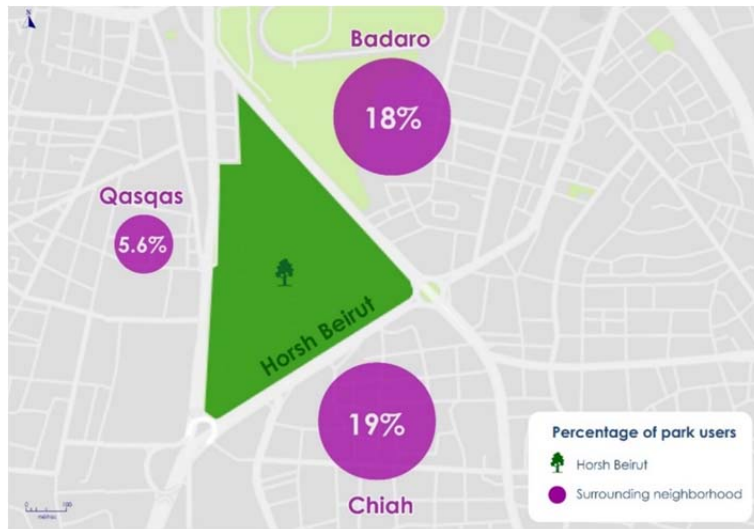


Figure 16. Percentage of users based on place of residence in surrounding neighborhoods. Source: Joumana Stephan, 2019

19% of the park users are Chiah residents, although Chiah entrance has been closed since the end of the war. 18% of the users are Badaro residents. And only 5.6% are Qasqas residents, despite the proximity to Qasqas garden, the part of the Horsh that has been rarely closed to the public. (Figure 16) These results show an unbalanced relation of the system with each of the three bordering neighborhoods.

Its relation with the city as a whole

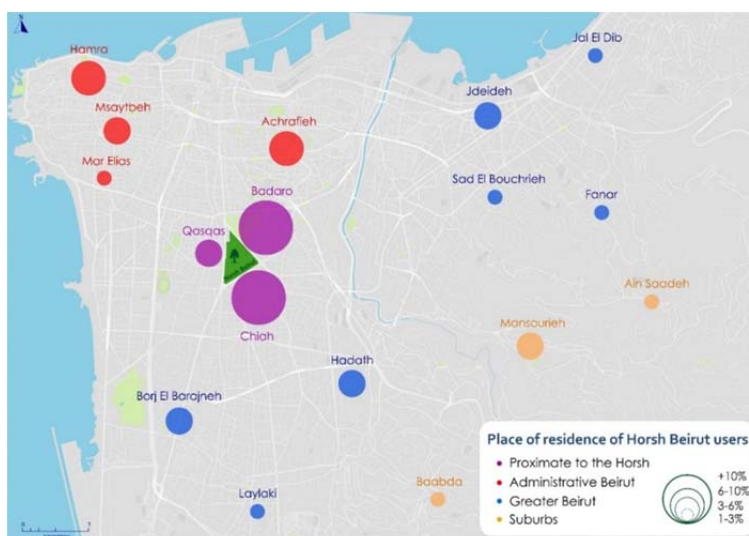


Figure 17. Place of residence of park users. Source: Joumana Stephan, 2019

21% of park users are residents of neighborhoods within the municipal limits of the city, 21% are residents of the greater Beirut, and 6% are residents of the suburbs. The highest percentage of users (43%) live in proximity to the park (in Badaro, Chiah or Qasqas). This means that Horsh Beirut is not playing its role as a park on the scale of the city, but only as a neighborhood garden. (Figure 17)

Actors: Power mapping

Main actors and stakeholders and the nature of their relation with Horsh Beirut and with each other are modelled in the map below (Figure 18) showing a lack of collaboration. Nahnoo NGO is playing the role of the key coordinator between different stakeholders especially the residents, the municipality and the governor. While the latter have limited coordination with other stakeholders such as research and information centers.

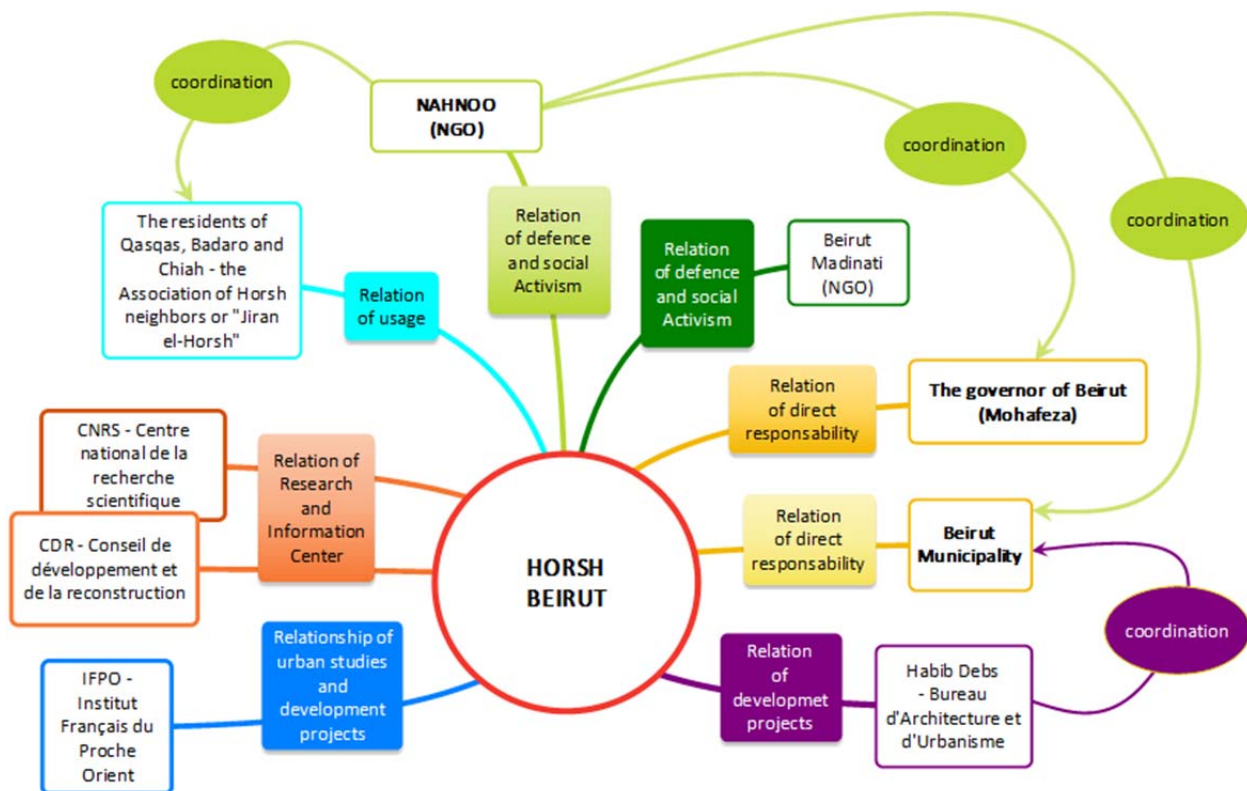


Figure 18. Power mapping of Horsh Beirut. Source: Joumana Stephan. 2019

2.2 VOCATIONAL: What need does it fulfill in the city?

Among the provenance areas of users within the administrative boundaries of Beirut, the largest percentage of users come from Hamra and Ashrafieh neighborhoods. (Figure 19) It is remarkable that these two neighborhoods include the main two large public gardens of the city: Sanayeh garden (Hamra) and Sioufi garden (Achrafieh), and yet their residents still choose to visit Horsh Beirut. “(I) prefer Horsh when seeking calm

and relaxation, public gardens are usually small and crowded” one respondent (age 68) said. “It gives a better “out of the city atmosphere” another respondent (age 26) declared. Horsh Beirut seems to have the advantage of size while other gardens are small and crowded.

Its function in the ecological system

Beirut takes its name from the Phoenician word "Beriet" or the Egyptian word "Barût" which translates to "Sanawbar" (Pine) in Arabic. This explains the association of Beirut with its unique pine forest or "Horsh Beirut". It historically consisted of a large green stretch, located at the southern entrance of Beirut, which helped stop the sand dunes creeping into the city because of the southwest winds, and which provided Beirut with fresh air full of the pleasant pine trees aroma (Al-wali, 1993). It still plays the same role but at a much smaller scale due to its surface reduction over time. Formerly, the large stone pine forest's surface exceeded 1.25 million m2. In 1982, it was burned down during the Israeli invasion which destroyed most of the pine trees. During the civil war (1975-1990), many trees were also damaged and burned by fire. Today, after its post-war renovation in 1992, the park covers 330,000 m2, which makes only 26% of its original surface area. It is still though the largest green space in Beirut (Shayya, 2010). The stone pine (botanical name: *Pinus pinea*) also known as the Italian stone pine, is a tree from the pine family (Pinaceae) native to the Mediterranean region and characterized by a tall trunk and branches spreading in the form of an umbrella.

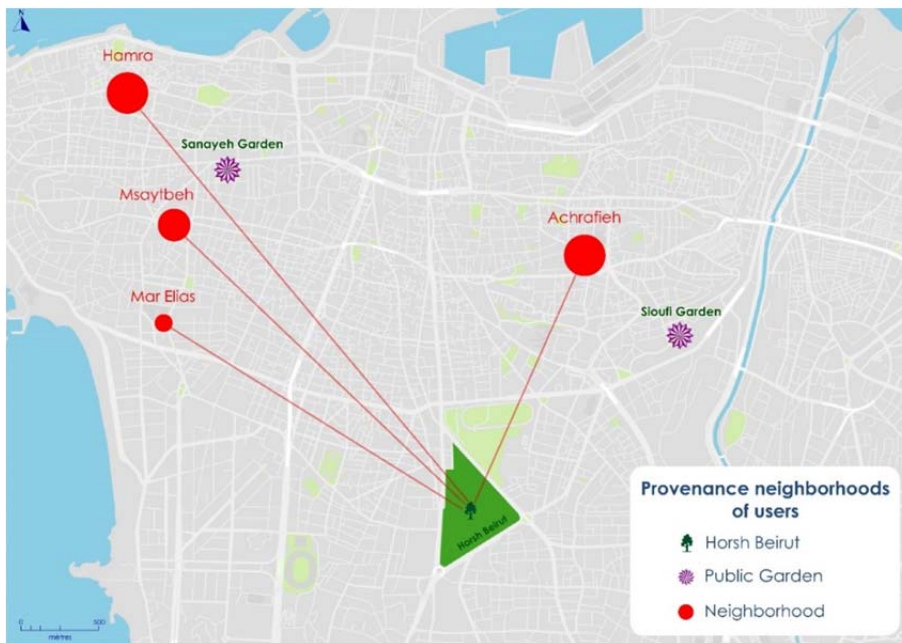


Figure 19. Provenance place of users within administrative Beirut.
Source: Joumana Stephan, 2019

As a forest, Horsh Beirut was only planted with stone pine, while its redevelopment as a park has introduced several other species which has resulted in an even greater biodiversity. According to Paul Abi Rached, ecologist and president of the association TERRE-Lebanon, there are various kinds of forest trees inside the park today, such as

pistachio and oak, besides several species of fruit trees such as pomegranate, olive and bitter orange trees, and ornamental trees like palms, Jerusalem thorn, blue jacaranda, frangipani, bay laurel, and others. According to Abi Rached, this biodiversity attracts a great variety of birds which take refuge inside the park. Shayya (Shayya, 2010: 161) confirms that the trees of Horsh Beirut “constitute a significant sanctuary for birds and other wildlife” and lists 32 species identified inside the park like the White Pelican, European Bee-eater, Redstart and Spotted Flycatcher. Among the most important bird species present in the park is the Cuckoo. Being insectivorous, Cuckoo birds (Figure 20) help get rid of insects, worms and caterpillars, especially harmful hairy species avoided by other birds. A disease caused by one of these poisonous hairy caterpillars that feed on pine needles, better known as “pine processionary”, has been spreading to Horsh Beirut since 2001. It sags the branches of trees, takes off their needles, before killing them slowly. The decline in the number of their main predator, the Cuckoo bird, allows their population to increase. Although Cuckoo birds are not globally endangered, in Lebanon, they are listed as rare birds, mainly because of irresponsible hunting practices.



Figure 20. Cuckoo (grey female). Source: The Royal Society for the Protection of Birds (RSPB), www.rspb.org.uk

Finally, besides biodiversity, Horsh Beirut is also crucial for chemical and bacteriological purification, thermoregulation and fixation of dust, tarry and oily products. However, mismanagement, irresponsible practices, climate change, age and vulnerability of trees have led to the proliferation of the disease which threatens this rich ecosystem in the heart of the city.

Its function in the socio-economic system

The degradation of Horsh Beirut's situation has had many socio-economic impacts. It mainly caused the progressive loss of attachment in the communities, as well as the loss of traditional practices, such as the dynamic holiday's festivities which used to be held inside the Horsh inducing social inclusion and providing income for local vendors. This will eventually lead to the loss of livelihood of the sector. Around 79% of users consider Horsh Beirut to be a good place to meet new people. And around 93% think that it could play a role in reconnecting bordering neighborhoods. But since Horsh Beirut is actually creating a physical barrier between the neighborhoods, it's actually playing the opposite role: one of socio-economic segregation.

Its function in the political system

Horsh Beirut has played a crucial role during the civil war due to its strategic position, being part of the “no man’s land” alongside the demarcation line. Unfortunately, and due to the political decisions and long periods of closure since the end of the war, it still plays that same role today. By a conscious political decision, or by accident, it is actually an element of social, sectarian and political division.

In conclusion, Horsh Beirut is modelled via the functional angle in the map below (Figure 21):

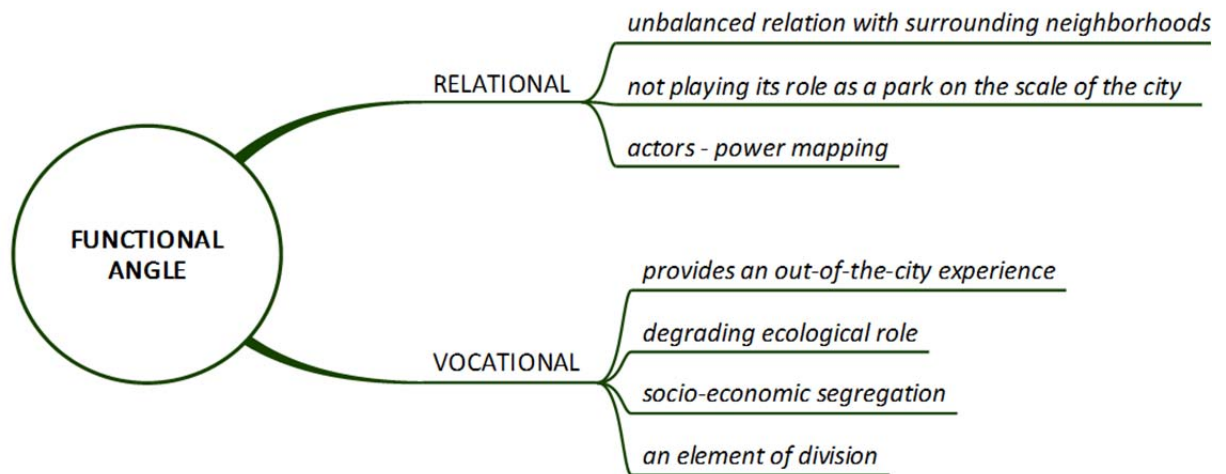


Figure 21. Functional angle model of Horsh Beirut. Source: Joumana Stephan, 2019

3. Dynamic angle: the system’s evolution

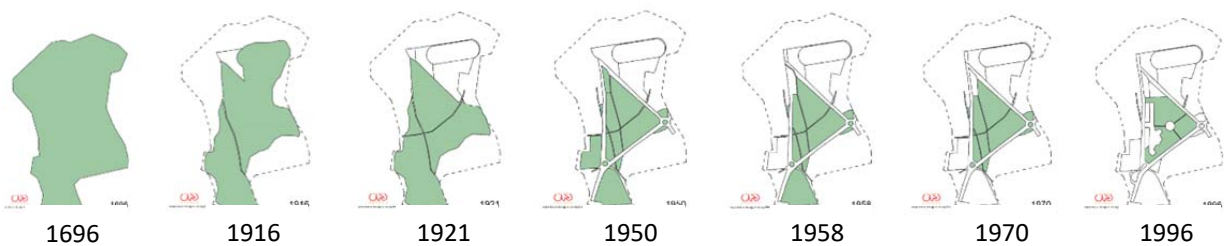


Figure 22. Horsh Beirut’s morphology evolution. Source: Our reproduction of a GIF published by Nahnoo NGO

Despite a dramatic surface reduction (Figure 22) and the fact that Horsh is classified as a protected natural site since 1940, the municipality of Beirut recently took the decision to build a military field hospital inside Horsh Beirut’s plot (plot 1925). This sparked outrage among the park’s visitors, neighbors and the civil society working on protecting public spaces. On 9 February 2017, hundreds of people gathered in protest asking the municipality to stop its nibbling policy.

3.1 STRATEGIES: Lebanese policies evolution on green public space

Plan Danger (1932) was the first urban planning proposal submitted for Beirut, under the French mandate. The five-year plan included municipal codes and provisions for public spaces and gardens, but was never approved. In 1943, the First Ecochard Plan was published by the French Urbanist Michel Ecochard, followed by the Second Ecochard Plan (1964) proposing the decentralization of the urbanization of Beirut by the identification of "new cities" around Beirut. This plan has neglected infrastructure as a whole, including green spaces. In 1954 the First master plan for Beirut was approved based on Ecochard's plans.

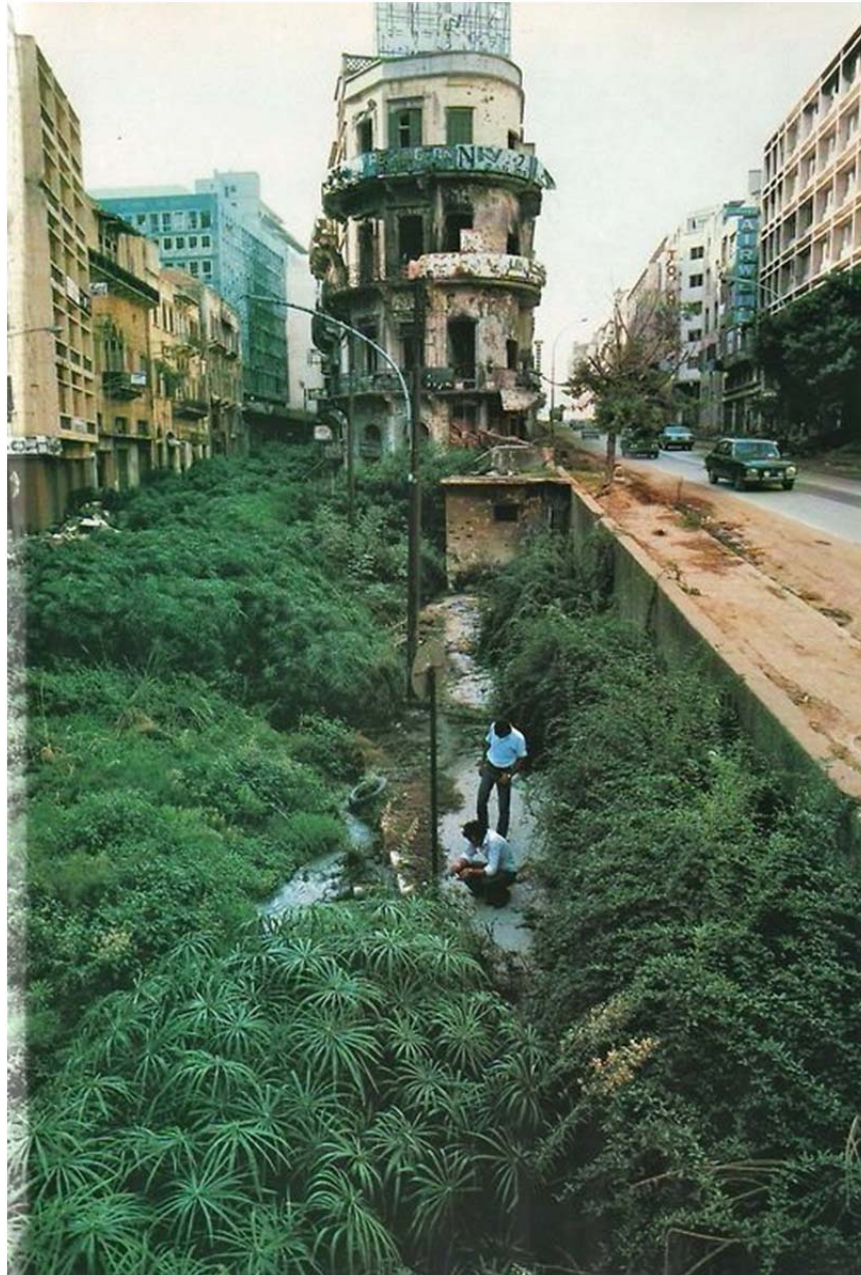


Figure 23. Green Line, 1983. Source: Personal collection of Gabriel Daher

But it did not mention green spaces. Between 1975 and 1990, the Lebanese civil war caused the deterioration of the already existing green public space. Interestingly, the years of war have allowed an abundant plant proliferation along the border line, which gave it its name: the Green Line. And turned it into a buffer zone between East and West Beirut (Figure 23).

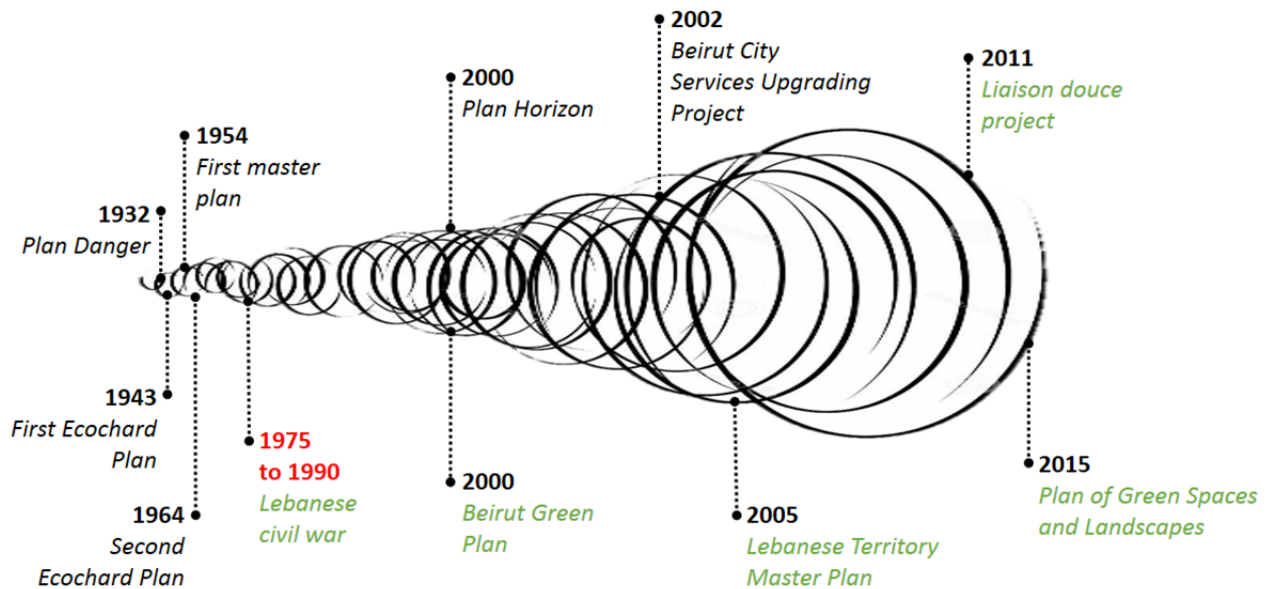


Figure 24. Lebanese policies evolution on green spaces featuring in green the few stages which highlighted their importance. Source: Joumana Stephan, 2019

In 2000 the Plan Horizon by the Council for Development and Reconstruction (CDR) was carried out by Solidere⁴ and focused on reconstruction. Green public spaces were still not mentioned. Also in 2000, Beirut Green Plan was funded by the Region Ile-de-France and developed by a French landscaping agency, Interscène. The role of the plan was limited to a simple reference document at the municipality of Beirut. In 2002, the Beirut City Services Upgrading Project was finished by the CDR, it included in its description a redevelopment of green spaces. But, in reality, the first phase of implementation, led by Dar Al Handasah Nazih Taleb & Partners, and the 2nd phase, led by Associated Consulting Engineers (ACE), covered only the road infrastructure. In 2005, Master Plan for Lebanese Territory by CDR provided a strategy for land, water and waste management, but mentioned green spaces only in the form of natural preservations rather than green pockets in urban areas. The Liaison Douce project, a collaboration between the Ile-de-France region and the Municipality of Beirut was launched. The studies were completed in 2013, but the project is not yet executed. In 2015, the Plan of Green Spaces and Landscapes was developed by the Municipality of Beirut in coordination with the Region Ile-de-France in Beirut, aiming to strengthen the capacity of action of the Municipality of Beirut in the field of public spaces. (Figure 24)

⁴ Solidere s.a.l. is a Lebanese joint-stock company in charge of planning and redeveloping Beirut Central District following the Lebanese Civil War.

This model illustrates the lack of a public green space policy throughout Lebanon's history. Up until this day, the private sector and the business market play a central role in the development of real estate in Lebanon, eventually side-lining the public interest.

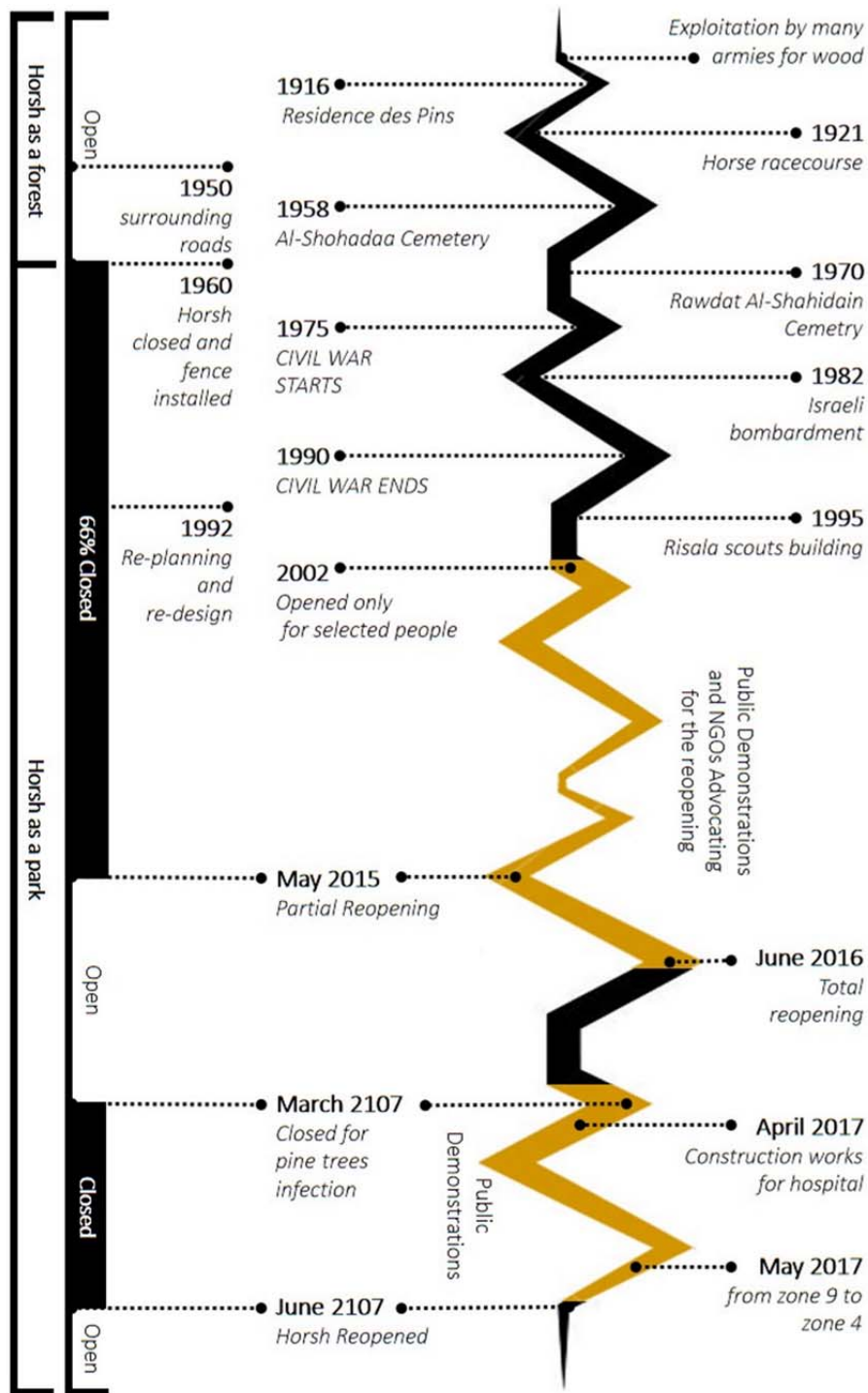


Figure 25. Horsh Beirut crises evolution. Source: Joumana Stephan, 2019

3.2 CRISES: continuous nibbling of Horsh Beirut

Throughout history, Horsh Beirut as an open forest was exploited by many armies for wood. During recent history, large parts of the forest were segmented-out to become buildings and lands to different public and private institutions.

In 1916, Résidence des Pins area was cut from it. In 1921, the Horse racecourse area was cut from it. In 1950, roads were planned inside it. Then, in 1958, Al-Shohadaa Cemetery area was cut from it. In 1960, it got fenced and closed. In 1970, Rawdat Al-Shahidain Cemetery area was cut from it. During the civil war, between 1975 and 1990, its condition deteriorated until it was entirely burnt after Israeli bombardment in 1982. After the war ended, it was re-designed and re-planned in 1992. In 1995, Risala scouts building was built on the Horsh plot. In 2002, the Horsh was opened only for selected people with special authorization. After many years of activism for the reopening of the park, it was finally reopened to the public on May 2015 but only for once a week. The NGO campaigns (mainly Nahnoo) and public protests persisted until it was entirely open to the public on June 2016. The park was closed again by the Municipality on March 2017, the official cause was to treat an infection of the pine trees, which was condemned by the public. On April 2017, construction works suddenly started inside the park to build a military field hospital. This was followed by many public protests up until June 2017 when the Horsh was opened again. Meanwhile, on May 2017 a law was approved by the council of Ministers to move a section of the park from zone 9 (protected green areas) to zone 4 (allows the construction of high rise buildings) (Figure 25).

In conclusion, Horsh Beirut is modelled via the dynamic angle in the map below (

Figure 26):

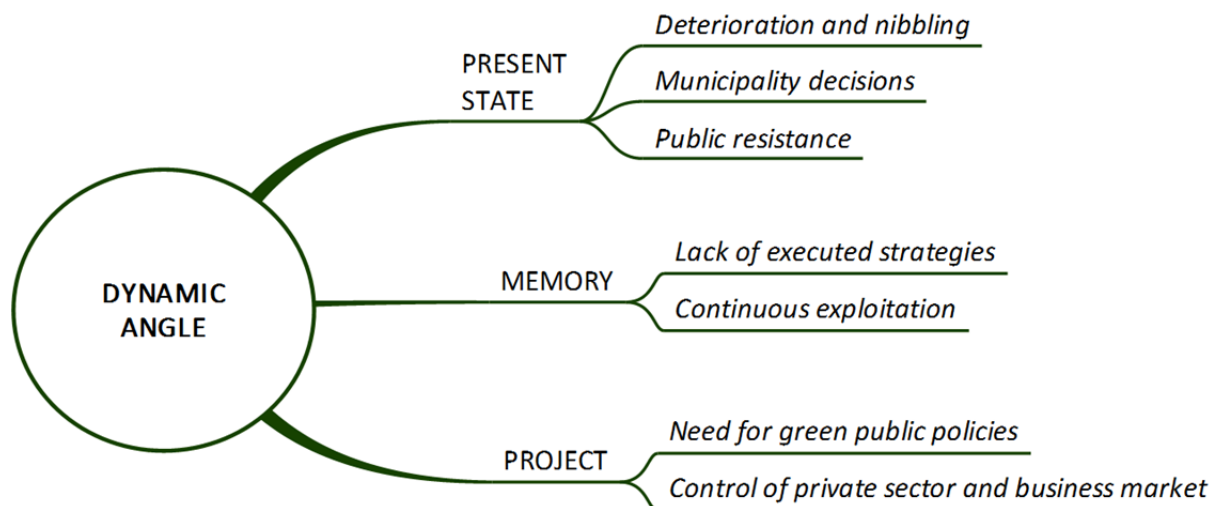


Figure 26. Dynamic angle model of Horsh Beirut. Source: Joumana Stephan, 2019

Discussion and conclusions: Emergent properties of Horsh Beirut

In the study, the focus is on local interactions and how they give rise to emerging phenomena on the macro scale of the entire urban system. Global organizational patterns emerge, often chaotic in a dynamic world in constant evolution, where nothing is fixed. We model the latter in an attempt to capture these local causal links and how they bring out unexpected patterns of long-term behavior. While diagnosing the situation, we avoid an exhaustive description of the components by detailing the events. Contrariwise, we push back events seeking to model the dynamics behind them, what really drives the system. The main underlying dynamics deduced from the results of our diagnosis of Horsh Beirut by Systemic Triangulation are modeled in the figure below. (Figure 27)

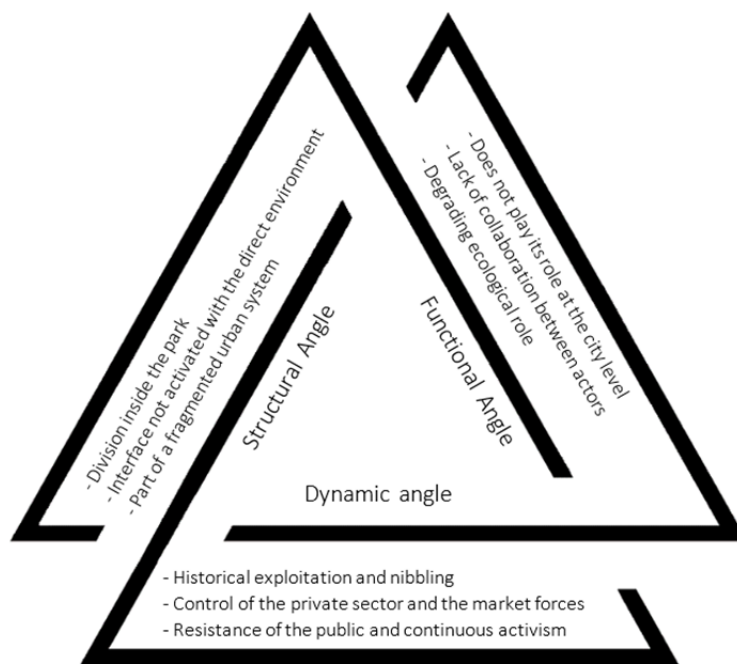


Figure 27. Conclusions of the underlying dynamics of HB based on the Systemic Triangulation diagnosis. Source: Joumana Stephan, 2019

The results prove that public space has the properties of a complex adaptive system, with Horsh Beirut being the complex final product of more than the sum of its parts. First, despite historical exploitation, degradation and nibbling strategies, it remains a rich ecosystem, which makes its basic ecological dimension. In addition, Horsh forms with the surrounding districts a complex social entity controlled by emergent properties. Therefore, it's a socio-ecological entity. But as the social dimension is closely associated with the sectarian and political dimension in Beirut, it is a socio-political ecological entity. The results also allow us to identify different human and information flows passing through the system, both showing problems and discontinuities, such as: unbalanced accessibility based on sectarian tensions, poorly informed public about the park's problems, lack of coordination between the different actors and lack of transparency between local governance and the public. Consequently, because of the

large number of components of this entity, which have strong connectivity in the form of networks, energy flows, as well as many emergent properties, Horsh Beirut could be considered a *complex system*, more specifically a socio-political ecological system. In subsequent studies, a technological dimension of the system could be explored. Furthermore, after studying the evolutionary nature of Horsh Beirut and documenting the different underlying dynamics, we conclude that its past and current usages reveal the ability of people, throughout history, to negotiate their practices in spaces strictly managed and under different types of management. This dimension of adaptability, makes Horsh Beirut a *complex adaptive system*, and the appropriation of public space by people an emergent property that exists in none of the structural, functional or historical components of the park alone.

The diagnosis also highlights a number of emergent properties generated by Horsh Beirut as a system. First, a remarkable property, not detectable at the level of each individual but generated by the interaction of individuals and emerging at the level of the entire urban system, is *fear* associated with collective memory. Appearing in the three angles of the study, this emergent property reflects the residual fear of the other, still present almost 30 years after the end of the civil war. Horsh's positioning consolidates this dynamic.

Second, we detected the emergence of two collective socio-economic trends in the form of systemic properties: (i) *gentrification* on the old demarcation line axis; and (ii) *consumerism* on the scale of the entire city. These two emerging properties disrupt the balance of the system, diverting human flow away from the park, while public resistance and NGO activism could create momentum bringing the system back to its equilibrium state, if the good leverage points were mobilized.

The third systemic property detected is actually one of the most intriguing emergent properties of urban systems (Lonjon, 2017), it's called *self-organization*. In reality, the city is constantly redefined by emergent properties producing the self-organization of a territory manifested by a temporary transformation of the environment (Volpi, 2016: 2). Since complexity is a product of the degree of autonomy and adaptation of the elements in the system, only when the elements have a very low level of autonomy, the system can be designed, managed and controlled in a top-down way. But as the autonomy of the elements increases, as in the context of a contemporary urban territory, this no longer becomes possible, as control and organization actually become distributed, which increases interactions on the local level and effectively defines how the system is developing. This causes self-organization. One must be aware that when agents can self-organize their interaction forms global patterns and emerging states that cannot be previously planned or designed (Batty, 2007). Thus, as opposed to simple linear systems where order typically comes from some form of centralized top-down coordination, order models in complex systems, such as that of Horsh Beirut, appear to be emerging from the bottom-up. Self-organization is an important property of complex systems, and treating a complex adaptive system as a simple system will bring unfavorable consequences (Mitchell, 2009).

Self-organization manifests itself in Horsh Beirut as spontaneous spatial practices such as daily walking and jogging activities on the sidewalk surrounding the park from the outside, as well as the intrusion and appropriation of space by the public when the park is closed. Saksouk-sasso states that public space in Beirut is "the embodiment of an

emerging form of sovereignty” which is “much more dynamic than the modern notion of public space, inextricable from the modern state.” She adds: “The informal and communal public space of Beirut does not rest in the property but in practice.” (Saksouk-sasso, 2015: 310). Self-organization is also expressed in the form of the activism of local NGOs through their judicial activism, advocacy, official complaint letters and petitions, public campaigns, and demonstrations. Another form of self-organization has also been detected in the form of urban segregation where the residential spatial distribution around the park is based on sectarian and political affiliation. We also noticed discrimination based on social status as well as accessibility oriented by sectarian tensions (Figure 28).

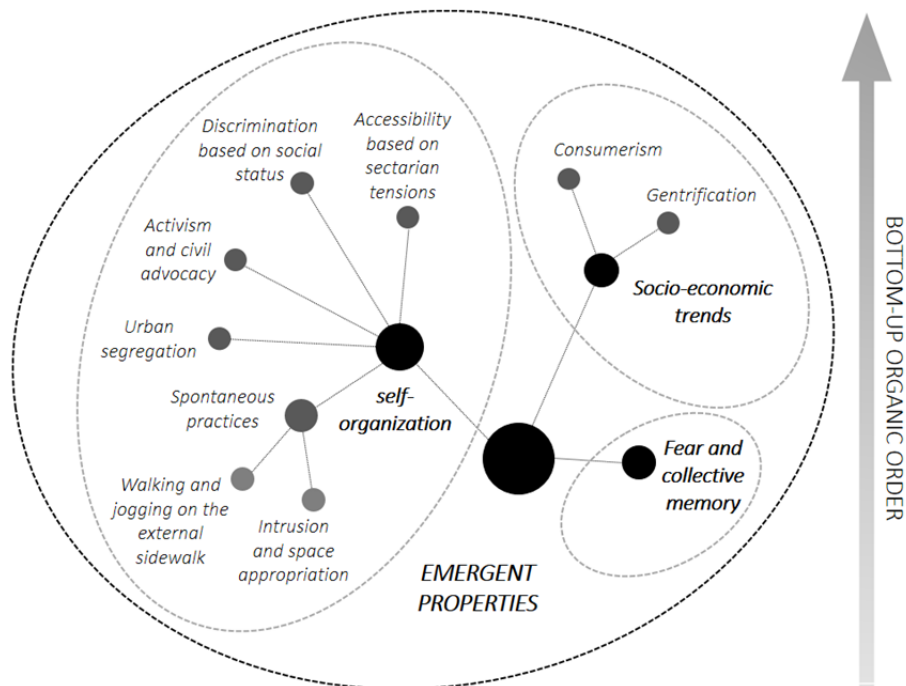


Figure 28. Horsh Beirut emergent properties: bottom-up organic order.
Source: Joumana Stephan, 2019

Urban segregation is an emergent socio-political property that structures the system into divided entities controlled by fear of the other. In the case of Horsh Beirut, and for various interdependent factors, the neighbourhoods self-organized according to the sectarian division around the park, which catalysed segregation. To overcome this, it is necessary to implement policies based on a better understanding of the underlying dynamics of segregation. However, a crucial challenge in achieving such understanding is that segregation emerges from local interactions that can produce unexpected and counter-intuitive results that cannot be defined a priori. For example, the majority of individuals in a certain community could be very open and not intend to practice segregation: the results show that about 79 % of users consider Horsh Beirut as a good place to meet new people and about 93% think it could play a role in reconnecting

neighbourhoods. However, segregation emerges anyway from the collective dynamic on the scale of the community, which could in return have serious consequences on the latter. It is impossible to attribute the emergence of segregation to a single cause. And it is important to keep in mind that this is a non-linear and multi-scalar process characterized by constant feedback loops, where the so-called causal mechanisms of segregation can also be affected in the long term. (

Figure 29) Therefore, it is necessary to seize segregation by giving priority to the process rather than the product (Batty, 2006).

This discussion demonstrates the limited role of government institutions in regulating segregation mechanisms. Since emergent properties cannot be controlled or created by strategy, they can only be induced by regulating feedback loops (Figure 29).

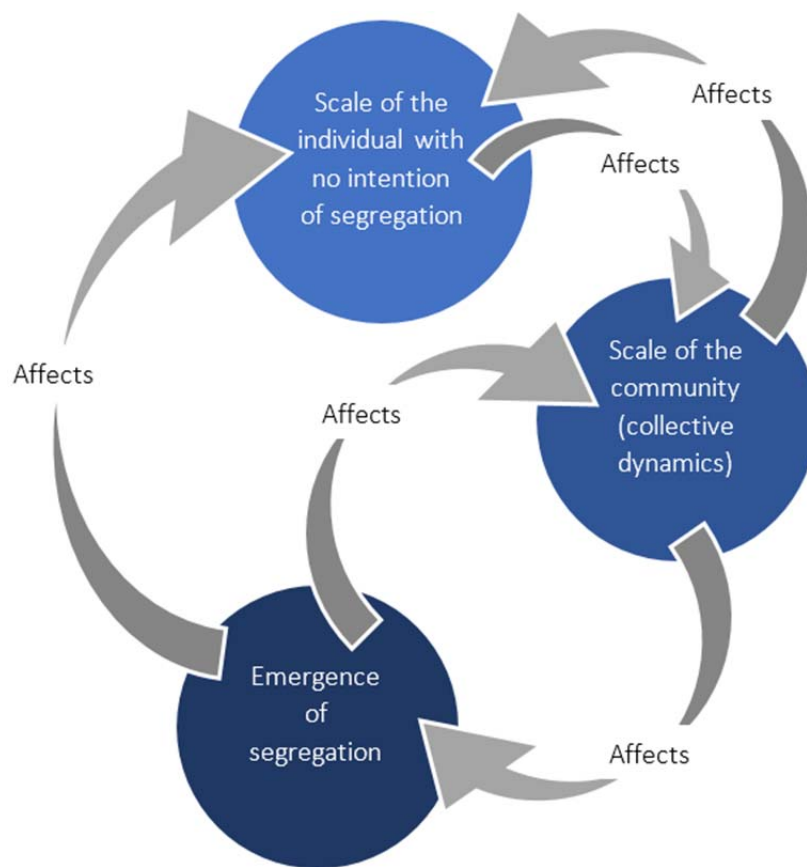


Figure 29. The underlying non-linear and multi-scalar dynamics of socio-spatial segregation.
Source: Joumana Stephan, 2019

Which makes us question the idea of order in the city. The results show that strategies used by park managers throughout its evolution follow a top-down mechanistic order. (Figure 30) To further understand underlying dynamics of the system it will be crucial to differentiate between organic order, embodied by emergent properties, and mechanistic

order imposed by classical governance. When systems have too little structure, they are too close to chaos, they become too sensitive to be disturbed. When they have too much structure, that they are too close to a static order, they become too rigid to deal with changes. Therefore, for a complex adaptive system to remain in place, it's important to be balanced at the edge of chaos. According to Youngblood (Youngblood, 1997), this equilibrium has the effect of self-organizing the system, thus creating a level of order superior to that of an imposed order - a more creative and stable order than an imposed order. So, in the organic vision, rigor is not an objective, contrary to the mechanistic vision. Order in the mechanistic view is an imposed order that stems from a centralized authority while order in the organic view emerges from disorder. The order in the organic view is not characterized by calm, but rather by a self-organizing model (Sanders, 1998). Systems (natural or man-made) that imply this emerging order concept, dynamic rather than static, have *life* according to Alexander (Alexander, 2002: 33). And so, planners should aim to preserve the natural order of living structures for more liveable and vibrant cities (Gehl, 2010).

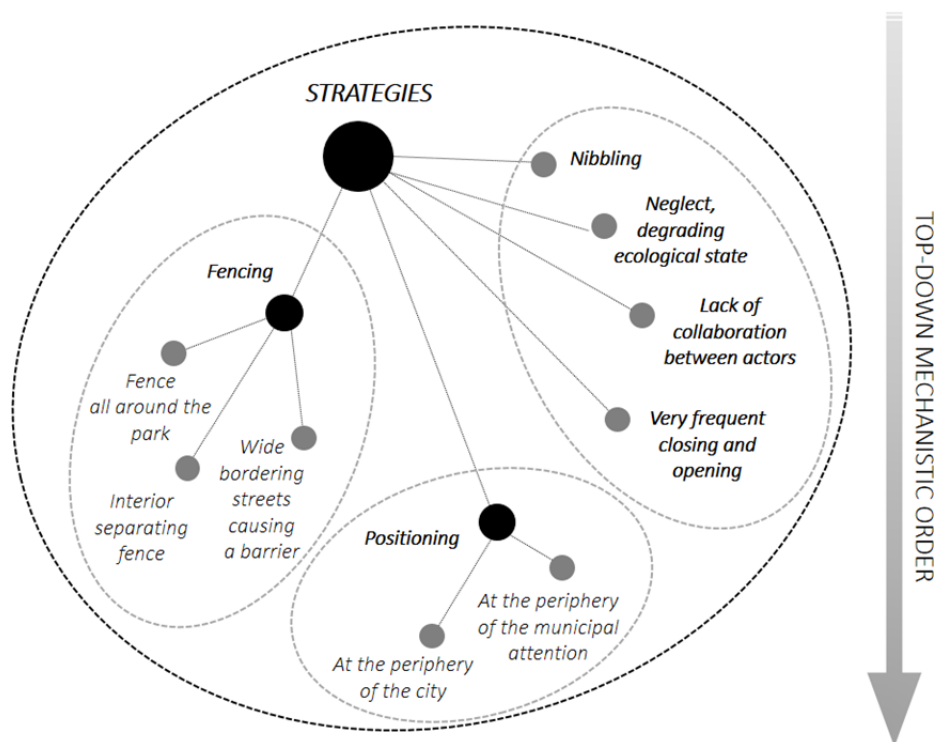


Figure 30. Horsh Beirut strategies: top-down mechanistic order.
Source: Joumana Stephan, 2019

The results show that the top-down mechanistic order imposed on Horsh Beirut by current official strategies takes several forms. First, there is a deliberate closure strategy: a separation fence inside the park, a fence all around the park, and large adjacent streets causing a barrier between the park and its surroundings. In addition, its positioning puts it not only on the physical periphery of the city but also on the periphery of the municipal attention. The results also show continued nibbling strategies

of the park surface in favour of privatization and corporate market, as well as negligence leading to a degrading ecological state, a lack of collaboration between the actors and an alternation of opening and closure decisions which does not leave the time to the public to appropriate it (Figure 30).

Since the end of the war, the Lebanese state has been pursuing a deliberate policy and carrying out physical interventions aimed at rendering the public space devoid of any political measure and depoliticizing the urban space, which has helped to make Horsh Beirut for example, a closed system devoid of any dynamics. As we have seen, closed systems are stuck in a false mechanistic state. This has contributed to the isolation of the park and aggravation of the tension between its bordering neighbourhoods.

Clausewitz, Prussian general and military theorist, states in a famous quote: "war is politics by other means". While Michel Foucault reverses his thesis declaring: *it is politics that is the continuation of war by other means*. Foucault's statement seems to be more adequate for the case of Beirut's public space.

In conclusion, the study of green public spaces, like Horsh Beirut, as complex adaptive systems, which are dynamic, open, and characterized by uncertainty and unpredictability, offers important possibilities for analysis, but also poses many challenges for design and management. Since emergent properties are, by nature, uncontrollable, the very nature of urban design is questioned. What kind of approach is appropriate for such systems? What should be our level of intervention? How to manage self-organization and emerging order? Should we learn the ability to take advantage of unintended and unforeseen results? Perhaps, our perception of the planners' role should change, to be redirected towards detecting synergetic opportunities and catalysing positive emergent properties.

Acknowledgement

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